TM 11-920

WAR DEPARTMENT TECHNICAL MANUAL

POWER UNITS

PE-49-C, -D, -F, and -G

AND MOTOR GENERATOR MG-37-A

WAR DEPARTMENT • MAY 1945

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This manual supersedes Instruction Book for Power Unit PE-49-C, 28 March 1940; pars. 14, 34, 49, and lubrication chart, TM 11-232, 9 August 1941 and C 1, 3 August 1942; Instruction Book for Power Unit PE-49-D, 11 December 1942; TM 11-920, 2 June 1943; TM 11-938, 28 September 1943; and TM 11-920G, 6 July 1944.

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Refer to FM 21–6 for explanation of distribution formula.

CONTENTS

WARNING

HIGH VOLTAGE

is generated by the operation
of this equipment.

DEATH ON CONTACT

may result if personnel
fail to observe safety precautions.

DESTRUCTION NOTICE

WHY — To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN — When ordered by your commander.

HOW — 1. Smash — Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

2. Cut — Use axes, handaxes, machetes.

3. Burn — Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

4. Explosives — Use firearms, grenades, TNT.

5. Disposal — Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT

WHAT — 1. Smash — Cylinders, cylinder heads, crankcases, governors, carburetors, pistons, gears, air cleaners, magnetos, flywheels, mufflers, and crankshafts, generators, armatures, fuel tanks, switches, relays, meters, wooden hoods and bases, and every other electrical or mechanical part, whether rotating, moving or stationary.

2. Cut — All wiring, cables, field coils, and electrical connections on the inside and outside of the equipment.

3. Burn — Cord, skid, armature, field coils, starting rope, wooden hoods and base, all means of identification, and this technical manual.

4. Bend — All tools and spare parts, gas line.

5. Bury or scatter — All of above pieces after destroying their usefulness.

DESTROY EVERYTHING

SAFETY NOTICE

This equipment generates high voltages that are dangerous to life. Operators must be very careful to observe every safety regulation at all times. If necessary to adjust equipment, take no chances.

Always open the FIELD SWITCH before inserting and removing plugs or opening the control box for any reason.

Do not touch the commutators, brushes and brush holders with the bare hands while the armature is revolving with the field switch closed. Never remove the covers on the generator while the unit is in operation. Always stop the unit before removing the gasoline-tank filler cap. Never spill gasoline on a hot engine.

Always provide sufficient ventilation of the engine exhaust. The exhaust gases contain carbon monoxide which is odorless and a deadly poison. Use respirator, if available, when moistureproofing and fungiproofing the equipment as varnish spray may have toxic effects. If respirator is not available, fasten cheesecloth or other cloth material over nose and mouth.

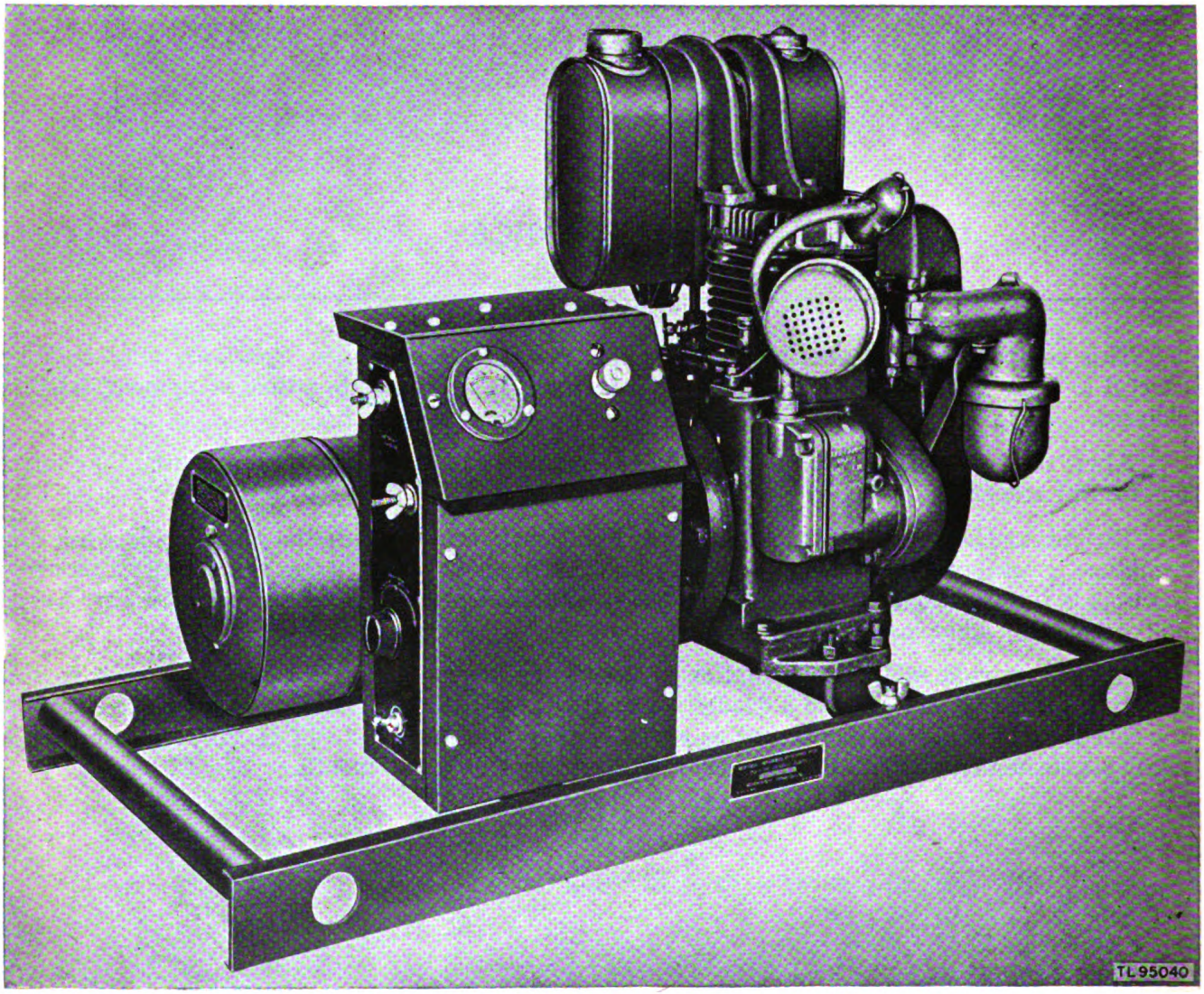


Figure 1. Power Unit PE–49–(*).

This manual supersedes Instruction Book for Power Unit PE–49–C, 28 March 1940; pars. 14, 34, 49, and lubrication chart, TM 11–232, 9 August 1941 and C 1, 3 August 1942; Instruction Book for Power Unit PE–49–D, 11 December 1942; TM 11–920, 2 June 1943; TM 11–938, 28 September 1943; and TM 11–920G, 6 July 1944.

PART ONE

INTRODUCTION

Section I. DESCRIPTION

1. General

a. Power Units PE–49–C, –D, –F, and –G and Motor Generator MG–37–A are compact, self-contained, light-weight, portable power generating sets, designed to supply continuous high- and low-voltage direct current for field radio transmitters. Provision is made for either electric or manual starting.

Note. Power Unit PE–49–C has been placed on limited standard. Distribution of the unit is limited to continental United States and all power units of this class for use overseas are replaced by Power Unit PE–49–D or later models. Units of the PE–49–C model, used in the field in this country for training purposes only, should be salvaged and replaced by Power Unit PE–49–D or a later model if repairs are required.

b. Power Unit PE–49–(*) will be used throughout this manual to indicate Power Units PE–49–D, –F, and –G, where discussion is applicable to all three of these units.

2. Nomenclature of Major Components

a. Power Unit PE–49–C consists of Engine GE–9–C, Generator GN–39–C, and Filter FL–9.

b. Power Unit PE–49–D consists of Engine GE–9–D and Generator GN–39–D.

c. Power Unit PE–49–F consists of Engine GE–9–F and Generator GN–39–F.

d. Power Unit PE–49–G consists of Engine GE–9–F and Generator GN–39–G.

e. Motor Generator MG–37–A consists of Motor MO–37–A and Generator GN–39–F.

f. Each unit has a control box which is a part of the generator. The unit is mounted on a skid base and is equipped with a hood for protection against dirt and moisture during transportation and when the unit is not in use. No nomenclature is assigned to the control box, skid base, or hood.

3. Performance Characteristics

Power Units PE–49–C and PE–49–(*), and Motor Generator MG–37–A have a total output of 0.715 kw each and are designed to provide a continuous high-voltage output of 1,000 volts, 350 milliamperes, and a low-voltage output of 14.6 volts, 25 amperes. Both outputs are available either separately or simultaneously. Test data showing output voltage and current with and without load at different speeds of the driving unit are given in paragraph 112.

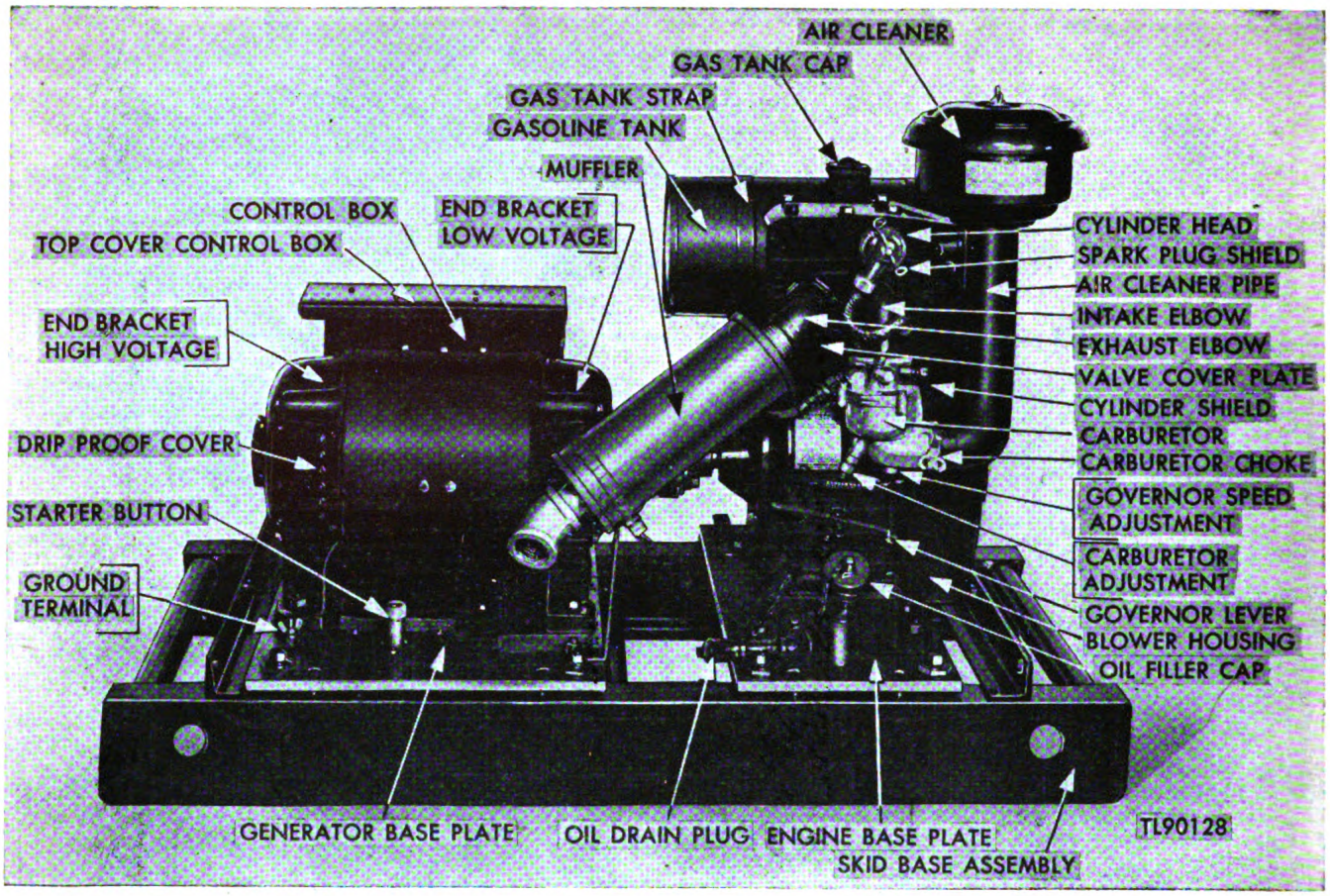


Figure 2. Power Unit PE–49–C—view from muffler side.

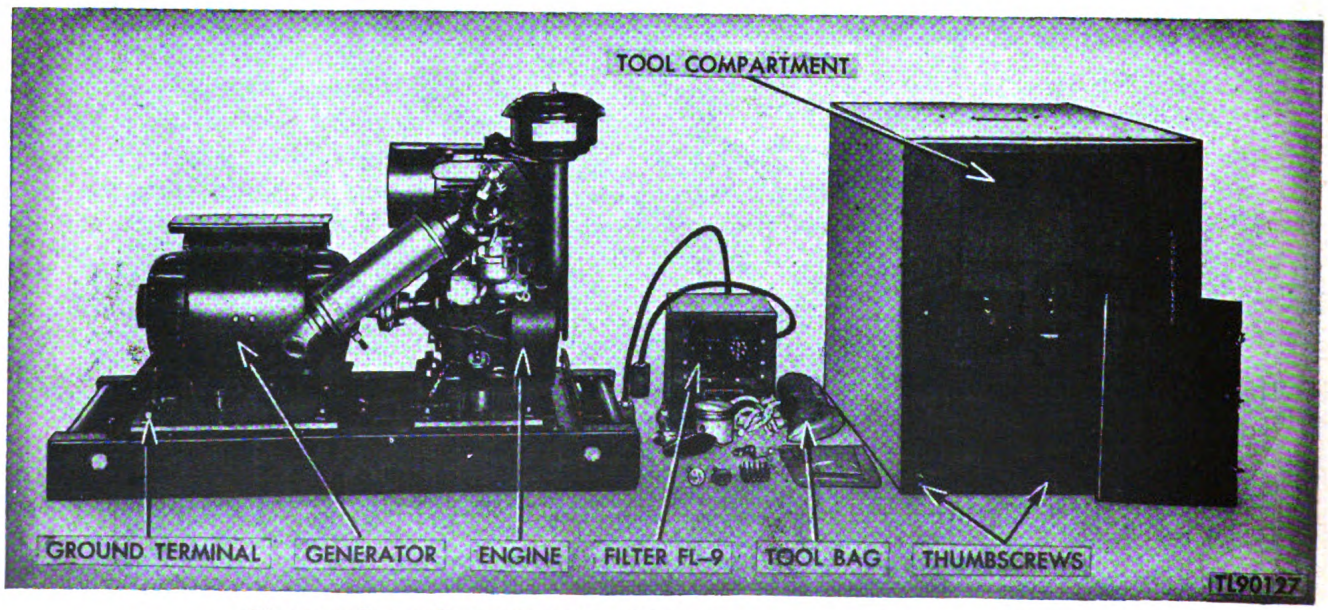


Figure 3. Power Unit PE–49–C, with hood removed, ready for operation.

4. Table of Condensed Specifications

a. POWER UNIT PE–49–C.

Engine GE–9–C, Briggs and Stratton
Model.....B Cycle.....4
Type cyl head.....L-head
Number of cylinders.....1
Bore.....2⅝ in. Stroke.....2⅝ in.
Piston displacement.....14.21 cu. in.
Compression ratio.....4.23 to 1
Engine speed.....2,650 rpm
Type of cooling.....air
Horsepower.....2.7 at.....2,650 rpm
Piston.....aluminum alloy
Piston rings.....2 compression 1 oil
Piston pin.....hollow, hardened, ground
Lubrication system.....pump and splash
Air cleaner.....oil bath
Spark plug....Champion No. 6M, gap 0.025 in.
Fuel tank capacity.....1 gal
Crankcase oil capacity.....1½ pts
Governor.....mechanical flyball
Main bearings.....SAE babbitt-lined
Battery voltage.....12 volts
Generator GN–39–C.....Pioneer General Electric, type CK–350
Rating.....0.715 kw
Generator speed.....2,650 rpm
High voltage.....1,000 volts, 0.350 amps d-c
Low voltage.....14.6 volts, 25 amps d-c
Generator bearings....ball, 1–17 mm, 1–20 mm
Generator brushes.....carbon

b. POWER UNIT PE–49–(*).

Engine GE–9–D or GE–9–F, Wisconsin
Model.....ABS Cycle.....4
Type cyl head.....L-head
Number of cylinders.....1
Bore.....2½ in. Stroke.....2¾ in.
Piston displacement.....13.5 cu. in.
Spark plug.....Champion No. 8, 18 mm gap 0.025 in.
Fuel tank capacity.....1 gal
Crankcase oil capacity.....⅞ qt
Governor.....centrifugal flyweight, Wisconsin Motor Corp
Compression ratio.....5.1 to 1
Engine speed.....2,700 rpm
Cooling.....air
Horsepower.....3.5 at 2,700 rpm
Piston.....heavy duty aluminum alloy
Piston rings.....2 compression, 1 oil
Piston pin.....press fit
Lubrication system.....pump and splash
Air cleaner.....oil bath, United Air Cleaner
Main bearings.....Timken roller
Battery voltage.....12 volts
Generator GN–39–D or GN–39–F (Continental Electric), or GN–39–G, Atlas Aircraft
Rating.....0.715 kw
Generator speed.....2,700 rpm
High voltage.....1,000 volts, 0.350 amps d-c
Low voltage.....14.6 volts, 25 amps d-c
Generator bearings..ball, presealed, 0.7874″ID
Generator brushes.....carbon
H-v.....¼″ x 0.156″ x 1⅞″
L-v.....½″ x ¾″ x 1″

c. MOTOR GENERATOR MG–37–A.

Motor MO–37–A, Continental Electric
Model.....R–204X Repulsion-induction
Volts.....220 a-c Phase.....1 Cycle.....50
Motor speed.....2,725 rpm
Horsepower.....1½ at 2,725 rpm
Brushes.....carbon, ⅜″ x ⅝″ x 1½″
Bearings.....ball, presealed, 0.7874″ID
Generator GN–39–F, Continental Electric
Rating.....0.715 kw
Generator speed.....2,725 rpm
High voltage.....1,000 volts, 0.350 amps d-c
Low voltage.....14.6 volts, 25 amps d-c
Generator bearings..ball, presealed, 0.7874″ID
Generator brushes.....carbon
H-v.....¼″ x 0.156″ x 1⅞″
L-v.....½″ x ¾″ x 1″

5. Table of Components, Dimensions, and Weights

a. POWER UNIT PE–49–C.

Component	Dimensions (in.)			Weight (lb.)
	Length	Width	Height	
Power Unit PE–49–C, complete unit, including inclosing hood.	36	19	26	255
Generator GN–39–C.	12½	18½	11	96½
Engine GE–9–C.	12½	18½	21	103½
Skid base.	36	18½	3⅞	16½
Inclosing hood.	29	19	22⅛	22½
Control box.	10¾	4½	10¾	9½
Filter FL–9.	9	8¾	8½	18½
Crate.	42⅝	24¼	30	67
Engine and generator spare parts.				6½

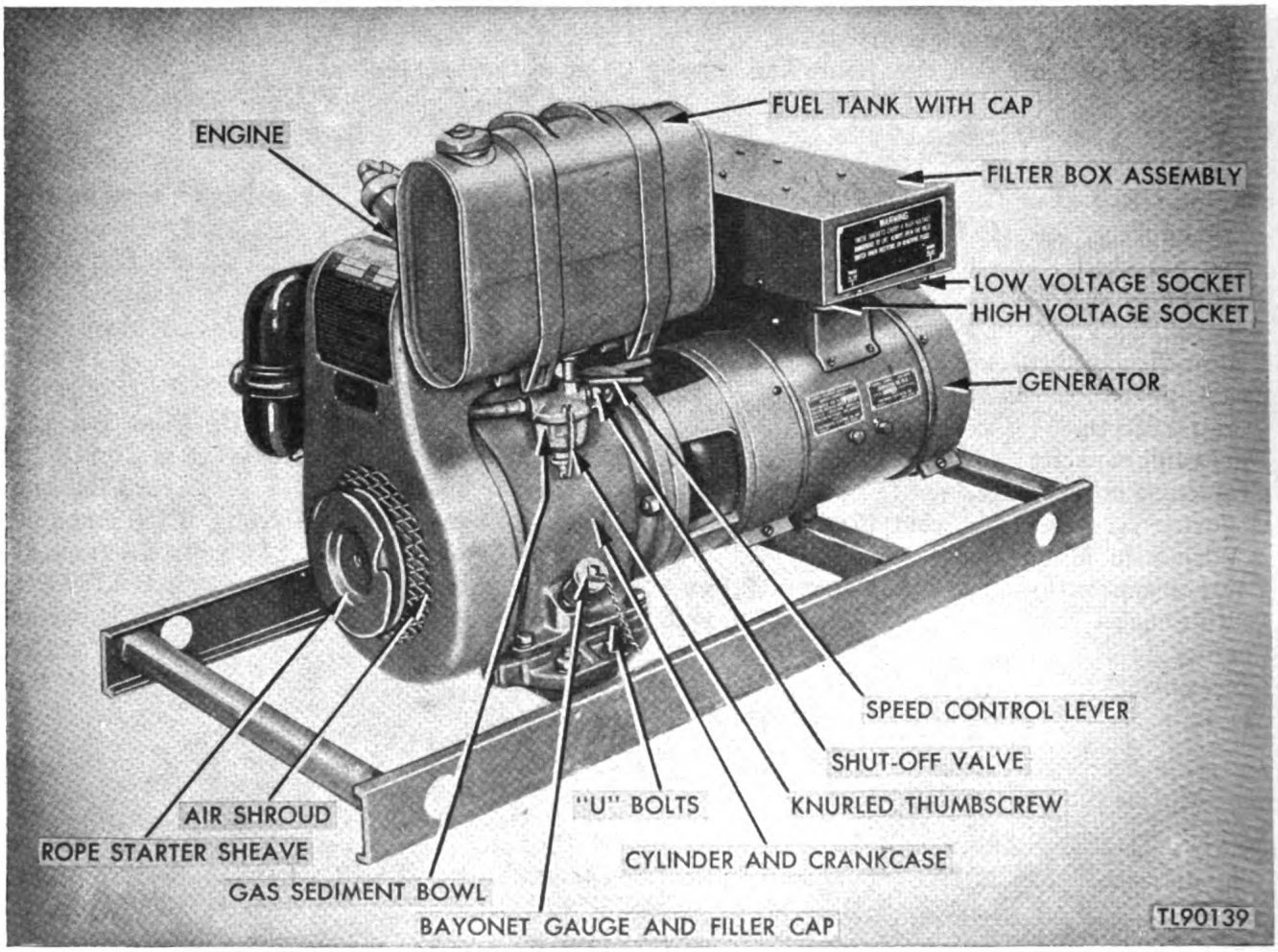


Figure 4. Power Unit PE–49–D ready for use—view from fuel-tank side.

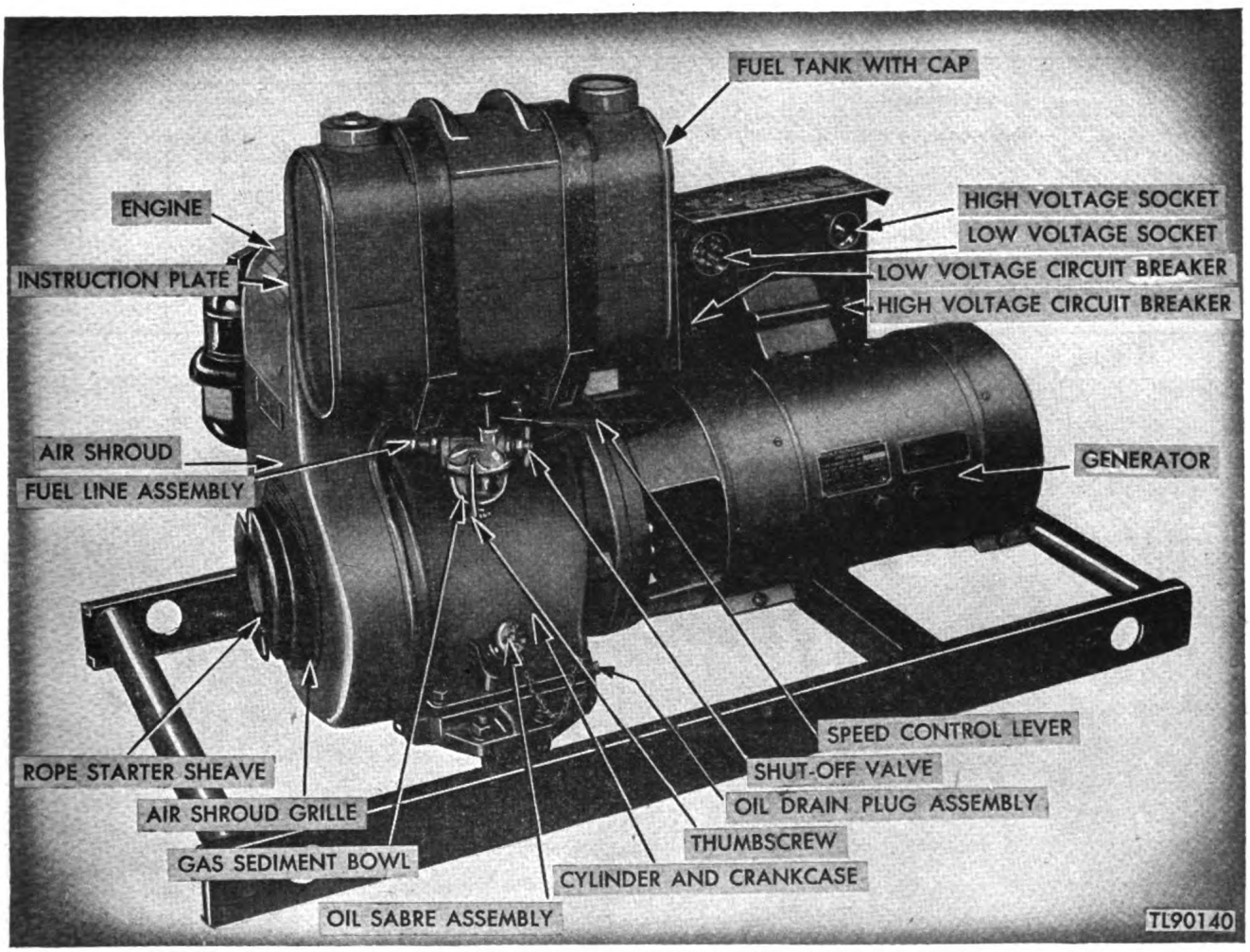


Figure 5. Power Unit PE–49–F ready for use—view from fuel-tank side.

b. POWER UNIT PE–49–D.

Component	Dimensions (in.)			Weight (lb.)
	Length	Width	Height	
Power Unit PE–49–D, complete unit, including hood.	36	18	23¾	260
Control box.	11½	8½	10½	14
Crate (wood).	42½	23¼	27	53
Engine GE–9–D.	12¾	16	20¼	90
Filter box.	14⅞	7½	7¼	11
Generator GN–39–D.	16¾	8	8¾	85
Hood (steel).	32¼	18	22¼	27
Skid base (steel).	36	17	2½	23
Spare parts and tools, in two bags.				10

c. POWER UNIT PE–49–F.

Component	Dimensions (in.)			Weight (lb.)
	Length	Width	Height	
Power Unit PE–49–F, complete unit, including hood.	37	19⅝	27⅛	300
Control box.	9¼	7¾	12 13/16	16
Engine GE–9–F.	12¾	16	20¼	103
Generator GN–39–F.	16¾	8	8¾	80
Hood (wood).	36	19⅝	25¼	50
Hood base (wood).	37	19⅝	1⅞	16
Skid base (steel).	36	18	2½	25
Spare parts and tools, in two bags.				10

d. POWER UNIT PE–49–G.

Component	Dimensions (in.)			Weight (lb.)
	Length	Width	Height	
Power Unit PE–49–G, complete unit, including hood.	37	19 5/8	27 3/16	325
Engine GE–9–F.	11	10 7/8	20 1/4	103
Generator GN–39–G.	16 1/2	8	8	85
Control box.	8	5	13	15
Skid base (steel).	38	17	2 1/2	23
Hood base (wood).	37	19 5/8	3 1/4	19
Hood (wood).	37	19 5/8	23 15/16	71
Tools.				6
Spare parts.				3

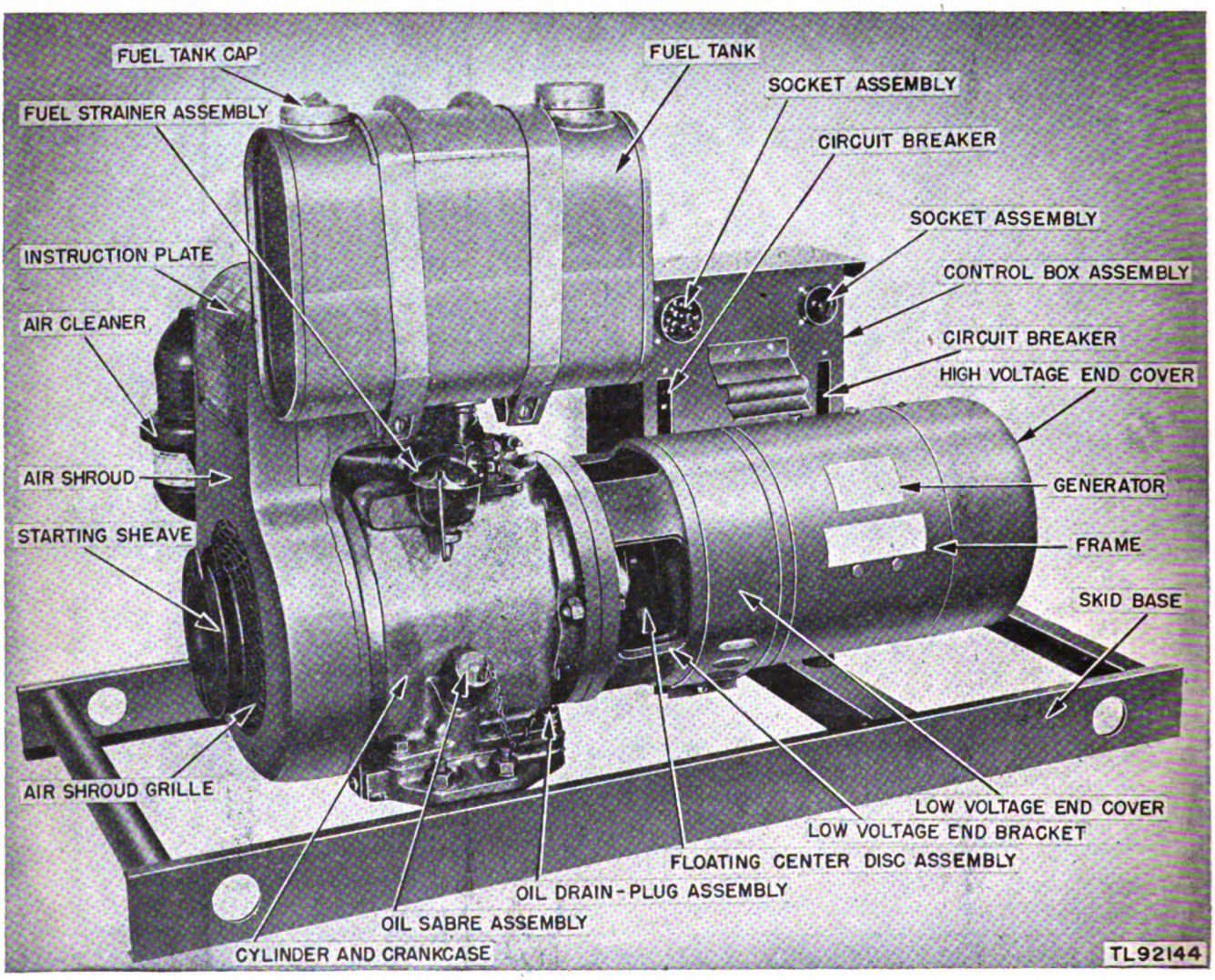


Figure 6. Power Unit PE–49–G ready for use—view from fuel-tank side.

e. MOTOR GENERATOR MG–37–A.

Component	Dimensions (in.)			Weight (lb.)
	Length	Width	Height	
Motor Generator MG–37–A, complete unit, including hood.	37	19⅝	27⅛	295
Control box.	9¼	7¾	12 13/16	16
Motor MO–37–A.	12 13/16	9¾	9⅞	94
Generator GN–39–F.	16¾	8	8¾	80
Hood (wood).	36	19⅝	25¼	50
Hood base (wood).	37	19⅝	3¼	12
Skid base (steel).	36	17	2½	25
Starting switch box.	4⅝	3⅝	7⅝	5
Spare parts and tools, in one bag.	....	....	....	5
Extension cable.	....	....	....	8

Note. Spare parts are for initial issue only and are not to be requisitioned as a kit or group as shown in the component column of the tables above.

6. Engine

a. Engine GE–9–C Briggs and Stratton, type B–300256, used with Power Unit PE–49–C, is a single-cylinder, 4-cycle, L-head, air-cooled unit with a 2⅝-inch bore and a 2⅝-inch stroke. It produces 2.7 horsepower, and operates at 2,650 rpm. It is controlled by an adjustable mechanical governor.

b. Engines GE–9–D and GE–9–F, used with Power Unit PE–49–(*), are both single-cylinder, 4-cycle, air-cooled units, Wisconsin model ABS. Engine GE–9–F has a gasoline gauge added and has a slight change in the spark plug shielding. Further reference to the engine of either or both units will be made to *the engine* when applicable to both engines. The engine has a 2½-inch bore, a 2¼-inch stroke, a 13.5-cubic inch piston displacement, and develops 3.5 horsepower at 2,700 rpm. Fuel is supplied from a 1-gallon fuel tank mounted on cast-iron brackets at one side of the cylinder head. The unit will operate for approximately 3 hours at full load on one filling of the fuel tank. The carburetor is of the float-feed, adjustable-jet type to which fuel is fed from the fuel tank through a conventional fuel strainer. Ignition is provided by a high-tension, radio-shielded magneto (fig. 10) with impulse coupling to facilitate starting at low cranking speeds. The engine is lubricated by a plunger-type oil pump and oil splasher. The engine speed is maintained at approximately 2,700 rpm by a centrifugal flyweight governor. A 12-volt storage battery may be connected to the wing terminals on the control box through suitable cables for electrical starting.

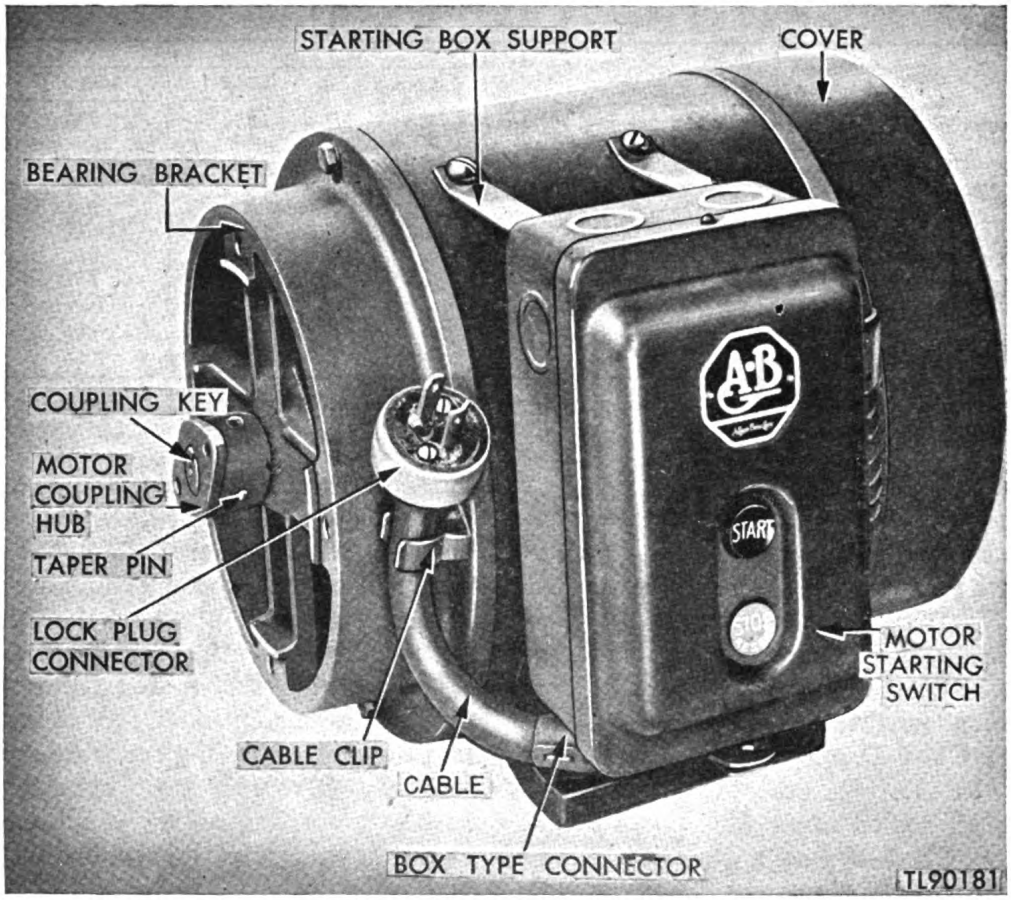


Figure 7. Motor MO–37–A and starter-switch box.

7. Motor MO–37–A

a. Motor MO–37–A (figs. 7 and 8) is the driving unit of Motor Generator MG–37–A. It is a 220-volt, a-c, single-phase, 50-cycle, repulsion-induction unit. The motor is dripproof and has high torque and quick-starting characteristics. Mounting flanges on the motor bearing-bracket are bolted to the union ring on the generator-bearing bracket with a rabbet fit. Two U bolts hold the motor rigidly to the skid base. The motor shaft is connected directly to and drives the generator shaft through a flexible coupling. A manually operated, push-button type, motor-starting switch (fig. 7) is mounted on the motor frame. A thermal overload relay is provided for motor protection.

b. The motor of Motor Generator MG–37–A is individually interchangeable with the gasoline engine of Power Unit PE–49–D, PE–49–F, or PE–49–G. This substitution should be made only when a suitable supply of alternating current is not available. Generator GN–39–F, supplied with the motor-generator set, is also interchangeable with the generator on Power Units PE–49–D, PE–49–F, or PE–49–G since the electrical output of all four units is the same. Procedures for interchanging the driving units and generators in these units are outlined in paragraph 23.

8. Generator

a. SIMILARITIES. Generators GN–39–C, GN–39–D, GN–39–F, and GN–39–G are dual-voltage, dripproof, semi-inclosed, d-c units, receiving power from their respective engines through a flexible coupling. The two separate windings of the armature, one for high voltage and one for low voltage, are connected to a high-voltage commutator and a low-voltage commutator, respectively, one at each end of the armature shaft. Each unit is permanently and accurately aligned with its engine by a union-ring flange, which is bolted to the engine crankcase flange with a rabbet fit. The generator is supported by a boss at one point on the angle-iron cross-member of the base. When battery power is applied, the generator serves as a starting motor for the engine.

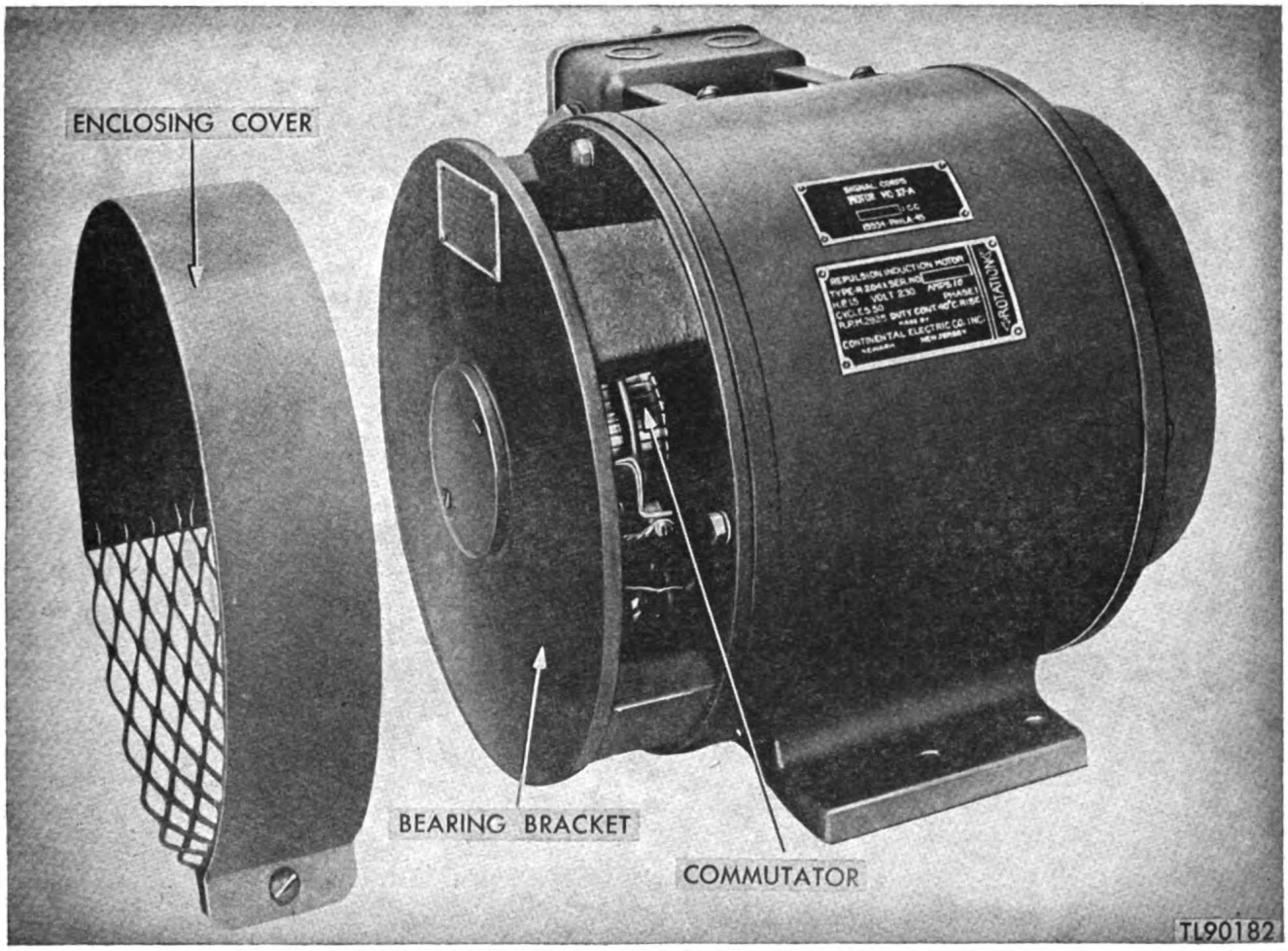


Figure 8. Motor MO–37–A with commutator-end inclosing cover removed.

b. DIFFERENCES. (1) Generators GN–39–C and GN–39–D are shunt-wound, require voltage regulators in their control boxes, and have high- and low-voltage fuses.

(2) Generators GN–39–F and GN–39–G are compound-wound, do not require voltage regulators, and have high- and low-voltage circuit breakers in place of fuses.

(3) Generator GN–39–G is cooled by a flow of air circulated around the armature and field windings by a fan on the end of the armature shaft. The fan is inclosed by a screened cap attached to the end bracket.

9. Control Box

a. GENERAL. The control box (figs. 9, 10, 11, and 12) is of sheet-metal construction and is attached to one side of the generator. The covers are readily removable permitting access to the control devices. Gaskets and a dripproof top make the box a weatherproof housing for the controls. The shape of the box, the position of controls, and the electrical components of the control circuits differ with the different models of the power unit.

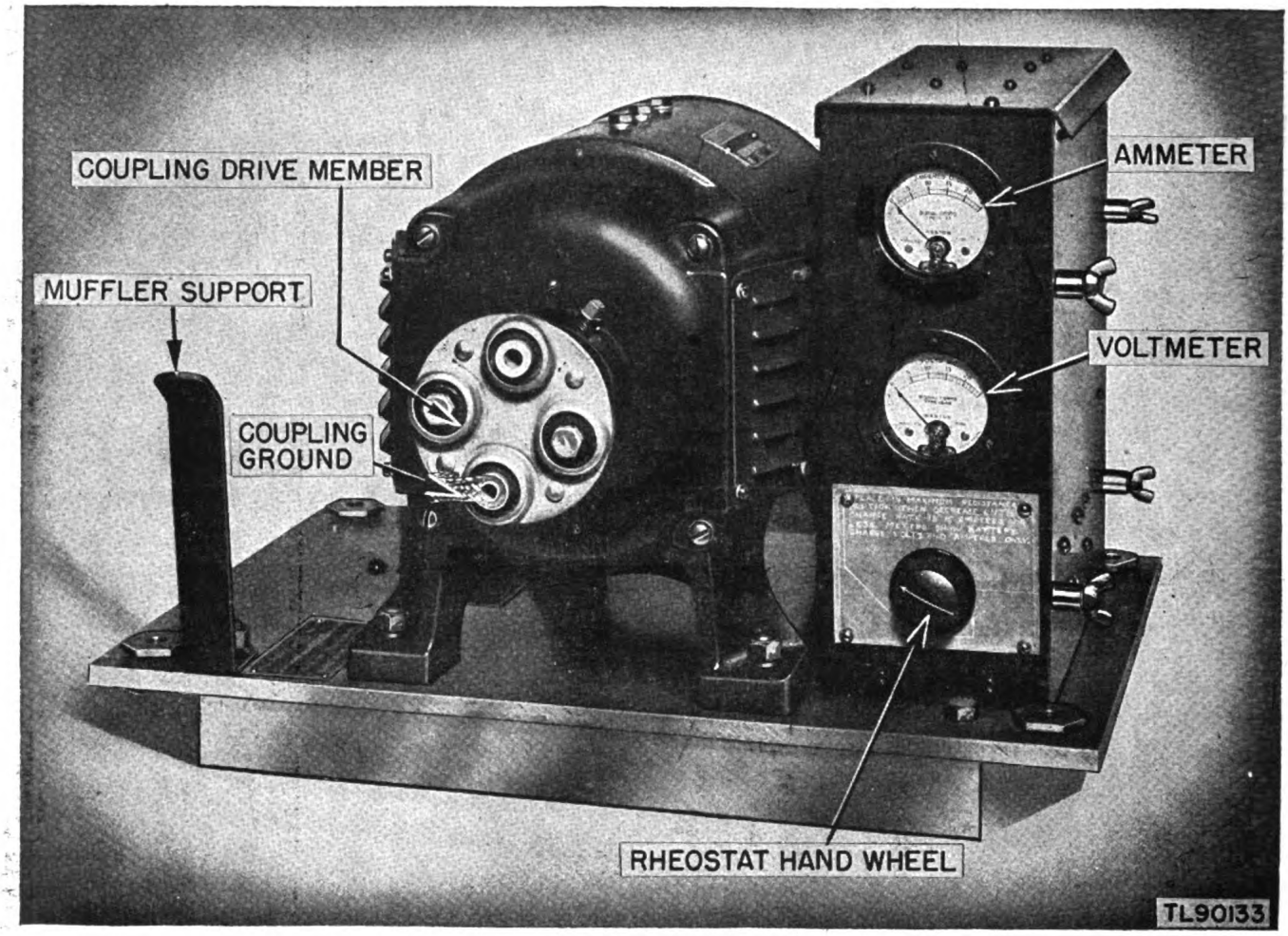


Figure 9. Generator GN–39–C and control box.

b. CONTROL BOX ON POWER UNIT PE–49–C (fig. 9). The control box on Power Unit PE–49–C has both top and front covers removable for access to interior parts. It contains the voltage regulator, a rheostat control knob, regulator resistor, reverse-current cut-out, switching relay, filters, capacitors, an ammeter, a voltmeter, fuses for both high- and low-voltage circuits, and a field switch. Two sockets for making connections to the radio transmitter with cords are supplied with the power unit. Two ¼-inch brass studs for battery-charging leads are brought out at one end of the control box. Gaskets on the control-box covers prevent dust or rain from entering the box. The ammeter and voltmeter are also protected from bad weather by extra glass covers mounted on the outside of the panel.

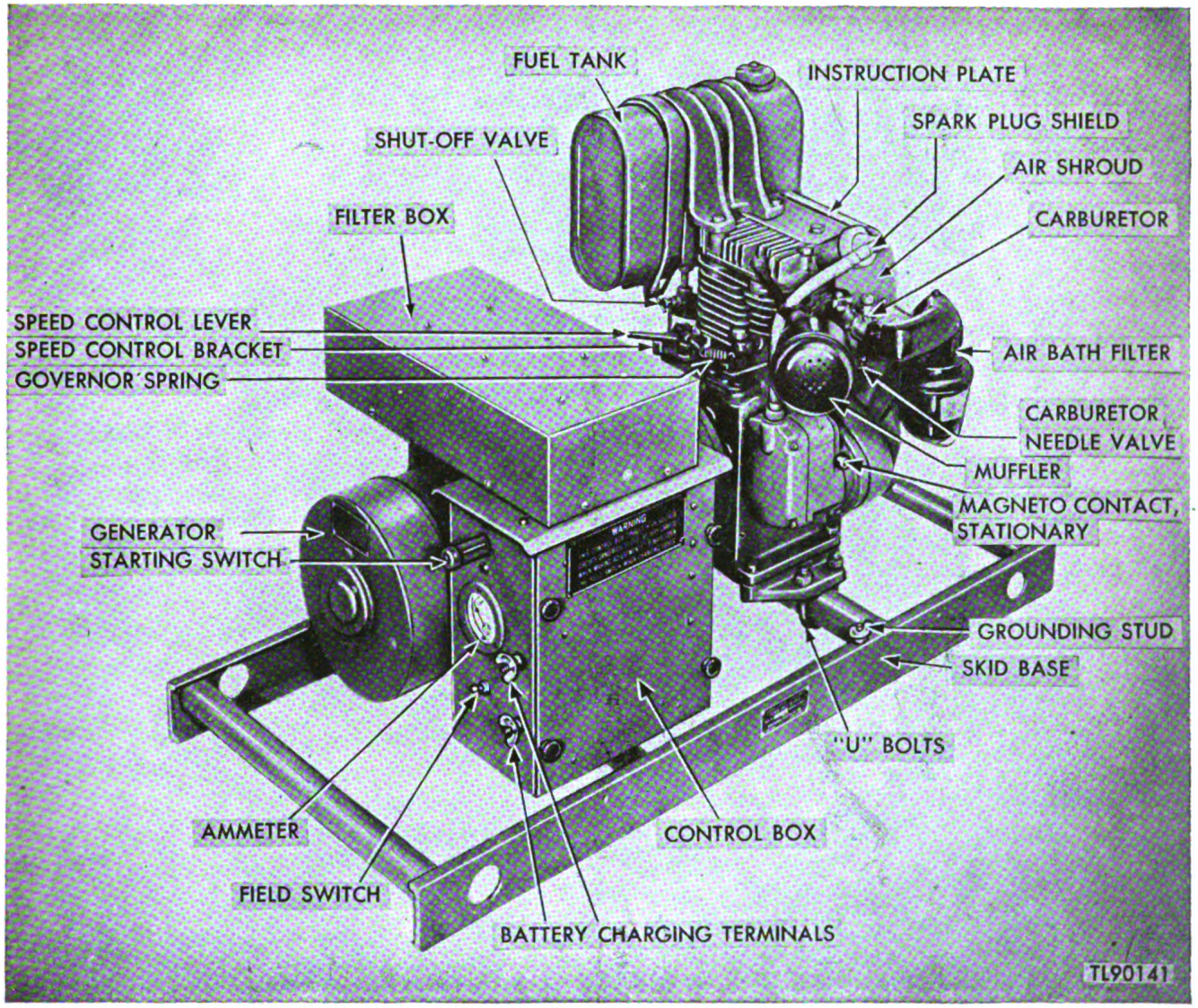


Figure 10. Power Unit PE–49–D from control box side.

c. CONTROL BOX ON POWER UNIT PE–49–D (fig. 10). A starting switch, ammeter, field switch, and two battery-charging binding posts are located on the outside at one end of the box. A label showing the complete circuits of the controls, the filter, and the generator is located inside the front cover. Spare fuses are also carried inside this cover. The control equipment includes a voltage regulator, reverse-current battery cut-out, a switching relay, resistors, capacitors, and fuses. The filter connections are brought through the top of the box and the generator leads through the back of the box.

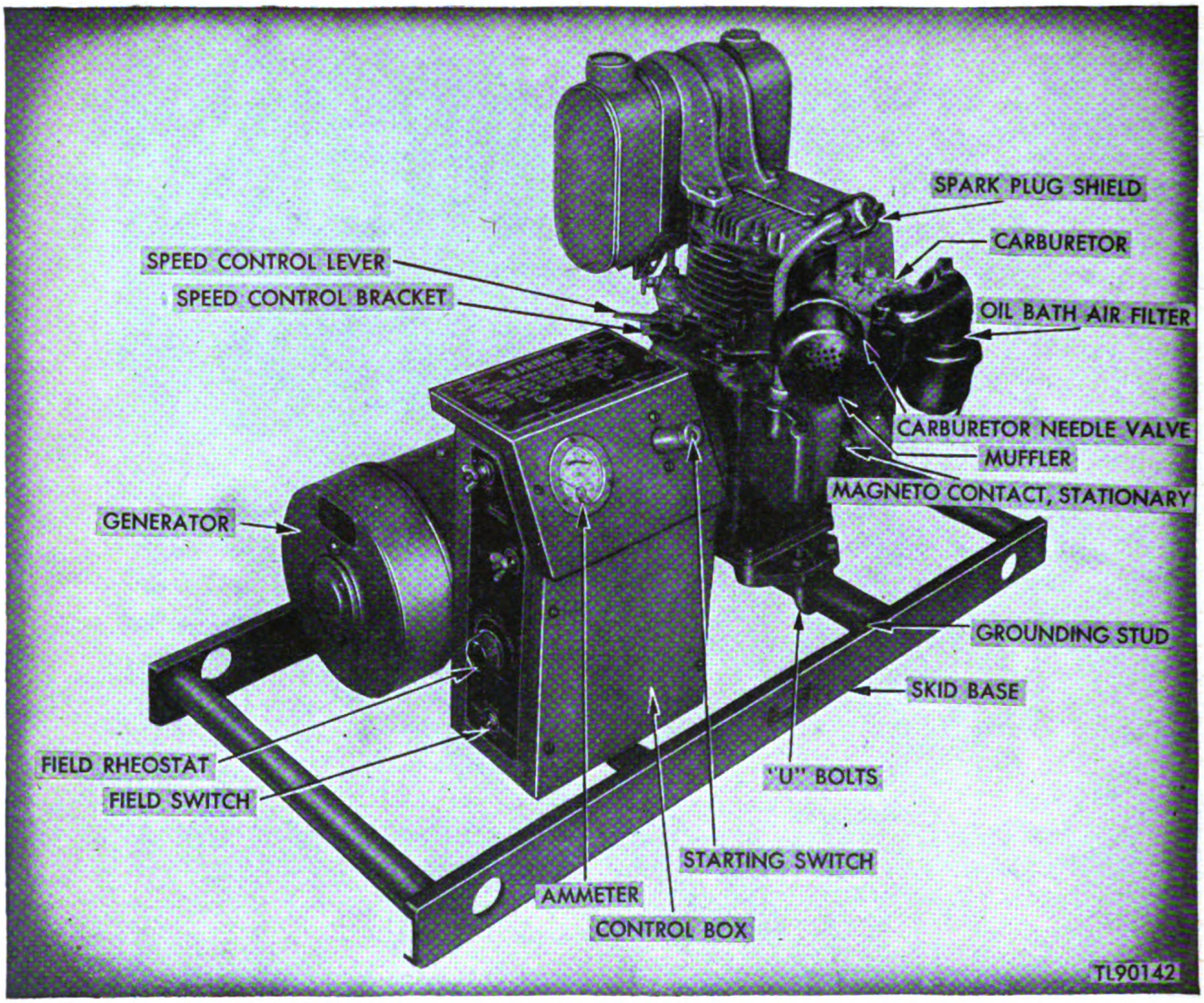


Figure 11. Power Unit PE–49–F from control box side.

d. CONTROL BOX ON POWER UNIT PE–49–F (fig. 11). The starting switch and ammeter are located at the top of the box. The field switch, two battery-charging binding posts, and a field rheostat are mounted on the outside at one end. A complete circuit label is mounted on the inside of the front cover. The control box includes the filter unit, a reverse-current battery cut-out, a switching relay, high- and low-voltage circuit breakers, resistors, and capacitors. The generator leads are brought in through the back of the box.

e. CONTROL BOX ON MOTOR GENERATOR MG–37–A. The control box on Motor Generator MG–37–A is identical with that used on Power Unit PE–49–F.

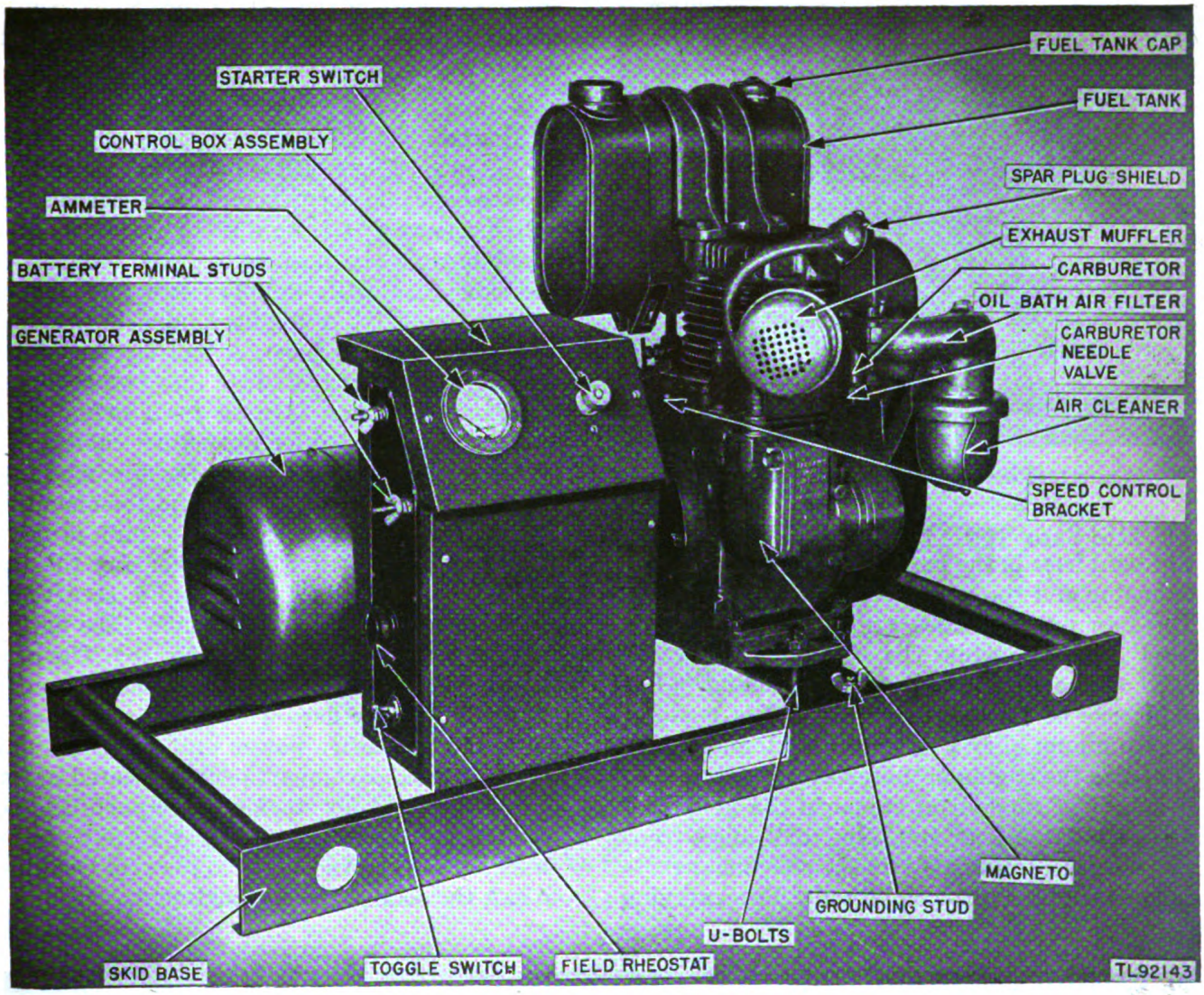


Figure 12. Power Unit PE–49–G from control box side.

f. CONTROL BOX ON POWER UNIT PE–49–G (fig. 12). The control box on Power Unit PE–49–G is similar to that on Power Unit PE–49–F with the exception of an added resistor which is in parallel with the field switch. (See fig. 59.)

10. Filters

a. FILTER FL–9. Filter FL–9, used on Power Unit PE–49–C, is contained in a separate metal box, which is placed near the control box during operation. (See fig. 3.) Provision is made for connecting the filter to the control box of the power unit. The output cables to the radio set connect to plugs on the front of Filter FL–9.

b. FILTER BOX. The filter for Power Unit PE–49–D, consisting mainly of choke coils and capacitors, is mounted in a separate weatherproof sheet-brass box with a removable cover. Two sockets are located on the under side at one end of the box. The transmitter is connected to the power unit at these points through cords. (See fig. 13.) No filter box is used on Power Units PE–49–F, PE-49-G, or on Motor Generator MG–37–A. The filter system is contained in the control boxes of these power sets.

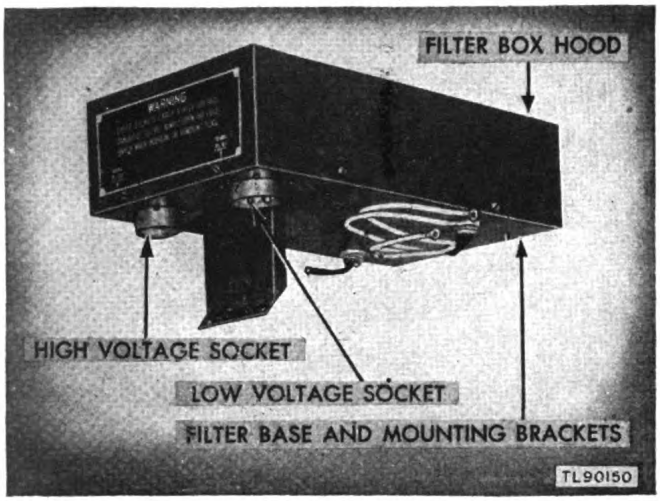


Figure 13. Filter box for Power Unit PE–49–D.

11. Skid Base (fig. 14)

The skid base is the main support of the engine or motor and the generator in each power set. The two parallel sides are made of standard steel channels, while the carrying handles at each end are of seamless steel tubing. (The skid base of Power Unit PE–49–C is made of an aluminum alloy.) A length of standard pipe supports the engine or motor at two points, and a length of angle-iron supports the generator at one point. All tubing, pipe, and angle-irons are welded continuously to the side channels to form a rigid, light-weight unit. For carrying the power unit in the field, 1-inch pipes can be inserted in the four holes in the sides of the skid base.

12. Hood

a. POWER UNIT PE–49–C. An aluminum-alloy removable hood completely incloses the unit, protecting it from dust or water when it is not in use. The hood is fastened securely to the skid base with thumbscrews and can be removed quickly. A lifting handle is provided at each end of the hood. A tool box is located inside the hood. It is divided into two sections: the smaller section is used for storing tools, spare parts, and interconnecting cables; the larger section provides space for storing Filter FL–9 and is equipped with a stud for mounting the air cleaner when the power unit is being stored or transported. The cover for the tool box is fastened with a chain and is secured by three thumbscrews in the bottom. (See fig. 3.)

b. POWER UNIT PE–49–D (fig. 15). The hood is constructed of stainless steel sheets, and is spot-welded together. The hood serves as a cover for the entire power unit when the unit is not in use. A compartment is located at one end of the hood for storing spare parts and accessory equipment. Thumbscrews are provided to fasten the hood securely to the skid base, and to lock the door of the compartment.

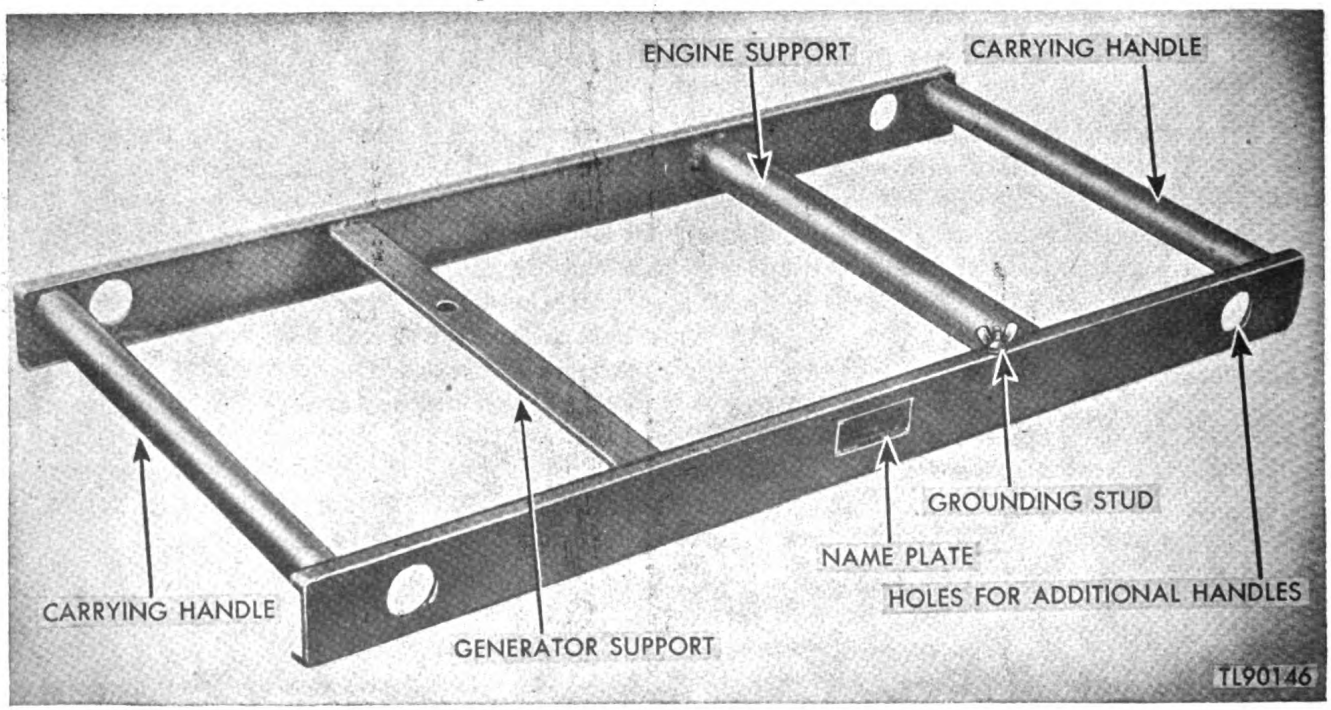


Figure 14. Skid base for Power Unit PE–49–(*).

Figure 15. Metal hood for Power Unit PE–49–D.

c. POWER UNIT PE–49–F, PE–49–G, OR MOTOR GENERATOR MG–37–A (fig. 16). This hood is made entirely of wood and is fastened together with resin-coated nails. It provides protection for the power unit during transportation and when the unit is not in use. Two drawbolts attached to each end of the hood can be hooked under the skid base carrying handles to hold the hood securely in place over the unit. A storage compartment (fig. 17) for spare parts and accessory equipment is built into one end of the hood. This compartment is reached by removing the hood and setting it up on end. The hood is equipped with two handles on each end for easy removal.

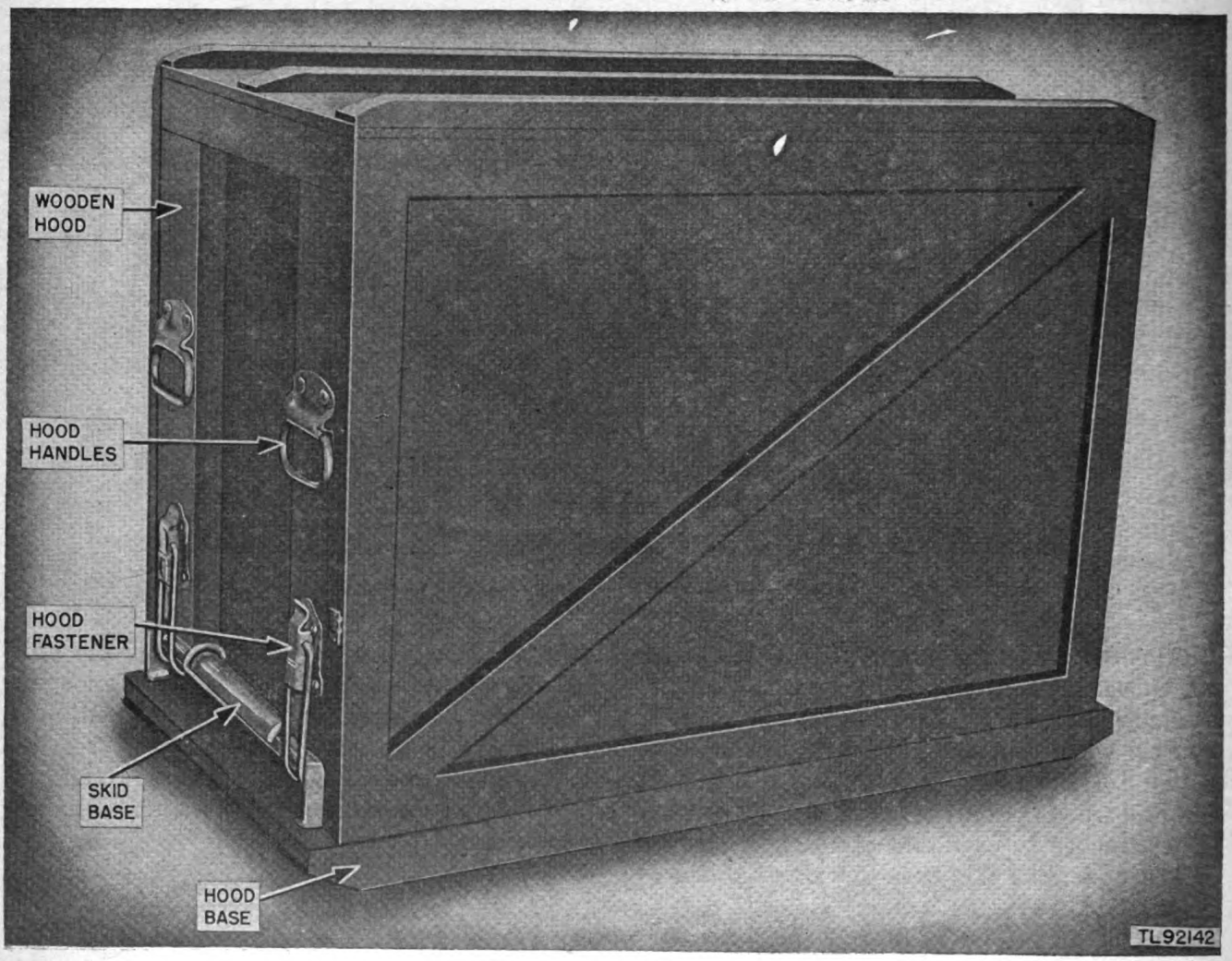


Figure 16. Wooden hood.

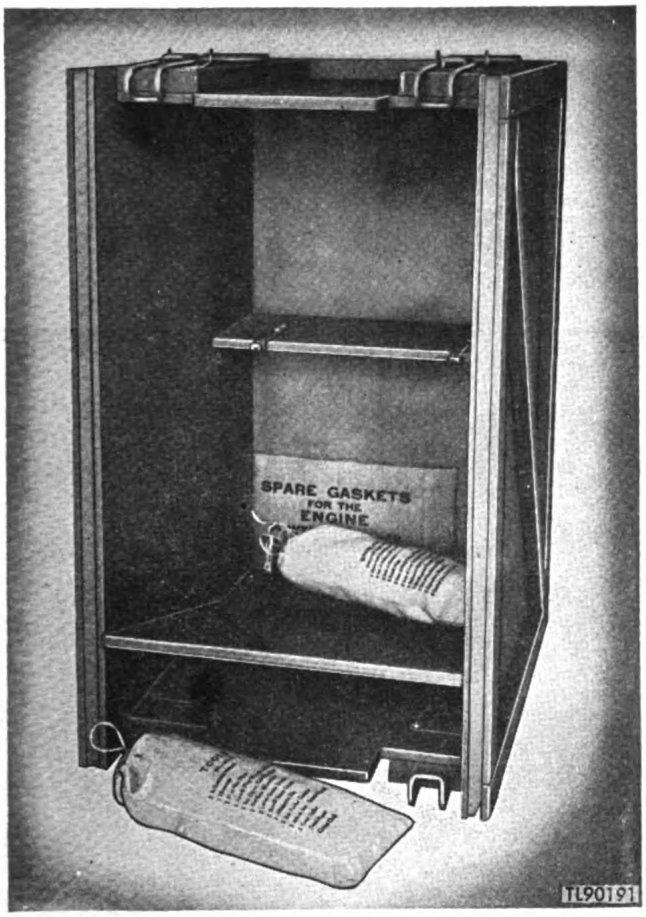


Figure 17. Interior of wooden hood.

d. HOOD BASE. The removable hood base (fig. 16) on Power Unit PE–49–F and PE–49–G and Motor Generator MG–37–A provides a support for the entire unit and hood during transportation, and permits skidding the power set over rough terrain in the field. It is constructed of wood and is held together by resin-coated clinch nails. Four J-bolts hold skid mounting to the hood base.

13. Crate

A wooden crate, consisting of a top and base, protects Power Unit PE-49–C or PE–49–D during extended transportation. It is fastened together securely with screws and bolts. (See fig. 18.) The top is bolted to the base with four drawbolts. The top can be lifted from the base with the handles provided at each end. Four J-bolts hold the skid base to the crate base. The skid base can be removed easily from the crate base by loosening the J-bolts.

14. Tools

a. GENERAL. A set of hand tools is furnished for the maintenance and adjustment of *each* power set. These tools are inclosed in a fabric toolbag and should be kept in the storage compartment of the hood when not in use.

b. TOOLS FOR POWER UNIT PE–49(*) (figs. 19 and 20). A cloth toolbag (fig. 20(900)) with a list of contents printed on the bag, contains the following tool equipment:

Ref. No.	*Tool*
901	1 adjustable wrench
902	1 hammer
904	1 spark-plug wrench and handle
903	1 pair of pliers
905	1 set of wrenches
906, 907	3 screw drivers
908	1 magneto file
909	1 set of feeler gauges
910, 915	1 Allen setscrew wrench (2 for Power Unit PE–49–G)
911	1 gear puller
912	Sandpaper
913	Crocus cloth

c. TOOLS FOR MOTOR GENERATOR MG–37–A (fig. 23). A cloth bag contains the following tool equipment:

1 adjustable wrench
1 hammer
3 screw drivers
1 set of open-end wrenches
1 set of double-end box wrenches
1 setscrew wrench
1 pair of pliers
1 gear puller
Sandpaper
Crocus cloth

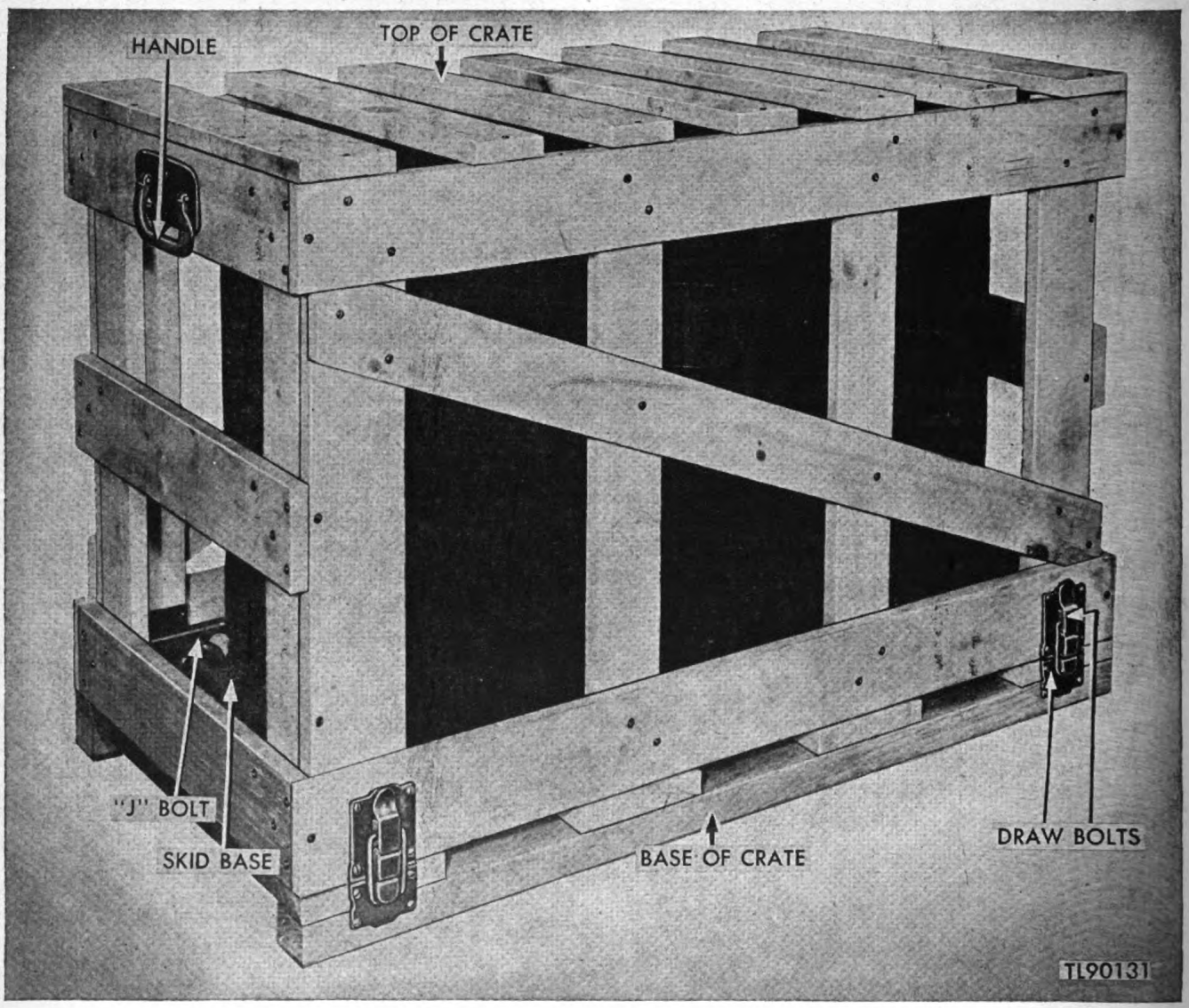


Figure 18. Power Unit PE–49–C or PE–49–D—crated, ready for transportation.

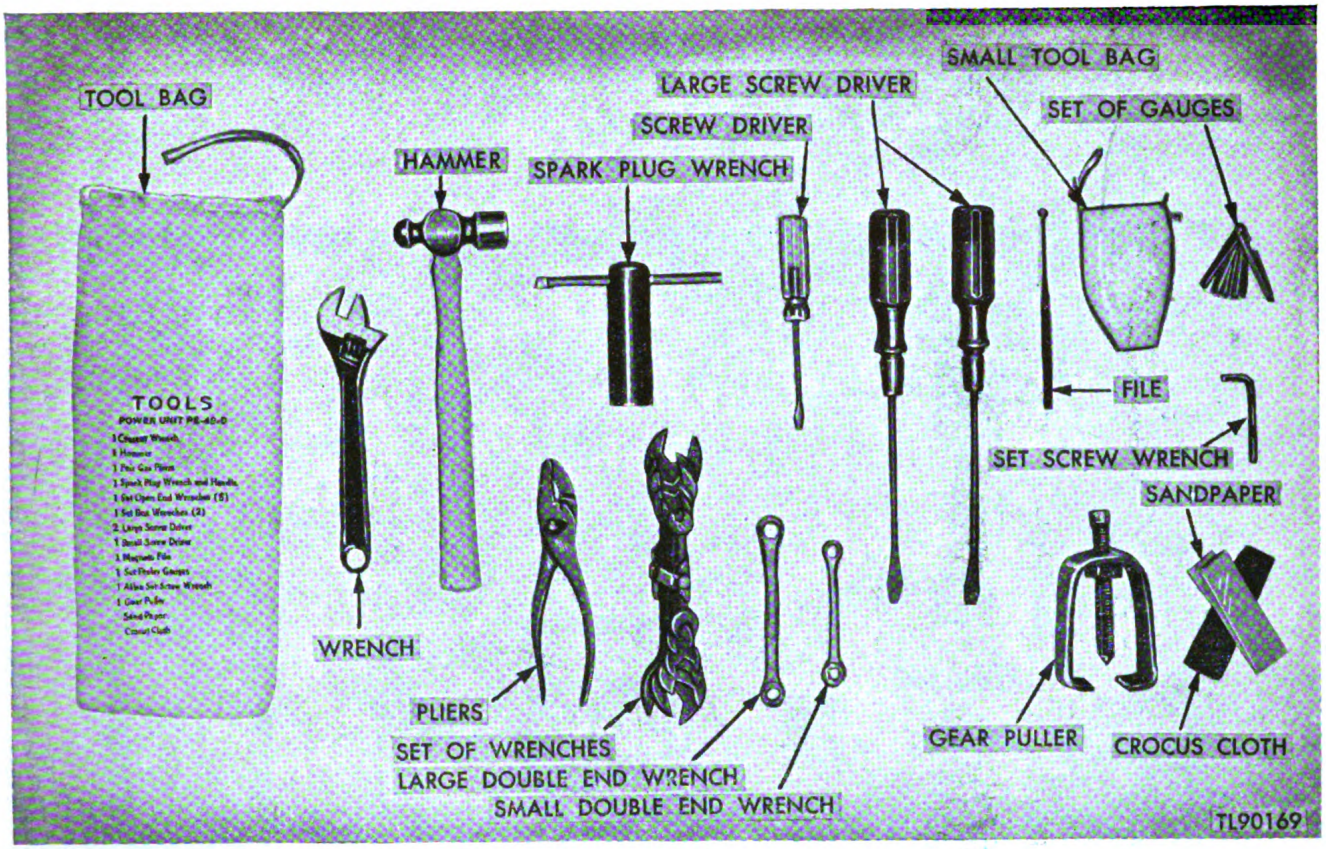


Figure 19. Tools for Power Unit PE–49–D or PE–49–F.

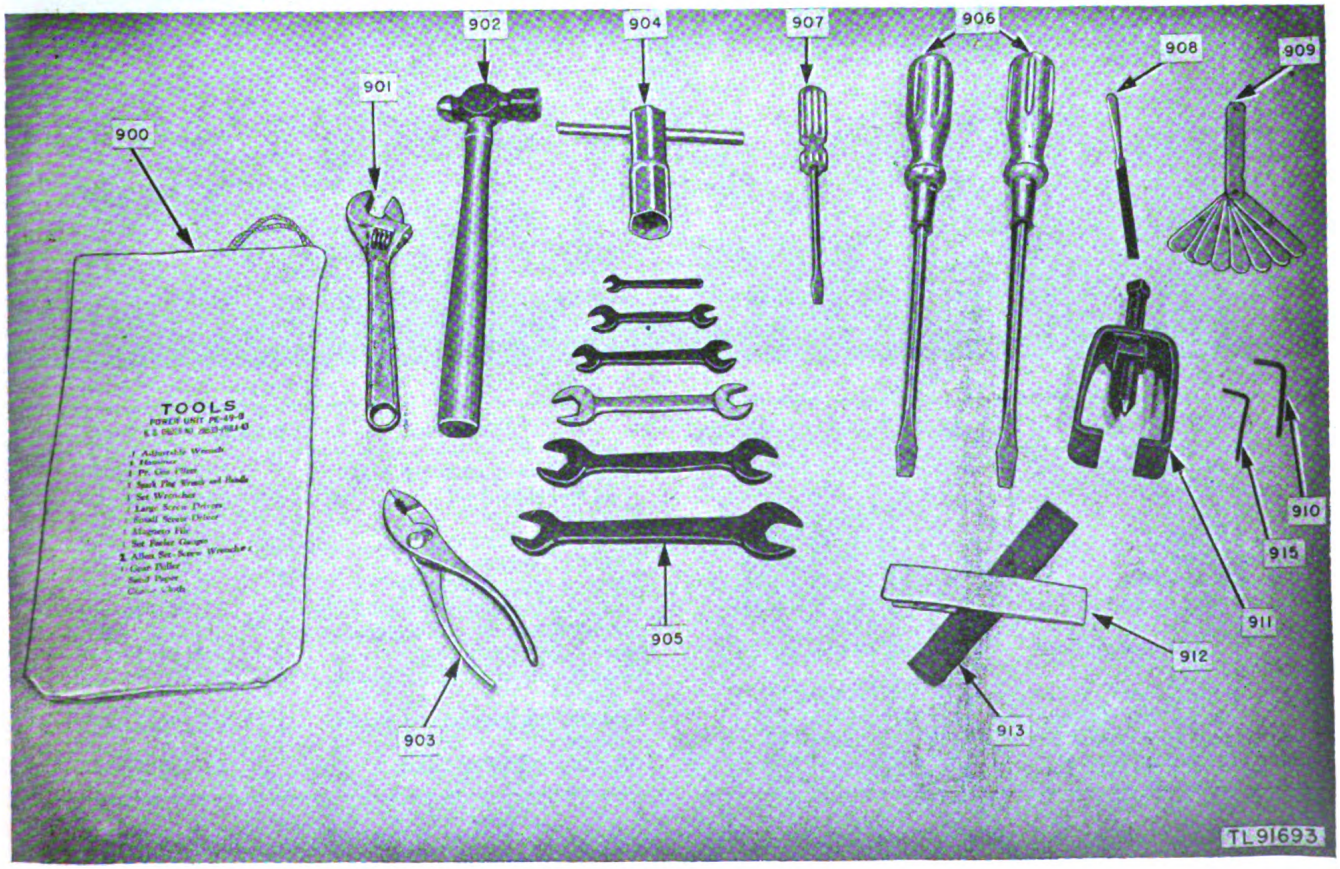
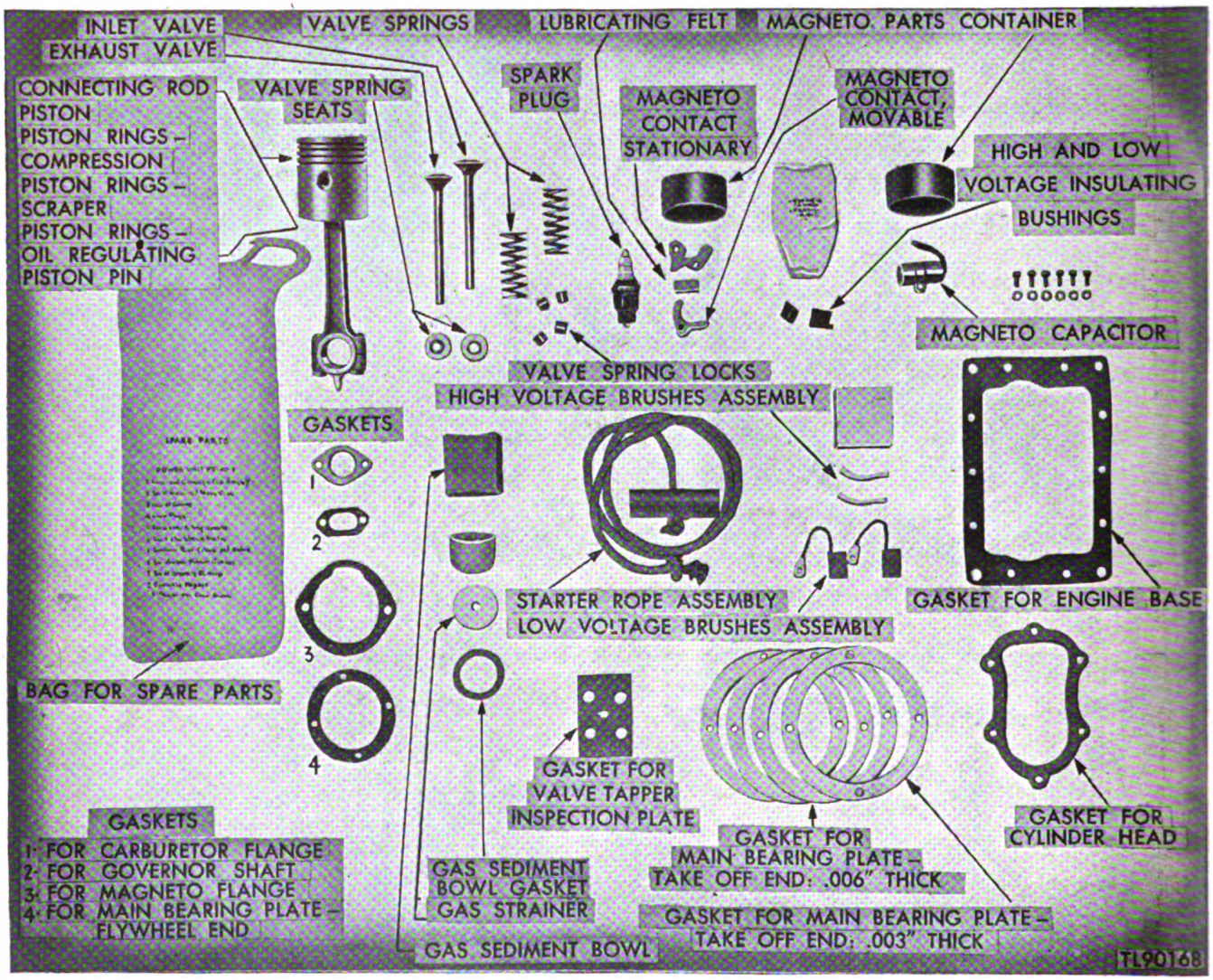


Figure 20. Tools for Power Unit PE–49–G.

15. Spare Parts

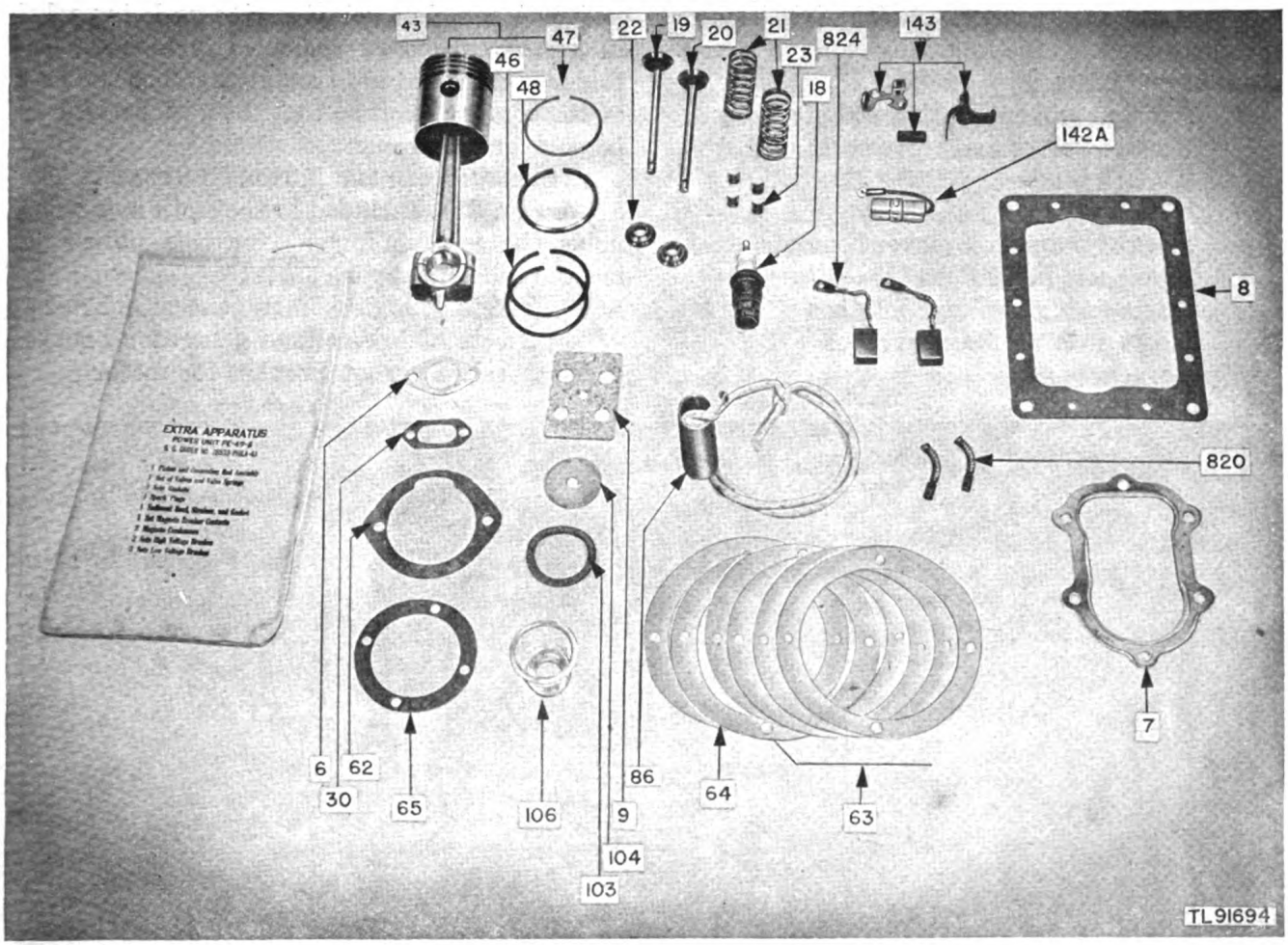
Spare parts for the engine or motor and generator are included with *each* equipment. They comprise replacements that are ordinarily needed in field service. These parts are kept in the storage compartment of the hood with the tools.



Spare part	*Signal Corps stock No.*
Piston and connecting rod assembly	3H1909F/R2
Exhaust valve	3H1909D/V1
Exhaust valve	3H1909D/V2
Valve springs	3H1909D/S106
Valve-spring seats	3H1909D/S108
Valve-spring locks	3H1909D/L109
Spark plug	3H4410–6
Magneto breaker-arm and points	3H4600–108/A1
Magneto capacitor	3H1909D/C3
Gasket, carburetor-flange	3H1909D/G5
Gasket, governor-shaft	3H1909D/G9
Gasket, magneto-flange	3H1909D/G200

Spare part	*Signal Corps stock No.*
Gasket, main-bearing plate, flywheel end	3H1909D/G6
Fuel-filter bowl	3H1909A/L14
Fuel-filter screen	3H1909A/L23
Gasket, filter-bowl	3H1909A/L21
Starter rope assembly	3H1909D/R4
High-voltage brush assembly	3H2339B/B7
Low-voltage brush assembly	3H2339C/B57
Gasket, engine-base	3H1909D/G1
Gasket, main-bearing plate, 0.006"	3H1909D/G3
Gasket, main-bearing plate, 0.003"	3H1909D/G2
Gasket, cylinder-head	3H1909D/G4

Figure 21. Spare parts for Power Unit PE–49–D or PE–49–F.



Ref No.	Spare part	Signal Corps stock No.
6	Gasket, carburetor-flange	3H1909D/G5
7	Gasket, cylinder-head	3H1909D/G4
8	Gasket, engine-base	3H1909D/G1
18	Spark plug	3H4410–6
19	Exhaust valve	3H1909D/V1
20	Intake valve	3H1909D/V2
21	Valve springs	3H1909D/S106
22	Valve-spring seat	3H1909D/S108
23	Valve-spring lock	3H1909D/L109
30	Gasket, governor-shaft	3H1909D/G9
43	Piston and connecting rod assembly	3H1909F/R2
46	Compression ring	3H1909F/R189
47	Scraper ring	3H1909D/R124
48	Oil ring	3H1909D/R1
62	Gasket, magneto-flange	3H1909D/G200

Ref No.	Spare part	Signal Corps stock No.
63	Gasket, main-bearing plate, 0.006″	3H1909D/G3
64	Gasket, main-bearing plate, 0.003″	3H1909D/G2
65	Gasket, main-bearing plate, fly-wheel end	3H1909D/G6
86	Starter rope assembly	3H1909D/R4
103	Gasket, filter-bowl	3H1909A/L21
104	Fuel-filter screen	3H1909A/L23
106	Fuel-filter bowl	3H1909A/L14
142A	Magneto capacitor	3H1909D/C3
143	Magneto breaker-arm and points	3H4600–108/A1
820	High-voltage brush and spring assembly	3H2339G/B5
824	Low-voltage brush assembly	3H2339F/B10

Figure 22. Spare parts for Power Unit PE–49–G.

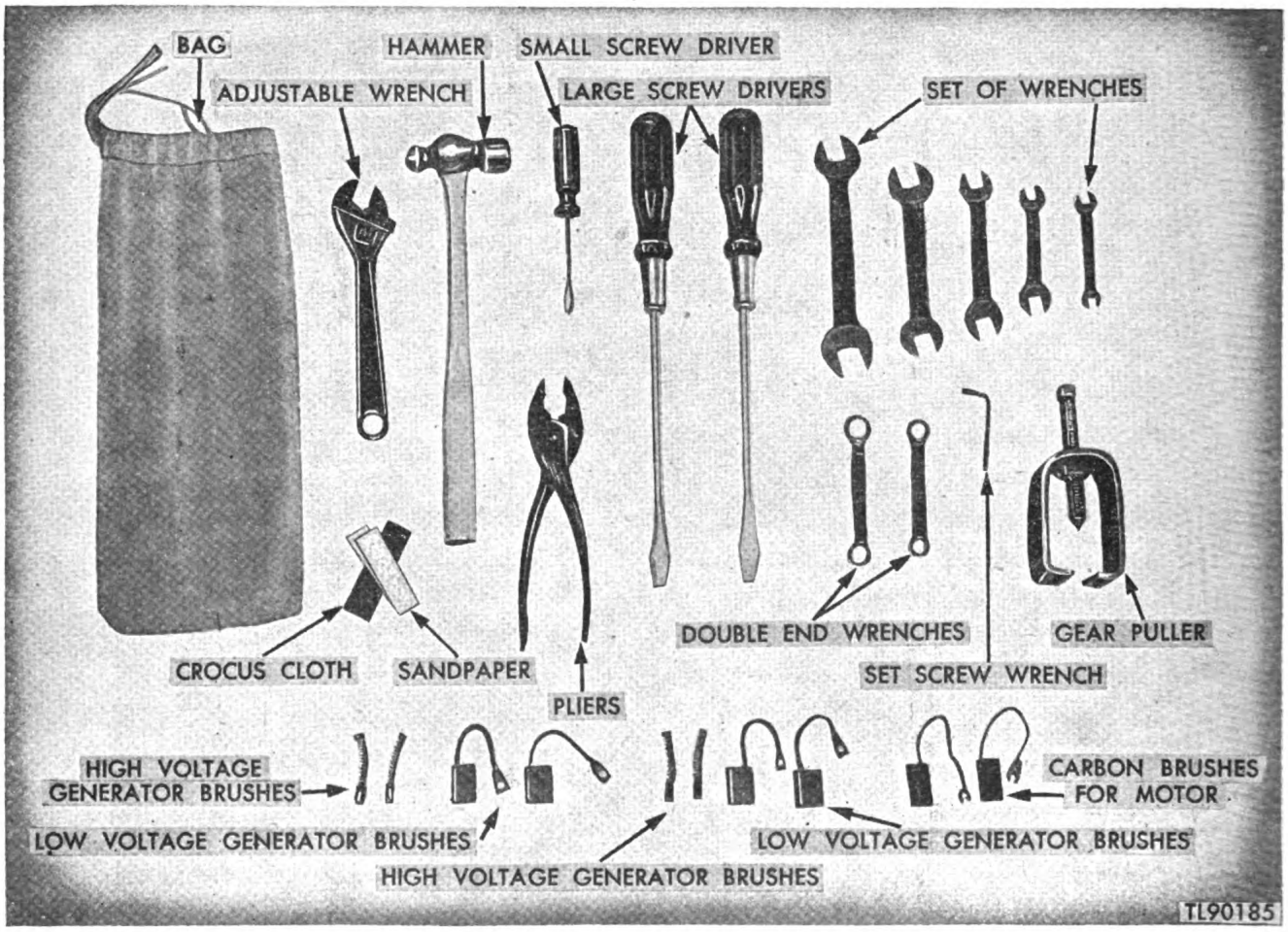
a. SPARE PARTS FOR PE–49–(*). (1) A spare parts bag contains the following running spares (figs. 21 and 22):

1 piston and connecting rod assembly
1 set of valves and valve springs
4 spark plugs
1 fuel-filter bowl assembly
1 set of magneto breaker contacts
2 magneto capacitors
2 sets of high-voltage brushes
2 sets of low-voltage brushes
3 washers

(2) A complete set of engine gaskets packed in a stiff cardboard folder is furnished. This folder is designed to fit snugly against the back of the compartment so that the gaskets will not be damaged in transit.

b. SPARE PARTS FOR MOTOR GENERATOR MG–37–A (fig. 23). Included in the cloth bag which holds the tool equipment for this power set are the following spare parts:

2 sets of high voltage generator brushes
2 sets of low-voltage generator brushes
1 set of carbon brushes for motor



Spare part	*Signal Corps stock No.*
High-voltage generator brushes	3H2339D/B43
Low-voltage generator brushes	3H2239D/B57
Carbon motor brushes	3H3437A/B10

Figure 23. Spare parts and tools for Motor Generator MG–37–A.

16. Differences in Models

Five models of this power equipment have been produced. They are Power Units PE–49–C, PE–49–D, PE–49–F, PE–49–G, and Motor Generator MG–37–A. The performance characteristics of all models are identical. Differences in weight, dimensions, design, materials, and components are noted in preceding paragraphs 4 through 15. Nomenclature of the major components of the different models is given in paragraph 2.

Section II. APPLICATION OF POWER SETS

17. Use With Radio Transmitters

a. GENERAL. Power Unit PE–49–C, Power Unit PE–49–(*), and Motor Generator MG–37–A are power sets designed to furnish high-voltage and low-voltage d-c power for field radio transmitters. These power sets furnish a high-voltage output of 0.350 amperes at 1,000 volts for the high-voltage requirements of the transmitter and a low-voltage output of 15 amperes at 14.6 volts for the transmitter filaments.

b. REFERENCES. For information concerning the transmitters and radio sets that are used with these power sets, consult the manuals for the radio sets: TM 11–232, Radio Set SCR–177–B; TM 11–233, Radio Set SCR–188–A; and TM 11–800, Radio Transmitters BC–191–A, BC–191–B, BC–191–C, BC–191–D, BC–191–E, BC–191–F, BC–191–G, and BC–AA–191.

18. Battery Charging

These power sets are designed to provide battery-charging facilities for 12-volt batteries. The equipment furnishes a 10-ampere charging current at 14.6 volts and operates by the constant potential method. Battery charging may be accomplished either with or without a high-voltage load simultaneously attached.

19. Other Uses

Any other application with similar d-c power requirements may be served by Power Unit PE–49–C, Power Unit PE–49–(*), or Motor Generator MG–37–A.

Note. Power Unit PE–49–C is limited standard and is used only in continental United States. Since its application and operation are similar to that of Power Unit PE–49–D, and since it is being replaced in the field by Power Unit PE–49–D or later models when maintenance or repair is required, no further discussion of Power Unit PE–49–C is included in this manual.

Section III. INSTALLATION AND ASSEMBLY

20. Uncrating and Unpacking (fig. 24)

a. GENERAL. Power Unit PE–49–(*) and Motor Generator MG–37–A are packed in export shipping cases of wood with steel straps bound around the case. The weights of these power sets, packed for export shipment, are as follows: Power Unit PE–49–D, 455 pounds; Power Unit PE–49–F, 495 pounds; Power Unit PE–49–G, 520 pounds; and Motor Generator MG–37–A, 490 pounds. These over-all weights include the weights of the sets with inclosing hoods, plus ten 5-pound bags of silica gel placed around each of the units and in the tool compartment of the hoods, in addition to the weight of the export packing material and the export packing cases.

b. PROCEDURE. The following steps give the uncrating and unpacking process in detail:

(1) Remove the steel straps from the shipping case. Remove the nails from the four sides of the bottom of the wood base for the shipping case.

(2) Lift the wood case up and clear of the unit to be unpacked, and set the case aside in a dry place.

(3) Remove the first covering of asphaltum-impregnated waterproof paper, separating the paper along the taped seams.

(4) Remove the second covering of the metallic vaporproof barrier, separating this barrier along the taped seams.

(5) Lift the top of the corrugated cardboard wrapping up and clear of the unit, and set this cardboard top aside.

(6) Open the bottom part of the corrugated cardboard wrapping along the taped seams, and let the panels of the cardboard lay flat around the hood base.

Note. When unpacking Power Unit PE–49–D, remove the wooden crate (fig. 18) by unfastening the four drawbolts, lifting the top of the crate from the unit, and setting it to one side. The skid base can be removed from the crate base by loosening the four J-bolts. (See fig. 18.) Preserve the wooden crate for future use if the power unit is to be transported for a great distance.

(7) Remove the hood. Turn the hood upside down, lift up the compartment cover, and remove the two 5-pound bags of silica gel. Check the contents of the tool compartment according to the procedure outlined in paragraph 21.

(8) After removing the nuts from the carriage bolts that mount the hood base to the base of the export shipping case, remove the four carriage bolts. Slide the unit off of the export wood base.

(9) Remove the eight 5-pound bags of silica gel packed around the engine or motor and the generator.

(10) Remove the cork plug from inside the air-cleaner intake pipe. First, loosen the nut on the air intake cleaner bracket, then loosen the screw on the air-cleaner pipe. (See fig. 32.) Remove air cleaner and extract the cork plug from the intake pipe.

(11) Remove the cork plug from the muffler pipe, by unscrewing muffler and extracting the cork.

Note. Omit steps (10) and (11) when unpacking Motor Generator MG–37–A. This unit has no air cleaner or muffler.

21. Equipment Checks

Before taking the power set into the field, check the contents of the storage compartment of the hood. The compartment should contain the items indicated below for each equipment.

a. POWER UNIT PE–49–(*). (1) Tool bag and tools. (See figs. 19 and 20.) See paragraph 14*b* for a complete list of tool equipment provided with the equipment.

(2) Spare parts bag with running spares. (See figs. 21 and 22.) See paragraph 15*a* for complete listing of running spares.

(3) A complete set of engine gaskets packed in a stiff cardboard folder. (See fig. 17.) This folder is designed to fit snugly against the back of the compartment so that the gaskets will not be damaged in transit.

(4) Starter-rope assembly.

b. MOTOR GENERATOR MG–37–A. (1) Bag containing tools and spare parts. (See fig. 23.) A complete list of tool equipment provided with the motor generator is given in paragraph 14*c*. A running-spares list is given in paragraph 15*b*.

(2) A 50-foot extension cable with plug and receptacle, for connection to a commercial power source.

22. Installation

a. GENERAL. (1) Choose a location for the power set that will be consistent with the assignment to be carried out, and with the length of the power cables that connect to the radio set. The power set will operate in any suitable location.

(2) Always remove the hood when the power set is to be operated.

(3) Connect the grounding stud to a good ground.

b. OUTDOORS. If Power Unit PE–49–(*) is to be located outdoors, proceed as follows:

(1) Select a reasonably level spot.

(2) A location on grass or soft ground that will absorb the vibrations from the engine is preferred to one on hard ground or concrete.

(3) Avoid low spots which may be flooded with water from a sudden rainstorm.

Caution: Provide sufficient ventilation for the power unit. All engine exhaust gases contain carbon monoxide, an odorless, poisonous gas.

c. INDOORS. If Power Unit PE–49–(*) is located indoors, proceed as follows:

(1) Place a mattress or blanket under the skid base to absorb the vibrations from the engine. No harm will result if the power unit operates on a hard surface, but vibration will cause the unit to "walk away."

(2) If the power unit is to be operated within a building, adequate ventilation should be provided to carry off escaping exhaust fumes and to supply an ample amount of oxygen. Place the unit so that the exhaust pipe may be extended to the outside of the building with the least possible bending in the exhaust line. Make certain that all exhaust connections are gastight. Protect the outdoor end of the exhaust pipe agains the entrance of rain or moisture. Provide not less than 2 feet of space on all sides of the unit. Observe these instructions also when the unit is installed in a trailer or other vehicle. The unit may be operated with the hood base either removed or in place, as occasion requires.

d. INSTALLATION OF MOTOR GENERATOR MG–37–A. (1) Select a reasonably level spot as convenient as possible to a suitable power source. If an outside location is chosen, avoid low spots which may be flooded with water from a sudden rainstorm.

(2) Press the STOP button on the motor-starting switch to make sure the switch is in the open position.

(3) Be sure that 220-volt, 50-cycle, single-phase, a-c power is available before attempting to operate the motor.

(4) Connect the motor-generator set to the power supply by means of the extension cable. The receptacle of a twist-lock connector which locks onto the plug at the end of the cable extending from the starter switch box is on one end of this cable. Insert the plug on the other end of the extension cable into an outlet at the power supply.

23. Interchanging Driving Unit

If it is necessary to replace Motor MO–37–A

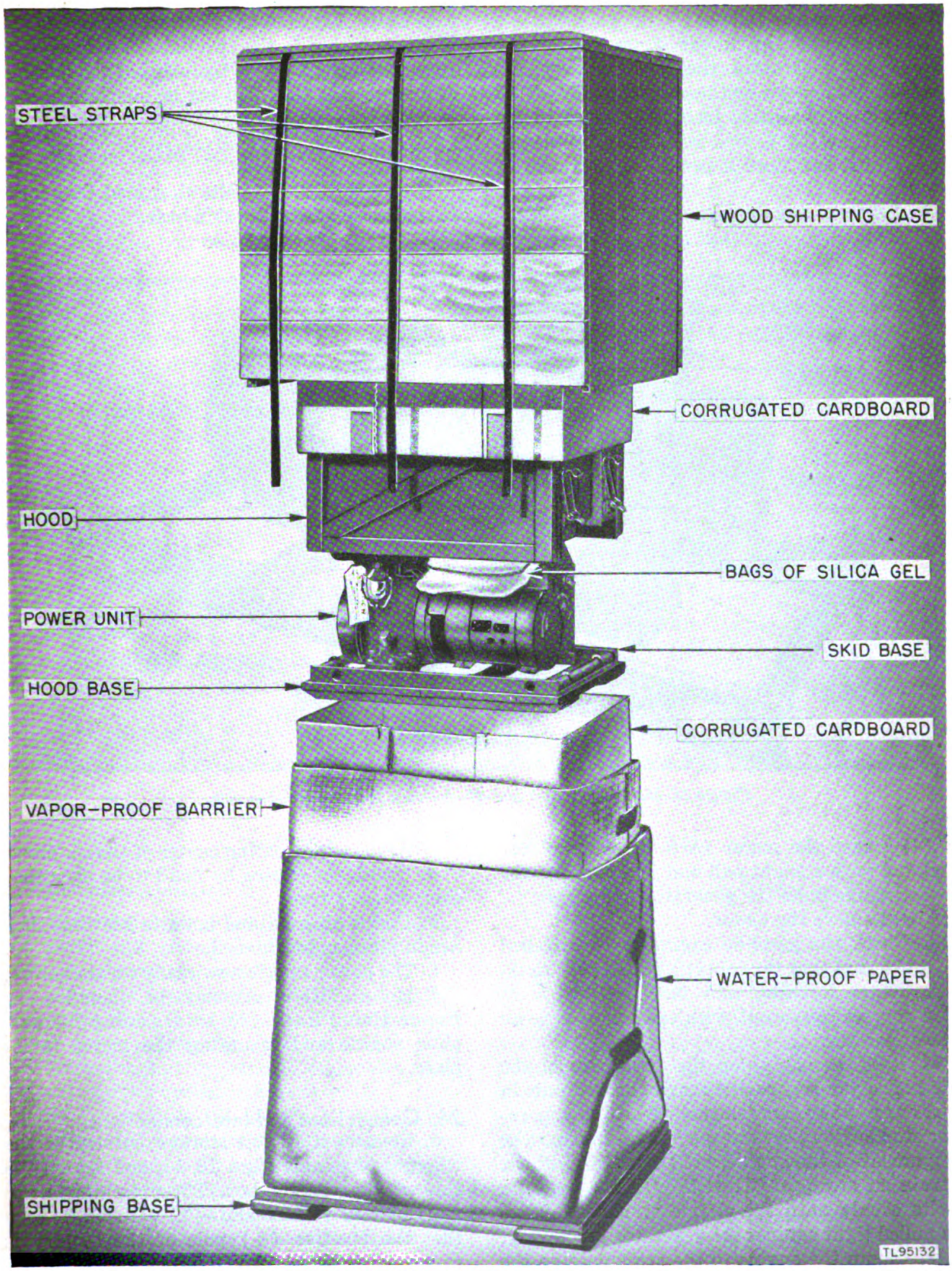


Figure 24. Unpacking sequence for Power Unit PE-49-(*) or Motor Generator MG-37-A.

with a gasoline engine from Power Unit PE–49–(*), proceed as follows:

a. Disconnect the motor from the power supply by separating the receptacle of the twist-lock connector on the extension cable from the plug on the cable lead. As the extension cable will not be needed with the gasoline engine, coil it and store it in the compartment of the hood.

b. REMOVE THE MOTOR FROM THE GENERATOR AND SKID MOUNTING. (1) Take out the four bolts that hold the floating center (fig. 7) of the coupling to the two hubs and remove it. Place the bolts back in the holes of the floating center, so that they will not be misplaced.

(2) Remove the four bolts that hold the union-ring bracket (fig. 25) to the motor flange.

(3) Remove the U-bolts that hold the motor to the crosspiece of the skid base.

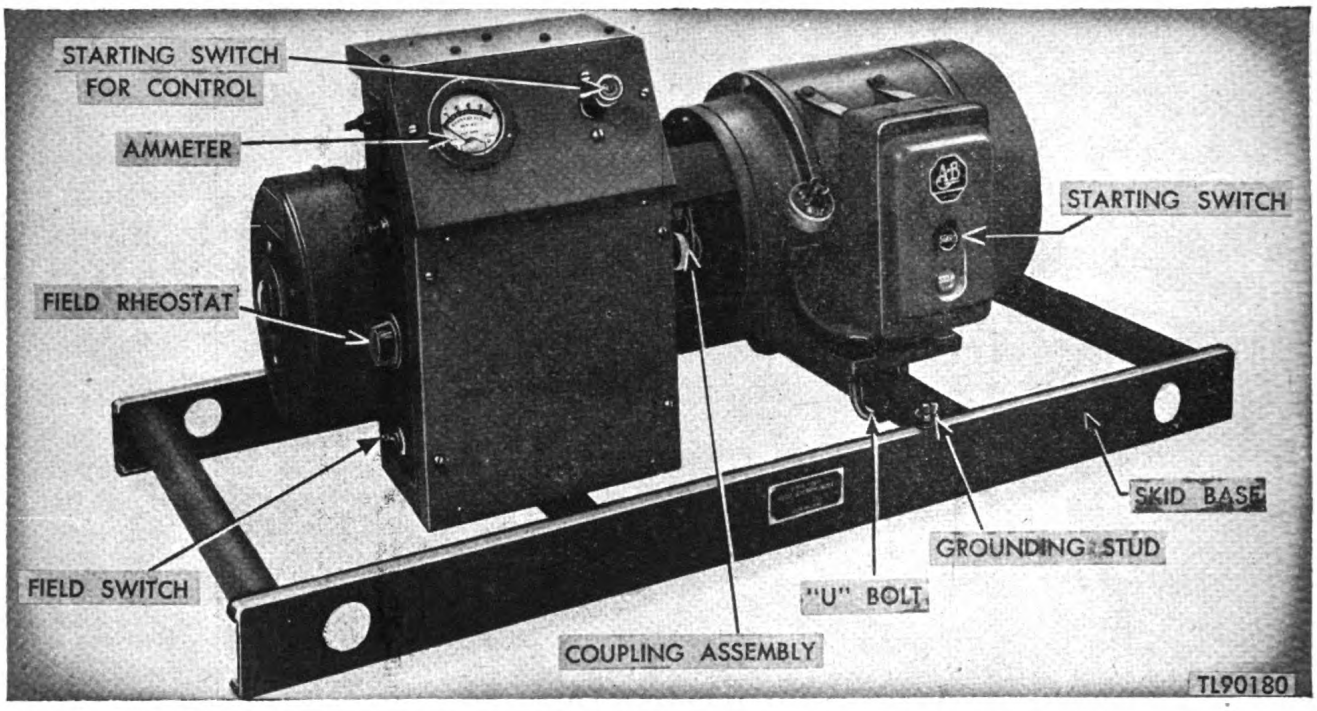


Figure 25. Motor Generator MG–37–A—view from control-box side.

(4) Grasp the motor from the commutator end and with a slight pull and jar, separate the motor flange from the generator union ring.

(5) Remove the motor.

c. Check the gasoline engine to be installed to make sure that the rabbet joint on the crankcase flange is clean, thus insuring proper fit and correct alignment with the union ring on the generator.

d. Rest the engine on the crosspiece of the skid base and replace the four bolts and nuts in the flange holes. Loosen the bolt of the generator stud support several turns to permit proper alignment of the engine and generator without strain on any part. Then tighten the opposite bolts evenly until the engine crankcase flange is pulled tight against the generator union ring.

e. Clamp the engine to the crosspiece on the skid base with the two U-bolts.

f. Replace the floating center of the coupling.

g. Crank the engine by hand to be sure that everything is free.

h. Check all nuts and bolts to see that they are in place and tightened.

i. The power unit is now ready for operation.

j. Motor MO–37–A may be installed on Power Unit PE–49–(*) by removing the gasoline engine and mounting the motor in its place.

24. Connections and Interconnections

a. Connect a 12-volt storage battery to the wingnut terminals (figs. 10, 11, and 12) on the side of the control box. These terminals are marked +12 VOLTS and —12 VOLTS. Be sure that the positive (+) pole of the battery is connected to the +12 VOLTS terminal and the negative (—) pole of the battery is connected

to the —12 VOLTS terminal. Make sure the connections are clean, then tighten the wingnuts securely.

b. Make sure the unit is grounded by a wire connected from the grounding stud on the skid base, directly below the magneto, to a ground rod driven into the earth. Make certain that the ground rod is driven in deeply, and moisten and tamp the earth around it.

c. Place the CLOSED - OPEN FIELD SWITCH at the bottom of the panel on the left-hand side of the control box (fig. 10) in OPEN position.

d. Lay out the connecting cables from the transmitting equipment and connect them at the back of the control cabinet. The output is through Socket SO–41 for low voltage and Socket SO–39 for high voltage. (See figs. 12 and 13.)

25. Repacking Instructions for Troop Movements

a. POWER UNIT PE–49–(*) When the power set is to be moved in connection with a movement of the using organization, prepare the unit for transportation as follows:

(1) Drain the used oil from the crankcase and air cleaner. Refill with new oil. (See fig. 34.) If the distance involved is short and the power unit is to be put in operation again before the engine cools, it will not be necessary to drain the oil.

(2) Disconnect all power connections and place the connecting cables in the storage compartment of the hood.

(3) Pick up the power unit by the skid base and set it on the hood base, if it has been removed from the hood base during operation.

(4) Check the contents of the storage compartment in the hood to see that nothing is missing. (See par. 21.)

(5) Set the hood over the unit and fasten it securely to the hood base by means of the two hood fasteners at each end of the hood. (Power Unit PE–49–D is provided with thumbscrews instead of hood fasteners.)

b. MOTOR GENERATOR MG–37–A. Omit step (1) of *a* above. Perform the four remaining steps exactly as given for Power Unit PE–49–(*).

Note. If Power Unit PE–49–(*) is to be stored for a period of 30 days or more, or is to be transported over a great distance, see paragraph 111 for proper procedures for rustproofing. For shorter periods of storage, lubricate the equipment according to instructions in the War Department Lubrication Order (fig. 34), thoroughly clean all exterior surfaces with Solvent, Dry Cleaning Federal spec No. P–S–661a, and store in a closed building if possible.

c. WEIGHTS. The weight of the power sets when assembled for transportation in troop movements are as follows:

	Pounds
Power Unit PE–49–D	260
Power Unit PE–49–F	300
Power Unit PE–49–G	325
Motor Generator MG–37–A	295

Section IV. PREOPERATION PROCEDURE

26. Preliminary Inspection

a. Inspect the power set thoroughly for missing parts and possible damage. Report any shortage or damage immediately.

b. Clean off any cinders, dirt, oil, or other foreign matter that may have accumulated on the power set during transportation.

c. Turn the unit by hand to make sure that all moving parts operate smoothly.

d. If Power Unit PE–49–(*) is used, drain the crankcase of any rustproofing oil that may be present. Remove all seals from the carburetor, exhaust, and other openings.

e. Inspect all electrical and fuel-line connections and make sure they are tight. Inspect all mounting bolts and screws and tighten any that are loose.

f. Check to see that the power set is properly located. (See par. 22.)

27. Servicing Power Unit PE–49–(*)

a. FILL CRANKCASE. Check to see that the oil drain in the crankcase is closed. Remove the crankcase oil-filler cap. Fill the crankcase to the top of the filler hole according to the instructions in the War Department Lubrication Order. (See fig. 34.)

b. FILL AIR CLEANER. Remove the bowl from the oil-bath air cleaner. Clean the bowl and fill it to the indicated level with the same grade of oil as used in the engine. Do not use diluted oil in the air cleaner. If the unit is being operated in zero temperatures, fill the bowl of the

air cleaner with Oil, Lubricating, Preservative, Special, U. S. Army spec. No. 2–120.

c. LUBRICATE LINKAGE. See War Department Lubrication Order, figure 34.

d. FILL FUEL TANK. Fill the fuel tank with 1 gallon of clean gasoline. Open the fuel valve and see that the fuel flows into the fuel-strainer bowl. (See fig. 6.)

28. Preparing Generator for Service

Before starting the generator for the first time, or after a prolonged period of idleness, check to see if the windings have been penetrated by moisture, either by accident or because of "sweating.." If there is moisture present on the windings. operate the engine of Power Unit PE–49–(*) with the field switch in OPEN position for a period of several hours. This operation will permit the circulation of air over the coils and dry out the surface moisture. If it is possible, heat the air circulated through the generator to hasten the drying process. If it is impossible to dry the windings by this method, so that the generator can be operated, notify repair personnel.

Note. If Motor MO–37–A on Motor Generator MG–37–A will not run because of moisture in its windings, replace the motor, either with another motor of the same model or with an engine from Power Unit PE–49–(*).

PART TWO

OPERATING INSTRUCTIONS

Note. For information on destroying the equipment to prevent enemy use, see destruction notice in the front of the manual.

Section V. OPERATION

29. Starting Power Unit PE–49–(*)

a. BATTERY STARTING. (1) Set the carburetor-choke lever (fig. 26) in the closed position.

(2) Release the governor-control lever below the fuel tank. (See fig. 6.)

(3) Set the throttle-stop lever (fig. 26) so that the throttle is in a half-open position.

(4) Press the starter-switch button (fig. 12) on the control box and hold it in for about 10 to 15 seconds. The unit should start within this period. If the unit does not start, release the starter button and wait about 15 seconds before making another attempt. If the unit is new and still fails to start, remove the spark plug (fig. 12) and wash it thoroughly in dry-cleaning solvent. Replace the spark plug and make another attempt to start the unit. If it continues to be difficult to start, see trouble chart, paragraph 83.

(5) When the unit starts, gradually open the carburetor-choke lever as the engine warms up. Permit the unit to operate at half-throttle for about 10 minutes.

(6) At the end of the 10-minute warm-up period, move the governor-control lever (fig. 6) toward the fuel strainer until it locks in the notch in the quadrant. This will open the throttle and place the unit under governor control.

(7) If it is necessary to keep the choke valve partially closed after the engine has warmed up, open the high-speed needle valve slightly, turning it in a counterclockwise direction until the unit operates smoothly with the choke valve wide open.

(8) When the unit has started, check the ammeter on the control box (figs. 10, 11, and 12) to see that the battery-charging circuit is functioning.

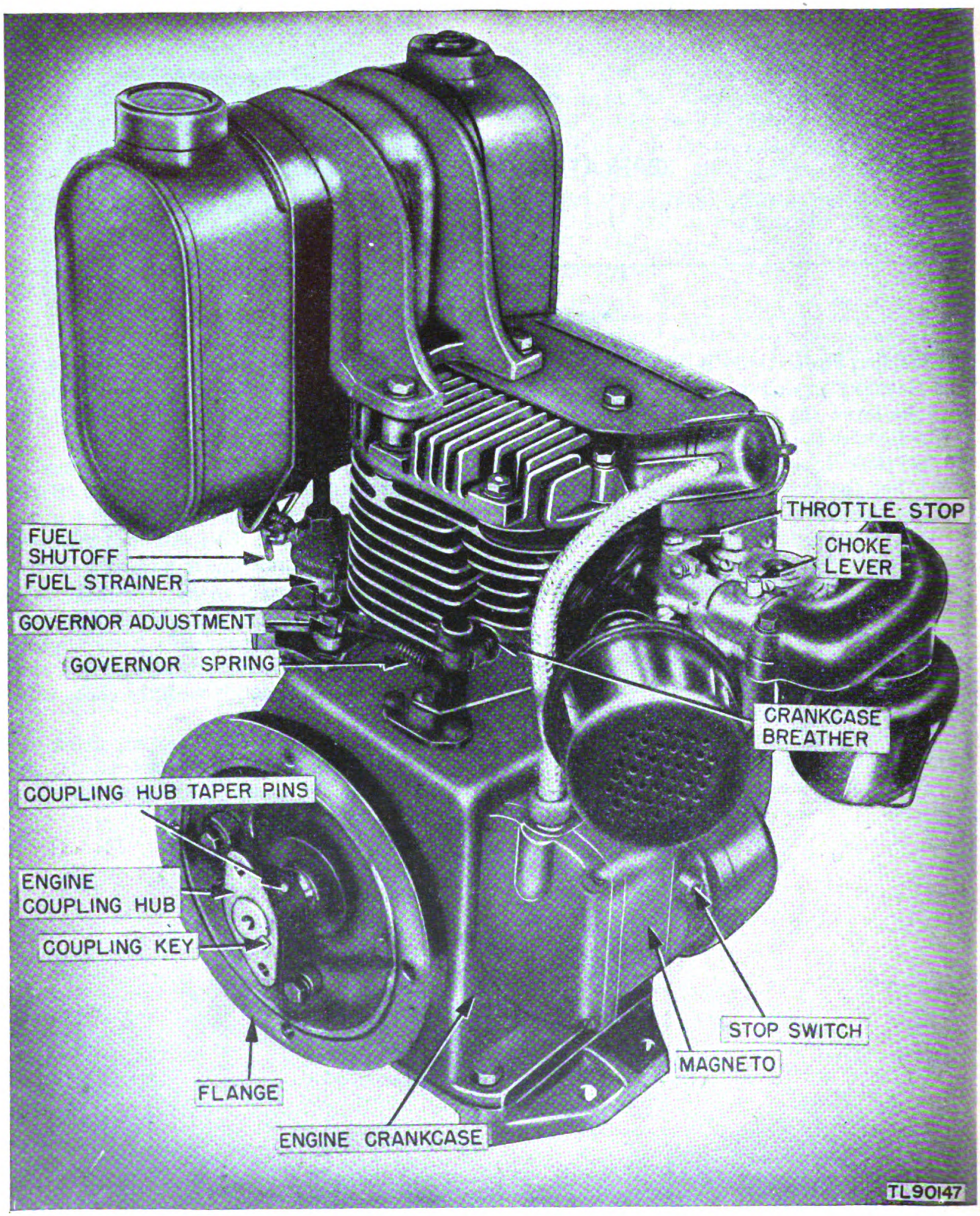


Figure 26. Engine GE–9–D or GE–9–F.

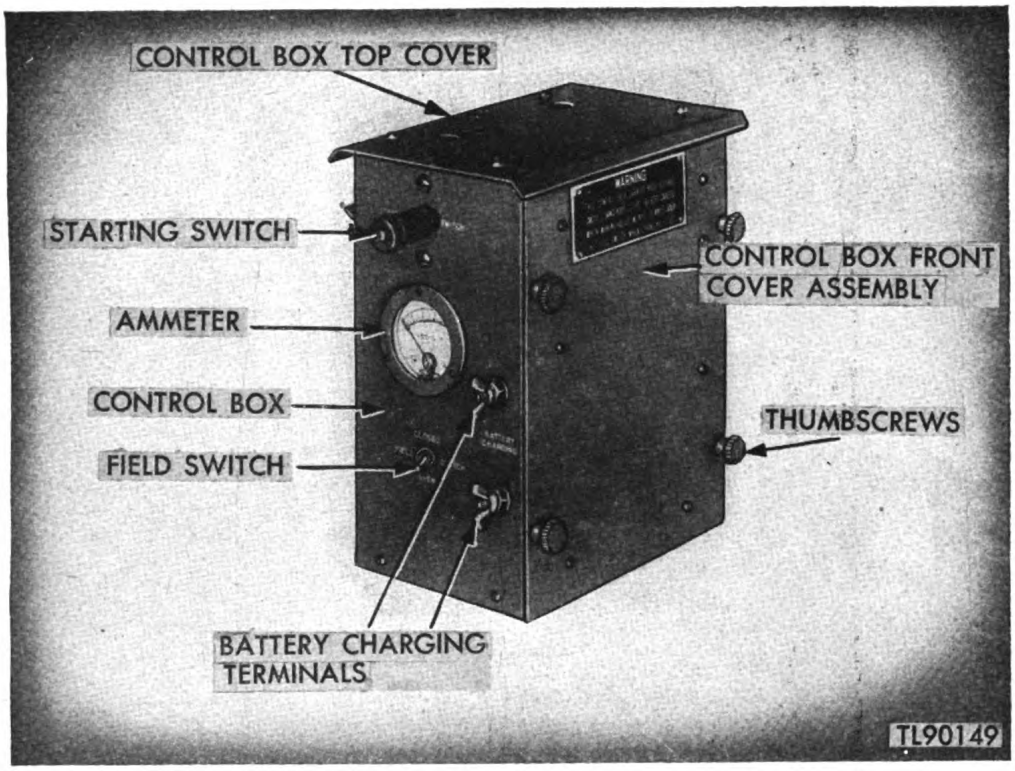


Figure 27. Control box for Power Unit PE-49-D.

(9) As soon as the unit has warmed up and reached a steady operating speed, throw the CLOSED-OPEN FIELD SWITCH to CLOSED position. (See figs. 27 and 28.) This will apply the load to the unit.

Note. In an emergency, the load may be applied to the unit immediately. In this case, do not release the governor lever when starting.

b. ROPE STARTING. (1) If no storage battery is available, if the storage battery is in a discharged condition, or if the electric starter fails to function from some other cause, the unit may be started manually. Follow the instructions given for the first three steps of electric starting. (See *a*(1) through (3) above.) Do not press the starter button. Instead, wind the starting rope around the starting sheave (figs. 4, 5, and 6) in a clockwise direction and give it a quick, steady pull.

(2) Under low-temperature conditions, it may be necessary to repeat the rope-starting operation several times before the unit starts.

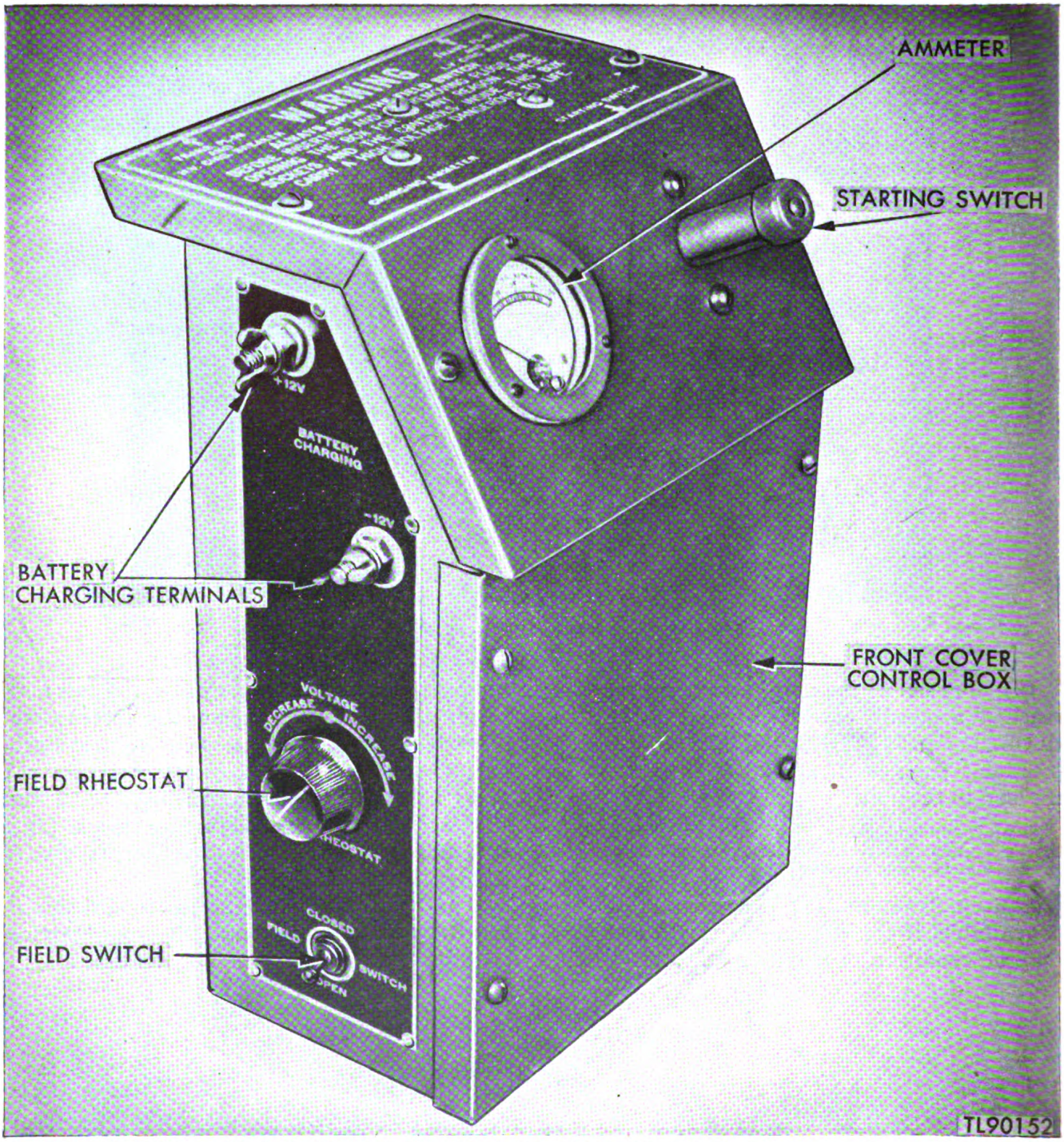


Figure 28. Control box for Power Units PE–49–F and PE–49–G—front cover view.

30. Starting Motor Generator MG–37–A

a. Be sure that the field switch (fig. 25) is in OPEN position.

b. Press START button on starting-switch box (fig. 25) to start the motor.

c. Stop the motor by pressing the STOP button on the starting-switch box.

d. Start and stop the motor with no load connected to the generator to be sure that the equipment is in satisfactory operating condition.

e. Start the motor again, allow it to attain its full operating speed, and place the field switch in CLOSED position. Power should then be available at the output sockets (fig. 29) on the back of the control box and at the battery-charging terminals (fig. 25) on the control box.

Note. When starting Motor Generator MG–37–A, after long exposure in a humid atmosphere, operate the unit at full speed for at least 10 or 15 minutes before closing the field switch.

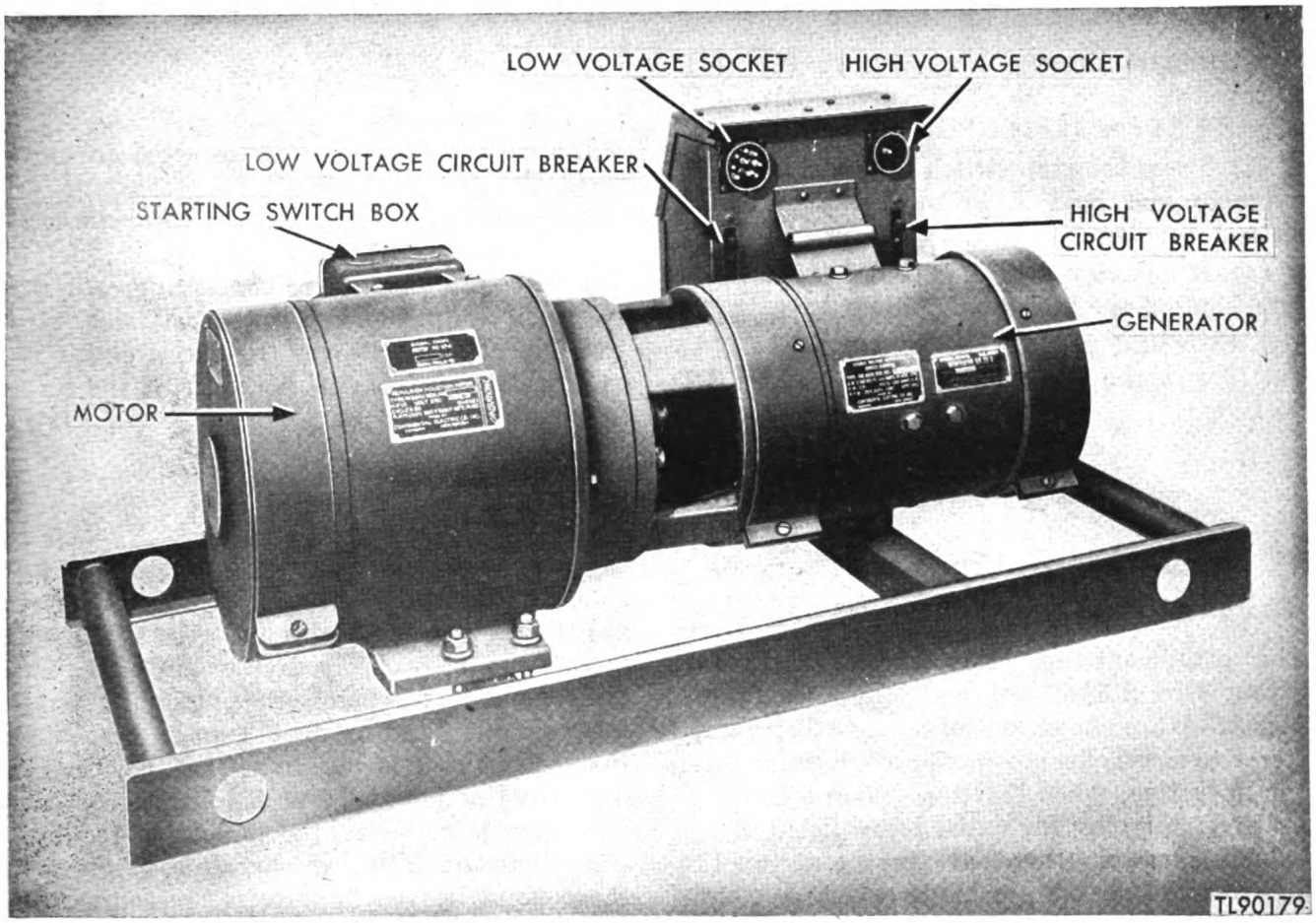


Figure 29. Motor Generator MG–37–A ready for use—view from generator side.

31. Operational Hints for Arctic Locations

a. In extremely cold weather, starting a gasoline engine is often difficult. Try turning the engine over for several revolutions with the choke pulled out to its extreme limit. If the engine still does not start, it may be necessary to prime the cylinders by pouring a small amount of gasoline into the spark-plug hole. Wait a few moments for the gasoline to evaporate, replace the spark plug and start as usual.

b. Do not race a cold engine.

c. If it is possible to keep the unit in a heated building when it is not in use, cold-weather starting difficulties will be largely eliminated.

d. Follow lubrication instructions given on the War Department Lubrication Order (fig. 34) for cold-weather operations. Drain the crankcase while the engine is still hot, if the engine is to be stopped for an hour or more. Attach a tag to the unit stating that the crankcase has been drained as a warning to others not to start the unit without first filling the crankcase. Storage of oil containers in a heated building will help prevent the oil from becoming stiff.

Caution: Never attempt to heat the oil mixture for the crankcase after gasoline has been added. The mixture might explode!

e. Keep spark-plug electrodes clean with sandpaper. Always keep a cleaned or new plug handy.

f. Crank the engine with a *quick, hard pull.* Slow cranking speed is a major factor in cold-weather starting difficulty.

g. Always keep the fuel tank full when the engine is not running. This will prevent condensation of moisture in the fuel tank, which is often an annoying trouble in cold weather.

h. Do not start the engine in subzero temperatures unless the crankcase oil is fluid. Remove the bayonet gauge (figs. 4, 5, and 6) and observe the condition of the oil.

i. Operate the engine without load for at least 10 minutes when it is started in very cold weather, unless the engine is thoroughly warm.

j. Do not pour hot water on the carburetor or fuel strainer. (See figs. 4, 5, and 6.)

32. Routine Procedure for Stopping

a. STOPPING POWER UNIT PE–49–(*). (1) Throw the CLOSED-OPEN FIELD SWITCH (figs. 10, 11 and 12) to OPEN.

(2) Press the stop switch on the side of the magneto and hold it in until the unit has stopped turning.

(3) If the stop switch button fails to function, shut off the fuel supply.

b. STOPPING MOTOR GENERATOR MG–37–A. (1) Throw the field switch (fig. 25) to OPEN position.

(2) Press the STOP button on the starting-switch box. (See fig. 25.)

33. Procedure for Extended Stop

a. Stop the power set as directed in paragraph 32.

b. If weather is very cold, or in arctic locations, see paragraph 31.

c. Disconnect and store connecting cables to the radio equipment and to the batteries.

d. Place the hood over the entire power set as a protection from the weather, if the set is to remain out-of-doors.

Section VI. EQUIPMENT OPERATION CHECK SHEET

34. Purpose and Use of Equipment Operation Check Sheet

The equipment operation check sheets for Power Unit PE–49–(*) and Motor Generator MG–37–A are shown in paragraphs 35 and 36. Refer to these charts when preparing the units for operation, when starting, when operating, or when stopping the units. Items listed in the column marked "Item" are the points on the units where checks are made or where operations are performed during the operating steps. Normal indications given in the check sheets are the conditions which must exist if the unit is performing properly. For example, the fuel tank should be full before the engine is started; the ammeter reading should go to zero after the field switch is put in OPEN position. A corrective action to be accomplished for each item to obtain the normal indication required, thereby insuring proper operation, is given in the column headed "Corrective measures."

35. Equipment Operation Check Sheet for Power Unit PE–49–(*)

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	1	Crankcase	Check oil gauge.	Full	Add oil. (See WDLO.)
	2	Air cleaner	Check oil bowl.	Up to bead	Add oil. (See WDLO.)
	3	Fuel tank	Check fuel gauge.	Full	Add fuel.
	4	Field switch	Check position of switch.	OPEN	Place in OPEN position.
BATTERY STARTING	5	Carburetor-choke lever	Check position.	Closed position	Set in closed position.
	6	Governor-control lever	Release lever.	Locked in notch	Release by pressing lever.
	7	Throttle-stop lever	Check position.	Halfway open	Set in correct position.
	8	Starter switch	Press and hold in.	Engine starts	If engine does not start, see trouble chart, paragraph 83.
ROPE STARTING	9	Items 5, 6, and 7 above.	Perform actions in items 5, 6, and 7.	Same as in items 5, 6, and 7 above	Sams as in items 5, 6, and 7 above.
	10	Starting rope and sheave.	Wind rope around sheave and give quick pull.	Engine starts	If engine does not start, see trouble chart, paragraph 83.
PERFORMANCE	11	Carburetor-choke lever	Open gradually as engine warms up.	Full open when engine is warmed up.	Open gradually.
	12	Governor-control lever	Lock lever in notch.	Throttle open	Move lever to notch.
	13	Field switch	Place in CLOSED position.	Ammeter shows reading.	If there is no output, see trouble chart, paragraph 85.
	14	Ammeter	Check reading.	25 amperes when battery charging circuit is functioning without transmitter load, 10 amperes with transmitter.	Adjust field rheostat.
STOPPING	15	Field switch	Place in OPEN position.	Ammeter reading goes to zero.	Perform next step. Make necessary repair.
	16	Magneto stop switch	Press and hold in till engine stops turning.	Engine stops	If engine does not stop, shut off fuel supply.

36. Equipment Operation Check Sheet for Motor Generator MG–37–A

	Item No.	Item	Action or condition	Normal indication	Corrective measures
PREPARATORY	1	Field switch	Check position of switch.	OPEN	Place in OPEN position.
STARTING	2	Starting switch	Press START button on switch on side of motor.	Motor starts	If motor does not start, see trouble chart, paragraph 84.
PERFORMANCE	3	Field switch	Place in CLOSED position when motor reaches full speed.	Ammeter shows reading	If there is no output, see trouble chart, paragraph 85.
	4	Ammeter	Check reading.	25 amperes when battery charging circuit is functioning without transmitter load, 10 amperes with transmitter.	Adjust field rheostat.
STOPPING	5	Field switch	Place in OPEN position.	Ammeter reading goes to zero.	Perform next step. Make necessary repair.
	6	Starting switch	Press STOP button on switch on side of motor.	Motor stops running	If motor does not stop, disconnect cord leading to power source.

PART THREE

PREVENTIVE MAINTENANCE

Section VII. OPERATOR'S PREVENTIVE MAINTENANCE TECHNIQUES

37. Meaning of Preventive Maintenance

Preventive maintenance is a systematic series of operations performed periodically on equipment in order to maintain top efficiency in performance, to reduce unwanted interruptions in service, and to eliminate major breakdowns. To understand preventive maintenance, it is necessary to distinguish between it and trouble shooting and repair. The primary function of preventive maintenance is to prevent major break-downs and the consequent necessity of repair. The primary function of trouble shooting and repair is to locate and correct existing defects. The importance of preventive maintenance cannot be overemphasized. Power equipment is but one component of a complete system. Each component of an over-all system must be ready when needed and able to operate at peak efficiency. It is vitally important that operators and repairmen maintain all power supply equipment properly.

38. Purpose of Operator's Maintenance

a. To insure mechanical efficiency, it is necessary to inspect the power unit systematically at intervals each day it is operated and at other specified intervals, so that defects may be discovered and corrected before they result in serious damage or failure. Certain scheduled maintenance services will be performed at these designated intervals. The services set forth in this section are those performed by the operator before operation, during operation, during stop periods, after operation, and at other specified intervals.

b. Every operator of the individual power unit should have available War Department Form 48 (Driver's Trip Ticket and P.M. Service Record). (See figs. 30 and 31.) The form should be adapted to all Signal Corps power units by elimination of items pertaining only to vehicles. Items pertaining to Power Unit PE-49-(*) and Motor Generator MG-37-A, but not listed on WD Form 48, are covered in manual procedures under items to which they are related. Certain items listed on the form, but not pertaining to the power units involved, are crossed out on the form and eliminated from the maintenance procedures. Every organization must thoroughly school each operator in performing the maintenance procedures set forth in the manual, whether or not the procedures are listed specifically on WD Form 48.

c. The items listed on WD Form 48 that apply to these power sets are expanded in this manual to provide specific procedures for accomplishment of the inspection and services. These services are arranged to facilitate inspection and conserve the time of the operator, and are not necessarily in the numerical order in which they are shown on WD Form 48. The item numbers, however, are identical with those shown on that form.

d. The general inspection of each item applies also to any supporting member or connection, and generally includes a check for good condition, correct assembly, secureness, or excessive wear.

(1) Inspection of the unit for good condition is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limit. The expression "good condition" is explained further by the following terms: not bent or twisted, not chafed or burned, not broken or cracked, not bared or frayed, not dented or collapsed, not torn or cut.

(2) Inspection of the unit for correct assembly is usually an external visual inspection to see whether the unit is in its correctly assembled position in the power unit.

(3) Inspection of the unit for secureness is usually an external visual examination, with

the aid of a wrench, a hand-feel, or prybar to check for looseness. Such an inspection should cover brackets, lockwashers, locknuts, locking wires, or cotter pins used in assembly.

(4) Excessive wear will be understood to mean wear close to or beyond serviceable limits. It is wear which is likely to result in a failure if the unit is not replaced before the next

War Department Form 48
Approved April 12, 1943

PE-49-F

Serial ~~U.S.A.~~ No. 419

Driver's name Cpl John Smith Date 6 Dec. 44

DRIVER'S TRIP TICKET AND P. M. SERVICE RECORD

Report to _____ Time out _____

Organization 1st Sig Bn Time in _____

Department or address _____

Kind of work (or route) SCR-188-A

Requested by _____
(Organization or individual)

_____
(Dispatcher's signature)

	SPEEDOMETER	HOUR METER
Fuel added (gals.) 5 In		
Oil added (qts.) ½ Out		
Total: Miles—Hour		

I have performed the "Preventive Maintenance Services" of this form and recorded all deficiencies and any accident.

(Driver's signature) John Smith, cpl.

I have noted all entries on this form and taken the necessary action.

(Dispatcher's, etc., signature) _____

TRIP OR LOAD RECORD	PASSENGERS OR WEIGHT	SPEEDOMETER OR HOUR METER
From 0030 to 0800		7½ hrs
To 0900 to 1030		1½ hrs
To 2000 to 2300		3 hrs
To		12 hrs
To		
To		
To		
To		
To		

Vehicle released at _____ _____ _____
(Speedometer—Hour meter) (Date) (Hour)

Official user _____ _____
(Signature) (Grade)

10—35500-1

(SEE REVERSE SIDE)

TL95388

Figure 30. Front of WD Form 48, adapted for use with Power Unit PE-49-(*).

scheduled inspection.

e. Any defects or unsatisfactory operating characteristics beyond the scope of repair of the first echelon must be reported at the earliest opportunity to the designated person in authority.

DRIVER'S DAILY PREVENTIVE MAINTENANCE SERVICES

Perform these services according to the instructions in TM 9-2810, or vehicle operator's manual.

BEFORE OPERATION SERVICE

1. Tampering and damage.
2. ~~Fire extinguishers.~~
3. Fuel, oil, and water.
4. Accessories and drives.
5. ~~Air brake tanks.~~
6. Leaks—general.
7. Engine warm-up.
8. Choke or primer.
9. Instruments.
10. ~~Horn and WS wipers.~~
11. ~~Glass and RV mirrors.~~
12. ~~Lamps and reflectors.~~
13. ~~Wheel and flange nuts.~~
14. ~~Tires and/or tracks.~~
15. ~~Springs and suspensions.~~
16. ~~Steering linkage.~~
17. ~~Fenders and bumpers.~~
18. ~~Towing connections.~~
19. Body, ~~load, and tarps.~~
20. ~~Decontaminator.~~
21. Tools and equipment.
22. Engine operation.
23. ~~Dr's permit and Form 26A.~~
24. ~~Amphibian services.~~
25. During operation check.

Electrical controls

DURING OPERATION SERVICE

26. ~~Steering brakes.~~
27. ~~Foot and hand brakes.~~
28. ~~Clutch.~~
29. ~~Transmission.~~
30. ~~Transfer.~~
31. Engine and controls.
32. Instruments.
33. ~~Steering gear.~~
34. ~~Running gear.~~
35. Body ~~and trailer~~.
36. ~~Guns—mountings and elevating, traversing, gyro, and firing controls.~~
37. ~~Amphibian services.~~

AT HALT SERVICE

38. Fuel, oil, and water.
39. Temperatures—~~hubs, brake drums, transfer, transmission, and axles.~~
40. ~~Axle and transfer vents.~~
41. Propeller shafts.
42. ~~Springs and suspensions.~~
43. ~~Steering linkage.~~
44. ~~Wheel and flange nuts.~~
45. ~~Tires and/or tracks.~~
46. Leaks—general.
47. Accessories and belts.
48. Air cleaners.
49. ~~Fenders and bumpers.~~
50. ~~Towing connections.~~
51. Body, ~~load, and tarps.~~
52. ~~Appearance and glass.~~
53. ~~Amphibian services.~~

AFTER OPERATION SERVICE

54. Fuel, oil, and water.
55. Engine operation.
56. Instruments.
57. ~~Horn and WS wipers.~~
58. ~~Glass and RV mirrors.~~
59. ~~Lamps and reflectors.~~
60. ~~Fire extinguishers.~~
61. ~~Decontaminator.~~
62. *Battery ~~and voltmeter.~~
63. *Accessories and belts.
64. *Electrical wiring.
65. *Air cleaners ~~and breather caps.~~
66. *Fuel filters.
67. Engine controls.
68. ~~*Tires and/or tracks.~~
69. ~~*Springs and suspensions.~~
70. ~~Steering linkage.~~
71. Propeller shafts, center bearing, ~~and vent.~~
72. ~~*Axle and transfer vents.~~
73. Leaks—general.
74. ~~Gear oil levels.~~
75. ~~*Air brake tanks.~~
76. ~~Fenders and bumpers.~~
77. ~~*Towing connections.~~
78. Body, ~~load, and tarps.~~
79. ~~Armor and front roller.~~
80. ~~Vision devices.~~
81. ~~Turret and gun mountings and elevating, guns, traversing, and firing controls.~~
82. ~~*Tighten wheel, rim, axle drive flange, and spring U-bolt nuts.~~
83. *Lubricate as needed.
84. *Clean engine and vehicle.
85. *Tools and equipment.
86. ~~*Amphibian services.~~

Electrical controls
power connections

***Those items marked by an asterisk (*) require additional weekly services.**

Record any accident and all deficiencies, indicating if corrected:

16—85690-1

TL95389

Figure 31. Back of WD Form 48, adapted for use with Power Unit PE-49-(*).

39. Before-Operation Service

a. PURPOSE. This inspection schedule is designed primarily as a check to see that the power unit has not been damaged, tampered with, or sabotaged since the after-operation service was performed. Various combat conditions may have rendered the power unit unsafe for operation, and it is the duty of the operator to determine whether the power unit is in condition to carry out any mission to which it might be assigned. This operation cannot be entirely omitted even in extreme tactical situations.

b. PROCEDURES. Before-operation service consists of inspecting items listed below according to the procedure described, and correcting or reporting any deficiencies. Upon completion of the before-operation service, results should be reported promptly to the designated person in authority.

40. Before-Operation Service Items

a. ITEM 1. TAMPERING AND DAMAGE. Check for injury to the power unit or items of special equipment. Check for damage that may have resulted from falling debris, shell fire, sabotage, collision, or presence of booby traps. Remove hood and look for signs of tampering or sabotage, such as disconnected wiring or damaged parts. To facilitate starting, dry out wet spark plugs, magneto, and wiring.

b. ITEM 3. FUEL, OIL, AND WATER. Check the amount of fuel in the tank, noting any indications of leaks or tampering. Add fuel if necessary and check spare fuel cans. Check oil level. Add oil if necessary.

Note. Any appreciable change in oil levels since the last after-operation service should be investigated and reported to designated authority.

c. ITEM 4. ACCESSORIES AND DRIVES. Check all accessories, the carburetor, generator, control box, and air-cooling shrouds for loose connections or mountings. Check coupling between engine and generator for looseness and wear.

d. ITEM 6. LEAKS, GENERAL. Check under the power unit for indications of fuel or oil leaks. Check the engine crankcase and air filter for indications of oil leaks. Check the fuel system for indications of leaks. Trace all leaks to their source and correct or report them to designated authority.

e. ITEM 7. ENGINE WARM-UP. Start the engine (par. 29) and note the action of the starter mechanism. Set the throttle so that the engine will run at normal (fast idle) warm-up speed; during the warm-up period, proceed with the following before-operation services.

Caution: Great damage will result to air-cooled engines if placed under load before reaching normal operating temperature.

f. ITEM 8. CHOKE OR PRIMER. While starting the engine, check the operation of the choke or primer. As the engine warms up, set the carburetor choke lever as required to prevent overchoking and thus cause dilution of engine oil.

g. ITEM 9. INSTRUMENTS. (1) *Ammeter.* The battery-charging ammeter should show a high charging rate for the first few minutes after starting until the generator restores to the battery the current used in starting. As the battery attains an increased charge, the charging current decreases. When the battery becomes fully charged, the ammeter should show a zero reading.

(2) *Fuel gauge.* Observe whether the gauge is operating properly. Normally, fuel tanks would be filled before operation, and the gauge should register FULL. Power Unit PE–49–D has no fuel gauge.

h. ITEM 19. BODY. Inspect power unit body for looseness and damage.

i. ITEM 21. TOOLS AND EQUIPMENT. See that tools and equipment (par. 14) belonging to the power unit are present, serviceable, and properly mounted or stowed. The Technical Manual, WD Form 48, War Department Lubrication Order, and WD AGO Form 468 should be present and in legible condition.

j. ITEM 22. ENGINE OPERATION. Normal operating temperature may be assumed when the engine will operate under load with the choke lever fully open. Gradually accelerate the engine several times after it has reached normal operating temperature, and not any unusual noise or unsatisfactory operating characteristics which would indicate trouble.

k. ELECTRICAL CONTROLS. Add this item to Form 48. (See fig. 31.) Note whether electrical controls operate smoothly, and whether their operation is followed by the proper indications. Notify the proper person in authority if there is indication of faulty operation of switches, buttons, circuit breakers, rheostats potentiometers, relays, voltage regulators, or other electrical controls. Refer to the equipment operation check sheet, paragraph 35.

l. ITEM 25. DURING-OPERATION CHECK. The

during-operation services should start *as soon as* the load is put on the unit.

41. During-Operation Service

a. GENERAL. While the power unit is in operation and delivering its normal load, listen for rattles, knocks, squeaks, or hums that may indicate trouble. Look for indications of trouble in the cooling system. Watch for smoke from any part of the power unit. Be alert to detect the odor of overheated components or units such as the generator or the wiring, fuel vapor from a leak in the fuel system, exhaust gas, or other odors indicating trouble. Watch the instruments on the control panels frequently, and note unusual instrument indications that may signify trouble in the system to which that instrument pertains.

b. PROCEDURES. During-operation service consists of observing items listed below according to the procedures following each item, and investigating any indications of serious trouble. Note minor deficiencies to be corrected or reported at the earliest opportunity, usually the next stop period.

42. During-Operation Service Items

a. ITEM 31. ENGINE AND CONTROLS. The operator must be on the alert for deficiencies in engine performance such as lack of usual power, misfiring, unusual noise or stalling, indications of engine overheating, or unusual exhaust smoke. Notice whether the engine responds to the controls satisfactorily, and see that the controls are in proper adjustment.

b. ITEM 32. INSTRUMENTS. Observe the readings of all instruments frequently during operation to see whether they are indicating properly.

(1) *Ammeter.* During operation, the battery-charging ammeter indicates the amount of charging current through the battery. As the battery nears its full charge, the ammeter reading approaches zero.

(2) *Fuel gauge.* See that the gauge continues to indicate the approximate amount of fuel in the tank.

c. ITEM 35. BODY. The operator must be on the alert for looseness of the power unit body mounting, and attachments.

43. At-Halt or Stop Service

a. PURPOSE. The at-halt or at-stop service may be regarded as minimum battle maintenance and must be performed under all tactical conditions, even though the more extensive maintenance services may be slighted or omitted altogether.

b. PROCEDURES. This service consists of investigating any deficiencies noted during operation, inspecting the following items according to the procedures described below, and correcting any deficiencies found. At the end of the stop period, report immediately any uncorrected deficiencies to the designated individual in authority.

44. At-Halt or Stop Service Items

a. ITEM 38. FUEL, OIL, AND WATER. Check the fuel supply and refill the fuel tank. When refueling, use safety precautions to prevent a discharge of static electricity. The ground bond must be connected on the skid base. (See par. 24*b*.) Use a funnel when pouring gasoline and make certain that the fuel tank, funnel, and gasoline container contact each other so that an electrical path to ground will eliminate danger of a spark. Allow space in the filler neck for expansion, see that the filler cap vents are open, and replace the cap securely. Check the crankcase oil level; if necessary, add oil to the proper level.

b. ITEM 39. TEMPERATURES: GENERATOR OR MOTOR HOUSINGS AND BEARINGS. Place hand cautiously on each bearing housing and the generator to see whether it is abnormally hot. If bearing housings are too hot to grasp with the hand, they may be inadequately lubricated, damaged, or improperly adjusted. Regular check of these items will go far to avoid premature failure or possible accidents.

c. ITEM 41. PROPELLER SHAFTS. Check coupling between driving unit and generator for looseness or damage.

d. ITEM 46. LEAKS, GENERAL. Check beneath the unit for indications of leaks. Check to see whether oil is leaking from the crankcase, storage tanks, or air filter.

e. ITEM 47. ACCESSORIES AND BELTS. Check to see that the generator, control box, filter box (on Power Unit PE–49–D), and engine muffler are secure and undamaged. Ordinarily report any damage on Form 48 for correction by the unit mechanic.

f. ITEM 48. AIR CLEANERS. Inspect the air cleaner and breather holes to see that they are

in condition to deliver clean air properly. Service if necessary.

g. ITEM 51. BODY. Inspect power unit body to see that it is not damaged.

45. After-Operation and Weekly Service

a. PURPOSE. After-operation service is particularly important. At this time the operator inspects his power unit to detect deficiencies that have developed and corrects those he is permitted to handle. The operator should report promptly, to the designated person in authority, the results of his inspection. If this schedule is performed thoroughly, the power unit should be ready to operate at a moment's notice. After completion of the after-operation service, the before-operation service, with a few exceptions, is necessary only to determine whether or not the power unit is in the same condition in which it was left. The after-operation service should never be omitted entirely, even in extreme tactical situations, but it may be reduced to the bare fundamental services, if necessary.

b. PROCEDURES. When performing the after-operation service the operator must remember and consider any irregularities noticed during the day in the before-operation, during-operation, and after-operation services. The after-operation service consists of inspecting and servicing the following items.

46. After-Operation and Weekly Service Items

a. ITEM 54. FUEL, OIL, AND WATER. Fill fuel tank, observing safety precautions for grounding static electricity, and bring engine oil to proper level. Check to see that the supply of fuel and oil on hand is adequate. If an unusual amount of oil is required for the engine, check for leaks and report the condition.

b. ITEM 55. ENGINE OPERATION. Check to see that the engine idles satisfactorily. Accelerate and decelerate the engine, and note any tendency to miss or backfire, or any unusual engine noise or vibration that might indicate worn parts, loose mounting, incorrect fuel mixture, or faulty ignition. Correct or report any unsatisfactory engine-operating characteristics noted during operation.

c. ITEM 56. INSTRUMENTS. Check all instruments to see that they are securely mounted, properly connected, and undamaged.

Note. Those items of the after-operation service that are marked on WD Form 48 by an asterisk require additional weekly service. The procedures for the additional weekly service are indicated in subparagraph (2) of each applicable item that follows.

d. ITEM 62. *BATTERY (WHEN USED). (1) Check the battery to see that it is clean and secure.

(2) Clean dirt from the top of the battery every week. If terminal connections or posts are corroded, clean them thoroughly and apply a fresh, thin coating of Grease, General Purpose No. 2, U.S. Army spec No. 2–108. Tighten loose terminal bolts. Remove vent caps and check the level of the electrolyte. Add water if required, taking precautions not to damage the battery during freezing temperatures. The battery should be secure; and should not be bulging, cracked, or leaking electrolyte. Report any defects to the designated authority.

e. ITEM 63. *ACCESSORIES AND BELTS. (1) Check carburetor, generator, control box, fuel tank, and air-cooling shrouds for loose connections in couplings or mountings.

(2) Tighten or adjust once a week any loose connections, linkage, or mountings on accessories.

f. ITEM 64. *ELECTRICAL WIRING. (1) Check all ignition and control circuit wiring to see that it is securely connected, clean, and not damaged.

(2) Check weekly all accessible wiring to see that it is securely connected and supported, that the insulation is not cracked or chafed, and that its conduits and shielding are in good condition and secure. Report any unserviceable wiring.

g. ITEM 65. *AIR CLEANERS. (1) Check to see that oil in the air cleaner is at the correct level and not excessively dirty. Excessive dirt in the oil may be felt with the fingers. Swing the bail from under the cup (fig. 32) and remove the cup. The oil should be up to the level of the beaded mark inside the cup. If the oil in the cleaner is excessively dirty, clean and refill the cleaner with fresh oil. (See fig. 34.) In order to keep abrasive dirt out of the engine, the air cleaner and breather holes must be kept clean and properly serviced at all times.

(2) Remove and disassemble the air cleaner weekly. Loosen the clamp screw (fig. 32(213)) that holds the air cleaner to the carburetor air intake and remove it from the carburetor. Clean the entire unit by sloshing it up and down in Oil, Fuel, Diesel U.S. Army spec No. 2–102C or dry-cleaning solvent. Allow the parts to dry

before reassembly. Reinstall the air cleaner, giving special attention to mounting to see that cleaner is pressed firmly in place, correctly aligned, and secure.

h. ITEM 66. *FUEL FILTERS. (1) Examine fuel filter for leakage, damage, and loose mounting.

(2) For weekly service, close the shut-off valve in the fuel line. Remove and empty the strainer bowl (fig. 33) if there is an accumulation of foreign material in the bowl. Replace the bowl making sure that the rim of the glass is clean and that it is seated firmly against the gasket. (See fig. 33(103).) Replace the gasket if it is damaged.

i. ITEM 67. ENGINE CONTROLS. Check for worn or disconnected linkage. Also correct or report any unsatisfactory engine control linkage operation noted during operation.

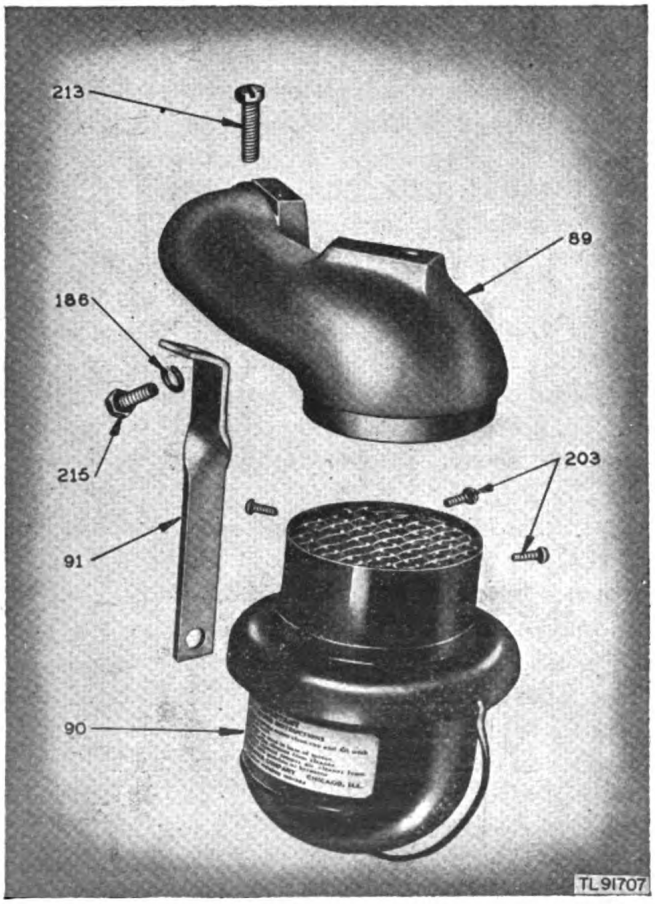


Figure 32. Air cleaner mounting parts.

j. ITEM 71. PROPELLER SHAFTS AND BEARINGS. Check couplings between driving unit and generator for loose connections and damage.

k. ITEM 73. LEAKS, GENERAL. Check beneath the unit for indications of fuel or oil leaks.

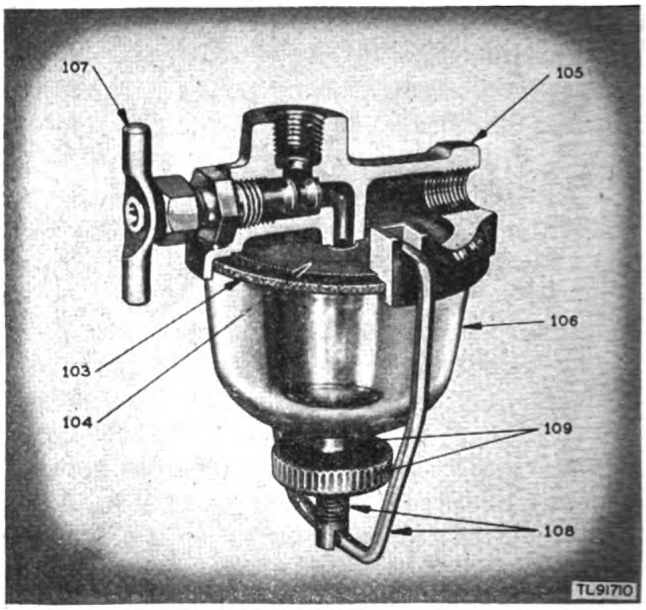


Figure 33. Fuel strainer and sediment bowl.

Trace all leaks to their source and correct or report them.

l. ITEM 78. BODY. Inspect the power unit body carefully for damage or loose parts.

m. ITEM 83. *LUBRICATION AS NEEDED. (1) Items such as linkage, latches, and other points that are lubricated by the operator should be lubricated if inspection indicates the necessity. See War Department Lubrication Order (fig. 34) for all lubrication requirements.

(2) Lubricate in accordance with the lubrication order. Lubricate all points shown on lubrication order requiring weekly lubrication. Abnormally hot, wet, or dusty operating conditions may make more frequent lubrication necessary than is provided by the regular lubrication schedule.

n. ITEM 84. *CLEANING ENGINE. (1) Remove dirt and excess grease from the exterior of the engine.

(2) Thoroughly wipe greasy surfaces of the unit weekly with dry-cleaning solvent (SD). Do not rub lusterless paint enough to create a shine that might cause reflection. When the unit is cleaned, care must be taken to see that solvent or dirt does not get into the bearings, fuel tank, or crankcase.

o. ITEM 85. *TOOLS AND EQUIPMENT. (1) Check unit packing lists to see that all tools (par. 14) and equipment assigned to the unit are present and property stowed. The Technical Manual, WD Form 48, War Department Lubrication Order, and WD AGO Form 468 should be present and in legible condition.

WAR DEPARTMENT LUBRICATION ORDER No. 3007

SIGNAL CORPS

POWER UNIT PE-49-D, F AND G

Lubricant • Operating Hours

Fuel Tank 1024
Clean inside of tank and fuel line. Keep fuel clean and vent in cap open. Cap. approx. 5 qt.

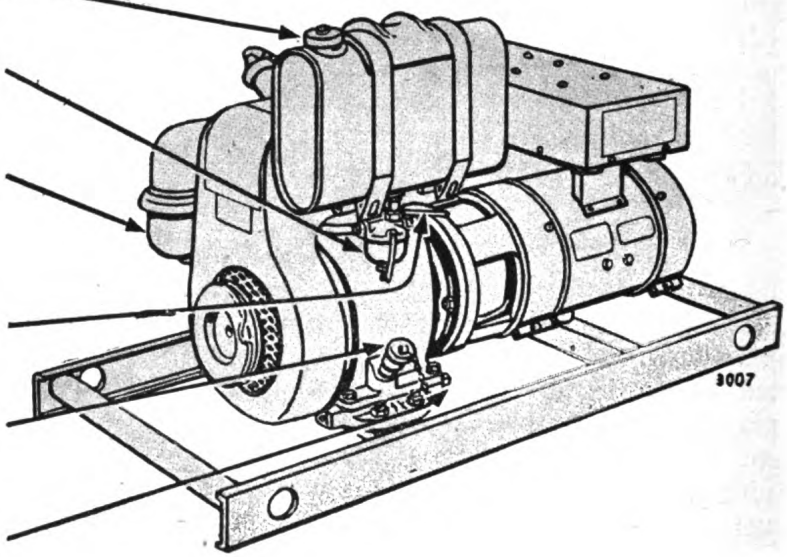
Fuel Strainer 64
Remove and clean sediment bowl and screen. Also, open fuel tank shut-off valve to drain water and sediment.

Air Cleaner OE 8
Check level and refill to level mark. Every 24 hours, remove, drain, clean and refill. Every 256 hours, remove and wash all parts.

Governor and Throttle Control Linkage OE 64

Crankcase Fill and Level Gage OE 4
Check level Keep breather vent open.

Crankcase Drain Plug 48
Drain and refill Cap. approx. 1 qt. Drain only when hot



COLD WEATHER—Below 0°F., drain Crankcase daily. Refill Crankcase with 75% OE SAE 10 and 25% gasoline thoroughly mixed. Check level more often. Maintain at FULL mark by adding undiluted OE SAE 10 only.

HOURS—Reduce hours under severe operating conditions.

CLEAN parts with SOLVENT, dry-cleaning, or OIL, fuel, Diesel. Allow parts to dry thoroughly before lubricating.

—KEY—

LUBRICANTS	LOWEST EXPECTED AIR TEMPERATURE		
OE—OIL, engine	above +32°F.	+32°F. to 0°F.	below 0°F.
Crankcase	OE SAE 30	OE SAE 10	See Cold Weather Note
Except Crankcase	OE SAE 30	OE SAE 10	PS
PS—OIL, lubricating, preservative, special			

DO NOT LUBRICATE—Generator Bearings, Engine Governor.

LUBRICATED BY SIGNAL CORPS MAINTENANCE PERSONNEL—Generator Bearing Housings, Magneto.

REFERENCE—Technical Manual TM 11-920.

By Order of the Secretary of War:
G. C. Marshall, Chief of Staff.

Requisition LUBRICATION ORDER from Philadelphia Signal Depot, or Utah ASF Depot, Ogden, Utah, by Signal Corps Stock No.

6D10113-07

24 Mar 1944
Supersedes all previous lubrication instructions.

TL 91680

Figure 34. War Department Lubrication Order No. 3007.

51. Approved Lubricants

The following list gives the standard nomenclature, specifications, and approved symbols for the lubricants used on Power Unit PE–49–(*) and Motor Generator MG–37–A:

Approved symbol	Standard nomenclature	Specification No.
OE–10	Oil, Engine	U.S. Army 2–104B
OE–30	Oil, Engine	U.S. Army 2–104B
PS	Oil, Lubricating, Preservative, Special	U.S. Army 2–120
SD	Solvent, Dry Cleaning	Federal P–S–661a
WB2	Grease, General Purpose No. 2.	U.S. Army 2–108
GL	Grease, Lubricating, Special	Ordnance AXS–637
DA	Oil, Fuel, Diesel	U.S. Army 2–102C

52. Special Lubricating Instructions

a. SEVERE OPERATING CONDITIONS. Under severe operating conditions, or over prolonged periods of operation in high surrounding temperatures, be sure to reduce the time intervals between lubrication periods for the unit. Under desert conditions take precautions to prevent sand and dust from blowing around the unit, either during operation or when idle.

b. COLD WEATHER INSTRUCTIONS. Since subzero temperatures affect both metals and lubricants, special precautions are necessary to prevent poor performance or total operational failure of the unit. The following methods for keeping crankcase oil fluid will be used, according to facilities available, preference being given to the order listed.

(1) Keep the unit in a warm place when it is not in operation. Place a tarpaulin or similar cover over the unit, and provide some means of heat within the inclosure formed. When this is done, give due consideration to the fire hazard involved.

(2) When the engine is stopped, drain the crankcase oil into a *clean* container while it is still hot, and store in a warm place until the engine is to be operated again. If a warm storage space is not available, heat the oil before refilling the crankcase.

Caution: Do not allow the oil to become too hot; heat only to the point where the bare hand can be inserted without burning. Do not apply heat directly to the oil. Tag the engine in a conspicuous place as a warning when the crankcase is empty.

(3) Drain the crankcase daily, according to the COLD WEATHER note on the lubrication order. (See fig. 34.)

c. SPECIAL PRECAUTIONS. (1) No lubrication will be performed on generator or motor bearings or engine governor.

(2) Lubrication of generator or motor bearing housings and the engine magneto will be performed by Signal Corps repair personnel *only*.

d. GENERATOR AND MOTOR LUBRICATION. The generator and motor are equipped with ball bearings (figs. 90 and 91(828)) that are sealed in grease at the time the power unit is shipped. These bearings are of the prelubricated, sealed type. The grease in the bearings is sufficient for several years of operation. If the bearings are disassembled for any reason, remove the old grease from the bearing housing and refill the housing ⅓ full of Grease, General Purpose, No. 2, U. S. Army spec No. 2–108 for temperatures above 32° F., or Grease, Lubricating, Special, Ordnance spec No. AXS–637 for temperatures below 32° F. Do not wash the sealed bearings in any kind of solution, as this action will dilute the grease in the bearing. Signal Corps repair organization personnel *only* will do this work.

53. Records and Reports

a. RECORDS. A complete record of lubrication must be kept for Power Unit PE–49–(*) in Duty Roster WD AGO Form 6), adapted as explained in paragraph 55.

b. REPORTS. If lubrication instructions are closely followed and proper lubricants used, and if satisfactory results are not obtained, make a report to the officer responsible for the maintenance of the equipment.

Section IX. UNIT MECHANICS' PREVENTIVE MAINTENANCE TECHNIQUES

54. Scope

a. PREVENTIVE MAINTENANCE SERVICES. Regular schedules, maintenance, inspections, and services are a preventive maintenance function of the using arms, and are the responsibilities of commanders of operating organizations. An efficient control system is an essential aid in determining when power units are due for periodic maintenance services either because of time elapsed or hours operated. (See par. 55.)

b. FREQUENCY. The frequency of the preventive maintenance services performed by unit mechanics (second echelon) outlined herein is considered a minimum requirement for normal operation of Power Unit PE–49–(*) or Motor Generator MG–37–A. Under unusual operating conditions, such as extreme temperatures or dusty or sandy terrain, it may be necessary to perform certain maintenance services more frequently.

c. OPERATOR'S PARTICIPATION. The operator (first echelon) should be present and should assist mechanics while periodic second echelon preventive maintenance services are performed. Ordinarily the operator should present the power unit for a scheduled preventive maintenance service in a reasonably clean condition; that is, it should be dry and should not be caked with mud or grease to such an extent that inspection and servicing will be seriously hampered. However, the power unit should not be washed or wiped thoroughly clean, since certain types of defects, such as cracks, leaks, and loose or shifted parts or assemblies, are more evident if the surfaces are slightly soiled or dusty.

d. TECHNICAL INSPECTIONS. (1) These inspections are performed by technically qualified personnel (usually third echelon or higher), under direct supervision of technically qualified officers. Technical inspections are made for the following purposes:

(*a*) To determine whether a power unit should be continued in service or withdrawn for overhaul or reclamation of component parts.

(*b*) To determine extent of damage and estimated cost of repair in Report of Survey and other similar proceedings.

(*c*) To discover causes of difficulties encountered by combat troops with matériel, so that efficiency may be improved.

(2) Whenever a power unit goes to a third or higher echelon maintenance shop for repair, it will receive a technical inspection to insure that all defects have been corrected before it is returned to the using organizations.

(3) Except in a theater of operations, technical inspections will be made whenever power unit accountability is transferred, to determine power unit conditions.

(4) After a technical inspection, the unit should be restored to a safe operating condition, unless it is to be scheduled for repair. Any disassembled parts or assemblies that are found to be damaged during the inspection should be replaced by serviceable ones.

55. Preventive Maintenance Roster (WD AGO Form 460)

a. DESCRIPTION. WD AGO Form 460 provides for recording preventive maintenance services scheduled over a 31-day period. The right-hand page contains 31 columns for the 31 days of a month. The adjacent columns on the left-hand page are used to list rank and name of operator, equipment nomenclature, remarks, equipment serial number (the number assigned the equipment by the using organization), accessory (this column remains blank), and equipment registration number (the serial number of the power unit). Only one line for each power unit will be used to record the periodic maintenance services performed during the month.

b. RECORDING SERVICES. Record services on the line corresponding with the nomenclature of each power unit.

c. LEGEND. In the column representing the appropriate date, enter the symbol legend for weekly (W), monthly (M), semiannual (S). Use the letter symbol P to indicate equipment deadlined for lack of parts. Use the letter symbol A to indicate equipment deadlined because of accident. Indicate equipment forwarded to higher echelons for repair by the letter symbol O.

d. INTERPRETATION OF SYMBOLS. For purpose of power unit maintenance, any period of 9 operating hours or any number of periods of operation totaling 9 hours are considered as 1 day; a total of 64 operating hours is considered as 1 week; a total of 256 operating hours is considered as 1 month; and a total of 1,024 operating hours is considered as ½ year.

e. ENTRIES. Plot WD AGO Form 460 in advance of each monthly period, making entries in pencil. Trace these penciled entries in with ink when the service is performed. Enter these services in the appropriate spaces as W_1 indicating the first weekly service, W_2 indicating the second weekly service, W_3 indicating the third weekly service, and W_4 indicating the fourth weekly service. Figure these weekly services from the last preceding monthly service. The monthly services are entered similarly with M_1, M_2, M_3, M_4, M_5, and M_6, and are figured from the last preceding semiannual service of the unit. The letter symbol S is used to indicate the semiannual service. In the event that a weekly and monthly, or any other two services fall on the same day, perform the shorter-period service 1 day in advance of its regularly scheduled date, placing the symbol in the appropriate space for the date on which the service was actually performed. If the unit is deadlined for lack of parts, accident, or higher echelon repairs, enter the appropriate symbol in the proper space for each day that the unit is out of service. When the unit is returned to service, carry out the previous plotted services as if there had been no interruption of the service. In the event that combat conditions make it impractical to perform the scheduled service on the scheduled date, perform the service at the earliest opportunity, circle the regularly scheduled date to indicate that the service has been performed. A sample of WD AGO Form 460, properly filled out, is shown in figure 35.

56. Preventive Maintenance Work Sheet

a. WD AGO Form 462 (Work Sheet for Full-track and Tanklike Wheeled Vehicles), adapted for use with Power Unit PE–49–(*) and Motor Generator MG–37–A, is provided to serve as a reminder and record of the unit mechanic's preventive maintenance services and technical inspections. (See figs. 36 and 37.)

b. The columns headed "Tech Insp," "100 Hour," and "50 Hour," on WD AGO Form 462 apply without modification to Power Units PE–49–(*).

c. The general procedures listed in this paragraph are to be applied in conducting the maintenance services and technical inspection. The manner in which each item listed on the form is to be inspected and serviced is explained in detail in paragraphs 57 and 58.

d. If instructions other than those contained in either the general or the specific procedures are required for the correct performance of a preventive maintenance service or for the correction of a deficiency, consult the officer in charge.

Note. Second echelon personnel must be so thoroughly trained in these procedures that they will apply them automatically.

e. All of the required identification data for the power unit should be entered in the space provided at the top of each form: The unit nomenclature should be complete; the serial number, operating organization, date, and hours of operation should also be recorded.

f. In order to indicate on the work sheet whether one of the periodic preventive maintenance services or the technical inspection is being performed, line out all words in the headings that do not apply to the service or inspection to be performed.

g. Opposite each item on these work sheets, a rectangle or box is placed, either under the periodic maintenance service heading, under the technical inspection heading, or under both. These boxes indicate which of the maintenance services or inspection is to be performed for each item. Each open box indicates that the item is to be inspected and corrected when necessary. Special service symbols like C, T, A, L, or S appear in some of the boxes. These symbols indicate that certain additional mandatory services are to be performed, and are explained in detail in *j* below.

h. All defects should be corrected upon discovery, or reported to higher echelon for correction.

i. The general inspection of each item applies also to any supporting member or connection, and usually includes a check to see whether the item is in good condition, correctly assembled, secure, or excessively worn. The mechanics must be thoroughly trained in the following explanations of these terms.

(1) The inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond safe or satisfactory limits or whether it is in such a condition that damage will result during operation. The expression "good condition" is explained further by such terms as the following: not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, not deteriorated, and adequately lubricated.

NO.	RANK AND NAME	EQUIPMENT NOMENCLATURE	REMARKS	UNIT SERIAL NO.	ACCESSORY	EQUIPMENT REG. NO.
1	T/4 Jones J.W.	PE-HE-43	FULL SERVICE	11		6-2098
2	T/5 MOORE A.M.	PE-214-B	FULL SERVICE	12		S-4713
3	T/5 SMITH C.W	PE-75-AD	FULL SERVICE	13		16405
4	PFC BROWN A.B.	PE-210	STAND-BY SERVICE	14		B-3119
5	T/4 HORN W.O.	PE-77-B	FULL SERVICE	15		Z-4112
6	Pvt BLOCK N.S.	PE-74-B	FULL SERVICE	16		A-3119
7	T/4 MONROE A.L	PE-95-G	FULL SERVICE	17		C-6743
8	T/5 SCHERE M.O	PE-113-B	FULL SERVICE	18		O-7211
9	PFC MULLER B.O	PE-85-L	FULL SERVICE	19		S-5666
10	T/5 MACK. R.T.	PE-205-B	STAND-BY SERVICE	20		B-3128
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PREVENTIVE MAINTENANCE ROSTER — MONTH APRIL — YEAR 1945

NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	NO.
1	W2							W3						W4	M4							W1							W2			1
2			W1							W2							W3					W4	M6	S							W1	2
3					W1							M5				P	P		W3						W4	M7						3
4	O	O	O	O	O	W1	O	O	O	O	O	O	W2	O	O	O	O	O	O	W3	O	O	O	O	O	W4	W3	O	O	O	O	4
5	W1							W2							W3						W4	M5							W1			5
6						M6	S																A	A	A							6
7										M1																						7
8											M3	O	O	O																		8
9																													M4			9
10																	M6	S														10
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TL.96890

Figure 35. Sample WD AGO Form 460, filled out.

Serial No. 419
WD No.

PREVENTIVE MAINTENANCE SERVICE AND TECHNICAL INSPECTION

Mileage _____ Date 18 Dec 44

WORK SHEET

FOR

FULL-TRACK AND TANK-LIKE WHEELED VEHICLES

(See AR 850-15)

Hour meter _____

Organization 1st Sig Bn

Vehicle nomenclature PE-49-F (Make) SCR-188-A (Model) (Engine No.) (Size) (Tank, medium armored car, etc.)

Special instructions: See TM 9-2810 for detailed instructions and procedures. See vehicle maintenance manual for technical information.

Legend for marking: ✓-Satisfactory X-Adjustment required XX-Repair or replacement required O-Defect corrected

SYMBOLS: ☐ -INSPECT AND CORRECT, C-CLEAN, T-TIGHTEN, A-ADJUST, L-SPECIAL LUBRICATION, S-SERVE

Line out words and sentences that do not apply.

100-HOUR MAINTENANCE OR TECHNICAL INSPECTION

50-HOUR MAINTENANCE

ROAD TEST

1 Before-operation Inspection

2 Instruments and Gages (oil pressure and hour meter) (Ammeter and voltmeter) (speedometer and odometer) (tachometer and revolution counter) (engine temperature) (transmission oil temperature) (transmission oil pressure) (fuel) (clock)

3 Windshield, Windshield Wipers, and Glass

4 Wheel Brakes (braking effect) (fail) (side pull) (noise) (chatter) (pedal travel) (vacuum booster action).

5 Brakes (steering and parking) (levers) (braking effect) (steering action) (hydro-vacuum booster)

6 Clutch (free travel) (drag) (noise) (grab) (chatter) (slip)

7 Transmission and Transfer (lever action) (vibration) (noise) (constant synchronization)

8 Steering (free play) (bind) (wander) (shimmy) (side pull) (booster)

9 Engine (idle) (acceleration) (power) (noise) (smoke) (governed speed) (oil consumption)

10 Unusual Noise (propeller shafts and joints) (differential and final drives) (sprockets) (idlers) (wheels) (support rollers) (tracks)

11 Temperatures (transmissions) (transfer) (differential and final drives) (hubs, sprockets, idlers, wheels, and rollers) (brake drums)

12 Gun Elevating and Traversing Mechanism (operation)

13 Leaks (engine oil) (water) (fuel)

14 Noise and Vibrations (engine) (mountings) (accessories and drives) (clutch) (exhaust)

15 Track Tension (final road test)

MAINTENANCE OPERATIONS

16 Engine Vacuum and Fuel Pump Test

Stop engine—Open Battery Switch

17 Crankcase (leaks) (level)

18 Side Armor (fenders) (guards) (paint and markings) (shackles) (sleeve)

19 Bottom (armor) (escape hatch) (inspection plates) (drain plugs)

20 Differential and Final Drives

21 Track (blocks) (connectors) (nudger)

22 Idler (wheels) (arms) (eccentrics) (serration plates) (adjustment nuts) (springs)

23 Bogie (levers) (arms) (lines) (guides, rollers and guides) (springs and seats) (frames) (wearing plates)

100-HOUR MAINTENANCE OR TECHNICAL INSPECTION

50-HOUR MAINTENANCE

24 Wheels (tires) (rollers and shids)

25 Sprockets (hubs) (teeth) (nuts)

26 Track Tension

27 Top Armor, (turret) (deck) (paint and markings) (grills) (doors) (hatches) (covers and latches) (antenna mast)

28 Caps and Gaskets (fuel) (radiator)

29 Radiator Removal (overhaul)

30 Engine Removal (when required)

31 Valve Mechanism (clearances) (lubrication) (cover gaskets) (rocker boxes) (push rod housings)

32 Spark Plugs (gaps) (deposits)

33 Compression test (record)

34 Generators and Starting Motors

35 Cartridge Starter

36 Distributors (cap) (rotor) (points) (shafts) (advance unit)

37 Magnetos (points)

38 Ignition Wiring and Conduits

39 Coils (standard) (booster)

40 Radial Engine (oil pumps) (sump) (oil screens and lines) (accessory case) (crankcase) (fuel screens and lines) (control linkage)

41 Diesel (fuel pumps) (injectors) (lines) (governor)

42 Breather Caps and Ventilators

43 Air Cleaners (carburetor) (Diesel)

44 Carburetor (choke) (throttle) (linkage) (governor) (primer)

45 Manifolds (intake) (exhaust)

46 Cylinder (heads) (gaskets) (radial cylinders)

47 Radial Engine (cowling) (air deflectors) (flywheel fan and guard) (steady bar) (support beam)

48 Clutch Assembly

49 Water Pumps, Fans, and Shrouds

50 Accessory Drives (belts) (pulleys) (shafts and couplings)

51 Engine Compartment (bulkhead) (control linkage)

52 Engine Oil (tanks) (coolers) (lines and fittings)

53 Fuel (tanks) (vents) (lines) (pumps)

54 Engine Oil Filters

55 Fuel Filters and Screens

56 Oil Coolers (transfer unit, transmission) (cores) (lines)

57 Exhaust Pipes and Mufflers

58 Engine Mountings

59 Clutch Release radial (yoke) (collars) (linkage) (mounting)

60 Fire Extinguisher System (tanks) (valves) (lines and nozzles) (mountings)

100-HOUR MAINTENANCE OR TECHNICAL INSPECTION

50-HOUR MAINTENANCE

61 Engine (install mountings) (lines and fittings) (wiring) (control linkage) (oil supply)

62 Radiators (install) (core) (mounting) (hose) (antifreeze, record)

63 Batteries (cables) (hold-downs) (carrier) (record gravity and voltage) (switch and fuel valves)

64 Accelerator (linkage) (dual throttle synchronization)

65 Starter (primer) (instruments)

66 Leaks (engine oil) (fuel) (water)

67 Ignition Timing

68 Regulator Unit (connections) (voltage) (current) (cut-out)

69 Engine Idle and Vacuum Test

70 Throttle Synchronization

71 Fighting Compartment (paint) (seats) (safety straps) (crash pads) (stowage boxes) (ammunition boxes, clips and racks)

72 Turret (basket) (cupola) (LOCKS)

73 Periscopes and Periscope

74 Clutch Pedal (free travel) (linkage) (return spring)

75 Brakes (steering) (parking) (levers) (latches) (linkage) (shafts)

76 Steering Brake Booster (hydro)

77 Differential and Breathers

78 Transmissions (breathers) (seals)

79 Transfer Unit (seals) (vent)

80 Transmission and Transfer Unit (controls) (linkage)

81 Propeller Shafts (joints and alignments) (seals) (flanges)

82 Hand-Crank Ratchet and Lever

83 Oil Dilution Valve and Lines

84 Compass (fluid) (lamp)

85 Lamps and Switches (head) (tail) (stop) (blackout) (interior)

86 Wiring (junction and terminal blocks and boxes) (fuses and spares)

87 Collector Ring (brushes) (leads) (cylinder) (cover)

88 Radio Bonding (suppressors) (filters) (condensers) (shielding)

AUXILIARY GENERATOR

89 Engine (crankcase) (fan and housing) (cylinder shield) (mountings) (exhaust pipe and heater duct)

90 Spark Plug (gap) (deposits) (baffle)

91 Magneto (points) (wiring) (shield)

92 Carburetor and Air Cleaner

93 Fuel (filter) (lines) (tank) (cap)

94 Generator (commutator) (brushes) (control box) (wiring)

95 Operation (engine) (generator) (ammeter) (heater) (leads)

*NOTE.—These items marked by an asterisk (*) require special additional services at each third 100 hour maintenance service.

FOLD TO ← VEHICLE NOMENCLATURE LINE → AND FILE

W. D., A. G. O. Form No. 462
April 12, 1943

TL95390

Figure 36. Front WD AGO Form 462, adapted for use with Power Unit PE-49-(*).

RECORD: Compression pressures: Right engine; Cylinder No. 1_____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____ 9 _____

Antifreeze protection to _____ °F. Left engine; Cylinder No. 1_____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____ 8 _____ 9 _____

BATTERY	No. 1 Battery	No. 2 Battery
SPECIFIC GRAVITY:	Cell No. 1 1.260 2 1.260 3 1.260 4 1.255 5 1.260 6 1.260	1 ____ 2 ____ 3 ____ 4 ____ 5 ____ 6 ____
VOLTAGE:	Cell No. 1 1.9 2 1.9 3 1.9 4 1.8 5 1.9 6 1.9	1 ____ 2 ____ 3 ____ 4 ____ 5 ____ 6 ____

Man hours required for this 50-hour maintenance _____ 100-hour maintenance _____ or technical inspection _____

Driver John Smith, cpl. (Grade or title) Mechanic or inspector Charles Lucas T/5 (Grade or title)

Repairs by higher echelon entered on job order request No. _____ Supervising officer Robert M. Wright 1st LT (Grade or title)

Repairs requested _____ (Date) (Initials) Vehicle forwarded _____ (Date) (Initials) Vehicle returned _____ (Date) (Initials)

Disposition of worksheets: 50-hour—May be retained until completion of the third 100-hour, then destroy
100-hour—May be retained until completion of the third 100-hour, then destroy
Technical inspection—May be retained until completion of the third 100-hour, then destroy

EARLIER DESTRUCTION MAY BE ORDERED BY LOCAL COMMAND.

REMARKS OR RECOMMENDATIONS: _____

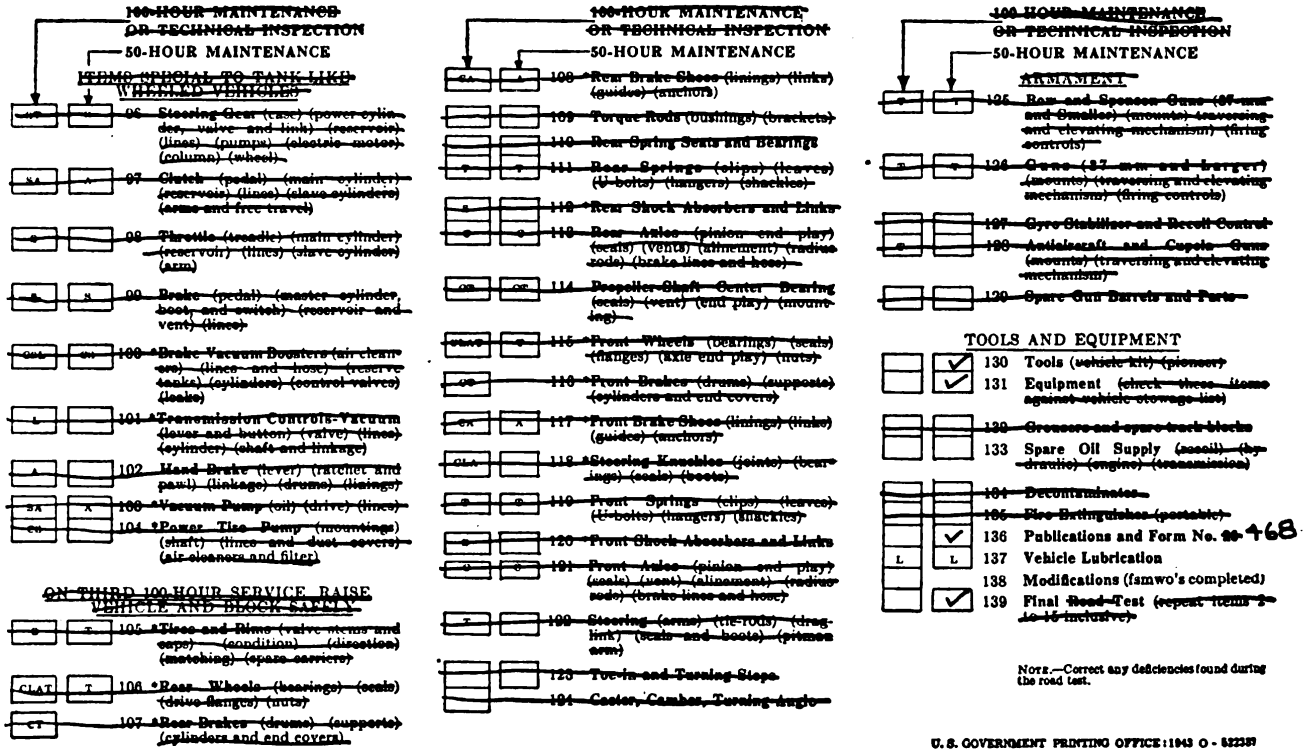


Figure 37. Back of WD AGO Form 462, adapted for use with Power Unit PE-49-(*).

(2) The inspection of a component 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 unit.

(3) The check of a component to determine whether it is "secure" is usually an external visual inspection or a hand-feel, a pry-bar, or a wrench check for looseness in the unit. Such an inspection will always include any brackets, and all lockwashers, locknuts, locking wires, or cotter pins, used to secure the tightening.

(4) The frequently used term, "excessively worn," will be understood to mean worn close to or beyond serviceable limits, and likely to result in failure if not replaced before the next scheduled inspection.

j. Special service symbols, as applied to the items of the periodic preventive maintenance services, indicate that the part is to receive certain mandatory services. For example: An inspection box with a T in it indicates that the part must not only be secure, but that the mounting bolts must be tightened properly with a wrench. These symbols are:

(1) *A, Adjust.* Make all necessary adjustments in accordance with the Technical Manual, special bulletins, or other current directives.

(2) *C, Clean.* (*a*) Clean components of the power unit to remove lubricant or dirt, using specified dry-cleaning solvent. After the parts are cleaned, rinse them in clean fluid and dry them well. Take care to keep the parts clean until reassembled. Keep cleaning fluid away from other material which it will damage.

(*b*) Clean the protective grease coating from new parts. This material is usually not a good lubricant.

(3) *L, Special lubrication.* Special lubrication (L) applies either to lubrication operations that do not appear on the lubrication order, or to items that do appear in the order but should be performed in connection with the maintenance operations if parts have to be disassembled for inspection.

(4) *S, Serve.* Compliance with the symbol S usually consists of performing special operations, such as replenishing battery water; draining and refilling units with oil; and changing or cleaning the fuel or oil-filter cartridge.

(5) *T, Tighten.* All tightening operations should be performed with sufficient wrench torque (force on the wrench handle) to tighten the unit according to good mechanical practice, using the proper tool without additional extension handle. Use torque-indicating wrench where specified. Do not overtighten, as this may strip threads. Tightening will always be understood to include the correct installation of lockwashers, locknuts, and cotter pins or locking wires provided to secure the tightening.

k. The condition in which items are found and the correction of defects should be indicated by the following markings:

(1) Mark the box with a V if found satisfactory.

(2) Mark the box X if adjustment is required.

(3) Mark the box XX if repair or replacement is required.

(4) When a defect is found and not corrected immediately, or if correction is to be made by higher echelon, explain under REMARKS, recording the item number of identification. When such a defect is corrected, either by organization mechanics or by higher echelon mechanics, encircle the X or XX thus: (*X*) or (*XX*).

l. The following considerations will determine whether a maintenance operation should be referred to a higher echelon, or performed by the operating organization. Repair to power units will be performed in the lowest echelon of maintenance consistent with:

(1) Availability of suitable tools.
(2) Availability of necessary parts.
(3) Capabilities of mechanics.
(4) Time available.
(5) Tactical situation.

m. When conditions make it difficult to perform the complete preventive maintenance service at one time, it can sometimes be handled in sections, planning to complete all operations within the week if possible. All available time at rest periods and in bivouac areas must be utilized if necessary. When limited by the tactical situation, items marked with special service symbols in the boxes should be given first consideration.

i. If a job order, WD AGO Form 9–67 (old WD OO Form 7362) is used when a power unit is sent to a higher echelon for the correction of any defect beyond the scope of organization maintenance, the job order number will be inserted in the space provided on the reverse side of the form.

o. The forms may be reduced to convenient

size for filing by folding up the line marked "Vehicle Nomenclature" but are to be filed only after all items marked X or XX have been corrected.

p. Hold 50-hour maintenance work sheets in the organization file until the third subsequent 100-hour maintenance work sheet is filed, then destroy. Hold 100-hour maintenance work sheets or technical inspection reports until the third subsequent 100-hour maintenance form is filed, then destroy.

57. Performing Items on Work Sheet

a. Perform the items on this form in the sequence listed wherever possible. They have been arranged for maximum efficiency and economy of motion. The general order is:

(1) A running test and closely related items.

(2) Maintenance operations, consisting of items on the exterior of the unit and items on the engine.

(3) Tools and equipment.

(4) Final running test.

b. Line out all items on the form which do not apply to maintenance procedures for Power Unit PE–49–(*) or Motor Generator MG–37–A. Figures 36 and 37 show WD AGO Form 462 with maintenance items deleted which do not apply to Power Unit PE–49–F.

c. Specific procedures for performing each item in the 50-hour and 100-hour maintenance services, and in the technical inspection are described in the following pages. Each page has three columns at its left edge, corresponding to the 50-hour maintenance service, the 100-hour maintenance service, and the technical inspection on Form 462, respectively. The 100-hour maintenance and technical inspection are both indicated in the same column on the form, but separate columns are provided in the following pages for clarification. Detailed procedures for each maintenance service and the technical inspection will be found in the procedure columns opposite the item numbers.

d. Very often a particular item does not apply to both the 50-hour maintenance, the 100-hour maintenance, or to the technical inspection. To determine which items to perform, follow the item numbers down the appropriate column, opposite the procedures.

e. Whenever it is necessary to disassemble a part or assembly during the technical inspection, perform the special services indicated for the item in the 100-hour maintenance service on the disassembled unit.

f. The following sample from the pages of maintenance items illustrates how to use them.

(1) Suppose work is being done on the 50-hour maintenance service. Item number 34, in the sample, appears in the 50-hour column opposite the first paragraph only, which means that the procedures for the 50-hour maintenance of item 34 are to be limited to instructions given in this paragraph only.

(2) Similarly, in the case of the 100-hour maintenance service, the presence of the number 34 opposite each paragraph indicates that all of these steps are to be performed for 100-hour maintenance. In the case of technical inspection, the first two paragraphs apply.

SAMPLE

Tech Insp.	100 Hour	50 Hour		
34	34	34	GENERATORS AND STARTING MOTORS. See that they are in good condition and securely mounted; that the wiring connections are tight; and that generators are correctly aligned with their drive belts and pulleys or drive shafts. On radial engines, look for evidence of oil leaks at the generator or starter mounting-pad gaskets.	Applies to all three columns
34	34		Remove the commutator inspection cover (par. 00) and inspect the commutator to see that it is in good condition and clean. Check to see that the brushes are free in the brush holders, clean, and not excessively worn and that the brush connections are secure. Note whether or not the wires are broken or chafing.	Applies to technical inspection and 100-hour maintenance

Tech Insp.	100 Hour	50 Hour		
	34		*Clean.* Clean the commutator end of the generators and starters by blowing out with compressed air.	Apply to 100-hour maintenance only
	34		*Tighten.* Tighten the starter mounting bolts securely.	

58. Maintenance Items

RUNNING TEST

Note. If the tactical situation does not permit a full test, perform items 2, 9, 13, and 14.

1	1	1	BEFORE-OPERATION INSPECTION. Perform the Before-operation Service outlined in paragraph 40 as a check to determine whether the unit is in a satisfactory condition to make the running test safely. See that the unit is adequately supplied with fuel, engine oil, and ventilation. ***Caution:*** Observe all starting precautions before starting the unit. (See pars. 29 and 30.)
2	2	2	INSTRUMENTS AND GAUGES. *Ammeter.* Watch the ammeter to see that it is indicating normally. (See pars. 35 and 36.) *Fuel gauge.* Observe whether the fuel gauge indicates the approximate amount of fuel in the tank. There is no fuel gauge on Power Unit PE–49–D.
9	9	9	ENGINE (IDLE, ACCELERATION, POWER, NOISE, SMOKE, GOVERNED SPEED, AND OIL CONSUMPTION). *Idle.* Observe whether the engine runs smoothly at normal idling speed. At all times during the test, note any tendency of the engine to stall. *Acceleration, power, and noise.* Observe whether the engine has normal acceleration, pulling power, and operating characteristics with different loads. With throttle wide open, listen for any unusual engine noise such as excessive "ping." Listen for other noises that might indicate damaged, excessively worn, inadequately lubricated engine parts or accessories, or loose coupling. *Smoke.* During the running test, look for any indication of excessive or unusual smoke from the exhaust. *Governed speed.* A check on the engine speed of Power Unit PE–49–(*) or Motor Generator MG–37–A may be made by observing the ability of the power set to supply the currents and voltages required for operation of the radio set and the battery-charging circuit. (See par. 3.)
11	11	11	TEMPERATURES (GENERATOR HOUSINGS AND BEARINGS, MOTOR BEARINGS). Feel the generator housing cautiously for abnormal temperatures, based on experience with the unit. Feel bearing housings of generator and drive motor (Motor MO–37–A on Motor Generator MG–37–A) for evidence of overheating. If any bearing appears to be overheated, lack of proper lubrication or excessive wear of the bearing is indicated. Report worn bearings promptly to the proper authority.
13	13	13	LEAKS. Look underneath the unit for indications of oil, or fuel leaks.
14	14	14	NOISE AND VIBRATIONS (ENGINE, MOUNTINGS, ACCESSORIES AND DRIVES, AND EXHAUST). Listen for any unusual noises in the engine or its accessories and accessory drives. Notice any excessive vibration that might indicate loose engine mountings, or noise that might indicate damaged,

Tech Insp.	100 Hour	50 Hour	
			loose, or inadequately lubricated parts. Note any unusual amount of smoke at the exhaust outlet or crankcase ventilators.
17	17	17	CRANKCASE (LEAKS AND LEVELS). Examine the crankcase for oil leaks, and see if the oil is up to the correct level.
	17	17	*Serve.* If an oil change is due, immediately after stopping the engine and completing the above inspection, drain the crankcase, and refill to the correct level according to the lubrication order. (See fig. 34.) However, if the engine is to be removed (par. 23*b*) do not refill the crankcase until the engine has been reinstalled, as in item 61.
28	28	28	CAPS AND GASKETS (FUEL). Observe whether they are in good condition, whether the caps lock securely on the filler necks, and whether their vents are open.
	30		ENGINE REMOVAL (WHEN REQUIRED). Engines should be removed on the 100-hour maintenance service, only if the inspections made in items 9, 13, 14 and a check on oil consumption indicate the need. See paragraph 23*b* for engine removal procedure.
	30		*Clean.* Clean and dry the exterior of the engine thoroughly, taking care to keep the dry-cleaning solvent away from electrical wiring and equipment. Hot water and soap, not harmful to insulation, should be used when available.
			Note. The above cleaning, and the following services, in items 31 to 58, should be performed in the best possible manner on engines that do not require removal.
	31		VALVE MECHANISM (CLEARANCES, LUBRICATION, COVER GASKETS, ROCKER BOXES, AND PUSH-ROD HOUSINGS). Observe whether the engine valve clearances are satisfactory. Also see that the engine valve tappets, rocker arms and shafts, and springs are in good condition, correctly assembled, and secure. Notice if oil is being properly delivered to overhead valve rocker arms and shafts. Observe whether the rocker arms or shafts are excessively worn, or whether the rocker-arm rollers have flat spots. Also examine the rocker box or valve chamber covers to see that they are in good condition, and their gaskets are serviceable. See paragraph 96 for disassembly and repair procedure.
	31		*Adjust.* Adjust the valve guide side clearance to 0.002 inch and valve tappet clearance to between 0.010 inch and 0.016 inch.
	32		SPARK PLUGS (GAPS AND DEPOSITS). Remove the spark plug and examine it for good condition. Always use the spark-plug wrench (fig. 20(904)) to remove the spark plug. Note whether the gap is satisfactory. Replace the plug if it has broken insulators, excessive carbon deposit, electrodes which are burned thin, or clogged cooling fins. Save and clean plugs which are unserviceable only because they are dirty. Inspect radio shielding for dirt and damage.
	32		*Clean.* Clean deposits from the insulators and electrodes, and check the insulators for cracks.
			Note. Report excessive carbon deposits and burned or cracked insulators, as these conditions may indicate incorrect heat range. Report damaged radio shielding.
	32		*Adjust.* Adjust electrode gaps to 0.025 inch by bending the grounded electrodes. After completing item 33, reinstall the plug, using new gaskets. Take care not to overtighten them as this may cause distortion and damage.

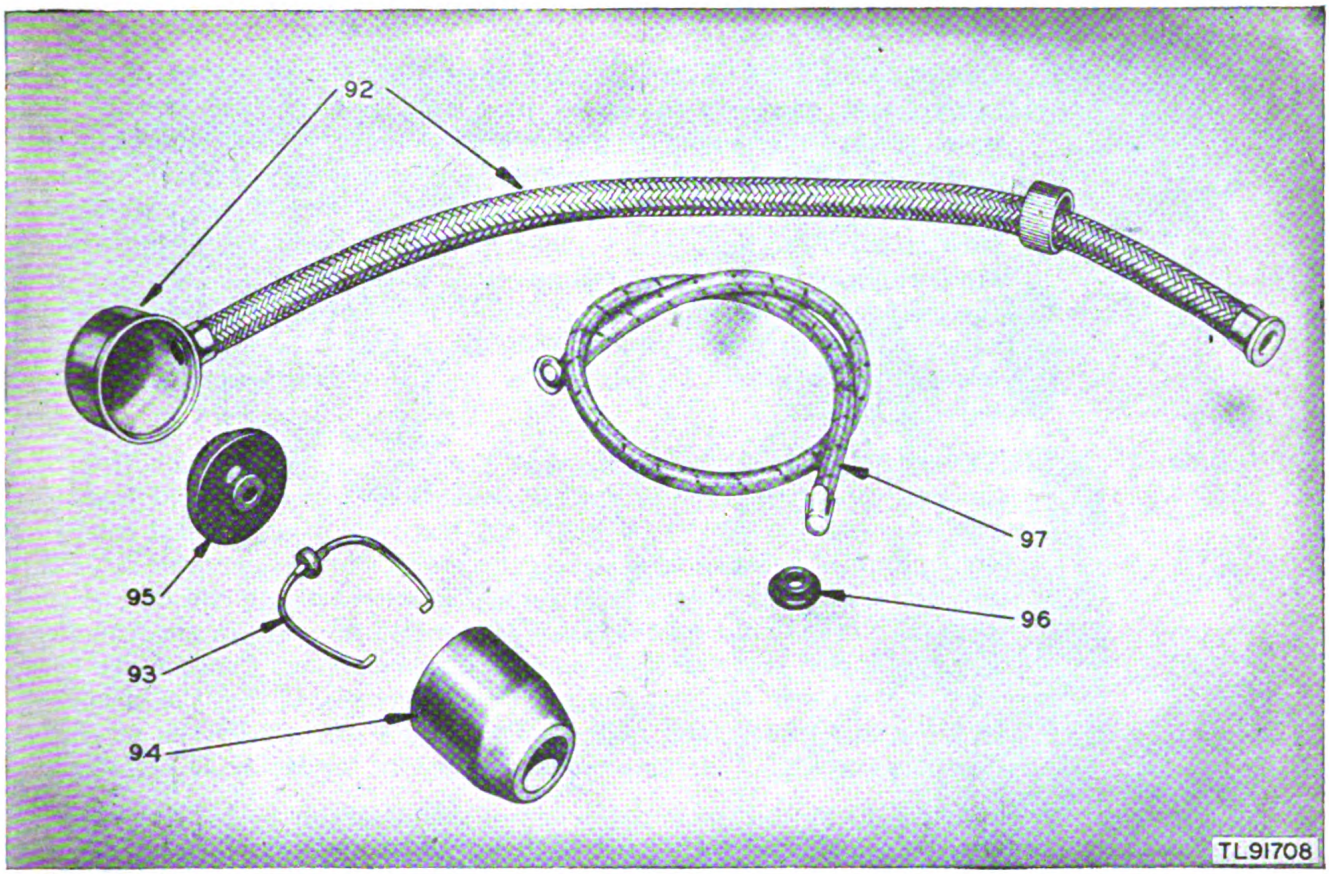


Figure 38. Spark-plug shield assembly.

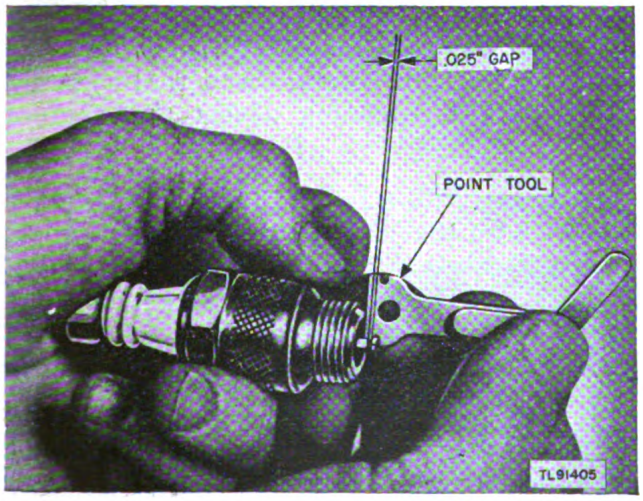


Figure 39. Setting spark-plug points.

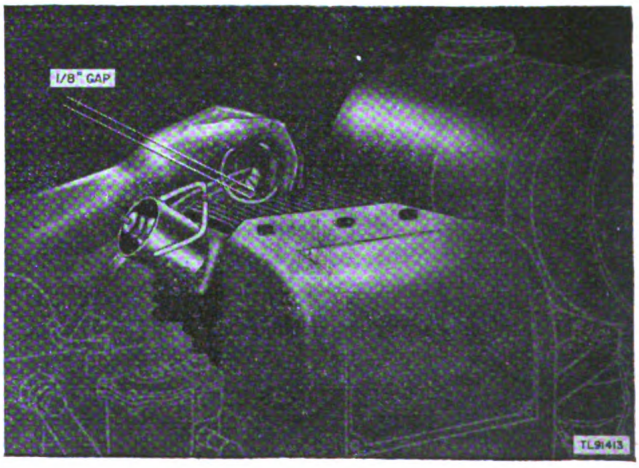


Figure 40. Testing ignition spark.

Tech Insp.	100 Hour	50 Hour	
	33		COMPRESSION TEST. With the spark plug out and engine warm, insert the compression gauge in the spark plug hole, and with the throttle wide open, revolve the engine at cranking speed until the maximum compression is indicated. A good compression reading is approximately 95 pounds. Record the reading in the space provided on the back of the form. If pressure is below normal, squirt sufficient engine oil on the piston head to temporarily prevent loss of compression, and recheck the compression of the cylinder. Low compression brought up to normal by oil sealing indicates piston, ring, or cylinder wear or damage. Low compression not brought up to normal by this method indicates compression leakage by a valve or gasket.
34	34	34	GENERATORS AND MOTORS. See that generator is in good condition and securely mounted, that the wiring connections are tight, and that it is correctly aligned with the drive shaft. Inspect wiring, general condition, and alignment between motor and generator if Motor Generator MG–37–A
34	34		is being used. Remove the high-voltage and low-voltage end covers (par. 101), and inspect the commutators to see that they are in good condition and clean. See that the high-voltage and low-voltage brushes are clean, free in the brush holders, and not excessively worn; that the brush connections are secure; and note whether lead wires are broken or chafed. See paragraph 100 for maintenance procedure for Motor MO–37–A.
	34		*Clean.* Clean the commutator end of the generator by blowing out with compressed air.
37	37	37	MAGNETOS (POINTS). Determine whether they are in good condition and securely mounted. Remove the four screws (fig. 41(212)) that hold the magneto-breaker cover (fig. 41(135)) to the magneto. Be careful not to damage the gasket (fig. 41(142)) when removing the cover. If only slightly pitted, dress the points with #00 sandpaper or a fine-grit bone. If the points are badly pitted, replace both points. Clean the magneto-breaker cover inside and outside with dry-cleaning solvent (SD) before replacing it.
	37		*Adjust.* Check the breaker-point gap with a feeler gauge. (See fig. 42.) The correct gap is 0.015 inch. Be sure that the points are open to their widest gap when checking. If the breaker gap is not satisfactory, loosen the fixed contact-locking screw (fig. 41(205)) and adjust the gap by turning the eccentric adjusting screw. Be sure to retighten the locking screw when a satisfactory adjustment has been made. Recheck gap after retightening screw.
38	38	38	IGNITION WIRING AND CONDUITS. See that these items are in good condition, clean, correctly assembled and connected, securely mounted, and not chafing against other engine parts.
	38	38	*Clean.* Clean all exposed ignition wiring with a dry cloth.
			Note. Do not disturb connections unless they are actually loose. Overtightening may result in damage to the terminals.
43	43	43	AIR CLEANERS (CARBURETOR). Remove the air cleaner elements. The oil in the reservoir should be at the proper level and not filled with sediment. Examine the disassembled air-cleaner parts and any connecting hose or tubes to see that they are in good condition. Note particularly whether the cleaner element is damaged.

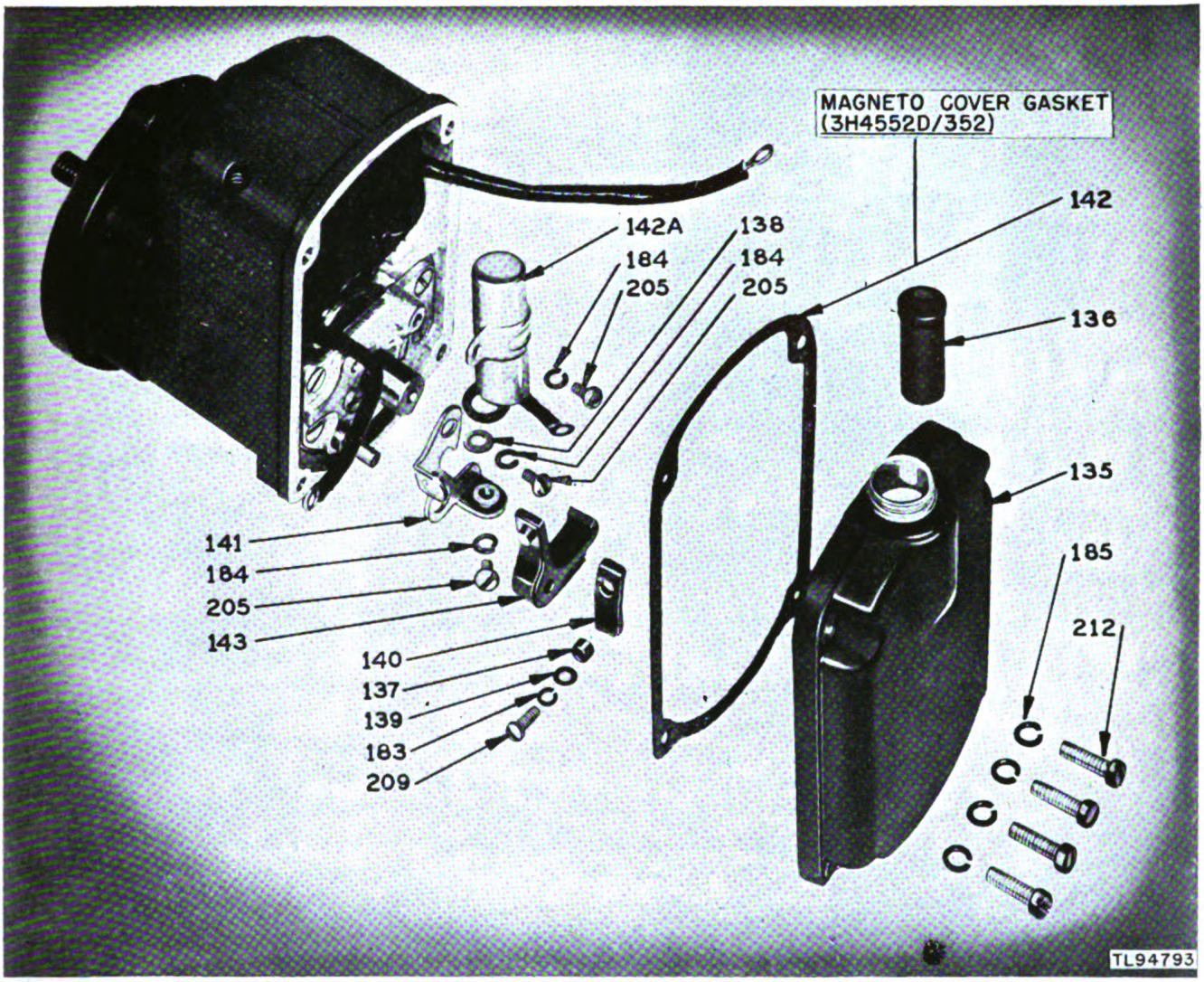


Figure 41. Magneto breaker-point assembly.

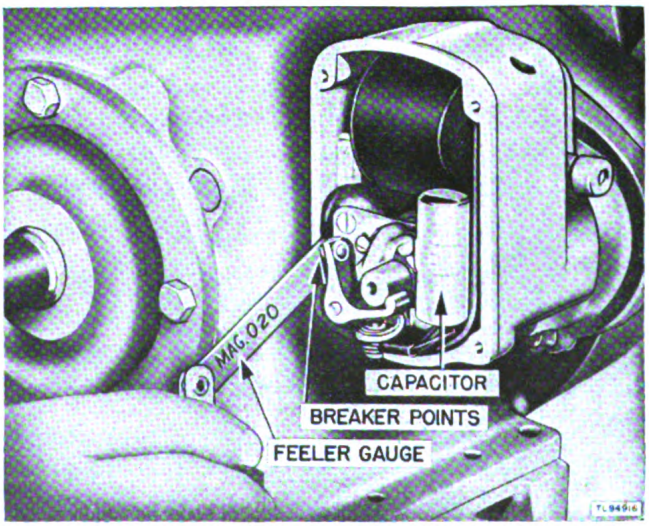


Figure 42. Checking magneto-point clearance.

Tech Insp.	100 Hour	50 Hour	
	43	43	*Clean.* Clean the reservoirs and elements in dry-cleaning solvent (SD), and drain.
	43	43	*Serve.* Fill the oil cup to the level of the beaded mark in the cup. Follow instructions in lubrication order. (See fig. 34.) Apply engine oil on elements and drain. Reassemble cleaner, making certain all gaskets are in good condition and in place. Reinstall air cleaner, giving special attention to mounting and fastening.
44	44	44	CARBURETOR (CHOKE, THROTTLE, LINKAGE, GOVERNOR, AND PRIMER). See that they are in good condition, correctly assembled, and securely installed. Be sure the carburetor does not leak; that the control linkage, including the choke and throttle shaft, is not excessively worn; and that the choke valve opens fully when the control is in its released position. See that the throttle valve functions properly; and that the governor is properly sealed.
	44	44	*Clean.* Remove the fuel-strainer screen from the carburetor fuel intake (fig. 73 and par. 93), clean it in dry-cleaning solvent (SD), dry and reinstall it.
46	46	46	CYLINDER (HEADS, GASKETS). See that the cylinder head is in good condition and secure, and note indications of oil leakage or blow-by around studs, cap screws, or gaskets. Blow-by is usually indicated by carbon streaks. ***Caution:*** Cylinder head, cylinder pad hold-down nuts or cap screws should ordinarily not be tightened, unless there is a definite indication of looseness or leaks. If a new head gasket is necessary to stop leaks, remove the cylinder head according to instructions in paragraph 95. Always check to see that the valve-tappet clearances are correct (par. 96) after tightening the cylinder head.
	46		*Clean.* Clean all deposits of dirt or excess grease.
49	49	49	FANS, AND SHROUDS. Observe whether they are in good condition, correctly assembled, and secure. Note particularly whether the flywheel and fan (fig. 43(80)) is securely keyed on the shaft.
50	50	50	ACCESSORY DRIVES (SHAFTS, AND COUPLINGS). See that these items are in good condition, correctly assembled, and secure.
52	52	52	ENGINE OIL (FITTINGS). Observe for good condition, correct assembly, secure mounting, and indications of oil leaks. Measure the oil level in the crankcase with the bayonet gauge. Inspect the sample of oil on the bayonet gauge for grit, water, or fuel dilution. Rubbing a sample of oil between the fingers may indicate the presence of grit. Also see that the filler cap and gasket are in good condition and seal properly.
53	53	53	FUEL (TANKS, VENTS, LINES). See that they are in good condition, correctly assembled, and securely mounted. See that the vent is open, and check for fuel leaks from the tank and line.
	53		*Tighten.* Tighten all fuel tank mountings and fuel line support clips or brackets securely.
	53	53	*Serve.* Drain the water and sediment from the fuel tank by removing the sediment bowl (fig. 33(106)) and opening the fuel-tank shut-off valve (fig. 33 (107)) until fuel runs clean. Tighten the shut-off valve securely to prevent leakage of good fuel.

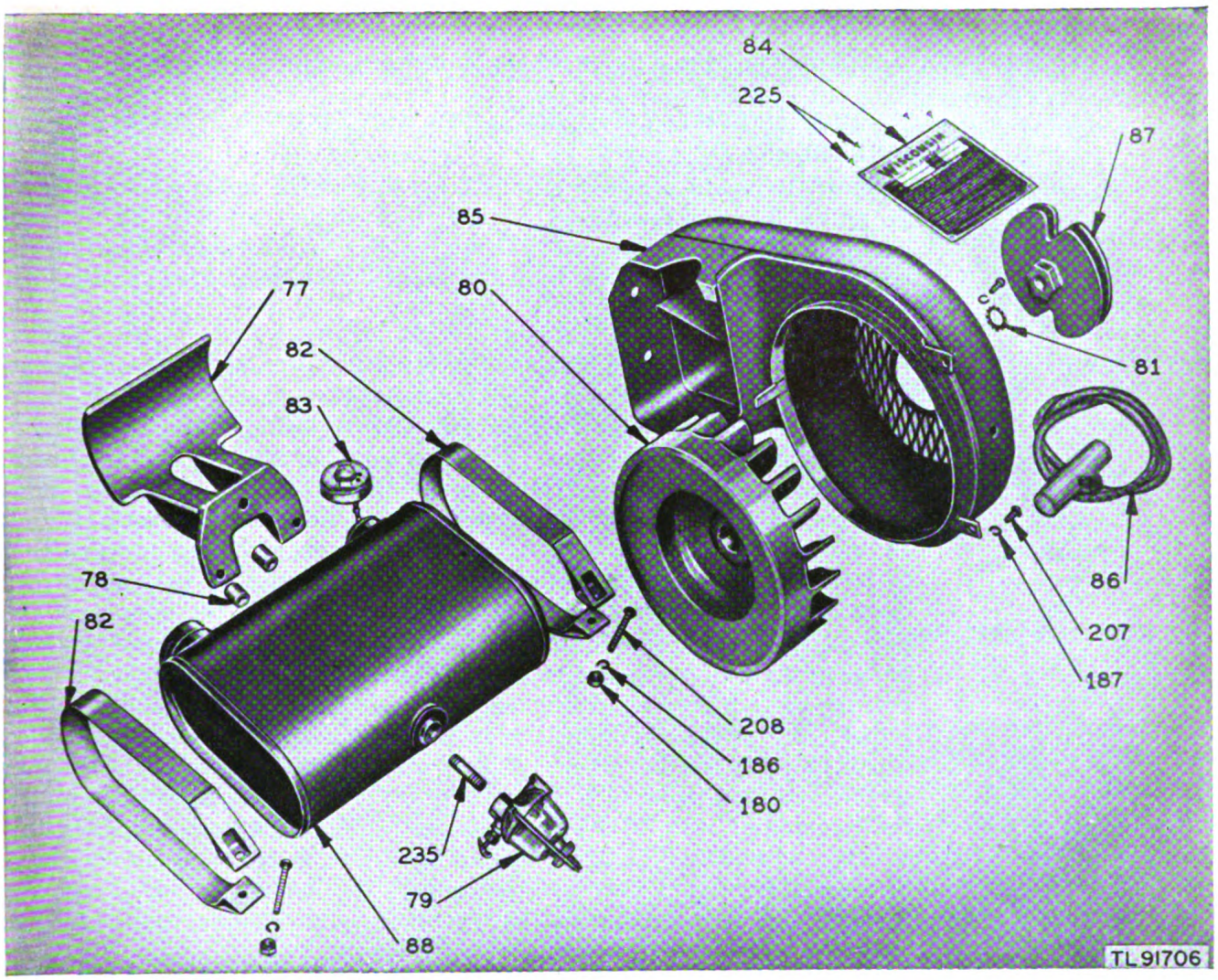


Figure 43. Fuel tank and air-cooling shrouds.

Tech Insp.	100 Hour	50 Hour	
			Caution: When performing this operation, use a container to catch the drainings, and use every precaution not to spill the fuel. If any fuel does spill, swab it thoroughly dry before starting the engine.
55	55	55	FUEL FILTERS AND SCREENS. Note whether the fuel filter and sediment bowl (fig. 33) are in good condition, secure, and not leaking at gaskets or connections.
		55	*Clean.* Remove fuel screen and clean it thoroughly in dry-cleaning solvent (SD), dry with compressed air, and reinstall. Remove the plug, and drain the sediment bowl. Remove and clean the glass sediment bowl.
57	57	57	EXHAUST PIPES AND MUFFLERS. Note whether they are in good condition, securely assembled, and mounted. Check for exhaust leaks, usually indicated by carbon streaks. Be sure the drain holes in the muffler (figs. 10, 11, and 12) are not clogged, so that all condensate may drain off.
	57		*Tighten.* Tighten all mounting bolts and connections securely.
58	58	58	ENGINE MOUNTINGS. Observe all accessible mountings to see that they are in good condition and secure.

Tech Insp.	100 Hour	50 Hour	
	58		*Tighten.* Tighten all accessible mountings and brackets securely.
	61		ENGINE: (INSTALL MOUNTINGS, LINES AND FITTINGS, WIRING, CONTROL LINKAGE AND OIL SUPPLY). *Serve.* Reinstall removed engine according to the instructions in paragraph 23. Tighten mountings securely and connect properly all fuel and oil lines, wiring, and control linkage which were disconnected when the engine was removed. Also refill the engine crankcase with specified oil. (See fig. 34.)
63	63	63	BATTERIES (CABLES, AND RECORD GRAVITY AND VOLTAGE). Inspect the battery externally to see that the case, posts, and cell straps are in good condition and secure. Note whether the case is leaking. Wipe dirt from around the filler caps. Remove the caps and see that the cap vents are open. Note the level of electrolyte in the cells. This level should be above the top of the plates, and may extend up to ½ inch above the plates. Before adding any water to the cells, test the specific gravity of each cell with a battery hydrometer, and record the gravity readings in the spaces provided on the reverse side of WD AGO Form 462. While the samples of the electrolyte are in the hydrometer for the gravity test, observe whether the electrolyte is discolored to a reddish-brown color, which may indicate that the battery is being overcharged because of improper regulator action. Report any gravity readings below 1.225 and variations of more than 0.025, and any reddish-brown discoloration of the electrolyte. Also take the voltage reading of each cell, and record it in the space provided on the reverse side of WD AGO Form 462. See whether the battery cables, terminals, and terminal bolts are in good condition, secure, and not corroded. If the terminals are corroded, disconnect the cable terminals from the battery. Clean and cover the battery posts and terminals with general purpose grease No. 2 and reinstall them securely.
63	63		*Test.* Make a high-rate discharge test of the battery to see that the cells are in satisfactory condition. Make the test according to the instructions for a condition test which accompany the test instrument. A true test cannot be made if the gravity of the battery is below 1.225. If the difference in the readings obtained from the cells is more than 30 percent, replace the battery.
	63	63	*Clean.* Clean the top of the battery with water or a soda wash if available, and dry with a clean rag or compressed air. Clean the battery carrier in the same way, and paint if corroded.
	63	63	*Serve.* Bring the electrolyte up to the correct level with distilled water. If not available, use any clean water in preference to letting battery run dry.
65	65	65	STARTER (PRIMER AND INSTRUMENTS). Observe all starting precautions as outlined in item 1. Start the engine, and observe whether or not the primer operates satisfactorily. Also, as soon as the engine starts, observe whether all instruments operate properly, particularly if ammeter indications are satisfactory.
66	66	66	LEAKS (ENGINE OIL, FUEL). Inspect for oil leaks from the engine and for any leaks from the fuel system parts.

Tech Insp.	100 Hour	50 Hour	
67	67		IGNITION TIMING. With the engine running see if the ignition timing is correct. If the engine operates smoothly, the timing should not be touched. If necessary, adjust the ignition timing according to instructions in paragraph 97.
68	68	68	REGULATOR UNIT (CONNECTIONS, VOLTAGE, CURRENT, AND CUT-OUT). See that they are in good condition and that all connections and mountings are secure. Connect the low-voltage circuit tester to the regulator correctly, and observe whether the voltage regulator, current regulator, and cut-out control the generator output properly. Follow the instructions in paragraphs 106 and 109. Power Units PE–49–F and PE–49–G are equipped with field rheostats instead of voltage regulators.
68	68		***Caution:*** Make these tests only after the power unit has reached normal operating temperatures.
69	69	69	ENGINE IDLE.
			Engine Idle. Note whether the engine idles smoothly at normal idle speed.
			Adjust. Adjust the engine idle speed to specifications by means of the throttle stop screw. (See fig. 68(210).) Turn the idle needle valve (fig. 68(116)) in the direction which "leans" the mixture until the engine idle becomes rough due to misfiring. Turn the needle slowly in the opposite direction to enrich the mixture until the roughness disappears and the engine idles smoothly. Do not turn further than necessary to smooth out the idle so that it will not stall. See paragraph 92 for additional information on carburetor adjustment.
82	82	82	HAND-CRANK. See that rope-starter sheave is in good condition and securely mounted. See that starter rope is in good condition.
86	86	86	WIRING (JUNCTION AND TERMINAL BLOCKS, BOXES, FUSES, AND SPARES). Observe all exposed electrical wiring and conduits to see that they are in good condition, well supported, with the wiring securely connected to its terminals. Also make sure that all junction and terminal blocks and boxes are in good condition, secure, and that all necessary fuses and spares are in place and in good condition. Check circuit breakers and switches for mechanical operation, cleanliness, and mountings.

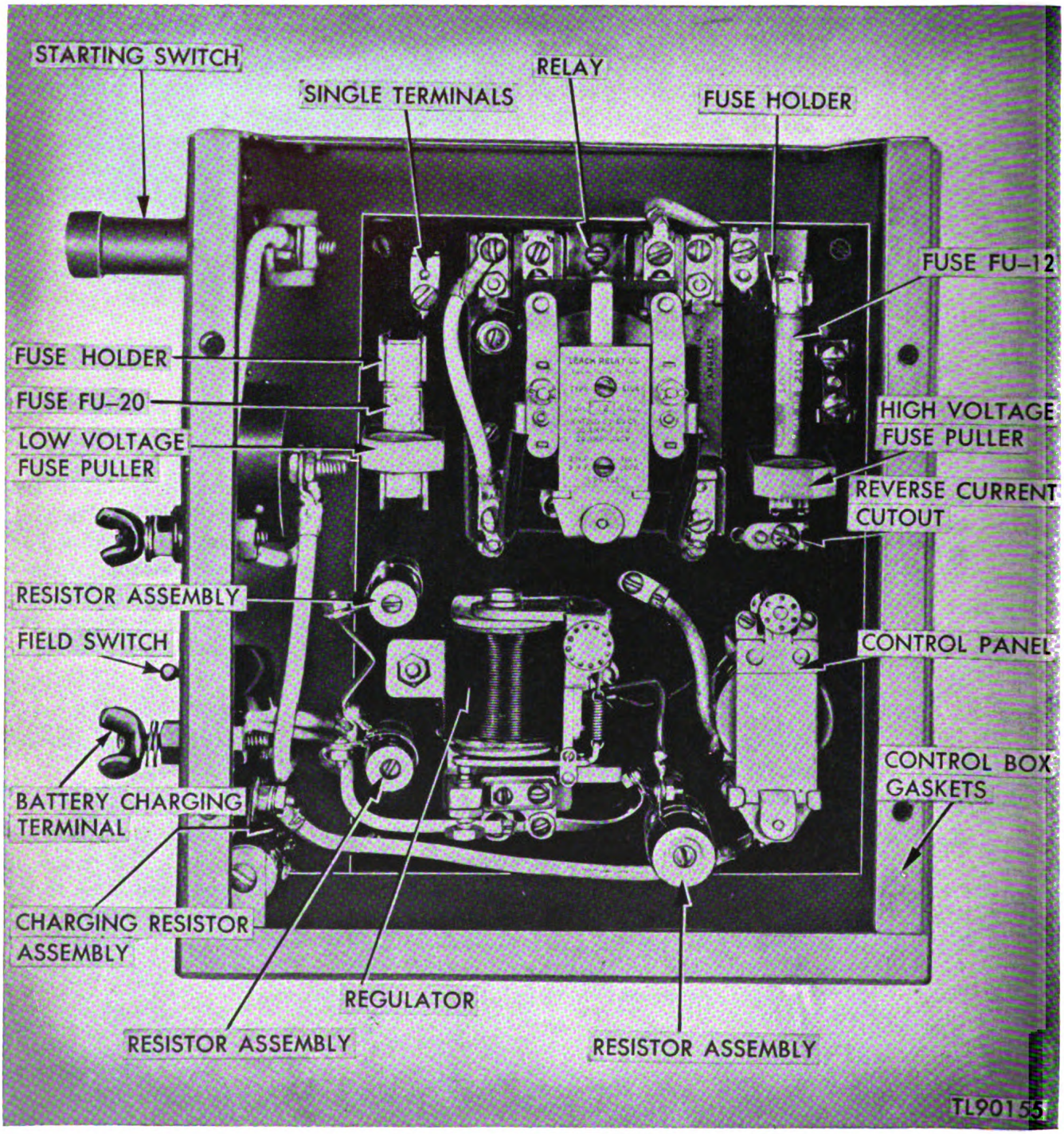


Figure 44. Control box for Power Unit PE–49–D—interior view.

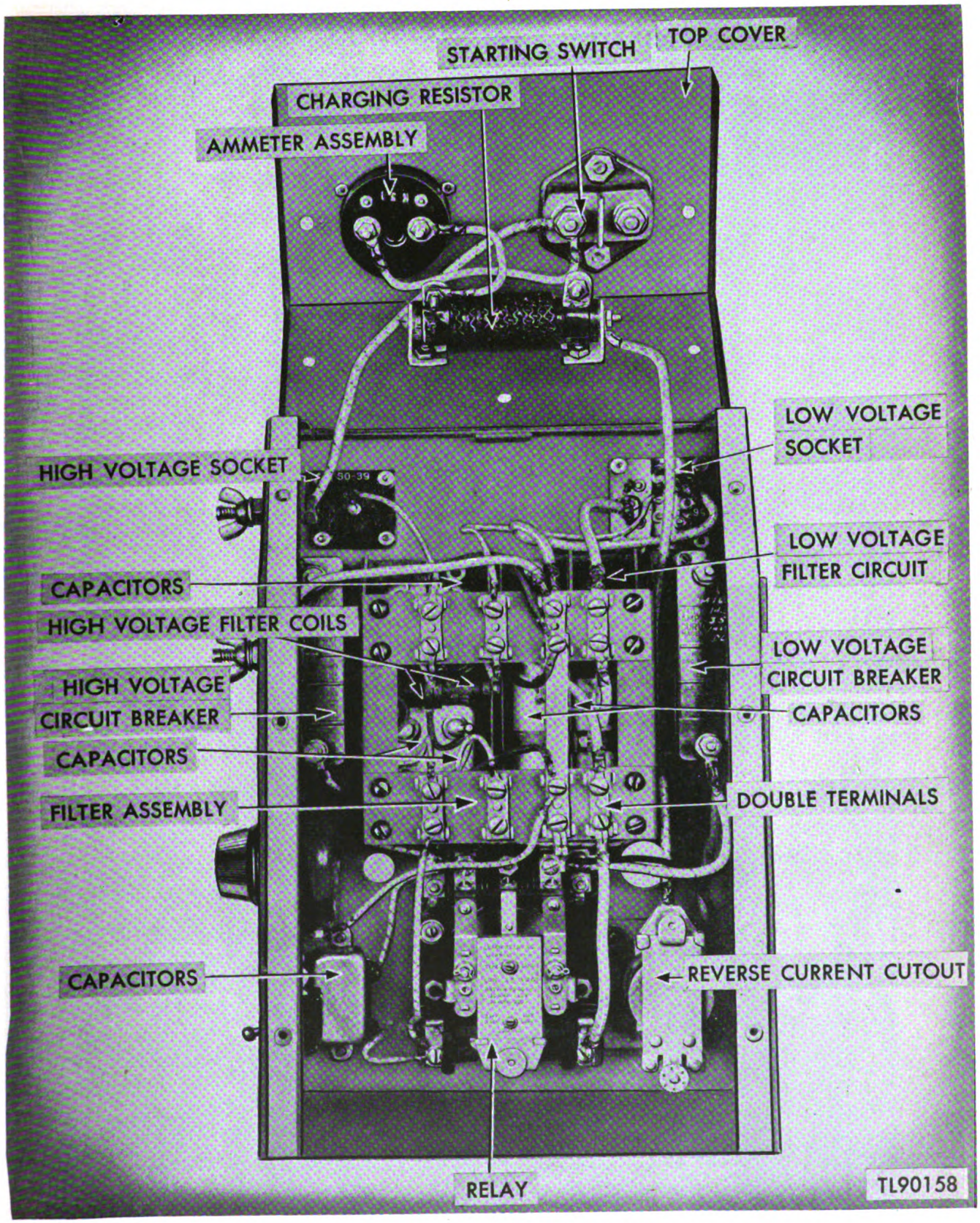


Figure 45. Control box for Power Unit PE–49–F—interior view.

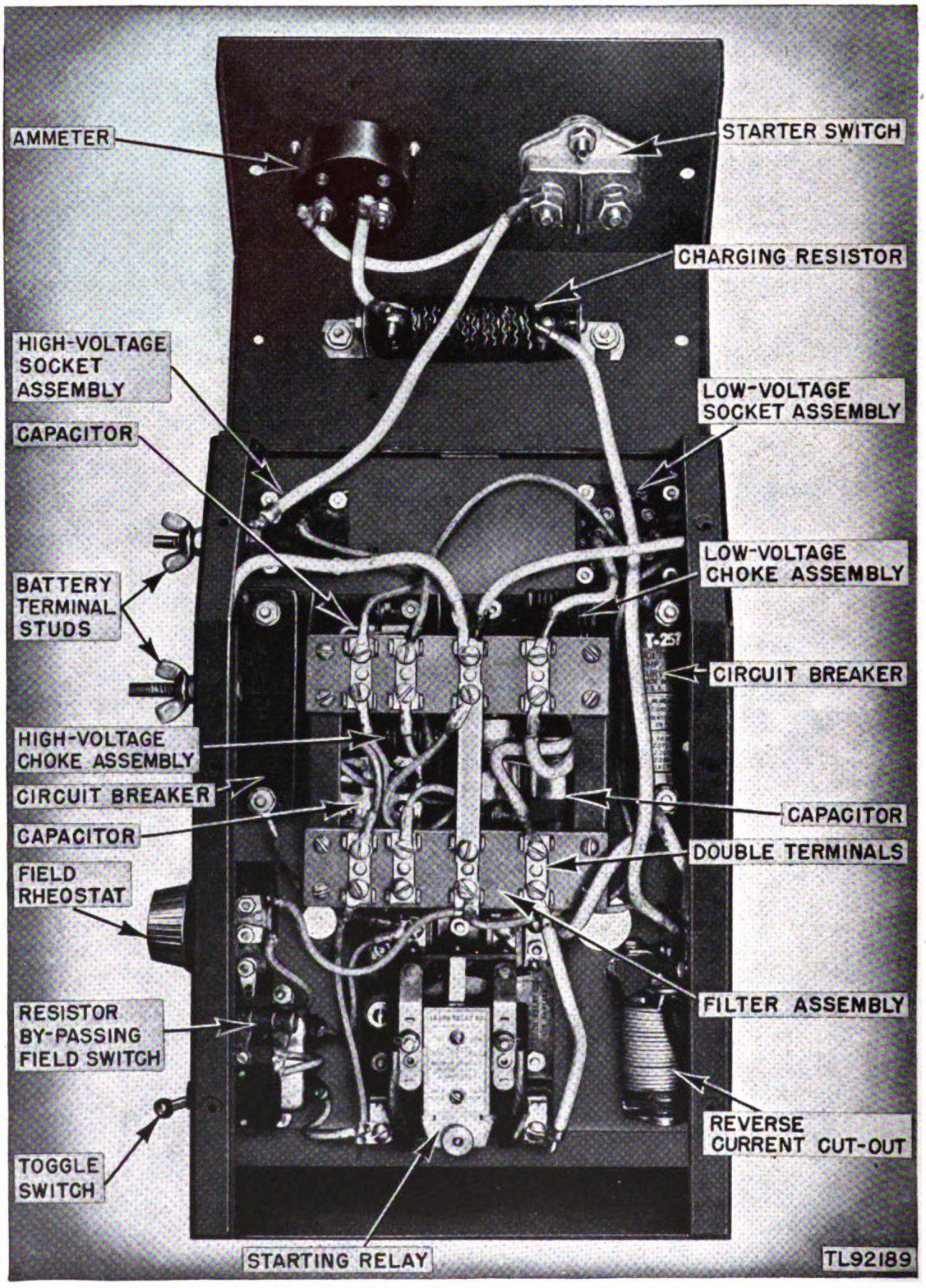


Figure 46. Control box for Power Unit PE-49-G—interior view.

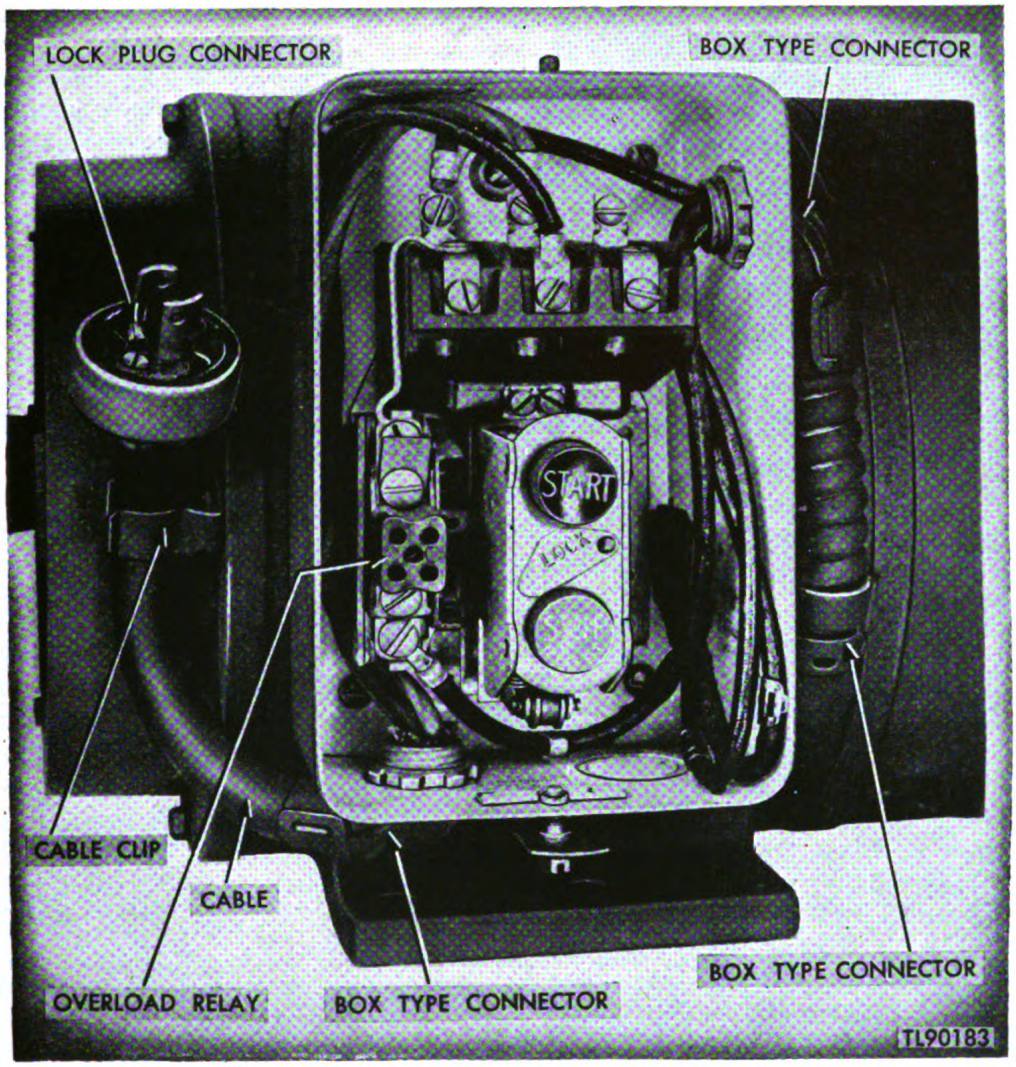


Figure 47. Starter switch box for Motor Generator MG–37–A—cover removed.

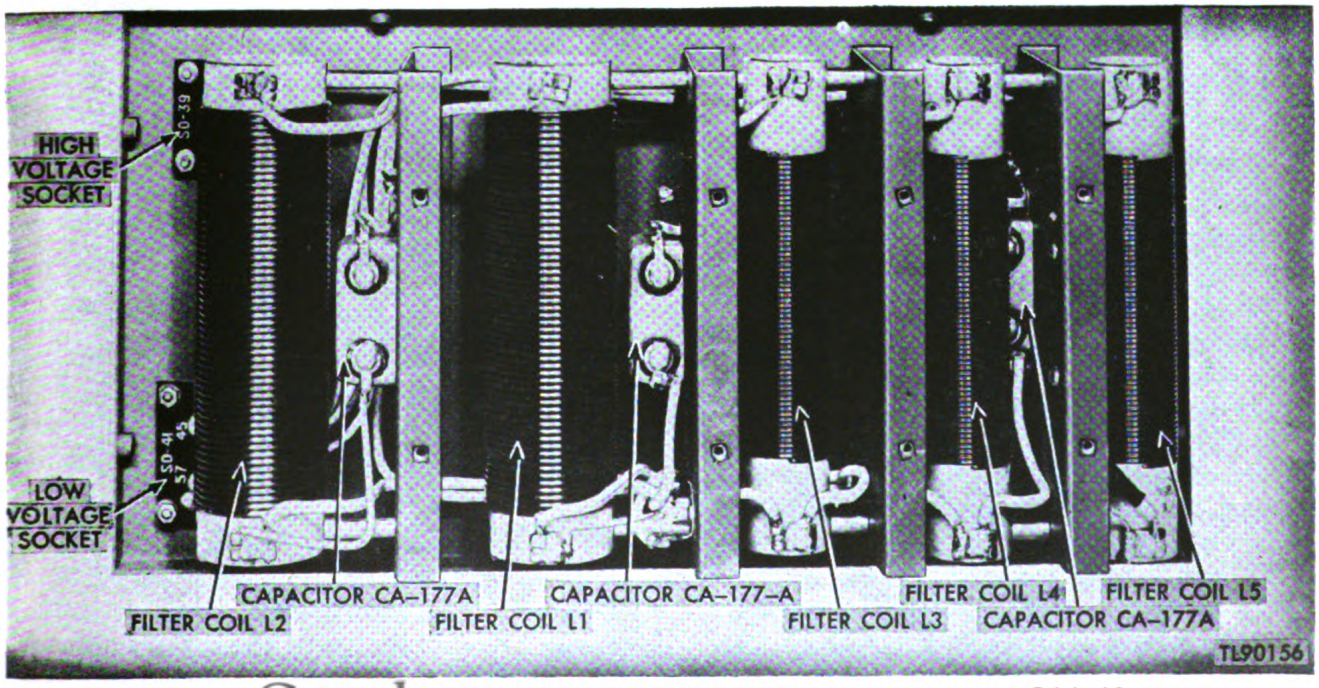


Figure 48. Filter box for Power Unit PE–49–D—cover removed.

Tech Insp.	100 Hour	50 Hour	
88	88	88	RADIO BONDING: (SUPPRESSORS, FILTERS, CONDENSERS, AND SHIELDING). Examine these items to see that their bonding connections are in good condition, clean, secure, and that all items are securely mounted.
			Note. Any irregularities, except cleaning and tightening, must be reported to the proper authority.
130	130	130	TOOLS. All standard tools (par. 14) should be present, in good condition, and properly stowed in the hood.
131	131	131	EQUIPMENT. Check against spare parts list (par. 15) to see if all items are present, in serviceable condition, and properly stowed in the hood.
133	133	133	SPARE OIL SUPPLY. Observe whether supply of spare oil is on hand. A supply should be maintained at all times.
136	136	136	PUBLICATIONS AND FORM 468. The Technical Manual, WD Form 48, War Department Lubrication Order, and WD AGO Form 468 should be present and in legible condition.
137	137	137	LUBRICATION. Inspect the lubrication of the entire unit to see whether it has been receiving proper attention. On any engine where disassembly is necessary for inspection purposes, lubrication must be performed, unless the power unit is to be scheduled for repair. Lubricate in accordance with the instructions on the lubrication order (fig. 34), section VIII, and current lubrication bulletins or directives. Wipe off excess lubricant that may drip onto operating surfaces, soil clothes, or detract from the appearance of the power unit.
138	138		MODIFICATIONS. Check to see that all field service modification work orders have been completed.
139	139	139	FINAL TEST. Make a final running test, rechecking items 2, 9, 11, 13, and 14.
			Note. Correct any deficiencies found during the test.

Section X. MOISTUREPROOFING AND FUNGIPROOFING

59. Moistureproofing and Fungiproofing Treatment

a. GENERAL. The operation of Signal Corps equipment in tropical areas where temperature and relative humidity are extremely high requires special attention. The following items represent problems which may be encountered in operation:

(1) Resistors, capacitors, coils, chokes, transformer windings, etc., fail.

(2) Electrolytic action takes place in resistors, coils, chokes, transformer windings, etc., causing eventual break-down.

(3) Hook-up wire and cable insulation break down. Fungus growth accelerates deterioration.

(4) Moisture forms electrical leakage paths on terminal boards and insulating strips, causing flash-overs and crosstalk.

(5) Moisture provides leakage paths between battery terminals.

b. TREATMENT. A moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection against fungus growth, insects, corrosion, salt spray, and moisture. The treatment involves the use of a moisture- and fungi-resistant varnish applied with a spray gun or brush. See TB SIG 13 for a detailed description of the varnish-spray method of moistureproofing and fungiproofing and the supplies and equipment required in this treatment.

Caution: Varnish spray may have toxic effect if inhaled. Use respirator if available; otherwise, fasten cheesecloth or other cloth material over nose and mouth.

60. Step-by-Step Instructions for Treating Power Unit PE–49–D

a. PREPARATION. Make all repairs and adjustments necessary for proper operation of the equipment.

b. DISASSEMBLY. (1) Remove cover from control box to be treated. (See fig. 27.)

(2) Remove cover from filter box (16 screws) to be treated. (See fig. 13.)

(3) Remove lead from negative charging terminal (fig. 44) to filter box.

(4) Remove lead from low side of remote-control relay (fig. 44) to filter box.

(5) Remove lead from remote-control solenoid (fig. 44) to filter box.

(6) Remove lead from high-voltage terminal on remote control relay (fig. 44) to filter box.

(7) Remove negative high-voltage lead from terminal block to filter box.

(8) Remove lead from reverse-current relay (fig. 44) to battery-charging resistor.

(9) Remove lead A from generator to negative charging terminal. (See fig. 44.)

(10) Remove lead L from generator to low-voltage fuse clip. (See fig. 44.)

(11) Remove lead F from generator to field switch. (See fig. 44.)

(12) Remove lead S from generator to starter switch (See fig. 44.)

(13) Remove negative high-voltage lead from generator to connection block.

(14) Remove positive high-voltage lead from generator to fuse clip. (See fig. 44.)

(15) Remove lead from field switch to resistor. (See fig. 44.)

(16) Remove lead from negative charging terminal to filter capacitor (back of panel).

(17) Remove panel assembly (four screws) to be treated.

(18) Remove two screws holding filter-box support, to generator frame. (See fig. 4.)

(19) Remove remaining screws holding filter box to control box.

(20) Remove filter box and control box cover to be treated.

(21) Remove lockwashers, holding nipples, from generator to control box.

(22) Remove screws, holding control-box supports to generator frame.

(23) Remove control box to be treated.

(24) Clean all dirt, dust, rust, fungus, oil, grease, etc., from the equipment to be processed.

c. MASKING (fig. 49). (1) Mask with tape the three pairs of contacts on switching relay.

(2) Mask contacts and contact screw on voltage regulator.

(3) Mask pivots on voltage regulator armature.

(4) Mask pair of contacts on reverse-current relay.

(5) Mask connecting lugs on all disconnected leads.

(6) Replace and tighten all disconnected terminal screws and nuts.

(7) Mask fuse clips.

d. DRYING. Place all parts to be treated in oven or under heat lamps and dry for 2 to 3 hours at 160°F.

e. VARNISHING. Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, spec. No. 71–2202 (stock No. 6G1005.3), or equal) with spray gun as follows:

(1) Spray panel on both sides.

(2) Spray interior surfaces of control box.

(3) Spray all components of filter box.

(4) Spray filter-box cover on inside.

(5) Spray inside of control box cover.

(6) Brush all crevices and joints in meter.

(7) Brush around glass window of meter where it meets the holding ring.

f. REASSEMBLY. (1) Remove all masking tape.

(2) Clean all contacts with varnish remover, and burnish the contacts.

(3) Reassemble the set and test its operation.

g. MARKING. Make the letter MFP and the date of treatment near the nomenclature nameplate on the equipment and in such a location that the marking will not become obliterated or rubbed off.

Example: MFP—8 Jun 45.

61. Step-by-Step Instructions for Treating Power Units PE–49–F and PE–49–G

a. PREPARATION. Make all repairs and adjustments necessary for the proper operation of the equipment.

b. DISASSEMBLY. (1) Remove four screws holding cover to control box. (See fig. 28.)

(2) Remove four screws holding top to control box. (See fig. 28.)

(3) Lift top and lay toward generator as far as leads will allow.

(4) Remove cover to be treated later.

(5) Remove field lead from FIELD SWITCH. (See fig. 46 (856).)

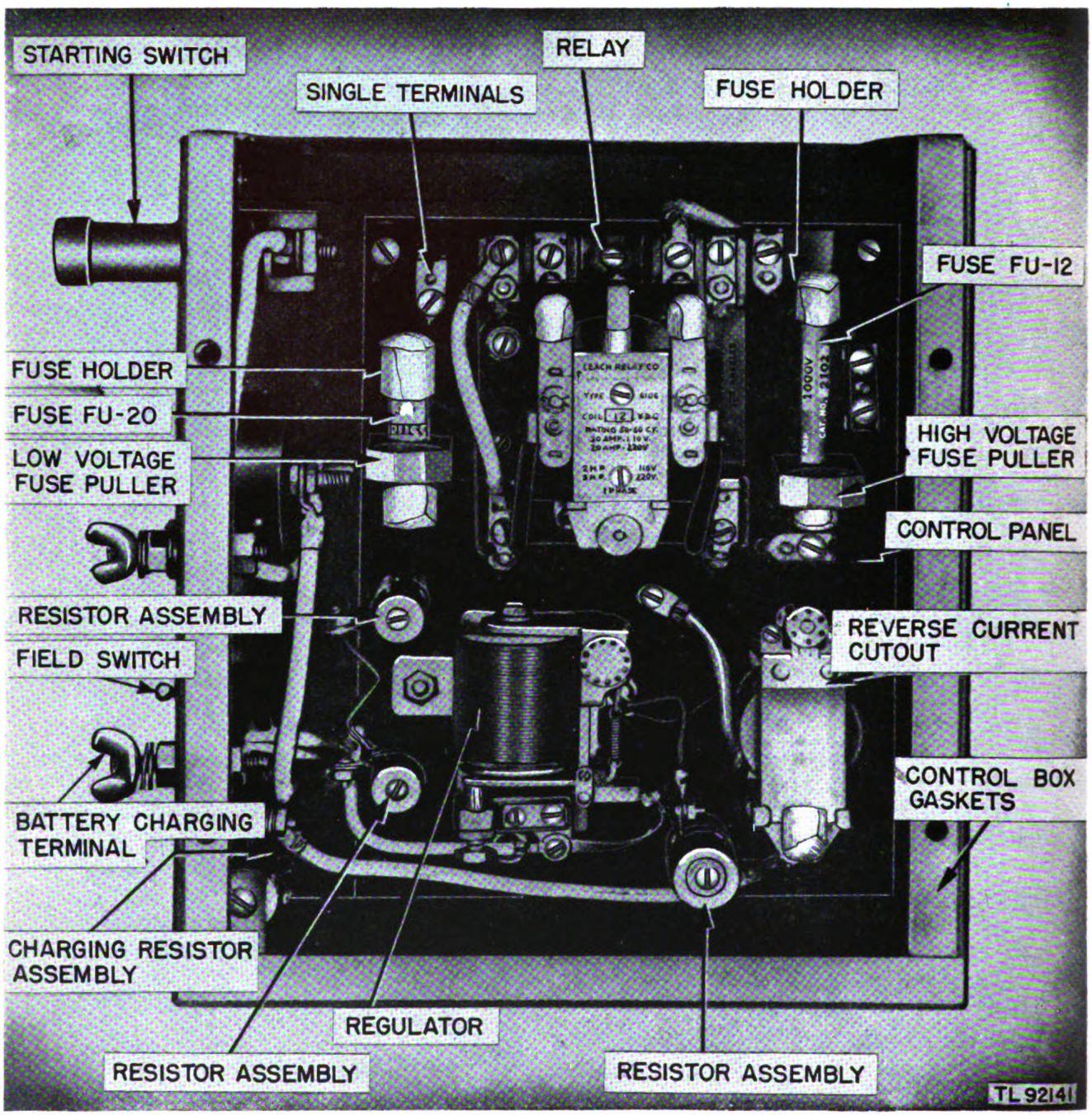


Figure 49. Control box for Power Unit PE–49–D—showing parts masked.

(6) Remove armature lead from lower terminal strip. (See fig. 50(853).)

(7) Remove armature lead from top terminal of low-voltage circuit breaker (See fig. 46(859).)

(8) Remove single lead connecting the exciter of the generator to the starter switch terminal. (See figs. 46 and 51(874).)

(9) Remove positive high-voltage lead (+) from top terminal of high-voltage circuit breaker. (See fig. 50(858).)

(10) Remove negative high-voltage lead (—) from lower terminal strip. (See fig. 50(853).)

(11) Remove four cap screws holding control box to generator.

(12) Remove two locknuts holding control box to nipples.

(13) Remove control box, pulling generator leads through back of control box. These leads will be treated later.

(14) Remove lead from positive battery-charging terminal (fig. 50(872)) to battery cut-out. (See fig. 50(835).)

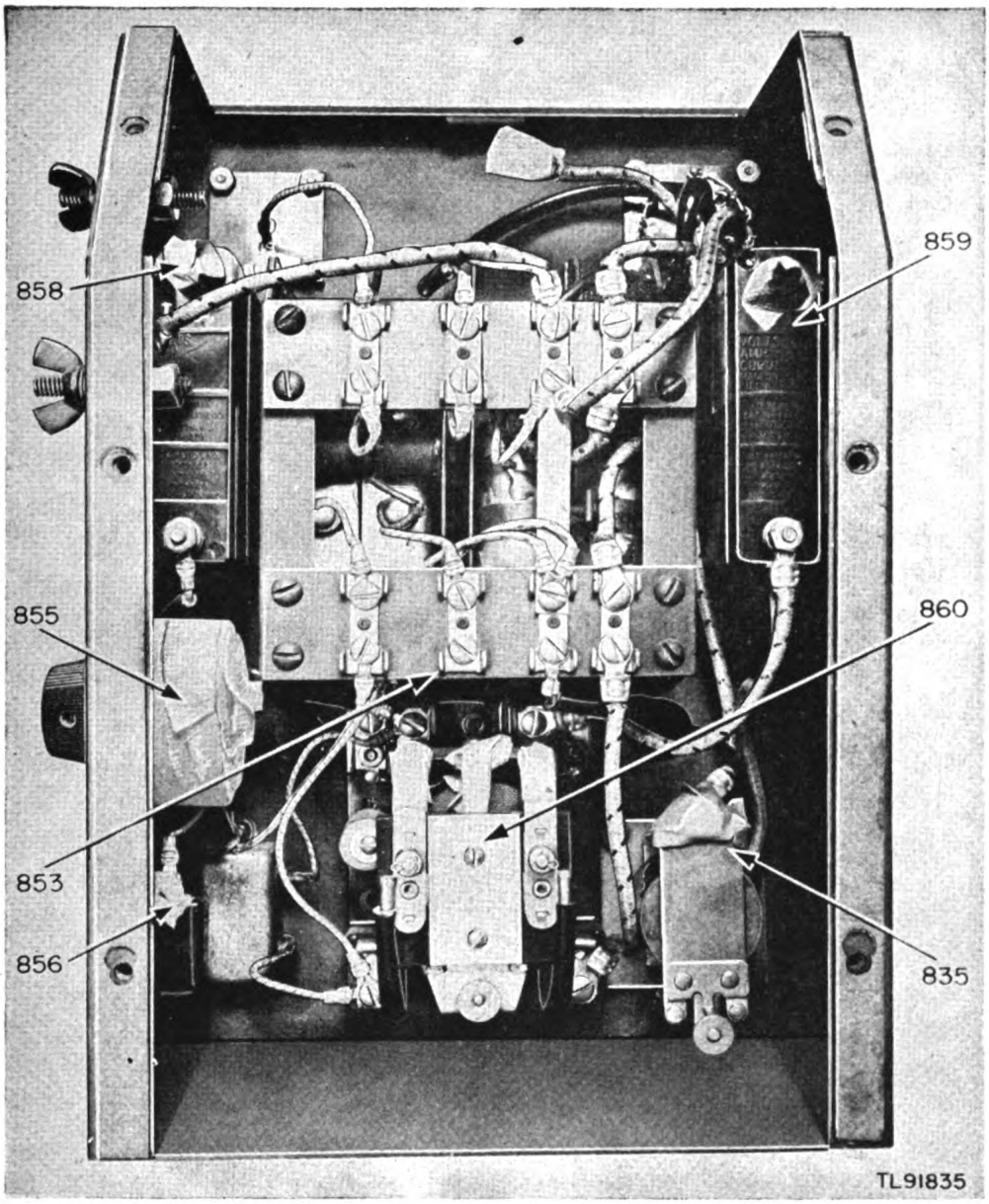


Figure 50. Interior of control box for Power Unit PE–49–F or PE–49–G—showing parts masked.

(15) Remove top of control box to be treated later.

(16) Replace and tighten all nuts and screws that were removed when the leads were removed.

(17) Clean all dirt, dust, rust, fungus, oil, grease, etc., from the equipment to be processed.

c. MASKING. (1) Use tape to mask the three pairs of contacts on top of the starting relay. (See fig. 50(860).)

(2) Use tape to mask the pair of contacts on the battery cut-out. (See fig. 50(835).)

(3) Use tape to mask the top terminal of the high-voltage circuit breaker. (See fig. 50-(858).)

(4) Use tape to mask contact on FIELD SWITCH. (See fig. 50(856).)

(5) Use tape to mask the top terminal on the low-voltage circuit breaker. (See fig. 50-(859).)

(6) Use paper and tape to mask rear and body of FIELD RHEOSTAT. (See fig. 50-(855).)

(7) Tape connecting lugs on the disconnected lead in top cover of control box, the exposed contact on the battery charging dropping resistor (fig. 51(872)), and the exposed contact on the starter-switch terminal. (See fig. 51(874).)

d. DRYING. Place all the parts to be treated in oven or under heat lamps and dry, for 2 to 3 hours at 160°F.

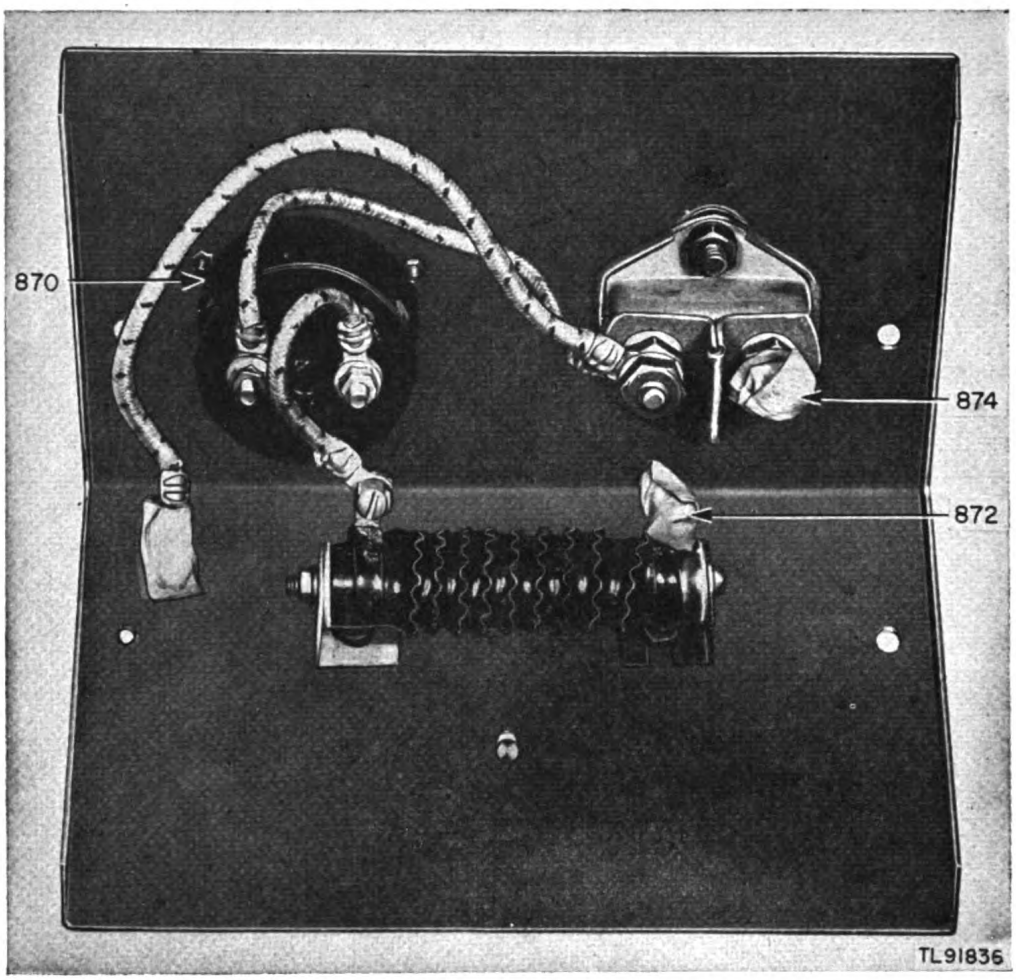


Figure 51. Control box for Power Units PE–49–F and PE–49–G, interior of top cover—showing parts masked.

e. VARNISHING. Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, spec No. 71–2202 (stock No. 6G1005.3), or equal) with spray gun as follows:

(1) Spray inside of control box and all attached components. (See fig. 50.)

(2) Spray inside of top cover of control box and all attached components. (See fig. 51.)

(3) Spray inside of control box cover.

(4) Hand brush the joint in ammeter where the back plate and ammeter case join. (See fig. 51 (870).)

(5) Hand brush the six generator leads, taking care not to varnish connecting lugs. (See fig. 52.)

f. REASSEMBLY. (1) Remove all masking tape.

(2) Clean all contacts with varnish remover, and burnish the contacts.

(3) Reassemble the equipment and test its operation.

g. MARKING. Mark the letters MFP and the date of treatment near the nomenclature nameplate on the equipment and in such a location that the marking will not become obliterated or rubbed off.

Example: MFP — B Jun 1945.

62. Instructions for Treating Motor Generator MG–37–A

Follow instructions given in paragraph 61 for moistureproofing and fungiproofing Generator GN–39–F of Motor Generator MG–37–A.

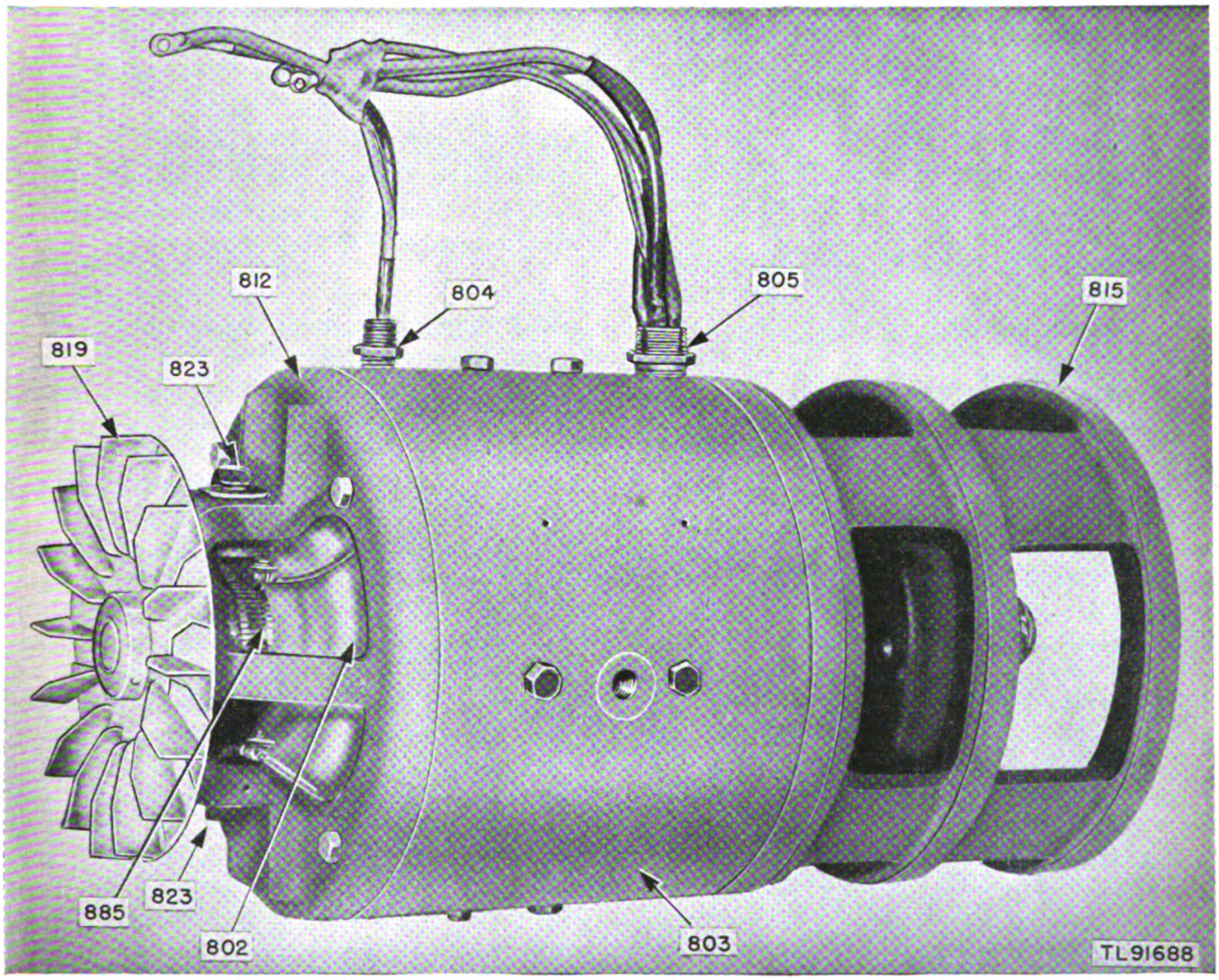


Figure 52. Generator GN–39–G, high-voltage end cover removed.

PART FOUR

AUXILIARY EQUIPMENT

Section XI. AUXILIARY EQUIPMENT FOR POWER UNIT PE–49–(*) AND MOTOR GENERATOR MG–37–A

63. Battery

a. A 12-volt battery is used when it is desired to start Power Unit PE–49–(*) electrically.

b. Connect the battery as directed in paragraph 24*a*.

c. There is no drain on the battery except during starting of the power unit. When the power unit is operating and the field switch (figs. 27 and 28) is in CLOSED position, a charging current is provided for the battery.

d. For information on maintenance and care of batteries see TM 11–430.

64. Auxiliary Equipment Used With Motor Generator MG–37–A

None is used.

PART FIVE

REPAIR INSTRUCTIONS

Section XII. THEORY OF EQUIPMENT

Note. Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on WD AGO Form 468 (Unsatisfactory Equipment Report); by Army Air Forces, on Form 54 (unsatisfactory report). If either form is not available, prepare the data according to the sample form reproduced in figure 97.

65. Functioning of Engine

a. Engine GE–9–D or GE–9–F (fig. 26) is of the 4-cycle type, in which each of the operations of intake, compression, expansion, and exhaust requires a complete piston stroke, or a total of two revolutions of the crankshaft.

b. The proper combustible mixture of gasoline and air is furnished by the carburetor.

c. The ignition spark is furnished by a high-tension magneto (fig. 80(68)) fitted with an impulse coupling (fig. 77) to facilitate starting.

d. Splash-type lubrication is used. A plunger pump maintains the oil level in a trough under the connecting rod. (See fig. 79.)

e. Cooling is accomplished by a flow of air which is circulated over the cylinder and cylinder head (fig. 71(1) and (2)) by a combination fan-flywheel, encased in a sheet-metal housing. (See fig. 43(80) and (85).) The air is directed by ducts and baffle plates to insure uniform cooling of all parts.

f. The speed of the engine is controlled automatically by the speed of the governor, which is of the centrifugal flyweight type. It is located in the crankcase and is connected through suitable linkage (fig. 75(38)) to the carburetor throttle. (See fig. 73(127).) When the speed of the engine increases, the centrifugal force on the governor weights increases and moves them apart against the action of the governor spring. (See fig. 74(99).) This movement is transmitted through the governor linkage to the carburetor throttle (fig. 73(127), (128), and (129)), causing it to close slightly. The closing of the throttle causes the engine to slow down, diminishing the centrifugal force on the governor flyweights. (See fig. 75(32).) The governor spring then moves the governor weights back, and the cycle is repeated. As the governor action is quite rapid, a constant speed is maintained.

g. An air cleaner (fig. 32(90)), is used on the carburetor intake to prevent dust and other foreign matter from being drawn into the engine.

Note. Complete information on carburetion and ignition systems will be found in the following Technical Manuals: TM 10–550 and 10–580.

66. Functioning of Motor

a. RATING. Motor MO–37–A (fig. 7) is a 1½-horsepower, 220-volt, 50-cycle, single-phase a-c repulsion-induction unit. The unit is dripproof and has high torque and quick starting characteristics. Correct performance is maintained with line-voltage fluctuations of plus or minus 10 percent.

b. ARMATURE. Connections from the armature windings (fig. 88) are brought out to a commutator. The radial carbon brushes are short-circuited through a brush rocker-yoke.

c. STARTING DEVICE. A short-circuiting starting device (fig. 88) is mounted on and rotates with the armature shaft at the commutator end. This device consists of many small, specially shaped, copper contact-fingers held in place in a circular, cupped retainer, next to the edge of the commutator bars, with a coil spring formed into a ring. When the armature is stationary, the spring holds the contact-fingers in such a position that they do not touch the commutator bars. When power is applied to the stator windings, voltage is induced in the armature windings, causing current to flow through the short-circuited brushes. This current is out of phase with the stator current, thus producing a torque which causes the armature to rotate. When the armature approaches full speed, the coil spring stretches sufficiently, due to cen-

trifugal force, to allow the contact-fingers to come in contact with the commutator bars. The result is that all bars are short-circuited, and the armature winding practically becomes the equivalent of a squirrel-cage rotor. By this arrangement, Motor MO–37–A starts by the repulsion method and runs at normal speed as a single-phase induction motor. (See fig. 62.)

d. INCLOSING COVER. A strap cover (fig. 8) at the commutator end provides almost complete electrical shielding without impairing the ventilation or cooling of the motor during operation. This cover is removed easily for inspection and maintenance purposes.

e. DIRECTION OF ROTATION. The motor is connected internally to operate in the correct direction of rotation for proper performance of the generator of Motor Generator MG–37–A or the generator from Power Unit PE–49–D, PE–49–F, or PE–49–G. From the commutator end of the motor, the correct direction of rotation is clockwise as indicated by the arrow on the motor nameplate.

f. STARTING SWITCH. (1) A manually operated push-button type starting switch (fig. 7), including a thermal overload relay for motor protection, is mounted on the motor frame. The motor is started by pressing the START button on the starter box. It is stopped by pressing the STOP button.

(2) A thermal relay is connected to the release mechanism of the switch. Overloads of about 10 percent greater than its current rating cause the relay to operate, returning the switch to the STOP position and opening the motor power supply line. Overloads of short duration will not cause the relay to operate, and the switch will remain in the closed or START position. The thermal relay is of the self-healing type. If it should trip because of an overload, it may be reset by pressing the STOP button on the starter box, after an interval of about 1 minute to allow the thermal element to cool. The motor can then be restarted by pressing the START button.

(3) The a-c power supply is connected to the set at the plug by means of an extension cable. Knockout plugs are provided in the sides of the switch box for convenience in making permanent power supply connections to the set with rigid or flexible conduit.

67. Functioning of Generator

a. GENERAL. Generators GN–39–D, GN–39–F, and GN–39–G are very much alike in external appearance (figs. 52 and 53) and very similar in their characteristics and functions. All are self-excited, dripproof, semi-inclosed units. All have two armature windings; one normally rated at 1,000 volts at 0.350 amperes, the other at 14.6 volts at 25 amperes. Two interpoles with high- and low-voltage windings are provided to insure good commutation.

b. DIFFERENCES. Generator GN–39–D is shunt-wound, requires a voltage regulator in the control box, and has high- and low-voltage fuses. Unlike Generator GN–39–D, Generators GN–39–F and GN–39–G are compound-wound, and do not require voltage regulators. Circuit breakers replace the fuses used in Generator GN–39–D. Generator GN–39–G also has an additional resistor (fig. 59(857)) across the field switch in its control box which is not present on Generator GN–39–F.

c. VOLTAGE ADJUSTMENT. (1) *Generator GN–39–D* (fig. 56). The potential of the low-voltage winding is maintained substantially constant automatically by a voltage regulator in the control box (fig. 44). Both high- and low-voltage windings have a common shunt-field. No independent adjustment is provided for the high-voltage output and the voltage is therefore dependent on the low-voltage adjustment. However, the output of the high-voltage winding remains within limits satisfactory for proper operation of connected equipment as the low-voltage output is adjusted to the correct value (14.6 volts plus or minus 2.5 percent).

(2) *Generators GN–39–F and GN–39–G* (figs. 57 and 59). The potential of the low-voltage winding is maintained substantially constant automatically by a compound winding on the generator field. Both the high- and low-voltage windings have a common shunt-field. The strength of this field is adjustable by the FIELD RHEOSTAT. (See fig. 28.) The compound winding is placed on the same field poles as the shunt-field. The current from the low-voltage armature winding passes through this compound winding. It increases or decreases the field strength as the low-voltage current increases or decreases, thereby maintaining the potential of the low-voltage output practically constant. No separate compounding is provided for the high-voltage winding. However, the inherent voltage regulation of the high-voltage winding is such that, as the low-voltage output is adjusted to the correct value (14.6 volts plus

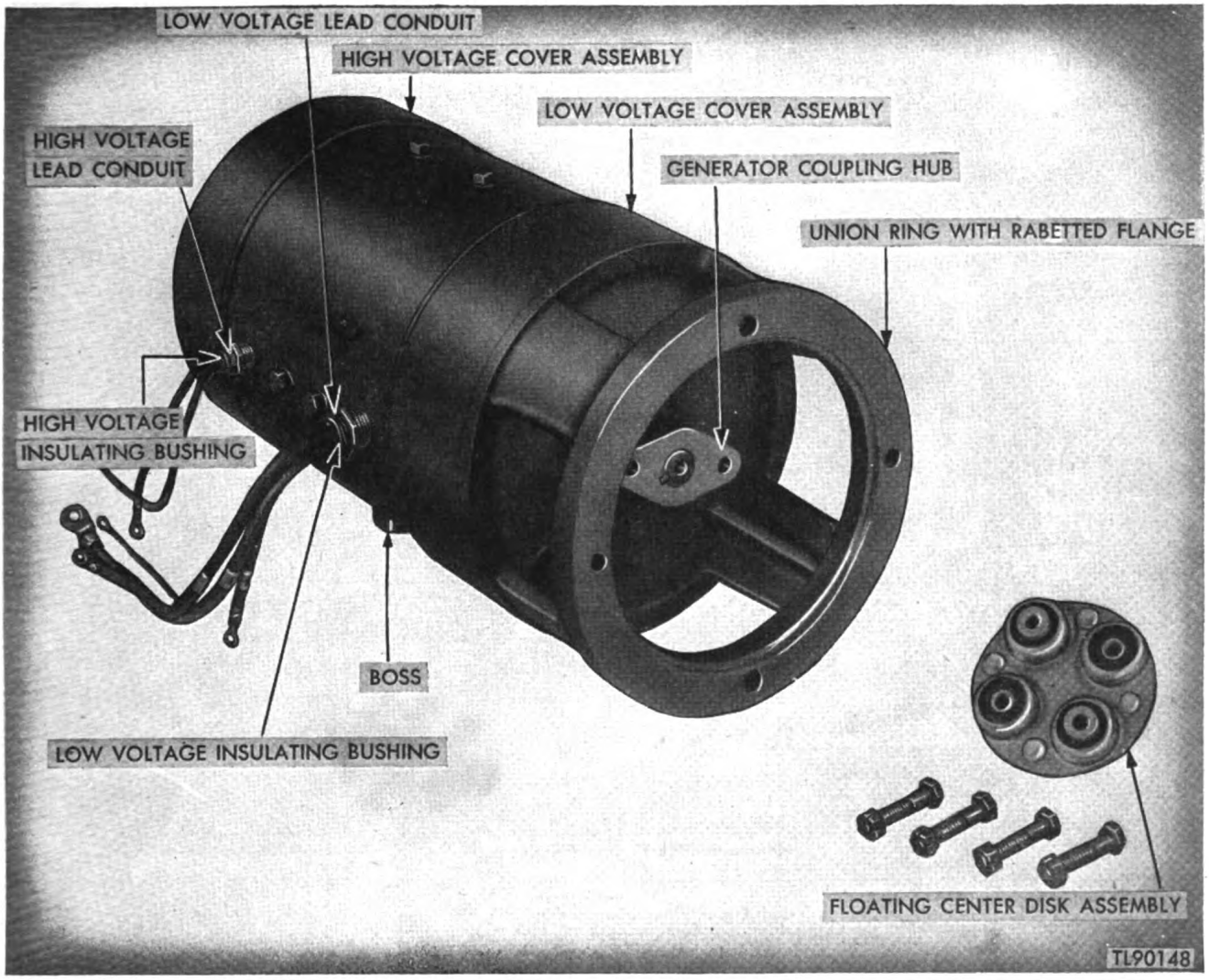


Figure 53. Generator GN–39–D or GN–39–F.

or minus 5 percent) its voltage will remain within the limits satisfactory for proper operation of the connected equipment.

Note. When checking voltage on the generators, the voltmeter must be connected to the generator leads in the control box, since the voltage drop in the leads between the generator and the output sockets would cause incorrect readings.

d. LOW-VOLTAGE CIRCUITS. (1) The voltage generated in the low-voltage armature winding causes current to flow from the low-voltage commutator through the brushes, through the interpole, through the switching relay (when closed), and through the low-voltage filter coil to the low-voltage socket. In Generators GN–39–F and GN–39–G, current also flows through the series winding on the main field poles.

(2) Current from the low-voltage commutator also flows through the battery cut-out when closed, through the battery-charging resistance, through the battery-charging ammeter, to the battery-charging terminals. In Generator GN–39–D, the voltage of this winding is held practically constant at 14.6 volts by the voltage regulator. (See figs. 56, 57, 59, and 62.)

c. HIGH-VOLTAGE CIRCUITS. The voltage generated in the high-voltage winding passes from the high-voltage commutator through the high-voltage brushes, through the switching relay (when closed), and through the high-voltage filter coils to the output socket. (See figs. 56, 57, 59, and 62.)

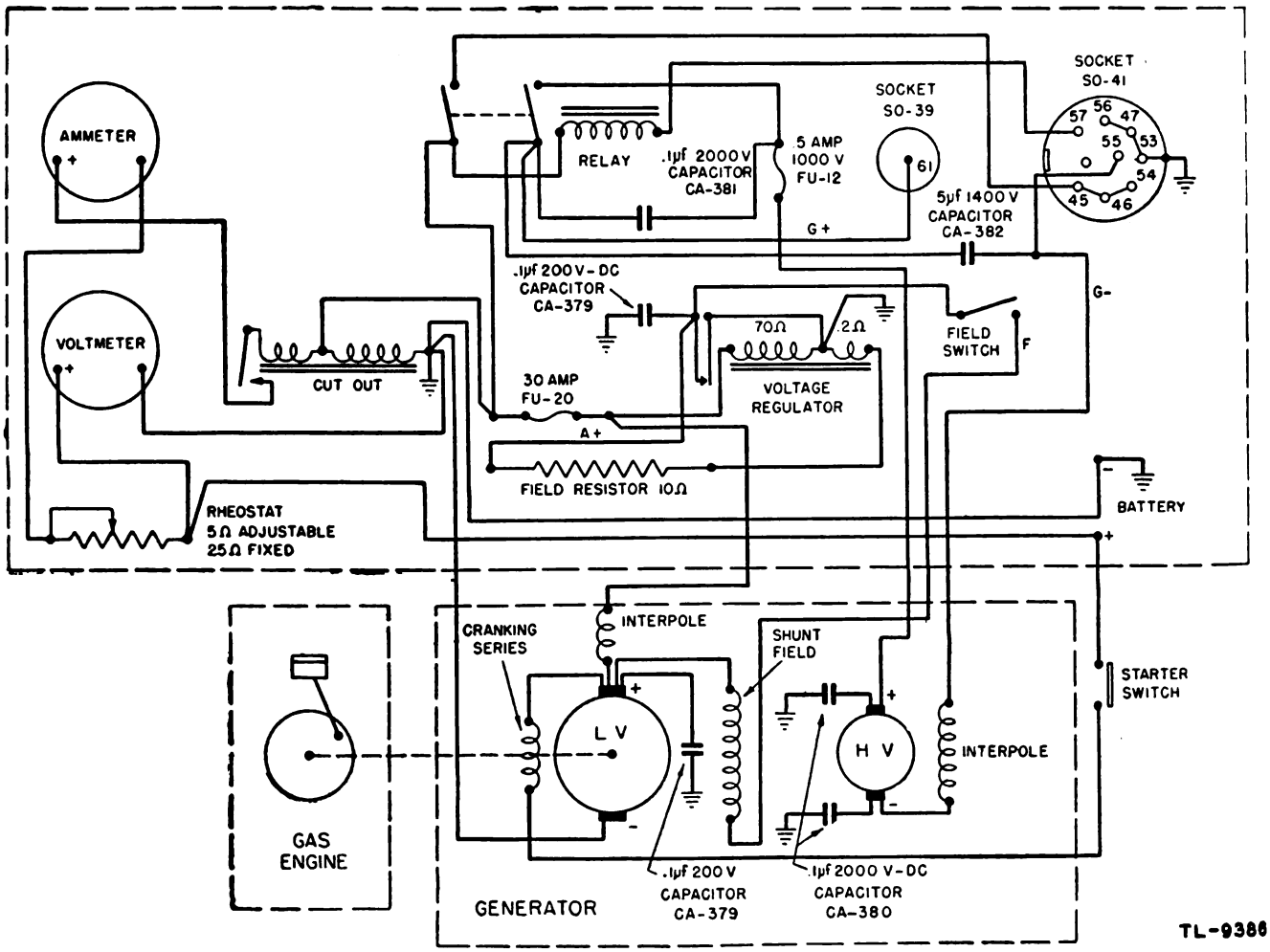


Figure 54. Connection diagram for Power Unit PE–49–C.

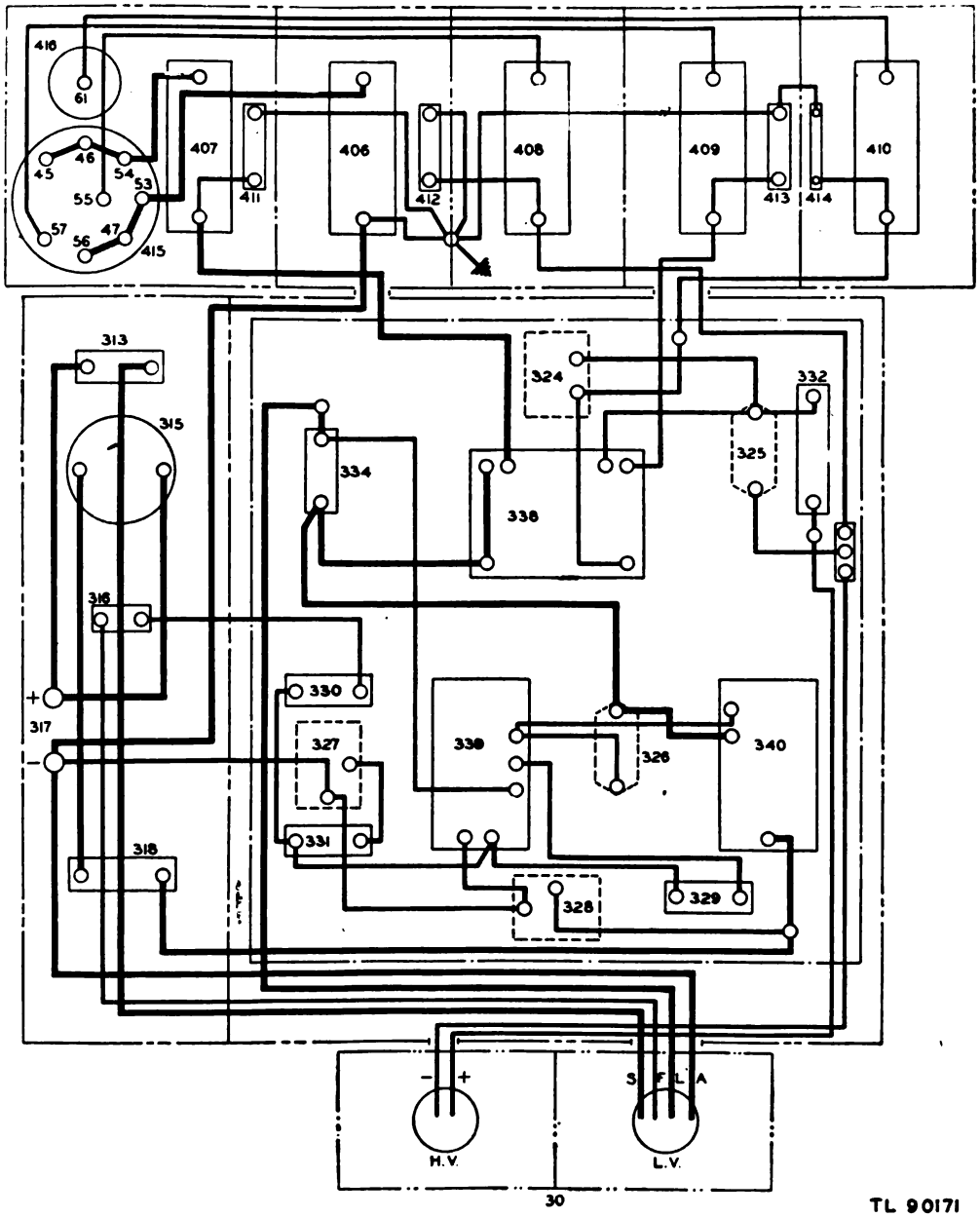


Figure 55. Practical wiring diagram for Power Unit PE–49–D.

Note. For number references see legend under figure 56.

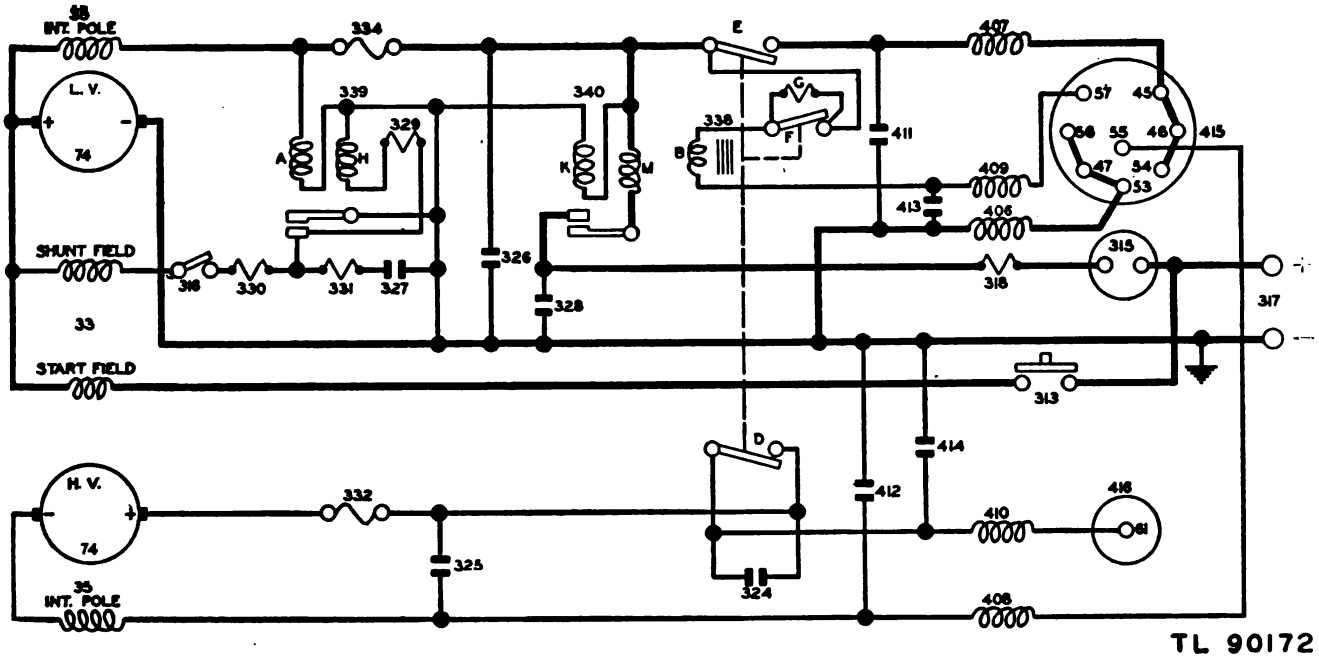


Figure 56. Schematic wiring diagram for Power Unit PE–49–D.

33. Field coil assembly.
35. Interpole assembly and coil.
74. Armature.
313. Starting switch.
315. Ammeter assembly.
316. Field switch assembly.
317. Battery-charging terminals.
318. Charging resistor.
324. Relay arc-quenching capacitor.
325. High-voltage filter capacitor.
326. Low-voltage filter capacitor.
327. Regulator spark-suppressor capacitor.
328. Low-voltage filter capacitor.
329. Field regulator resistor.
330. Field series resistor.
331. Regulator spark-suppressor resistor.
332. High-voltage fuse assembly.
334. Low-voltage fuse assembly.
338. Relay on low-voltage and high-voltage circuits.
339. Voltage regulator.
340. Reverse current cut-out.
406. Filter coil L1 for low-voltage negative.
407. Filter coil L2 for low-voltage positive.
408. Filter coil L3 for high-voltage negative.
409. Filter coil L4 for relay control.
410. Filter coil 15 for high-voltage positive.
411. Filter capacitor for low-voltage output positive.
412. Filter capacitor for high-voltage output negative.
413. Filter capacitor for relay control.
414. Filter capacitor for high-voltage output positive.
415. Low-voltage Socket SO–41.
416. High-voltage Socket SO–39.

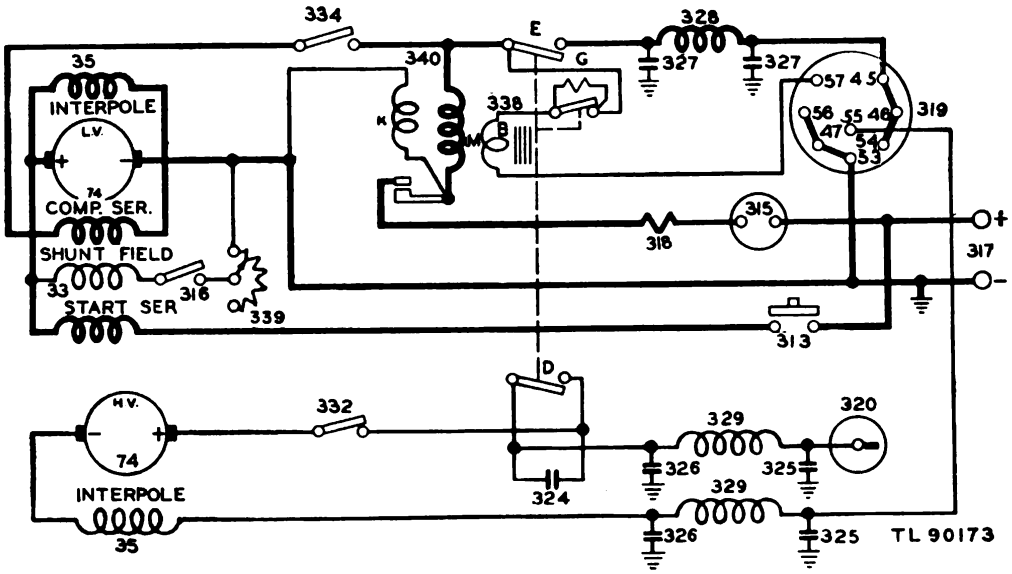


Figure 57. Schematic wiring diagram for Power Unit PE–49–F.

33. Field coil assembly.
35. Interpole assembly and coil.
74. Armature.
313. Starting switch.
315. Ammeter assembly.
316. Field switch assembly.
317. Battery-charging terminals.
318. Charging resistor.
319. Low-voltage Socket SO–41.
320. High-voltage Socket SO–39.
324. Relay arc-quenching capacitor.
325. High-voltage filter capacitor.
326. High-voltage filter capacitor.
327. Low-voltage filter capacitor.
328. Low-voltage filter choke.
329. High-voltage filter choke.
332. High-voltage circuit breaker.
334. Low-voltage circuit breaker.
338. High- and low-voltage relay control.
339. Field rheostat.
340. Reverse current cut-out.

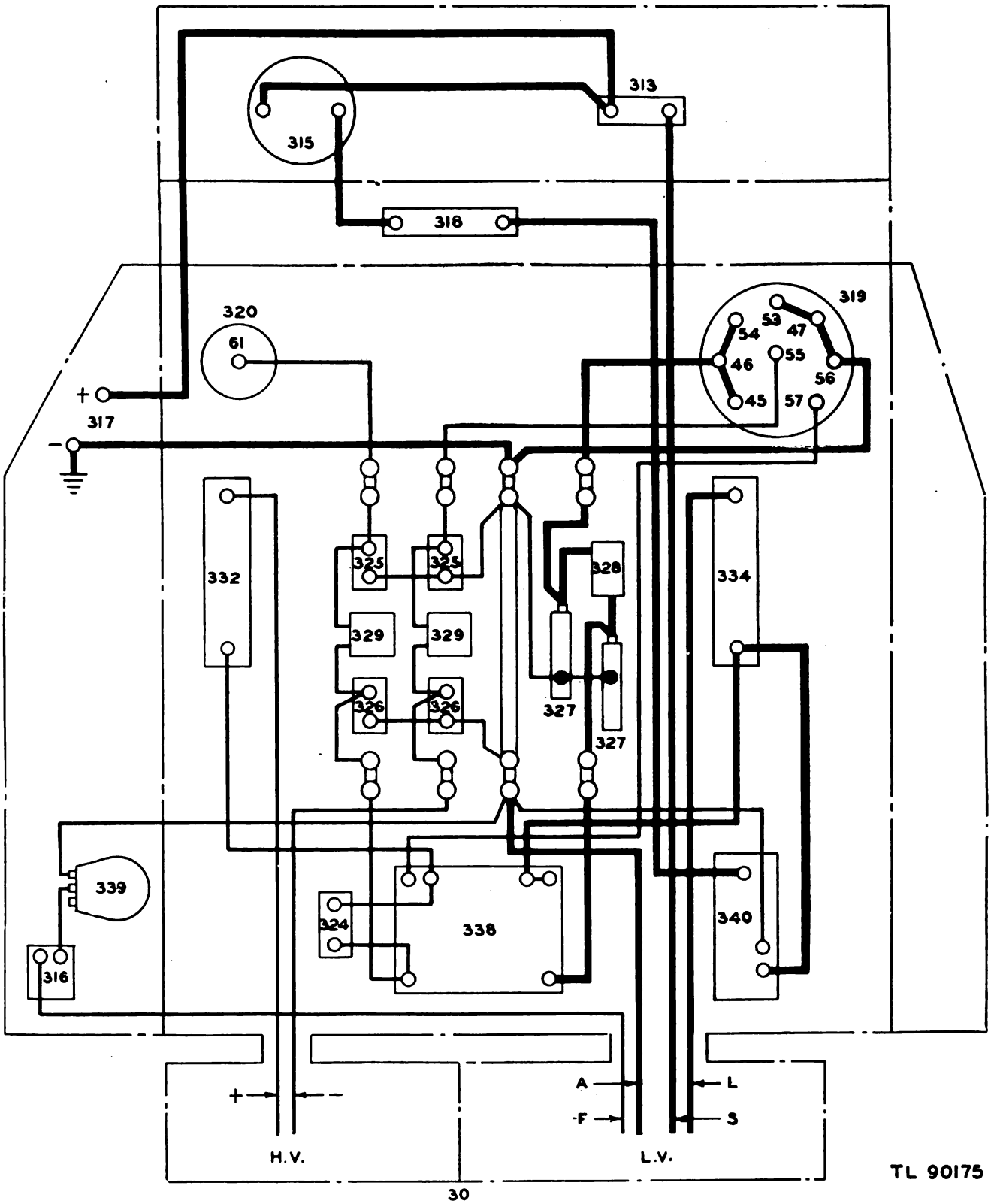


Figure 58. Practical wiring diagram for Power Unit PE–49–F.

Note. For number references see legend under figure 57.

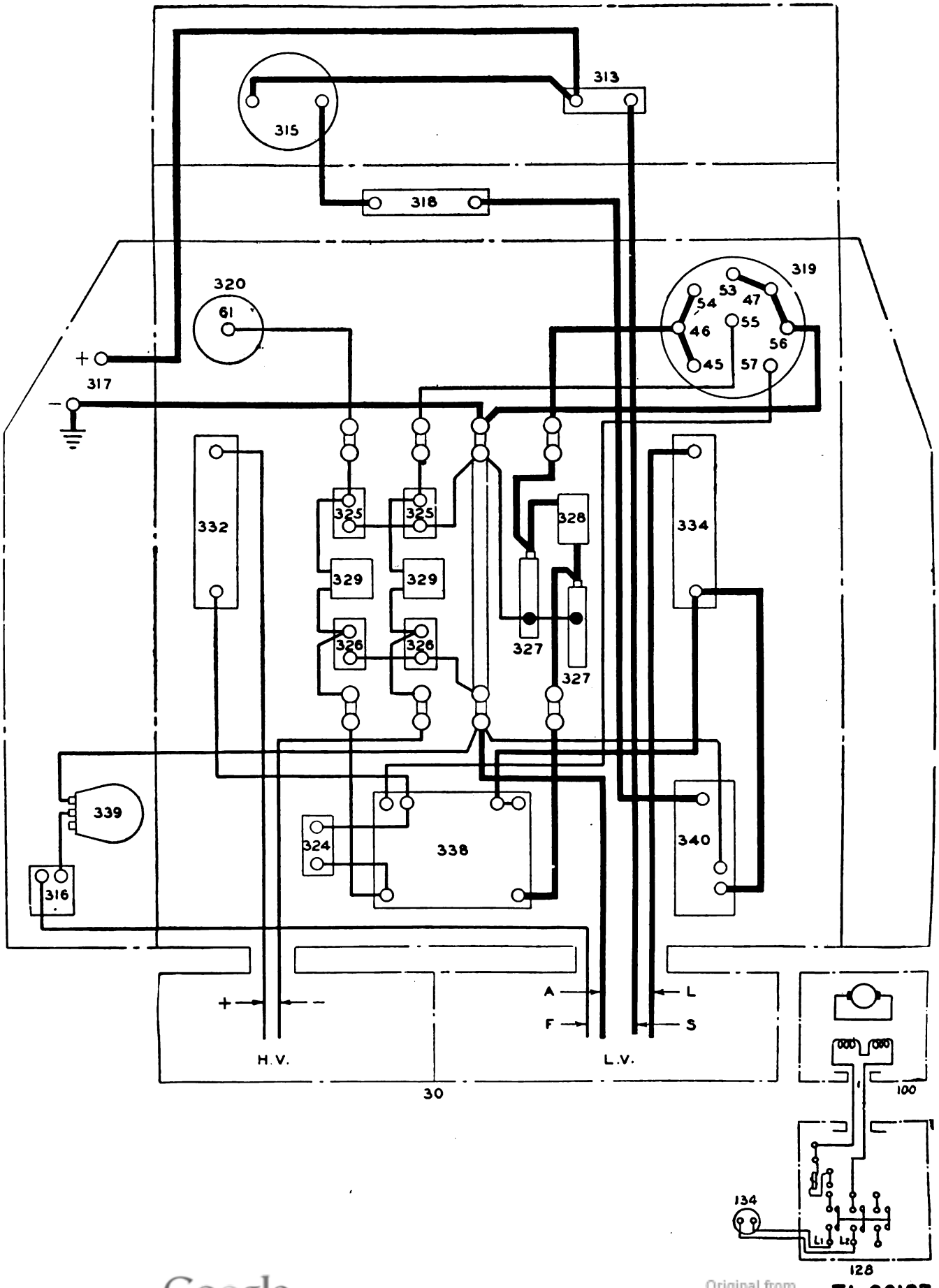


Figure 61. Practical wiring diagram for Motor Generator MG–37–A.

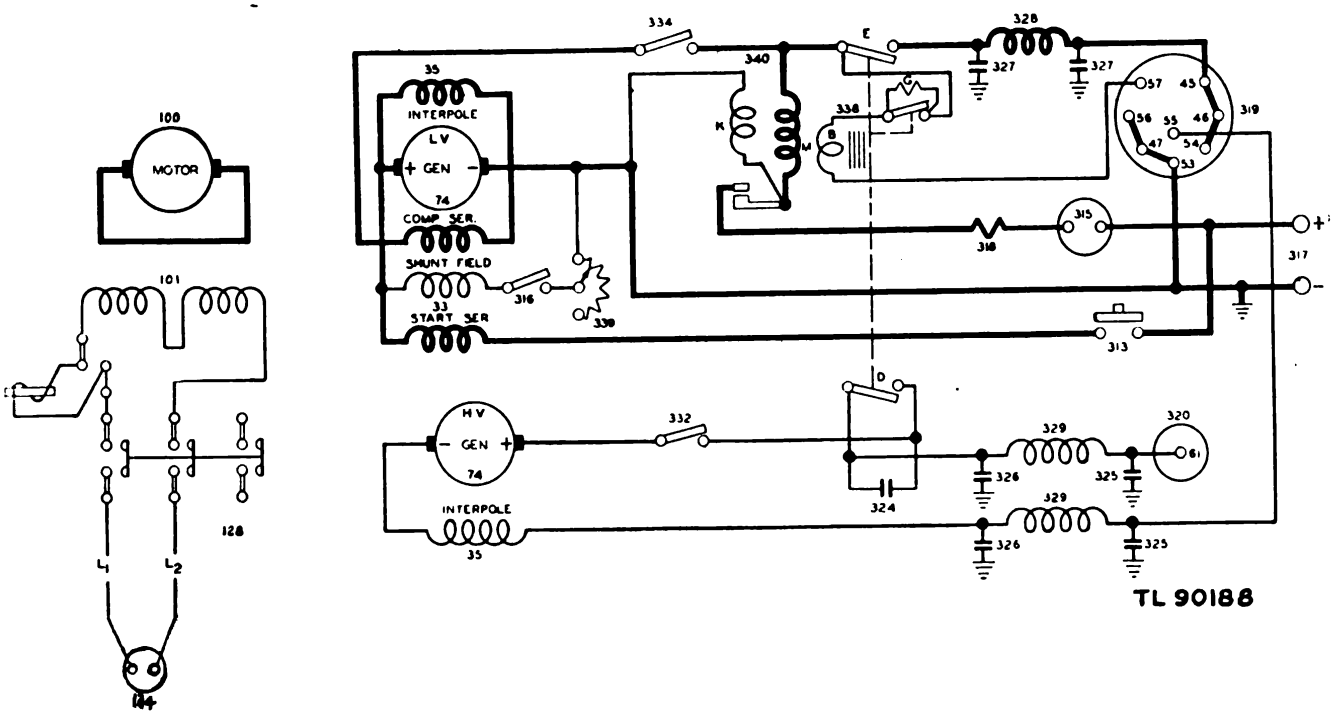


Figure 62. Schematic wiring diagram for Motor Generator MG–37–A.

33. Field coil.
35. Interpole assembly.
74. Generator armature.
100. Motor.
101. Stator assembly.
107. Motor armature.
128. Starting switch assembly.
134. Twist-lock plug connector.
313. Starting switch.
315. Ammeter.
316. Field switch.
316A. Arc-suppressor resistor.
317. Terminal assembly.
318. Battery-charging terminals.
319. Low-voltage Socket SO–41.
320. High-voltage Socket SO–39.
324. Relay arc-quenching capacitor.
325. High-voltage filter capacitor.
326. High-voltage filter capacitor.
327. Low-voltage filter capacitor.
328. Low-voltage filter coil.
329. High-voltage filter coil.
332. High-voltage circuit breaker.
334. Low-voltage circuit breaker.
338. High- and low-voltage relay.
339. Field rheostat.
340. Reverse-current cut-out.

68. Voltage Regulator for Generator GN–39–D

a. The potential of the low-voltage armature winding can be adjusted by the voltage regulator. Remove the front cover of the control box to gain access to the regulator. (See figs. 63 and 64.)

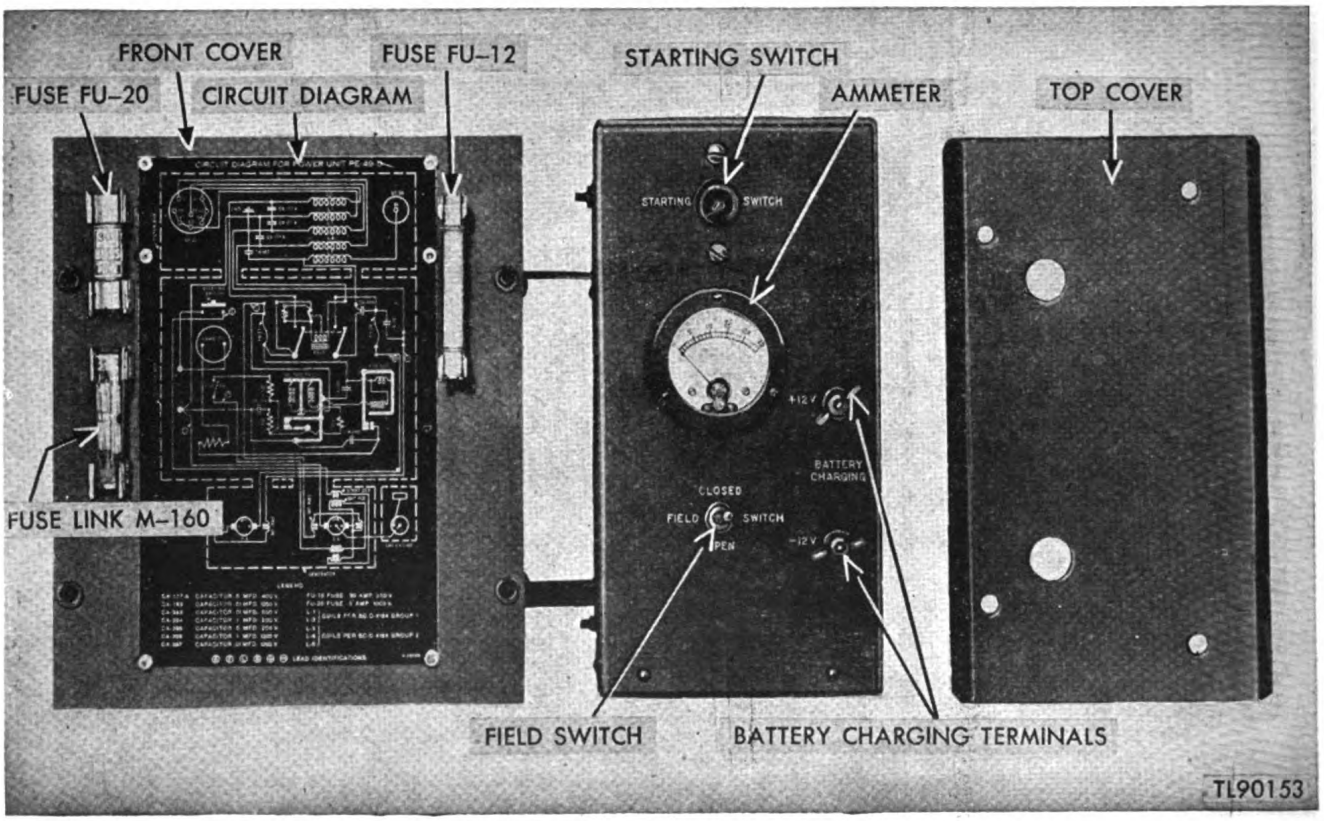


Figure 63. End view and inside of cover of control box for Power Unit PE–49–D.

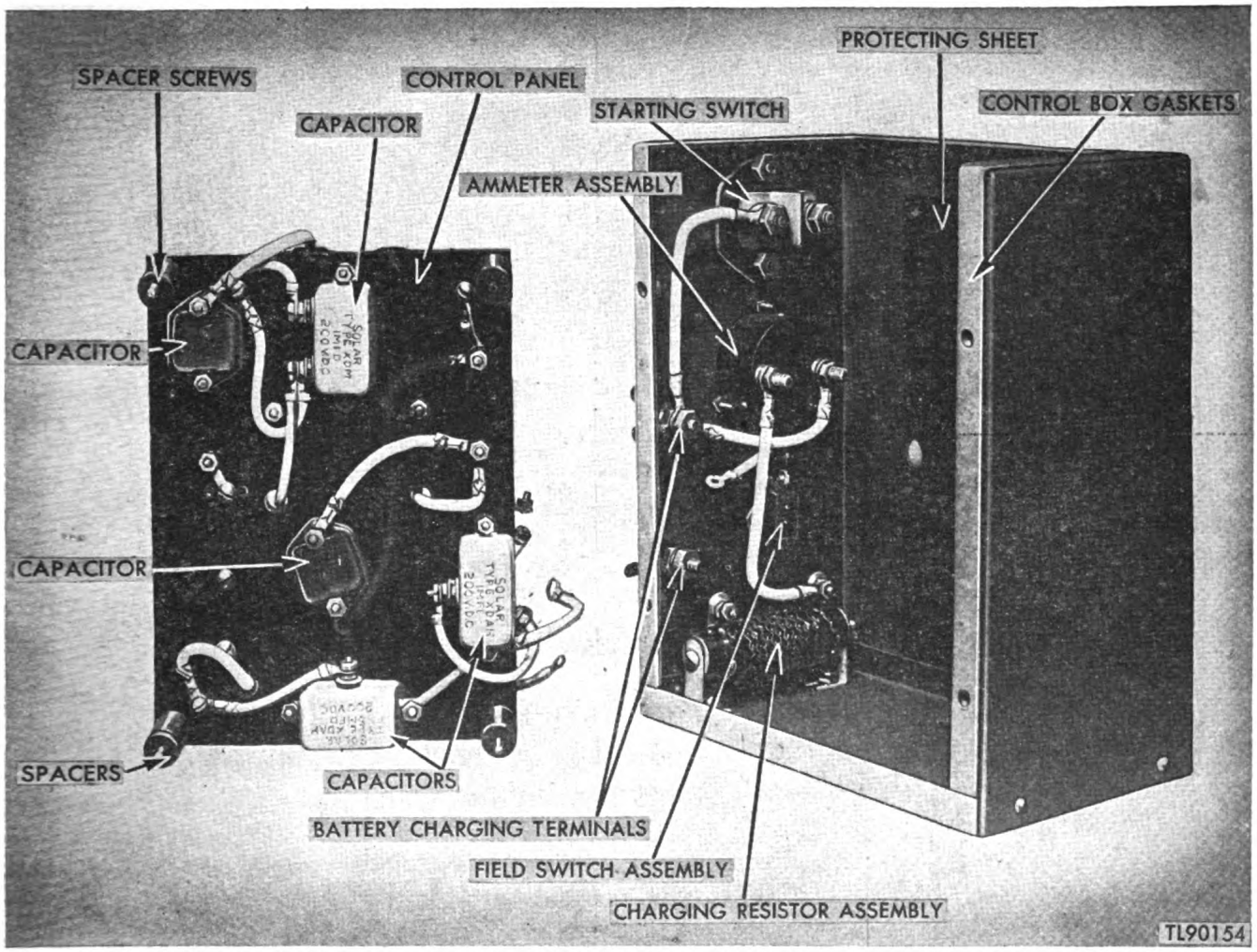


Figure 64. Control box for Power Unit PE–49–D—inside end of box and back of panel.

b. The regulator (fig. 44) is of the compound, magnetic vibrating-type. The potential coil, which actuates the regulator armature, is connected across the low-voltage armature of the generator on the supply side of the low-voltage fuse. If the low-voltage fuse should blow, due to overload or short circuit, the potential will still be maintained across the regulator potential coil. This will prevent the tendency of the regulator to raise the potential of the low-voltage winding, thereby raising the potential of the high-voltage winding above a level safe for the connected equipment.

c. The regulator armature (fig. 65) carries a contact which normally is held in contact with the stationary contact screw by a spring. This spring applies tension to the armature against the magnetic pull exerted by the regulator magnet core. The core is magnetized by current from the generator winding, which flows through the contacts when they are closed. When the armature voltage rises to such a value that the current flowing through the regulator potential coil produces a magnetic pull strong enough to overcome the spring tension, the regulator armature will be drawn toward the regulator core, separating the contacts. This will cause the shunt-field current to flow through the regulator resistance and the secondary regulator winding connected across the contacts. Because this resistance is connected in series with the shunt-field winding, the current flowing through the secondary regulator winding will be reduced. The magnetic flux passing through the field poles and the armature core will be reduced, and, consequently, the voltage generated in the armature windings will be reduced. This reduction in armature voltage results in the lowering of the magnetic pull exerted by the regulator magnetic core on the regulator spring, which will again close the contacts. The cycle will then be repeated. The action is extremely rapid so the generator voltage is maintained constant and steady, even with the fluctuating load on the generator.

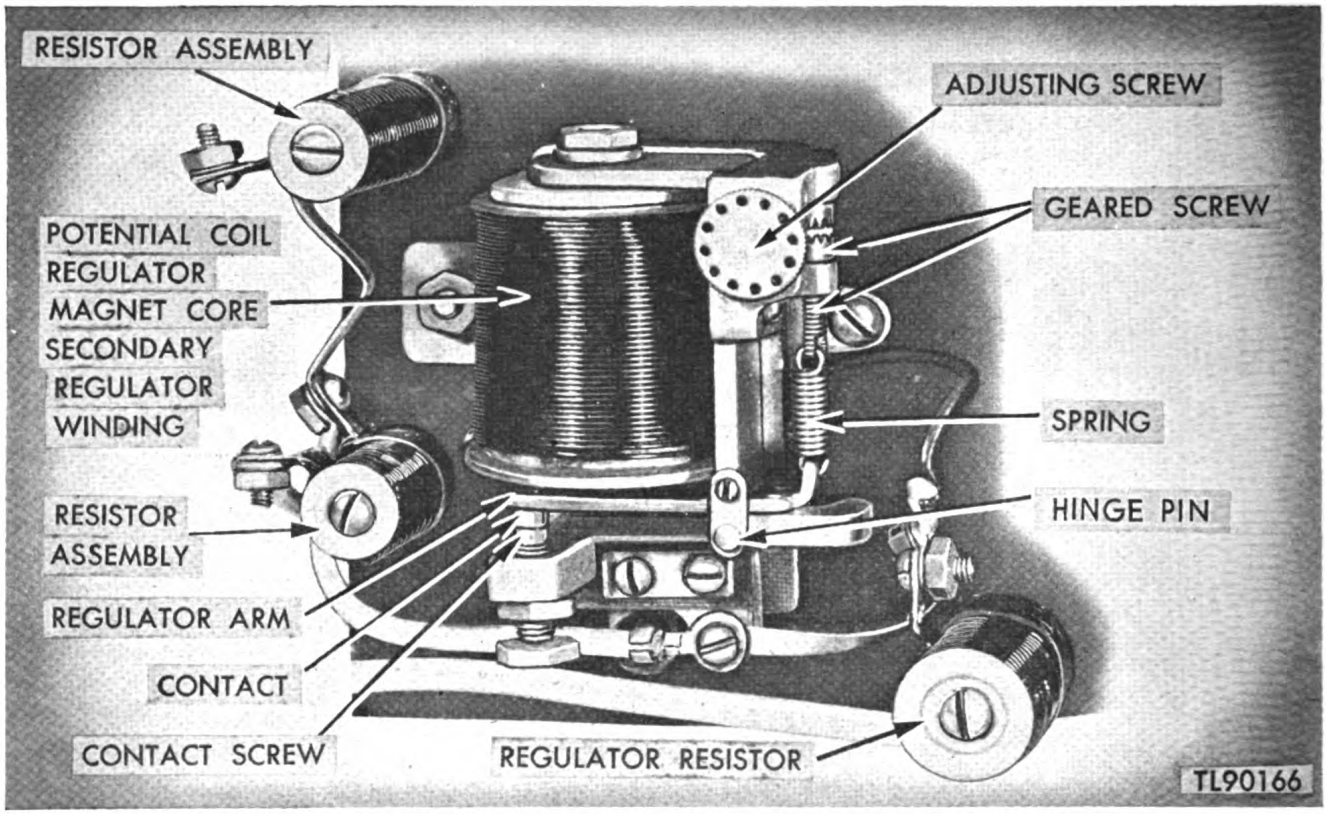


Figure 65. Voltage regulator for Power Unit PE–49–D.

d. The function of the secondary regulator winding is as follows:

(1) When the contacts open, the field current flowing through the regulator resistance also flows through the secondary regulator winding. This winding is placed on the regulator core so the magnetic flux produced by it opposes the flux produced by the regulator potential coil. This reduces the magnetic pull on the armature as soon as the contacts open and hastens the returns of the regulator armature to the closed position. The result is an increase in the rate of vibration of the regulator armature and stabilization of the beat to further smooth out the resulting generator voltage.

(2) The voltage adjustment is made with the knurled adjusting screw. Turning the screw to the left raises the voltage; turning it to the right lowers it. The adjustment screw actuates a geared screw which controls the tension of the regulator spring. Because of the gear reduction, very fine voltage adjustment is possible.

(3) For setting of the regulator contacts, see paragraph 109.

Caution: Too close a setting of the contacts causes burning and pitting. Too wide a setting results in jumpy regulation.

(4) The regulator is adjusted to provide correctly generated voltage with the power unit operating in surrounding temperatures of from 77° F., to 86° F. (25° C. to 30° C). The regulator will operate over a wide range of temperatures without further adjustment. However, for operation in extremely hot or cold climates, a readjustment may be necessary.

69. Battery Cut-Out (fig. 66)

a. The battery cut-out prevents the accidental discharge of the battery in case the generator voltage should drop below the voltage of the battery being charged.

b. The battery cut-out consists of a magnet core, a shunt winding, a series winding, an armature with contact, and an armature spring and stationary contact.

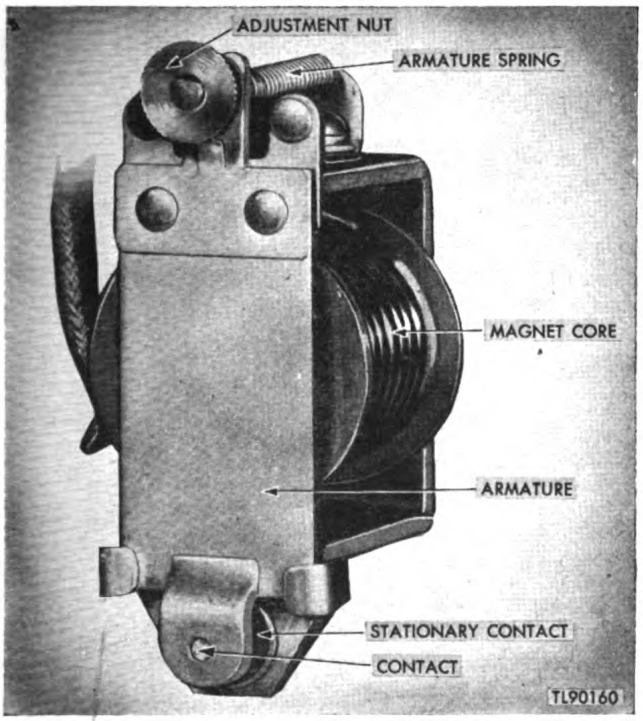


Figure 66. Reverse current cut-out in control box.

c. The shunt winding is connected across the generator low-voltage output. The current flowing through the winding produces a magnetic flux in the cut-out core. When the generator output reaches a certain value determined by the adjustment of the armature spring, this flux produces a pull on the cut-out armature strong enough to pull the armature toward the core and close the contacts. The series winding is connected in series with the positive side of the battery-charging circuit. It is so wound on the cut-out core, that when current flows through it from the generator to the battery the magnetic pull produced adds to the pull developed by the shunt winding.

d. If, for any reason, the generator voltage drops or the battery voltage rises, the charging current decreases. When the charging voltage equals the battery voltage, no current flows. If the charging voltage drops below the battery voltage, current flows from the battery into the generator through the series-winding of the cut-out, tending to drive the generator as a motor. Since the direction of this current is in reverse direction to the flow of the charging current, the magnetic force developed by the series winding is opposed to the pull developed by the shunt winding. The total pull is therefore weakened and the armature spring pulls the armature away from the cut-out, opening the contacts. This cuts the flow of current from the battery to the generator.

e. A reverse current of approximately 5 amperes will open the contacts. This value is determined by the number of turns in the series winding and is therefore not adjustable.

Caution: Never close the cut-out by hand while a battery is connected to the battery-charging terminals.

70. Battery-Charging Ammeter

The battery-charging ammeter (figs. 28 and 63) is connected in series with the battery-charging circuit and indicates the charging rate. It does not, however, indicate the current taken through the low-voltage socket.

71. Starting Relay

a. The starting relay (fig. 67) opens and closes the high- and low-voltage circuits. It is controlled from the transmitter position by a switch on the junction box. Only current passing through the output sockets is controlled by the starting relay.

Caution: The exposed contacts of this relay carry 1,000 volts, which is dangerous to life.

b. The starting relay consists of a magnet core with its winding, an armature with contacts, an auxiliary switch, a resistance connected in series with the winding, and an armature spring. When the control switch on the transmitter junction box is open, the armature spring holds the switching relay in the open position. This opens both the high- and low-voltage circuits and therefore, no power is available at the output sockets. The auxiliary switch is closed, shunting out the resistance. When the control switch at the transmitter junction box is closed, current flows from the low-voltage positive through the auxiliary contact, the relay coil, contact 57 on the low-voltage socket, through the connecting cable and the control switch, to the low-voltage negative.

c. This current, going through the relay coil, produces a magnetic pull in the relay core which overcomes the pull of the armature spring and moves the armature up against the relay core. The relay contacts, mounted on the relay armature, move with it and close the high- and low-voltage circuits to the output sockets. The auxiliary contact opens and removes the shunt around the relay resistance, reducing the current passing through the relay coil. Although a relatively heavy current is required through

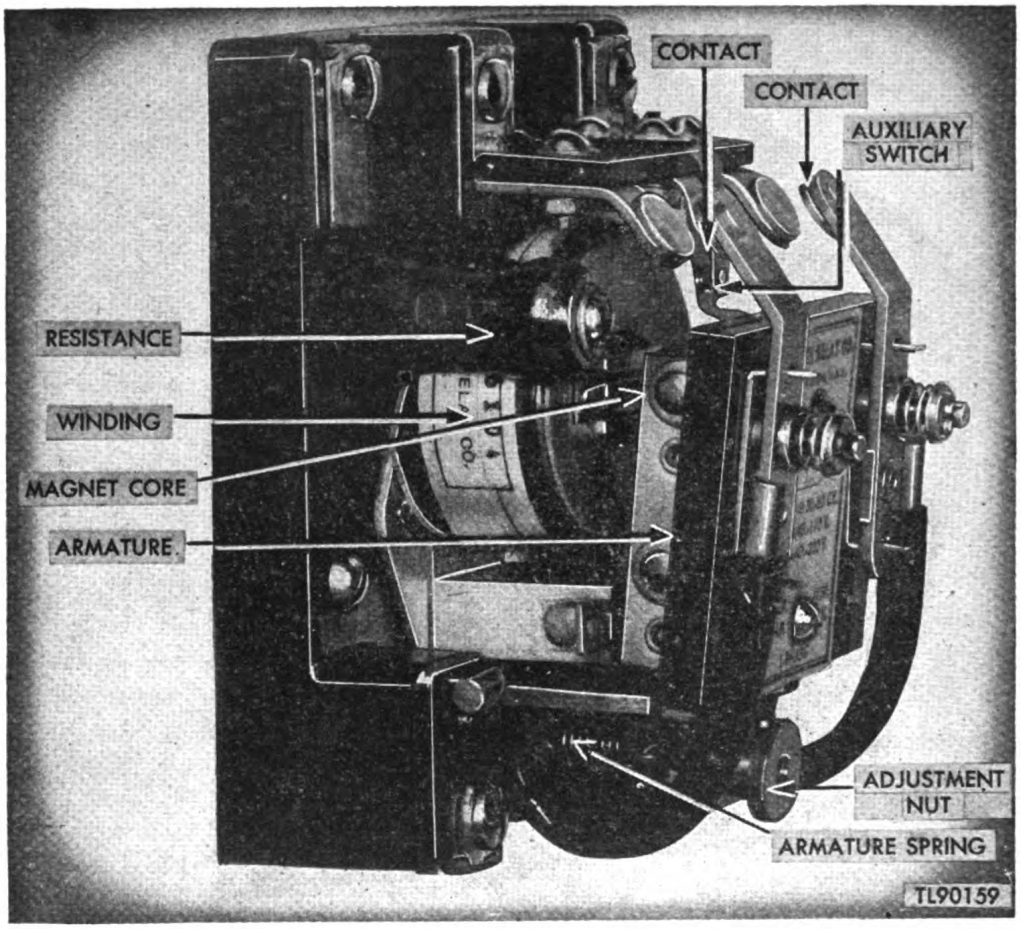


Figure 67. Starting relay in control box.

the relay coil to pull up the relay armature, only a small current is required to hold the armature in the closed position. This reduction in current will reduce the heating of the relay coil and lower the load on the generator.

72. Field Rheostat for Power Units PE–49–F and PE–49–G

The field rheostat (fig. 59(855)) is a variable resistance in series with the field circuit. It is used to adjust the low-voltage output. The high- and low-voltage windings have a common shunt field. As independent adjustment is provided for the high-voltage output, this voltage is dependent on the low-voltage adjustment. The inherent voltage regulation of the high-voltage winding is such that, as the low-voltage is adjusted to the correct value, the high-voltage will remain within the limits satisfactory for the proper operation of the connected equipment.

73. Fuses in Control Box of Power Unit PE–49–D (fig. 44)

a. Fuse FU–20, rated at 30 amperes, is connected in the low-voltage positive lead. This fuse protects the low-voltage armature winding from overloads and short circuits in both the transmitter and the battery-charging circuits. The high-voltage circuit is protected by Fuse FU–12, of 0.5-ampere rating.

b. These fuses consist of a body made from insulating material and two metal end caps. A wire, made from a metal alloy which melts at a relatively low temperature, is connected between the two end caps. When the current through this fuse wire reaches the approximate value at which the fuse is rated, the heat produced by the current becomes high enough to melt the fuse wire. The melting of the fuse wire opens the circuit in which the fuse is connected, and thus the rest of the apparatus is protected from damage.

74. Circuit Breakers (fig. 59)

Circuit breakers are used on Power Units PE-49–F and PE–49–G.

a. Both the high- and low-voltage output circuits of the generator are protected against

overload by individual circuit breakers in the control box. These electro-magnetic devices open the circuit automatically when the current exceeds safe values. The insulated reset handles (figs. 5 and 6) of these circuit breakers project through the back of the control box under their respective high- or low-voltage sockets.

b. The one high-voltage circuit breaker (fig. 57(332)) is rated at 0.5 ampere and the low-voltage circuit breaker (fig. 57(334)) is rated at 35 amperes. The circuit breakers will trip and open the circuit whenever the load is greater than the maximum load of 1,025 volts that the generator can carry safely. When the circuit breakers trip because of an overload, the reset switches move to the OFF position. (See figs. 5 and 6.) To close the circuit, return the reset switch to the ON position.

Note. When a safe operating load is suddenly applied, the circuit breakers may trip, opening the circuit. This is due to an instantaneous overload. To avoid this undue opening of the circuit, decrease the voltage with the field rheostat, connect the load, and then return slowly to the normal operating voltage.

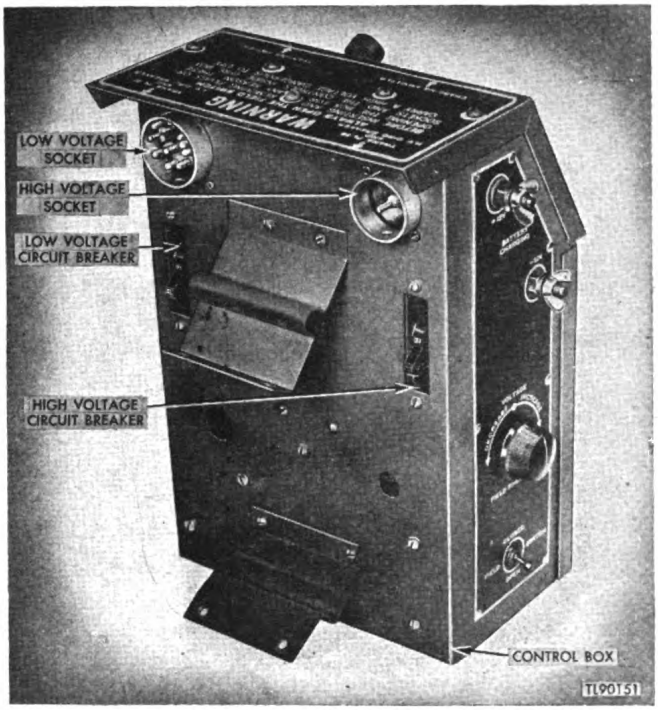


Figure 68. Control box for Power Units PE–49–F and PE–49–G—rear view.

75. Battery-Charging Resistor

The battery-charging resistor (figs. 45, 59, and 64) is a 0.25-ohm, 100-watt resistance connected in series with the battery-charging circuit. Its function is to limit the current drawn from the low-voltage armature winding to a safe value in case a completely discharged or short-circuited battery should be connected to the battery-charging terminals.

76. Starting Switch

a. The starting switch (figs. 28, 59, and 63) is connected between the positive side of the low-voltage circuit and the series starting winding of the generator. The other end of the starting winding is connected to the negative low-voltage brush in the generator.

b. When the starting switch is pushed toward the control box, it closes the battery-charging circuit and current flows from the battery to the battery-charging terminals, through the starting winding and the generator armature. This causes the generator to act as a motor and drive the gasoline engine.

77. Field Switch (figs. 28, 59, and 68)

The field switch controls the excitation of the generator. It is connected in series with the shunt-field winding of the generator. When the field switch is in the OPEN position, no field current passes through the field windings, and no output is produced by the generator. When the field switch is in the CLOSED position, excitation is produced in the field windings with resultant output voltage from the generator. A resistor bridged around the field switch on Power Unit PE–49–G reduces arcing on opening or closing the circuit.

78. Filter System

a. Output Filter for Power Unit PE–49–D (figs. 13 and 48). The output filter consists of air choke coils and a capacitor inclosed in a box mounted on top of the control box and the generator. The high- and low-voltage sockets are mounted on the under side of this box. The choke coils are connected in series with the output leads, and the capacitors are connected between the leads and ground. Connection to a good ground must be made at this point to insure effective operation of the filter system. The purpose of the filter is to suppress any r-f disturbances that may be sent up in the generator or in the control box.

b. Output Filter for Power Units PE–49–F and PE–49–G (figs. 45 and 46). These output filters serve the same purpose as the filter on Power Unit PE–49–D, but are mounted inside the control box.

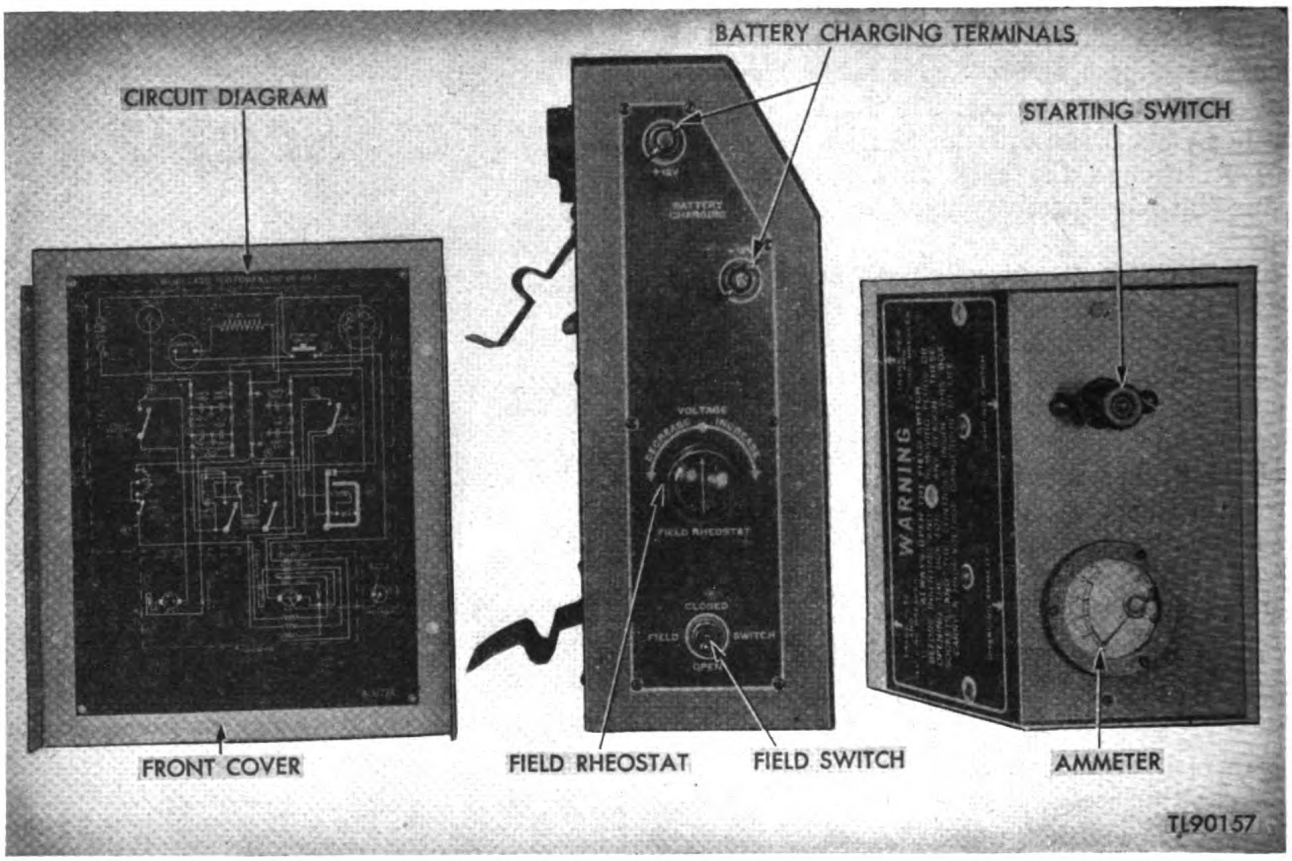


Figure 69. Control box for Power Unit PE–49–F—end view and inside of cover.

c. CAPACITOR IN SWITCHING RELAY CIRCUIT. The 0.1-microfarad capacitor (fig. 59(861)) connected across the high-voltage contacts of the switching relay, reduces the arcing across these contacts when the relay is opened.

79. Coupling

The coupling assembly (figs, 7, 26, and 53), consisting of two hubs and a floating center, serves to transmit the mechanical power of the motor or the engine to the generator. It is also used to disconnect the motor or the engine from the generator.

Section XIII. TEST EQUIPMENT USED IN TROUBLE SHOOTING

80. Standard Test Equipment

a. GENERAL. Proper test equipment is a valuable aid to the trouble shooter in locating defects in the equipment. The trouble shooter should take care that test equipment is not damaged through careless handling or lost because of failure to return the equipment to its proper place after use.

b. TEST INSTRUMENTS USEFUL IN TROUBLE SHOOTING ON POWER UNIT PE–49–(*) AND MOTOR GENERATOR MG–37–A.

Feeler gauges.
Hydrometer.
Compression meter.
Tachometer.
Battery.
Pair of test leads.
Test lamp and socket.
Voltmeter.
Ohmmeter.
Ammeter.

Section XIV. TROUBLE-SHOOTING PROCEDURES

81. General Trouble-Shooting Information

No matter how well equipment is designed and manufactured, faults occur in service. When faults occur, the repairman must locate and correct them as quickly as possible. Take advantage of the material supplied in this manual. It will help in the rapid location of faults. Consult the following trouble-shooting data when necessary:

a. Engine, motor, and generator trouble charts. (See pars. 83, 84, and 85.)

b. Wiring diagrams for Power Unit PE–49–D (figs. 55 and 56), for Power Unit PE–49–F (figs. 57 and 58), for Power Unit PE–49–G (figs. 59 and 60) and for Motor Generator MG–37–A. (See figs. 61 and 62.)

c. Illustrations throughout the manual of components. Of particular value for locating trouble are the exploded views in section XVI of engine parts, as well as those of motor and generator parts. Cross-sectional views of the engine from the side and end (figs. 86 and 87) are also valuable.

82. Sequence of Trouble-Shooting Procedure

a. A methodical system for localizing defects in the equipment is of prime importance to the repairman. He must be fast, but above all, accurate. In order to achieve both these objectives, observe the progressive steps outlined in the trouble charts, which have been prepared to save time and needless work.

b. The trouble charts for the engine, motor, and generator are arranged to show successive symptoms of defective operation, beginning with symptoms of defective operation during the starting period, following through the warm-up period and the period of continuous operation.

c. When the nature of the trouble has been determined, check the various points under the heading *Possible cause* in the sequence given. Follow the sequence, because seemingly major troubles may be reduced to minor troubles by checking the items in the prescribed order.

83. Trouble Chart for Engine

a. ENGINE WILL NOT START.

Possible cause	*Check*	*Remedy*
Fuel tank empty.	Fuel supply.	Replenish fuel supply.
Fuel line clogged.	Fuel strainer and line.	Clear fuel line.
Improper or dirty fuel.	Condition of fuel.	Use fresh fuel.
Carburetor clogged.	Carburetor.	Clean or replace.
Defective wiring.	Ignition wiring.	Make good electrical contacts.
Dirty or damaged spark plug.	Spark plug.	Clean or replace.
Improper spark gap.	Spark gap with gauge.	Adjust points.
Improper timing.	Timing.	Correct timing.

b. ENGINE MISFIRING.

Possible cause	*Check*	*Remedy*
Dirty or damaged spark plug.	Spark plug.	Clean or replace.
Improper spark gap.	Spark gap with gauge.	Adjust points.
Loose wiring.	Ignition wiring.	Make tight connections.
Magneto breaker points sticking.	Magneto breaker points.	Clean and free points.
Valves warped or broken.	Valves.	Replace valve.
Tappets improperly adjusted.	Valve tappets.	Adjust correctly.

c. EXCESSIVE SMOKE.

Possible cause	*Check*	*Remedy*
Carburetor needle valve open too far.	Needle valve.	Adjust correctly.
Carburetor float stuck or leaking.	Carburetor.	Replace carburetor.
Worn piston rings.	Piston rings.	Replace rings.

d. BACKFIRING THROUGH CARBURETOR.

Possible cause	*Check*	*Remedy*
Gas mixture too lean.	Needle valve.	Adjust valve.
Intake valve sticking.	Valve movement.	Free valve.

e. POOR COMPRESSION.

Possible cause	*Check*	*Remedy*
Valves not seating.	Valve and seat.	Grind valves.
Valves sticking.	Valve movement.	Free valve.
Piston rings worn.	Piston rings.	Replace rings.
Loose spark plug.	Spark plug.	Tighten spark plug.

84. Trouble Chart for Motor MO–37–A

a. MOTOR FAILS TO START.

Possible cause	*Check*	*Remedy*
Power line not properly connected.	Connection.	Make proper connection.
Overload relay open.	Relay and connections.	Repair or replace.
Starting switch not functioning properly.	Mechanical operation and connections.	Repair or replace.
Fuses blown out in power source circuit.	Fuses.	Replace blown fuse.
Motor leads disconnected.	Leads.	Make connections.
Poor brush contact.	Brushes and springs.	Adjust spring tension, clean brushes.
Brush rocker out of position.	Position of rocker.	Set in proper position.

b. MOTOR FAILS TO ATTAIN FULL SPEED.

Possible cause	*Check*	*Remedy*
Line voltage too low.	Line voltage.	Bring up line voltage if possible, or connect to different power source.
Starting device defective.	Spring in short-circuit device.	Adjust spring tension.

85. Trouble Chart for Generator

a. SPARKING AT THE BRUSHES.

Possible cause	*Check*	*Remedy*
Too much load.	Ammeter reading.	Reduce load.
Brushes not seated properly or dirty.	Brushes for uneven wear and dirt.	Seat properly, clean brushes.
Commutator rough or eccentric.	Commutator.	If slightly rough, smooth with fine sandpaper. If badly roughed, send to repair depot.
Grounded, open, or shorted field winding.	Field windings.	Replace winding, if shorted or open. If grounded, insulate at point ground occurs.
Brushes sticking in holders.	Brushes and holders.	Clean, adjust, or replace brushes.

b. VOLTAGE TOO LOW.

Possible cause	*Check*	*Remedy*
Engine speed low.	Engine speed with tachometer.	Adjust engine speed.
Brushes not set properly.	Brushes.	Sand brushes.

c. VOLTAGE TOO HIGH

Possible cause	*Check*	*Remedy*
Engine speed high.	Engine speed with tachometer.	Adjust engine speed.

d. ARMATURE OVERHEATED.

Possible cause	*Check*	*Remedy*
Armature overloaded.	Ammeter reading.	Reduce load.
Armature coil shorted.	Coil for shorts.	Replace armature.
Armature striking pole pieces.	Wear of bearings, also bearing brackets.	Replace bearing, reline brackets.
Poor ventilation.	Air space around generator.	Provide at least 2-foot clearance.

e. COMMUTATOR OVERHEATED.

Possible cause	*Check*	*Remedy*
Sparking of brushes.	See *a* above.	See subparagraph *a*.
Too much pressure on brushes.	Pressure.	Replace springs with weaker springs.
Too much load.	Ammeter reading.	Reduce load.
Poor ventilation.	Air space around generator.	Provide at least 2-foot clearance.

f. FIELD COILS TOO HOT.

Possible cause	*Check*	*Remedy*
Short circuit in field.	Coils for shorts.	Replace coil shorted.
Poor ventilation.	Air space around generator.	Provide at least 2-foot clearance.

g. NO OUTPUT.

Possible cause	*Check*	*Remedy*
Short circuit, ground, or open circuit.	Windings.	Replace armature or field, if necessary.
Residual magnetism too weak.	Magnetic quality of field poles.	Pass current from battery through field coils. Be sure positive pole of battery is connected to positive field lead.
Reversed field coils.	Coil connections.	Change coil positions.
Brushes not making contact.	Brushes.	See that brushes move freely in holders. Replace with new brushes, if badly worn.
Capacitor shorted.	Capacitor.	Replace.
Field switch left in OPEN position.	Field switch.	Place in CLOSED position.

86. Special Troubles with Power Unit PE–49–D

a. If the voltage as indicated by the transmitter voltmeter is too low or too high, adjust the voltage regulator located in the control box. (See fig. 44.)

Caution: The circuits in the control box carry high voltage, dangerous to life. Be careful not to touch any other part than the voltage adjusting screw. (See fig. 65.)

b. A short circuit or overload in the transmitter may blow either the high-voltage or low-voltage fuse in Power Unit PE–49–D. A short circuit in the battery-charging circuit may blow the low-voltage fuse. If a fuse should blow, proceed as follows:

(1) Open the field switch.

Caution: When the field switch is closed, the circuits in the control box carry high voltage, dangerous to life. Be sure to open the field switch. Never take chances.

(2) Remove the front cover of the control box. (See fig. 44.)

(3) Remove the blown fuse from the fuse clips by pulling out the fuse puller.

(4) Remove the fuse from the fuse puller. If it is a low-voltage fuse, unscrew one of the fuse ferrules to allow the fuse puller to be removed.

(5) Obtain a spare fuse from the control box cover, insert it in the fuse puller, and replace it in the fuse clips.

(6) If a low-voltage fuse is replaced, insert a new fuse link in the original cartridge as follows:

(*a*) Unscrew both fuse ferrules.

(*b*) Remove the unmelted portions of the old fuse link.

(*c*) Insert the ends of the new fuse link in the slots of the two small brass disks in the fuse.

(*d*) Bend the ends of the fuse link over the ferrules.

(*e*) Replace the fuse ferrules.

(7) Replace the repaired fuse in the spare fuse clips on the control box cover.

(8) Replace the control box cover.

87. Output Troubles With Power Unit PE–49–F or PE–49–G

a. If the voltage as indicated by the transmitter voltmeter is too low or too high, adjust the field rheostat accordingly. After the power unit has run for about 1 hour, the generator will have reached its normal operating temperature and the output voltage will have risen somewhat above its rated value. A readjustment of the field rheostat will then be necessary.

b. If it is impossible to correct high- or low-voltage output with the field rheostat, increase or decrease the engine speed as required by adjusting the governor. The correct engine speed is 2,700 rpm. Loosen the locknut nearest to the governor spring. To increase the engine speed, turn the outer locknut on the shaft toward the pin; to decrease the engine speed, turn the outer locknut in the opposite direction. Be sure to tighten both nuts after the adjustment has been made.

c. A short circuit or overload in the transmitter may trip either the high-voltage or the low-voltage circuit breaker. A short circuit in the battery-charging circuit will trip the low-voltage circuit breaker.

d. If either breaker should trip out, close it

by moving the handle upwards. If it should trip out again, investigate the cause and do not close the breaker until the fault has been removed. (See par. 85.)

88. Defective Battery

When a discharged battery is connected to any one of the power units, check the battery-charging ammeter on the top of the control box to make sure that the battery is not short-circuited. The charging current should not be over 10 amperes while the transmitter is being operated. If no power is taken by the transmitter, a charging current of 25 amperes is safe. If the charging current stays high for any length of time, it indicates that the battery has been damaged. If the charging current drops to zero or there is an indication of a discharge while the unit is operating, stop the unit and check the cause (par. 85) unless an emergency exists.

89. Special Troubles With Motor Generator MG–37–A

a. FAILURE TO START. If the motor-generator set fails to start when the START button on the starter-switch is pressed, proceed as follows:

(1) Press the STOP button on the starter switch.

(2) Check the a-c supply voltage at terminals L1 and L2 in the starter-switch box (fig. 47) with a voltmeter or test lamp. The voltage at these points should read within 10 percent of the voltage stamped on the motor nameplate.

(3) If no voltage is present in the starter-switchbox, check the fuses in the power supply. If voltage is available in the starter, try all connections in the starter box and all connections to the motor to make sure they are tight.

(4) If the fault is not found at any of the above points, remove the strap cover (fig. 8) on the motor and inspect the brushes, the commutator, and the brush connections. (See fig. 88.) Move the brushes to make sure they slide freely in the brush holders. See that the contact fingers press correctly on the brushes and that the tension springs exert enough pressure. Revolve the armature by hand to see if it turns freely. If none of these adjustments correct the failure to start, see trouble chart, paragraph 84.

b. VOLTAGE. When the motor-generator set is running at full speed, close the field switch. Power is then available at the output sockets on the back of the control box and at the battery-charging terminals on the side of the control box. Check the voltage at the transmitter. Since the motor-generator set is not equipped with a voltage regulator, it may be necessary to adjust the field rheostat in order to make the generator build up to the correct operating voltage. The normal low-voltage output is 14.6 volts; and the high-voltage output is 1,000 volts.

Note. When operating Motor Generator MG–37–A after long exposure in a wet, damp atmosphere, operate the unit at full speed for at least 10 to 15 minutes before closing the field switch.

c. SPEED TOO SLOW. Normal operating speed of the motor is about 2,985 rpm. If the motor does not come up to the proper speed, the a-c voltage supply may be too low, or the short-circuiting starting device may not be functioning properly. Proceed as follows:

(1) Stop the motor-generator set by pressing the STOP button on the starter-switch box. (See fig. 7.)

(2) Check the a-c supply voltage with a voltmeter or test lamp. If it is found to be lower than the minimum required for satisfactory operation, investigate the power supply.

(3) If the voltage is found to be satisfactory, remove the strap cover on the motor and follow the instructions in *a* above.

(4) If, after the short-circuiting starting device has operated, the motor fails to reach full speed, or alternately speeds up and slows down, the coil spring in the short-circuiting device is too weak or the voltage is too low.

d. MOTOR ROTATING IN WRONG DIRECTION. If the motor rotates in the wrong direction when started, the brush rocker, together with the brush holders and the brushes (fig. 88), may have become shifted from their proper position. The correct position is indicated by painted lines on the rocker and bracket. Stop the motor and check as follows:

(1) Remove the strap cover.

(2) With a large screw driver, loosen the roundhead screw which clamps the rocker onto the bracket. Shift the rocker until its painted line coincides with that on the bracket. The rocker, brush holders, and brushes will then be in proper operating position. Tighten the screw securely to hold the rocker in place on the bracket.

(3) Start the motor by pressing the START button on the starting switch to make sure the motor rotates in the proper direction, as indicated by the arrow on the nameplate.

(4) Replace the strap cover.

Section XV. SPECIAL TOOLS

90. Tool for Undercutting Commutator

A tool for undercutting the commutator (fig. 70) may be improvised from a broken hacksaw blade. Grind a piece of hacksaw blade to the exact width of the mica. Grind one end of the blade to fit a wooden handle and fit the handle and blade together. Use the improvised tool as shown in figure 70.

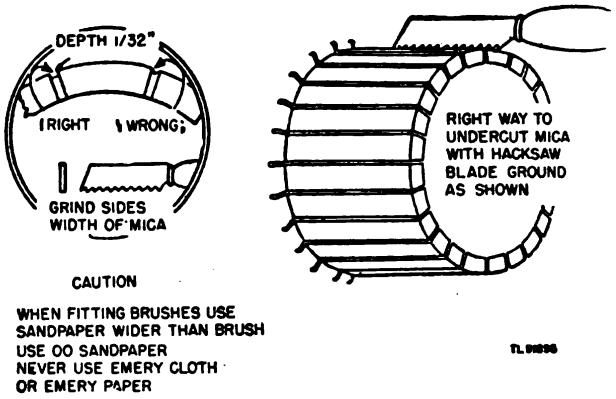


Figure 70. Undercutting the commutator.

Section XVI. DISASSEMBLY AND REPAIR

91. Engine Disassembly

Disassembly of and repair maintenance on the main parts of the engine will be discussed in subsequent paragraphs. Figure 71 shows the engine completely disassembled and indicates its main parts.

92. Carburetor Adjustments

a. The carburetor (figs. 72 and 73) is a float-feed, adjustable-jet type. Two adjustments are provided. The main adjustment is made by means of a T-shaped handle of the high-speed needle valve (fig. 72) that projects below the carburetor. If adjustment is necessary, turn the handle clockwise as far as it will go. Do not force it as damage to the needle valve and seat will result. Set the needle valve by turning the T-shaped handle counterclockwise 1¼ turns.

b. Release the governor control (figs. 10, 11, and 12) and start the engine. Set the throttle-stop lever (figs. 4, 5, and 6) in idle position and adjust the carburetor idling-valve screw (fig. 72(4)) to the best operating position.

c. Re-engage the governor lever and readjust the high-speed needle valve to the point where smoothest operation is obtained. It is desirable that this adjustment be very slightly over the peak, so that the mixture will be on the rich side. Warm up the engine and make final adjustment of the high-speed needle valve (fig. 72 (18)) with a load applied to the unit.

93. Carburetor Disassembly

a. Shut off the fuel supply and disconnect the fuel lines (fig. 71(13)) and governor-control rod (fig. 75(38)) from the carburetor.

b. Remove the oil-bath air cleaner or filter. (See fig. 32.) Remove the carburetor (fig. 71 (4)) from the engine.

c. Remove the high-speed needle valve and gasket (fig. 73(123)) from the bottom of the carburetor. Remove the main discharge jet from the same hole from which the needle valve was removed. (See fig. 73(122).)

d. Remove the strainer plug, gasket, and strainer from the fuel intake. (See fig. 73(134), (113), and (133).)

e. Remove the idle-needle valve (fig. 73 (116)) and spring (fig. 73(117)), and the throttle-stop screw and spring. (See fig. 73 (210) and (114).)

f. Remove the throttle-stop lever nut, lockwasher, and throttle lever. (See fig. 73(179), (185), and (128).)

g. Remove the screw (fig. 73(110)) that holds the throttle valve in the throttle shaft and remove the throttle valve (fig. 73(129)) and throttle shaft. (See fig. 73(127).)

h. Loosen the choke-lever setscrew (fig. 73 (226)) and remove the choke lever. (See fig. 73(31).)

i. Remove the screws (fig. 73(202) and (197)) and lockwashers that hold the choke valve (fig. 73(119)) in the choke-valve shaft and remove the choke valve and choke-valve shaft. (See fig. 73(118).)

j. Remove the float-chamber cover screws, lockwashers, cover, and cover gasket. (See fig. 78(211), (183), (120), and (121).)

k. Remove the float-fulcrum pin spring, the float-fulcrum pin, the float, and the float-needle valve. (See fig. 73(126), (125), (124), and

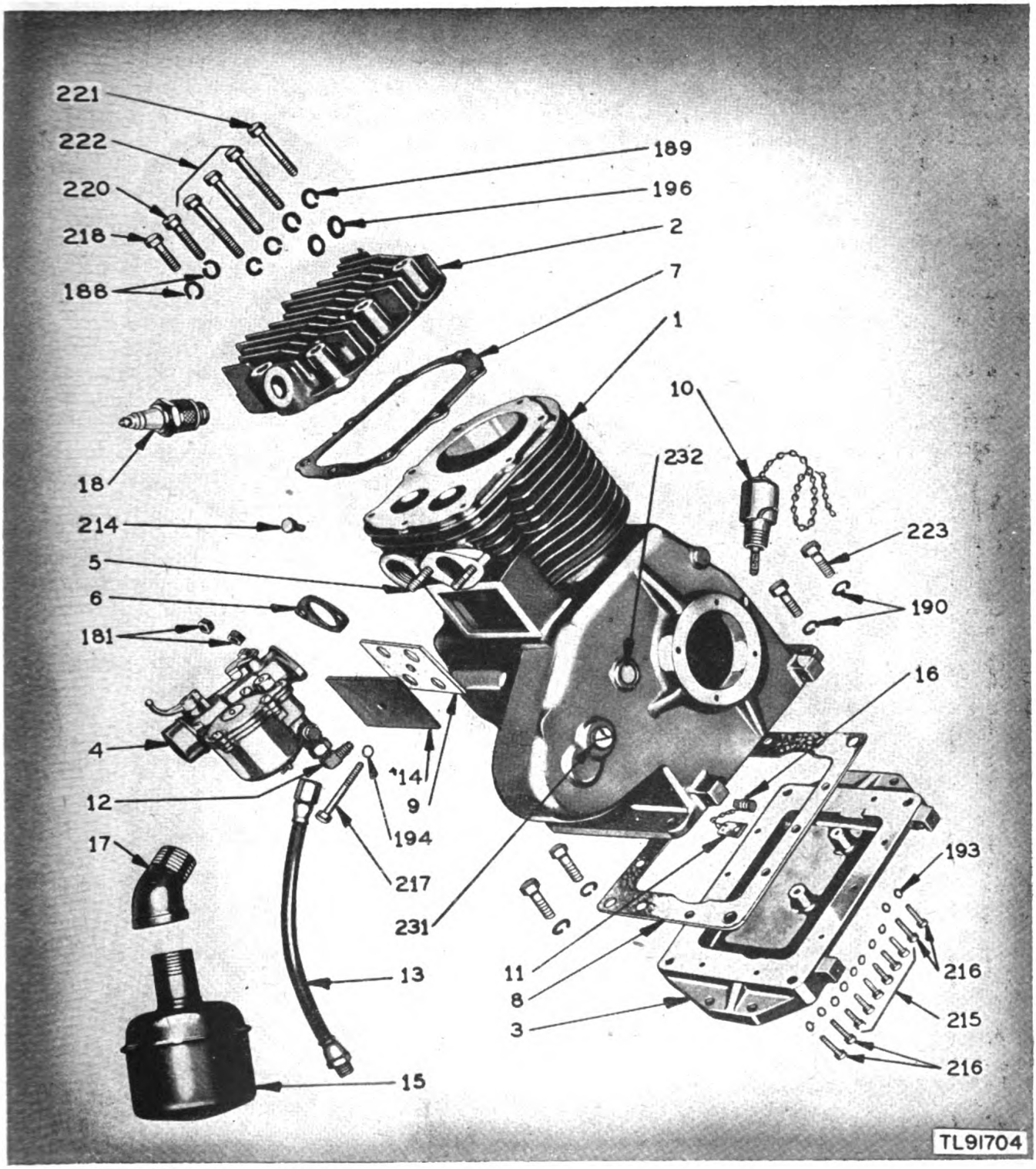


Figure 71. Main engine parts.

(130).)

l. Remove the float-needle valve seat and gasket. (See fig. 73(130) and (112).)

m. Blow out all jets and fuel passages with compressed air. Do not use a wire or other hard object to clean the jets or fuel passages.

94. Carburetor Reassembly

a. Insert the choke shaft (fig. 73(118)) from the lower side of the main body and assemble the choke. Make sure the choke valve (fig. 72 (119)) seats around its entire edge when closed.

b. Place the choke lever (fig. 73(131)) on

the choke shaft with the ball plunger in one of the indented holes on the top of the carburetor body. Press lightly on the choke lever to compress the plunger spring. Hold it in this position and fasten the setscrew (fig. 73(226)) securely. Make certain that the valve opens and closes freely.

c. Insert the throttle shaft (fig. 73(127)) into the body from the bottom. Hold the shaft so that the countersunk end of the hole for the throttle-valve screw (fig. 73(110)) is on the right-hand side of the shaft when looking at the flange end of the carburetor.

d. Insert the throttle valve (fig. 73(129)) in the slot of the throttle shaft. The projections on the valve must be on the same side as the countersink for the head of the throttle-valve screw and toward the flange end of the carburetor.

e. Place the throttle-stop screw and spring (fig. 73(210) and (114)) in position and place the throttle-stop lever (fig. 73(128)) on the shaft so that the lip on its long side is against the throttle-stop screw. Secure it in place with the nut and lockwasher. (See fig. 73(179) and (185).)

f. Screw the throttle-valve screw loosely in place and center the throttle valve within the tube. If necessary, tap the high side of the valve lightly to aid in centering it. Be sure that the throttle-stop screw is not holding it open. Hold the throttle in a fully closed position and tighten the throttle-valve screw.

g. Adjust the throttle-stop screw (fig. 73(210)) until it just contacts the throttle-stop lever and then give it an additional half turn.

h. Install the float needle-valve seat and gasket. (See fig. 73(130) and (112).) Place the strainer (fig. 73(133)) in the plug hole below the float-needle valve and make sure that it fits over the lower end of the float-needle valve seat. Install the strainer plug and gasket. (See fig. 73(113).)

i. Install the idle-needle valve and spring. (See fig. 73(116) and (117).) Seat it lightly with the fingers and then screw it back one-half turn.

j. Install the main discharge jet. (See fig. 73(122).) Unscrew the main needle valve a few turns and assemble it to the carburetor. Be sure that the gasket is in place and tighten the nut securely. Turn the adjustment in until it seats and then unscrew it 1½ turns.

k. Insert the float-fulcrum pin (fig. 73(125)) in the float lever. Place the float-needle valve (fig. 73(130)) in the fork of the float lever and place this assembly in position in the carburetor body. Place the float-fulcrum pin spring (fig. 73(126)) in the slots in the carburetor body with the curved side up and the two ends resting on the float-fulcrum pin.

l. Place the carburetor back on the engine, connect the fuel line (fig. 71(13)) and open the fuel valve. Make sure that the unit is set perfectly level. Check the fuel level in the float chamber. (See fig. 73(124).) The level of the

1. Choke Valve
2. Idle Air Bleeder
3. Main Discharge Jet
4. Idle Needle Valve
5. Idle Discharge Hole
6. Throttle Valve
7. Float Chamber Vent
8. Float Fulcrum Pin Clip
9. Float Needle Valve
10. Float Fulcrum Pin
11. Float Needle Valve Seat
12. Float Seat Gasket
13. Fuel Inlet
14. Fuel Strainer
15. Fuel Strainer Plug
16. Float Lever
17. Float
18. High Speed Needle Valve
19. High Speed Air Bleeder

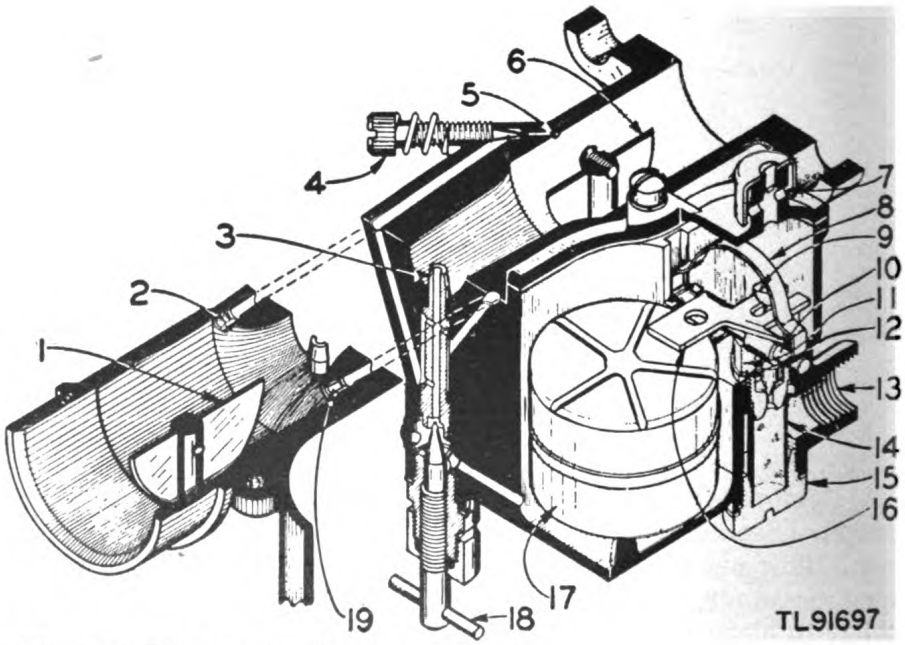
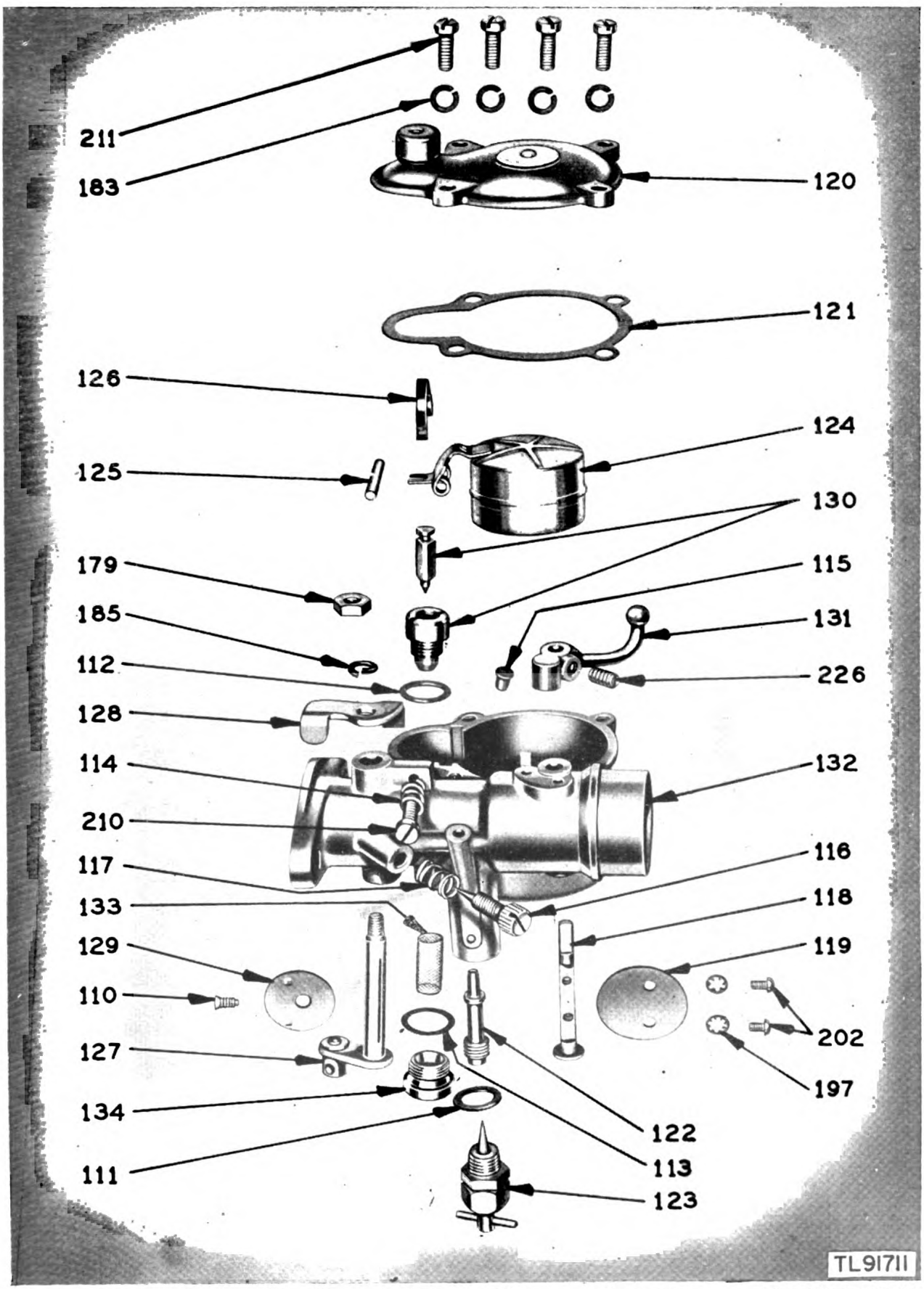


Figure 72. Diagram of carburetor.



Ref No.	*Spare part*	*Signal Corps stock No.*	*Ref No.*	*Spare part*	*Signal Corps stock No.*
111	Metering-jet gasket	3H712/G2	113	Gasoline strainer-plug gasket	3H751–1/G1
112	Float needle-valve-seat gasket	3H712/G1	121	Float chamber cover gasket	3H712/G3

Figure 73. Carburetor assembly.

fuel must be 17/32 inch below the gasket surface of the float chamber. Hold down on the float-fulcrum pin spring (fig. 73(126)) while measuring the fuel level so as to be sure that the float and float-valve assemblies are in their normal position.

m. If the fuel level is too high or too low, adjust the float level by bending the float arm. Bend the arm at the center line or the hole in the arm.

n. When the fuel level has been satisfactorily adjusted, replace the cover (fig. 73(120)) of the float chamber. Be sure that the gasket (fig. 73 (121)) is in place and in good position. If the gasket is not in good condition, replace it with a new gasket. Be sure there is a lockwasher (fig. 73(183) on each of the four screws (fig. 73(211)) and screw them down tight.

o. Replace the air cleaner (fig. 32) and reconnect the governor-control rod. (See fig. 75 (38).)

p. Start the unit and adjust the carburetor as instructed. (See par. 92.)

95. Cylinder Head

a. DISASSEMBLY. To remove the cylinder head (fig. 71(2)) for the removal of carbon, valve grinding, or piston ring or piston replace-

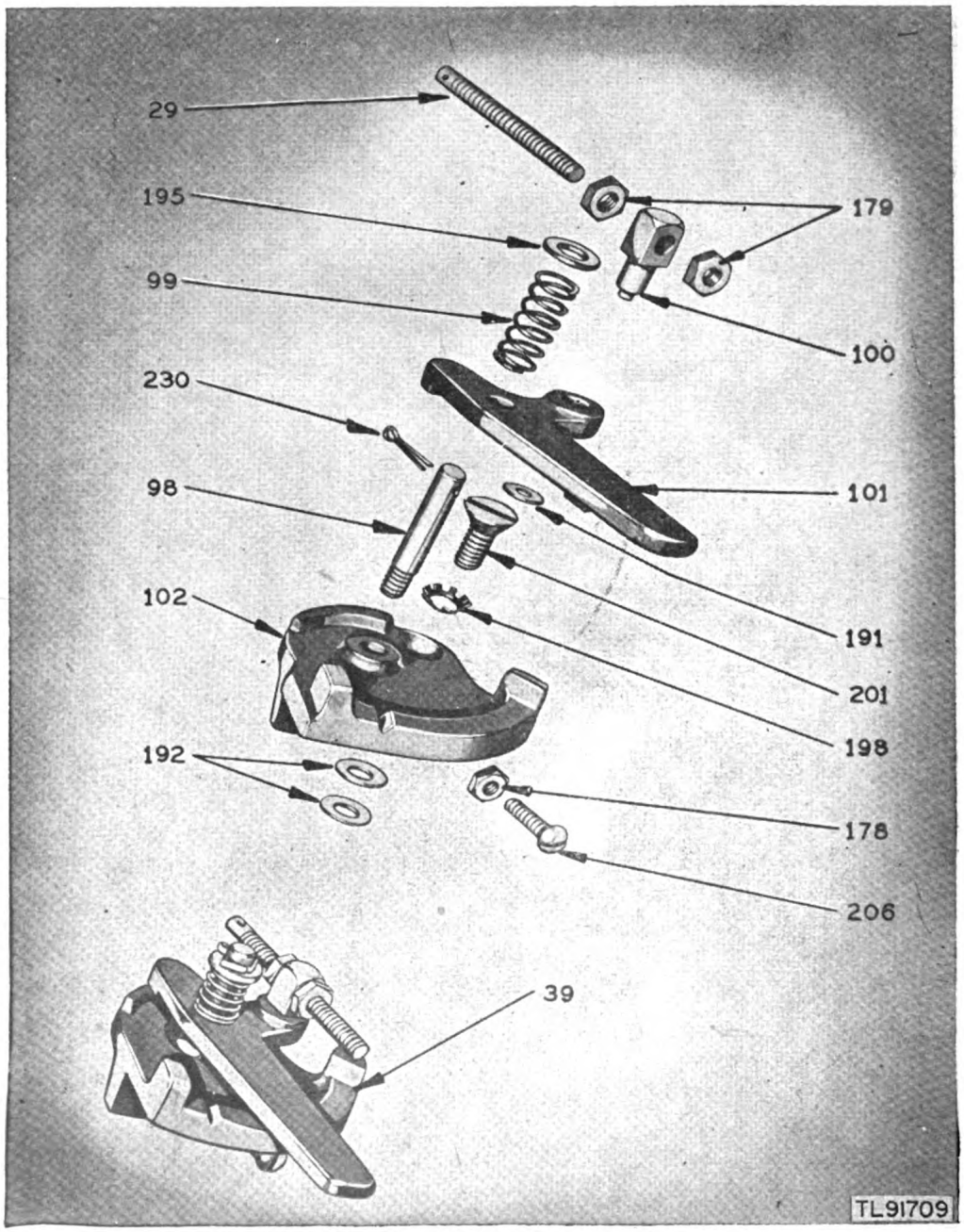


Figure 74. Governor control assembly.

ment, shut off the fuel supply and remove the fuel line (fig. 71(13)) and fuel tank. (See figs. 4, 5, and 6.) Observe the following procedure:

(1) Remove the spark plug (fig. 71(18)) and spark-plug shield. (See fig. 38(14).)

(2) Remove the air-cooling shroud. (See fig. 43(85).)

(3) Remove the cylinder head cap screws (fig. 71(218), (220), (221), and (222) and lift off the cylinder head (fig. 71(2)).

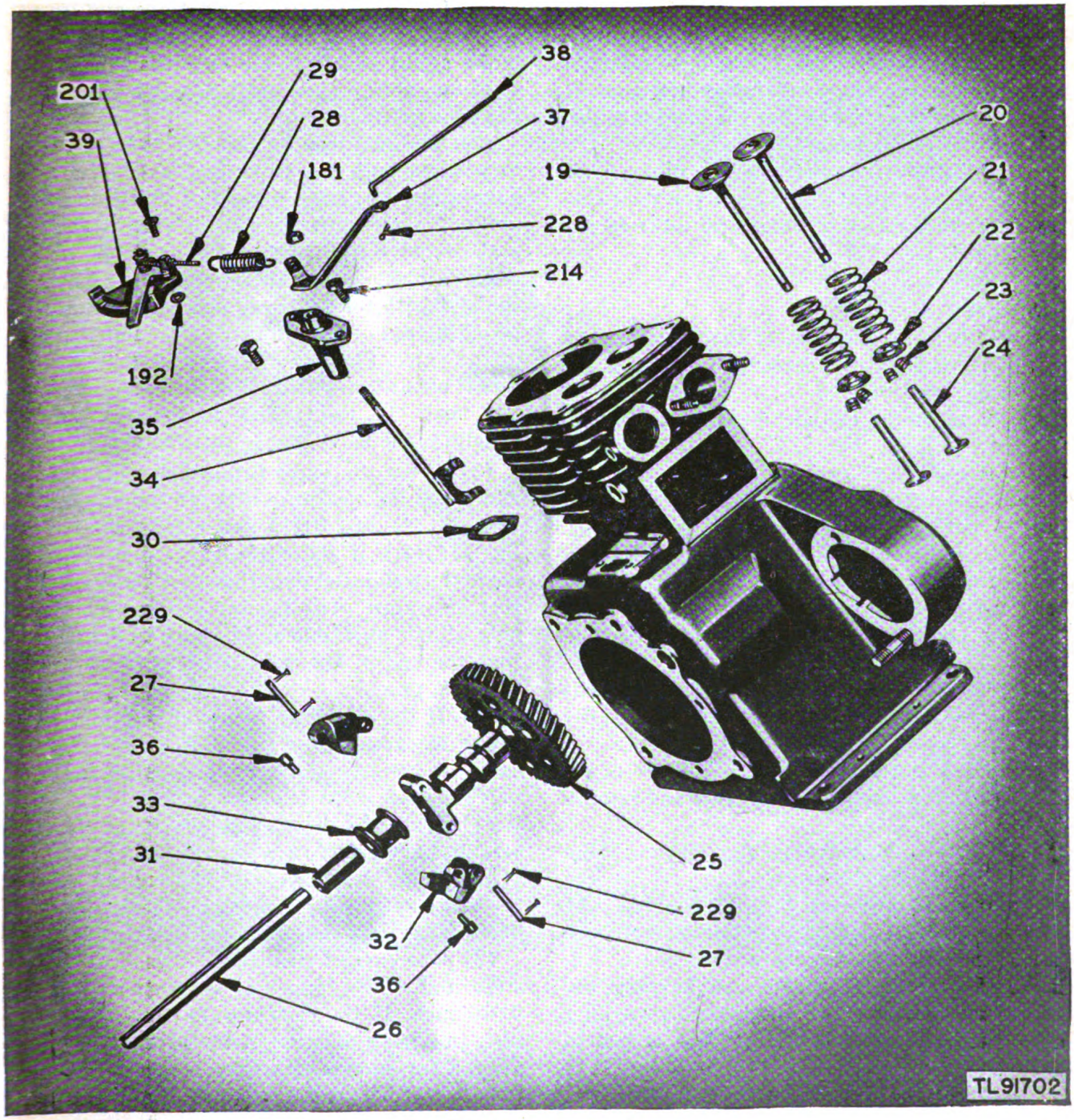


Figure 75. Valves, governor, and camshaft.

b. PROCEDURE FOR CARBON REMOVAL. (1) With a carbon-scraping tool or narrow putty knife, scrape the carbon from the inside of the cylinder head, the top of the piston (fig. 80 (45)) and from around the valves. (See fig. 75 (19) and (20).) Finish off with a wire brush.

(2) Inspect the valves while the cylinder head is removed and grind them if necessary. (See par. 96.) If no further work is to be done, replace the cylinder head. Use a new gasket if possible. Tighten the head fastenings (fig. 71 (2)) a little at a time so that the head is pulled down evenly on all sides.

c. REASSEMBLY. Reassemble the other parts in the reverse order to that used for their disassembly. Be sure all washers and lockwashers are replaced.

96. Valves

a. REMOVAL OF VALVES. If the valves are in need of grinding or adjustment, observe the following procedure:

(1) Remove the cylinder head as instructed. (See par. 95.)

(2) Remove the carburetor (par. 93) and remove the valve-cover plate and gasket (fig. 71(14) and (9)) from the side of the cylinder.

(3) Insert a valve lifter between the valve-spring seat (fig. 75(22)) and the bottom of the valve-spring chamber. Compress the valve lifter so as to compress the valve spring. (See fig. 75(21).)

(4) Remove the valve-spring retainer locks (fig. 75(23)) from the valve stems (fig. 75(19) and 20)).

(5) Mark the valves so as to be sure of returning them to their original seats and remove the valves.

(6) Remove the valve springs and tag them so as to replace them correctly.

b. CLEANING AND GRINDING OF VALVES. (1) Scrape as much carbon as possible from the valves and clean them with a wire brush. Examine the valves for evidence of burning, excessive wear of the stems, and possible warping or bending. Replace any valve that is not in good condition.

(2) Select the first valve to be ground and place a light coil spring over the valve stem. This spring should be just heavy and long enough to lift the weight of the valve from its seat. Coat the face of the valve with a light, even coating of valve grinding compound and place it in position on the seat (fig. 75(22)) from which it was removed. The spring on the valve stem will be under the head of the valve and within the valve chamber.

(3) Make sure the valve tappet (fig. 75(24)) is at its lowest point. Using a valve-grinding tool, bear down lightly on the valve and rotate it back and forth on its seat. Permit the spring to lift the valve every few rotations and give it a one-half turn while clear of the seat. Bear down again and continue the rotating action. Continue this action until a satisfactory seat has been ground.

(4) The seat may be assumed to be satisfactory when both the valve face and valve seat have a smooth, silvery band of uniform width around the circumference of the valve and valve seat. Remove the valve and wipe it off with a cloth dampened with Diesel oil (DA). Wipe off the seat with the same rag and place a series of pencil marks at close intervals around the face of the valve. Place the valve on its seat and rotate it about one-half turn while in contact with the seat. If the pencil marks are evenly smudged, the valve seat is satisfactory.

(5) Press the valve firmly down on its seat and check the clearance between the valve stem (fig. 75(19) and (20)) and valve tappet. (See fig. 75(24).) If the clearance is too close, remove the valve and grind its stem until the correct clearance ((8) below) is reached. Grind only a little at a time and be sure to grind it so that the end of the valve stem is square with the stem proper.

(6) If the clearance from valve stem to tappet is too great after grinding, it will be necessary to replace the valve and grind the new valve to its seat.

(7) Wash the valves and valve parts in Diesel oil, and be sure to clean any grinding compound from other parts of the engine. Check the valve springs by comparing them with new ones and replace those that are not satisfactory.

(8) The correct clearance between the valve stem and valve tappet is between 0.010 and 0.016 inch. If the clearance is less than 0.010 inch the valve must be removed and the stem ground for correct clearance. The clearance of the valve stem in the valve-stem guide should be between 0.003 and 0.005 inch.

(9) Reassemble the valves and other engine parts by reversing the operations for their disassembly. Make sure that all gaskets, washers, and lockwashers are replaced. Use new gaskets if the old gaskets are no longer serviceable.

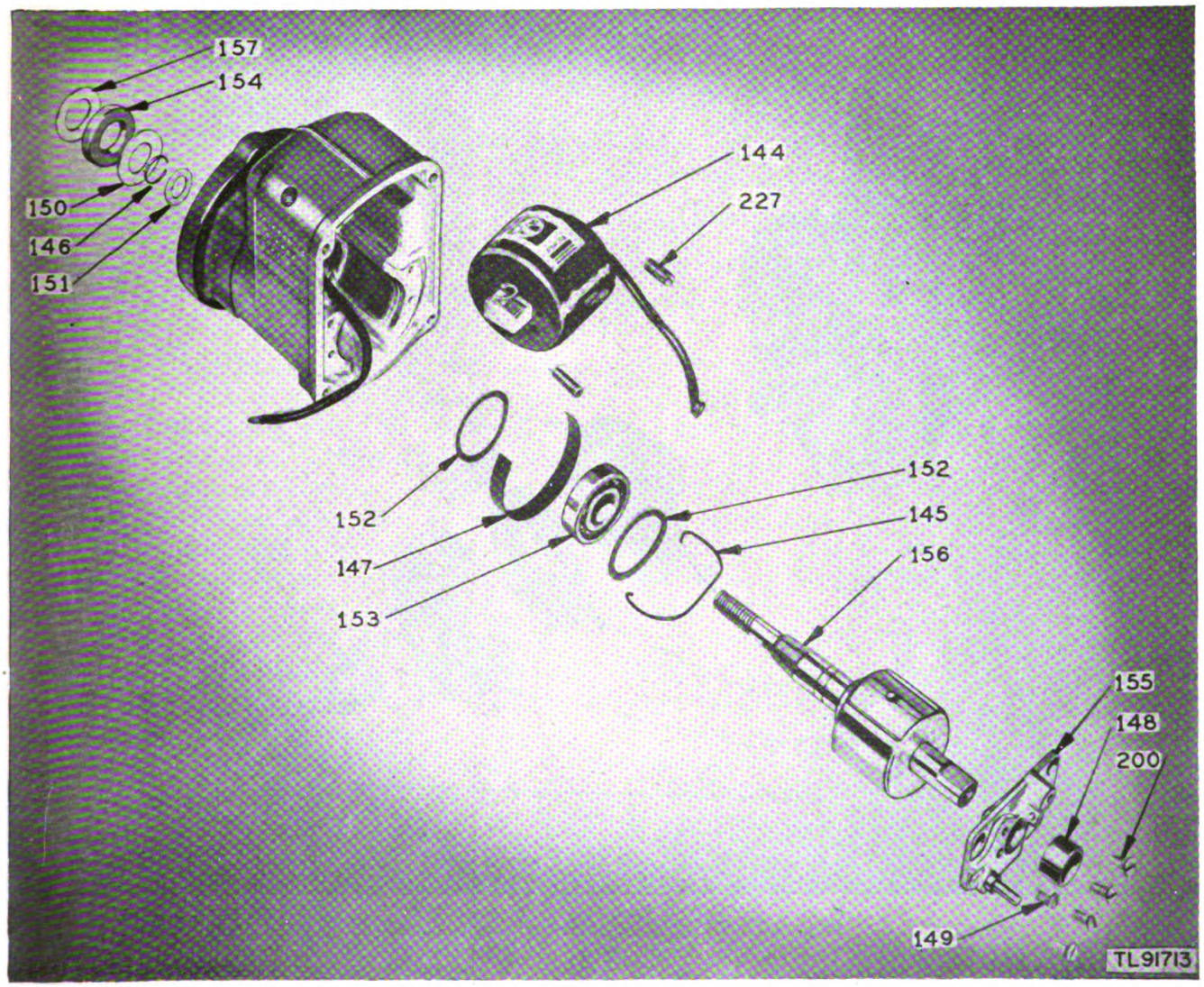


Figure 76. Magneto rotor, bearing, and coil.

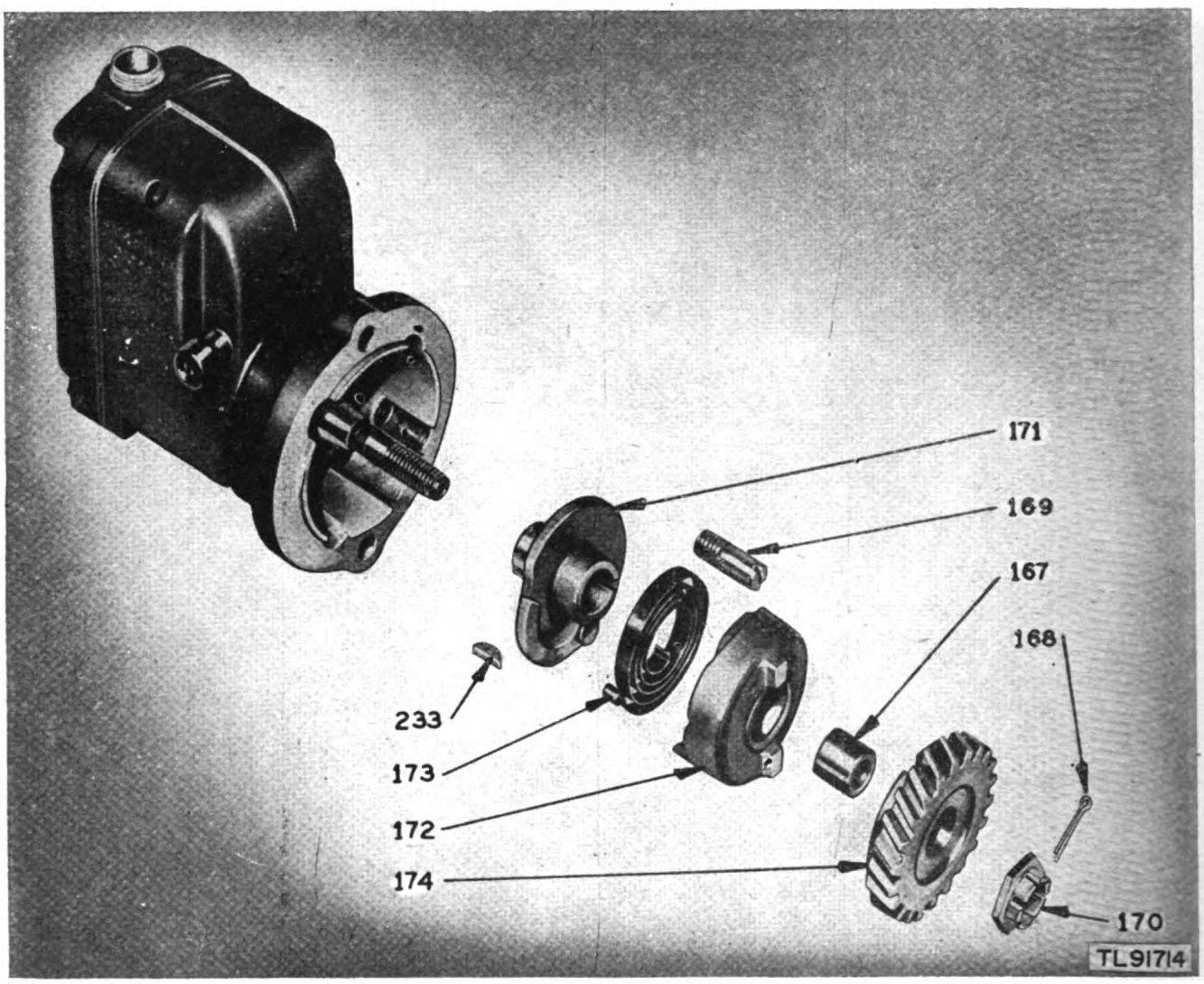


Figure 77. Magneto impulse-coupling assembly.

97. Magneto

a. To remove the magneto, loosen the knurled nut that fastens the ignition-cable shielding to the magneto and pull the wire and shielding from the magneto. (See fig. 41 (136).) Remove the cap screws (fig. 80 (59)) that hold the magneto to the engine base and remove the magneto assembly.

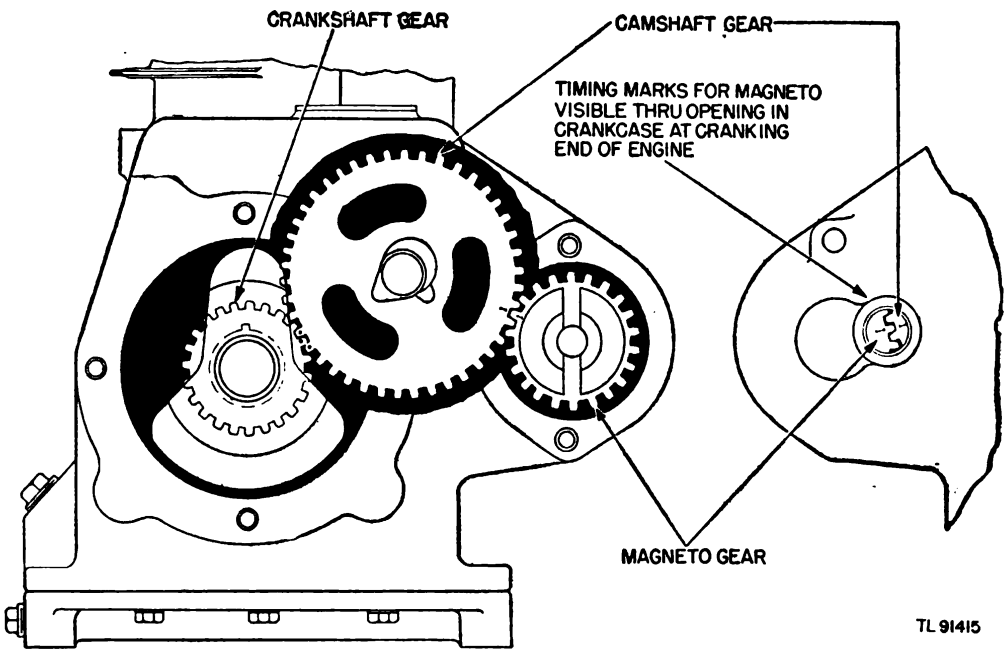


Figure 78. Timing diagram.

b. In replacing the magneto, turn the engine crankshaft until the mark on the camshaft gear is visible through the peep-hole in the front of the gear-case. (See fig. 78.) Turn the magneto gear so that the marked tooth will mesh with the mark on the camshaft gear. Place the magneto-mounting gasket in place and slip the magneto into place. Check to be sure that the timing gears are properly meshed (fig. 78), and fasten the magneto in place with the two cap screws, lockwashers, and nuts. (See fig. 80(59), (189), and (182). Replace the ignition wire and shielding in their original position. Be sure to push the ignition wire all the way down into the terminal.

98. Oil Pump

a. REMOVAL. (1) Removal of the oil pump (fig. 79) necessitates the removal of the engine (fig. 26) from the skid base and disconnecting the generator (fig. 53) from the engine. When the generator has been disconnected from the engine by disengaging the generator end of the coupling hub at the floating center disk assembly (fig. 53), drain the engine crankcase and remove the engine from the skid base by removing the U-bolts. (See figs. 4, 5, and 6.)

(2) Drain the fuel tank and turn the engine on its side. Remove the screws and washers (figs. 71(215), (216), and (193)) that hold the base to the engine and remove the base (fig. 71(3)). The oil trough and oil pump assembly (fig. 79) will come off as a part of the engine base.

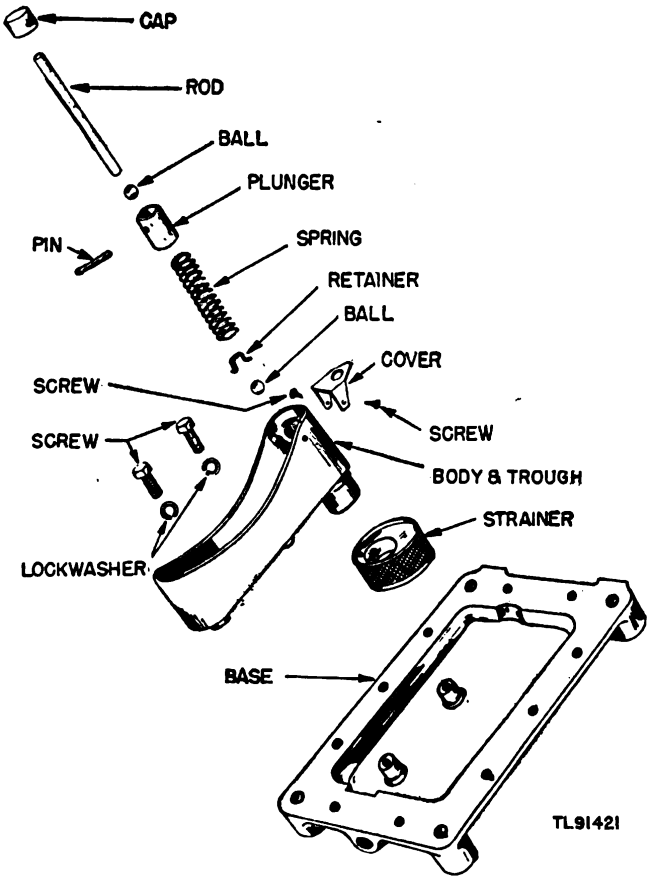


Figure 79. Oil pump assembly.

(3) Remove the cap (fig. 79(71)) that holds the oil pump plunger by removing the two screws that hold it in place. Hold a screw driver against the plunger to prevent its popping out as the cap is removed. Lift the plunger and spring (fig. 79) out of the pump cylinder bore. Turn the oil-pump body and trough assembly (fig. 79) over and permit the check ball to drop out. Remove the two cap screws that hold the trough assembly to the base and remove the assembly. (See fig. 79.)

b. INSPECTION AND REPLACEMENT. (1) Check all pump parts for wear and wash them thoroughly in Diesel oil. Replace all parts that appear to be worn.

(2) In reassembling the oil pump, fit the plunger (fig. 79) to the bore with a clearance of between 0.0035 and 0.006 inch. If this clearance is greater than 0.010 inch, replace the plunger and the oil-pump body. Inspect the check-ball seat in the bottom of the pump cylinder. This seat must be perfectly clean and not worn or pitted.

(3) Drop the check-ball (fig. 79) into the cylinder and tap it lightly into its seat with a punch and hammer. Next, drive the retaining pin (fig. 79) into place. Clean up any bur on the plunger that may have been caused by driving the retaining pin into place. Insert the plunger in the cylinder and hold it in place with a screw driver while replacing the retainer cap.

(4) Fill the base with about ½ pint of engine oil (OE) and with a screw driver pump the piston up and down to pump oil into the trough. If no oil is discharged into the trough, the pump and body are worn and must be replaced.

(5) If the pump functions satisfactorily, reassemble the base (fig. 71(3)) to the engine. Be sure that gasket (fig. 71(8)) is in good condition. If it is not, replace with a new gasket.

99. Piston and Connecting Rod

a. REMOVAL. (1) Before the piston and connecting rod assembly can be removed, remove the cylinder head and engine base. (See pars. 95*a* and 98*a*.)

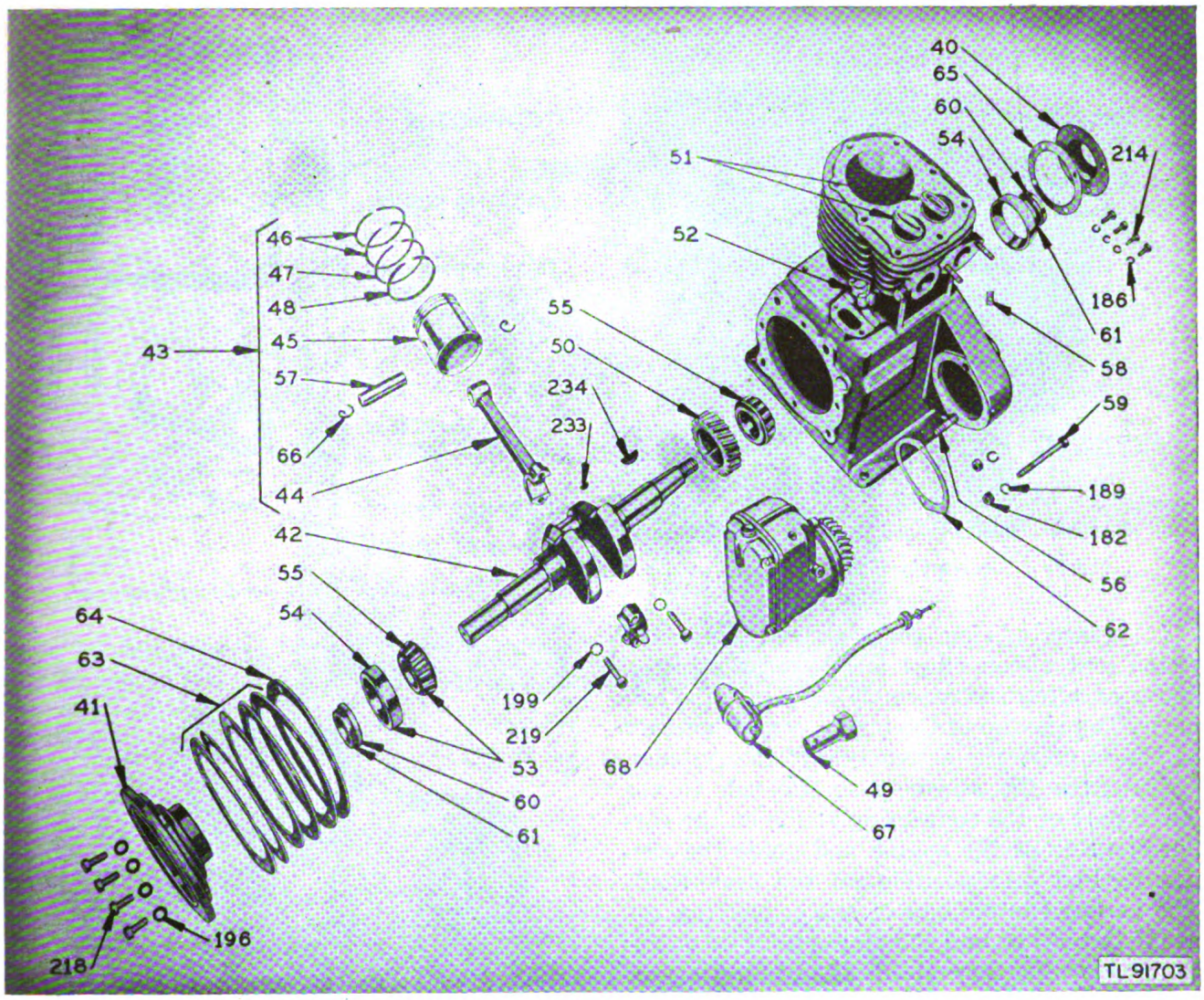


Figure 80. Crankshaft, bearing plate, piston, and connecting rod assembly.

(2) With the engine base removed, remove the two cap screws (fig. 80 (219 and 199)) and washers that hold the connecting-rod bearing cap to the lower end of the connecting rod and remove the bearing cap. With this cap removed, tap the lower end of the connecting rod with a hammer handle and push the piston and connecting rod up through the cylinder bore. Grasp the top of the piston and pull the assembly (fig. 80 (43)) out of the cylinder.

(3) Before withdrawing the piston from the cylinder, check the clearance between the skirt of the piston and the cylinder bore. This check must be made with the piston in a normal position within the cylinder bore. The correct clearance is between 0.0055 and 0.006 inch. If a greater clearance is noted it will be necessary to replace the piston and possibly install an oversized piston.

b. REPLACEMENT. (1) Check the piston rings and replace them if necessary. (See fig. 81.) The piston rings should have a side clearance in their grooves of 0.002 to 0.003 inch and a gap of 0.012 inch. The ring gap must be measured at the lower extreme of the piston travel. Clean the carbon from the ring grooves and make sure that the rings move freely in their grooves. Replace any rings that are not satisfactory.

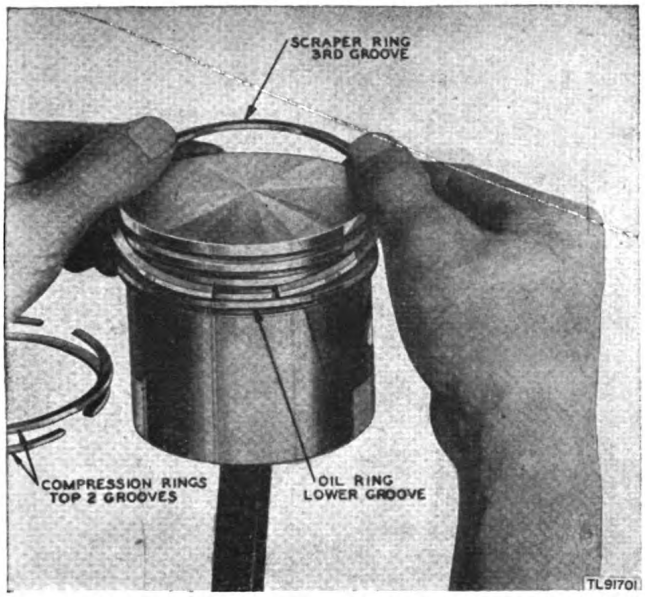


Figure 81. Assembly of piston rings.

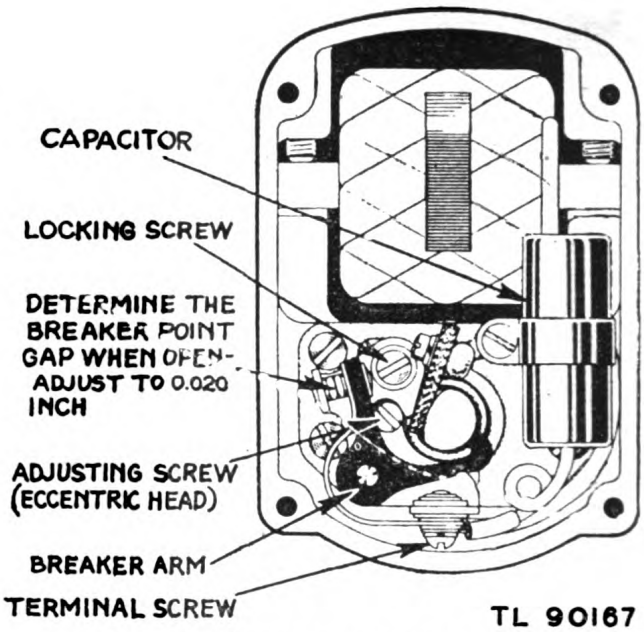


Figure 82. Magneto—end cover removed.

(2) Place a ring compressor around the piston and piston rings and lower the piston and connecting rod assembly back into the cylinder. Tap the top of the piston with a hammer handle to drive the assembly into the cylinder.

(3) Turn the assembly so the hole in the lower part of the connecting rod is on the carburetor side of the engine and guide the connecting rod into position on the crankshaft. The cap and lower end of the connecting rod are both marked and the marks must be on the same side when assembled. The connecting-rod bearing should have a clearance of between 0.001 and 0.002 inch on the crankshaft (fig. 80(42)) and a side clearance of between 0.006 and 0.010 inch. Replace the cap screws and washers and turn them up tight.

(4) When all work on the internal parts of the engine has been completed, replace the base, cylinder head, and other engine parts and then replace the engine on the skid base, tightening the U-bolts. (See figs. 4, 5, and 6.) Reconnect the generator to the engine through the coupling assembly making sure that everything is properly lined up and that all parts move freely.

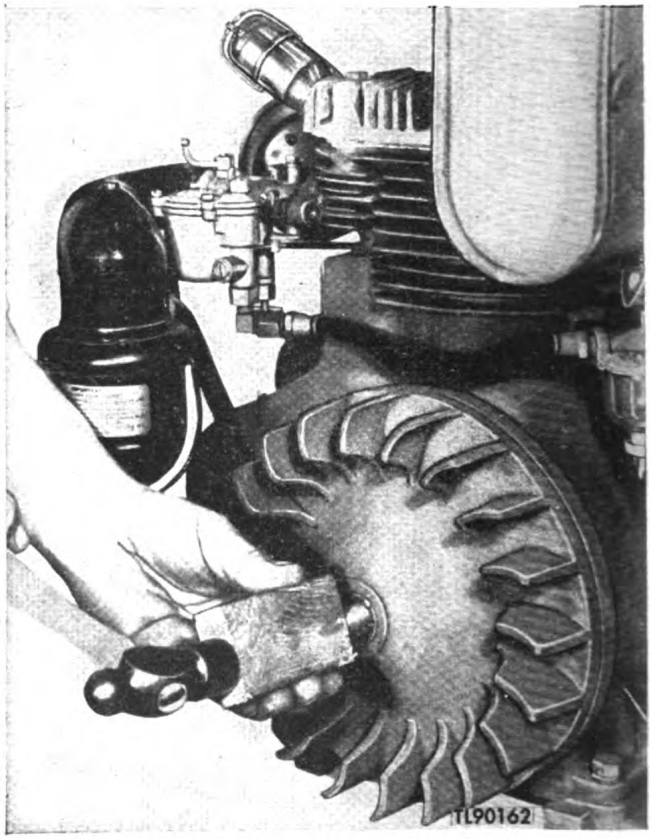


Figure 83. Removing engine fly wheel.

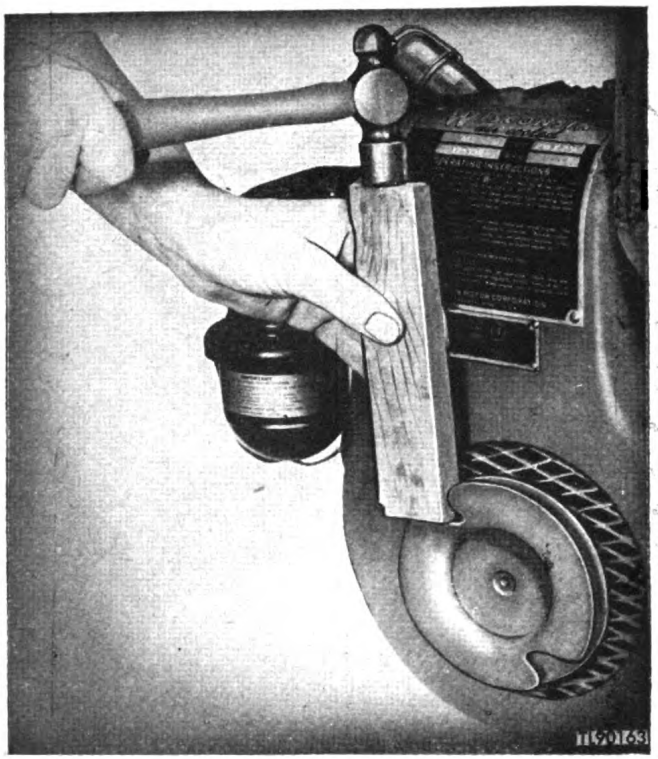


Figure 84. Removing rope-starter pulley.

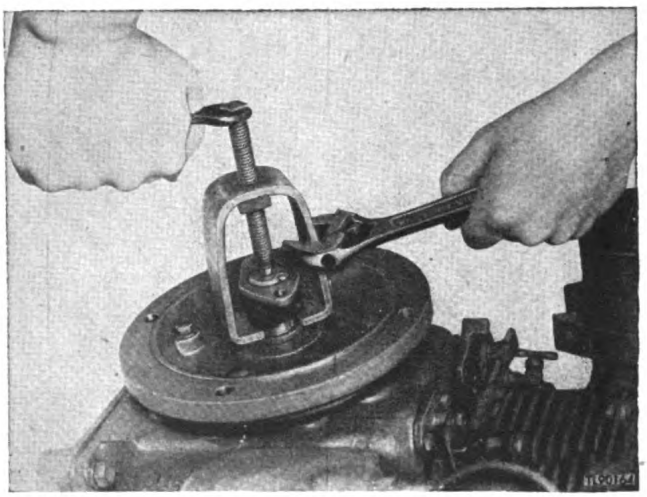


Figure 85. Removing engine coupling hub.

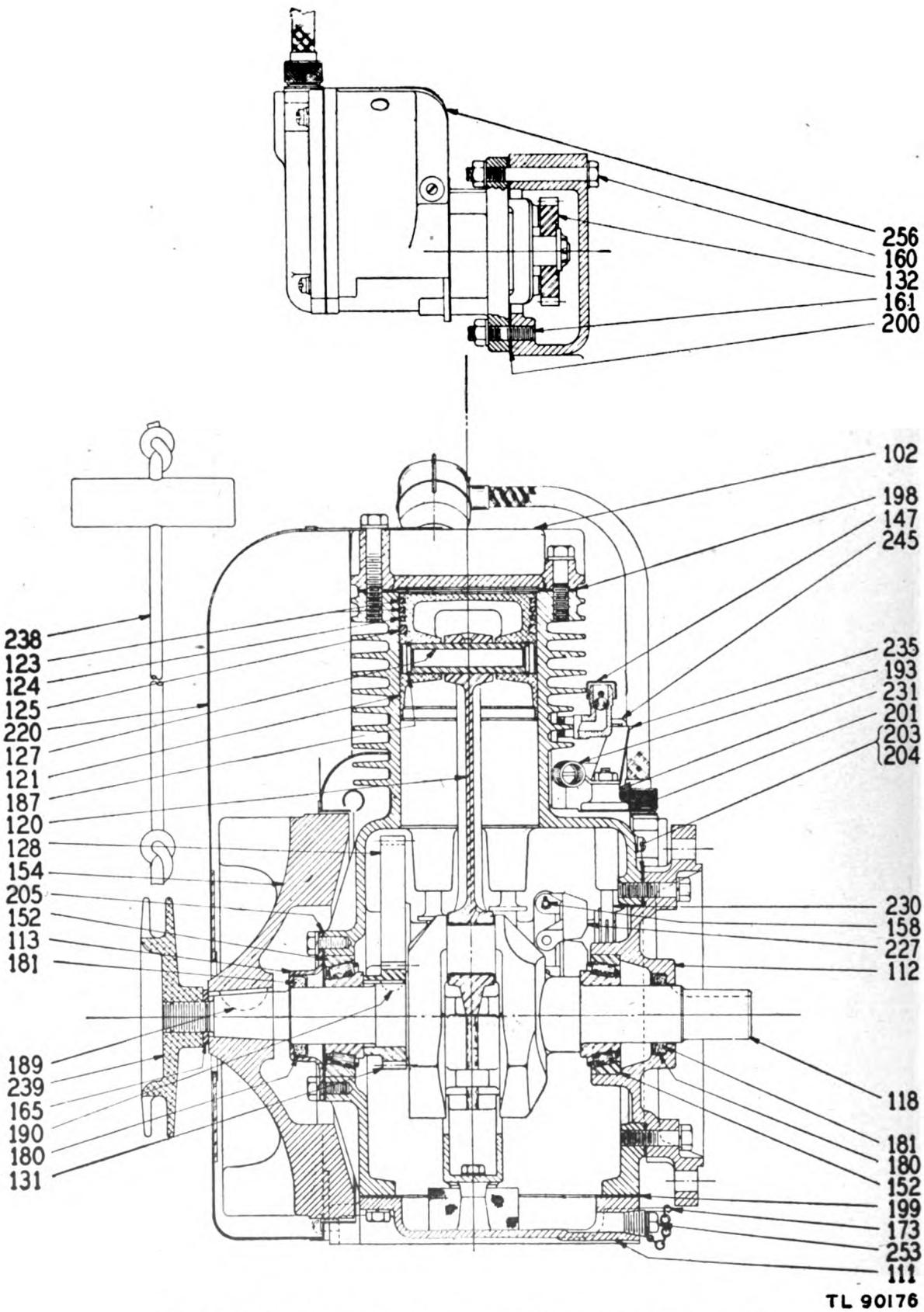


Figure 86. Engine GE–9–D or GE–9–F—cross-sectional view from side.

(Figure 86 continued)

102. Cylinder head.
111. Engine base.
112. Main-bearing-plate takeoff end.
113. Main-bearing-plate flywheel end.
118. Crankshaft assembly.
120. Connecting rod.
121. Piston.
123. Compression piston rings (2).
124. Scraper piston ring.
125. Oil-regulating piston ring.
127. Piston pin.
128. Camshaft and gear with support pin.
131. Crankshaft gear.
132. Magneto drive gear.
147. Breather assembly.
152. Main bearings (2).
154. Flywheel.
158. Governor flywheel toggle pin (2).
160. Screw for mounting magneto upper hole.
161. Stud for mounting magneto.
165. Lockwasher for rope-starter sheave.
173. Clip for oil drain and level plug chain.
180. Main-bearing oil seal cup (2).
181. Main-bearing oil seal (2).
187. Piston-pin retaining ring (2).
189. No. 13 Woodruff key for flywheel.
190. No. 3 Woodruff key for crankshaft gear.
193. Governor spring.
198. Gasket for cylinder head.
199. Gasket for engine base.
200. Gasket for magneto flange.
201. Gasket for governor shaft support bracket.
203. Gasket for main bearing plate 0.006 inch thick takeoff end (5).
204. Gasket for main bearing plate 0.003 inch thick takeoff end.
205. Gasket for main bearing plate flywheel end.
220. Air shroud.
227. Governor flyweight (2).
230. Governor yoke and shaft assembly.
231. Governor-shaft support bracket.
235. Governor-control lever.
238. Starter rope assembly.
239. Rope-starter sheave.
245. Governor control rod to carburetor..
253. Oil drain plug assembly.
256. Magneto.

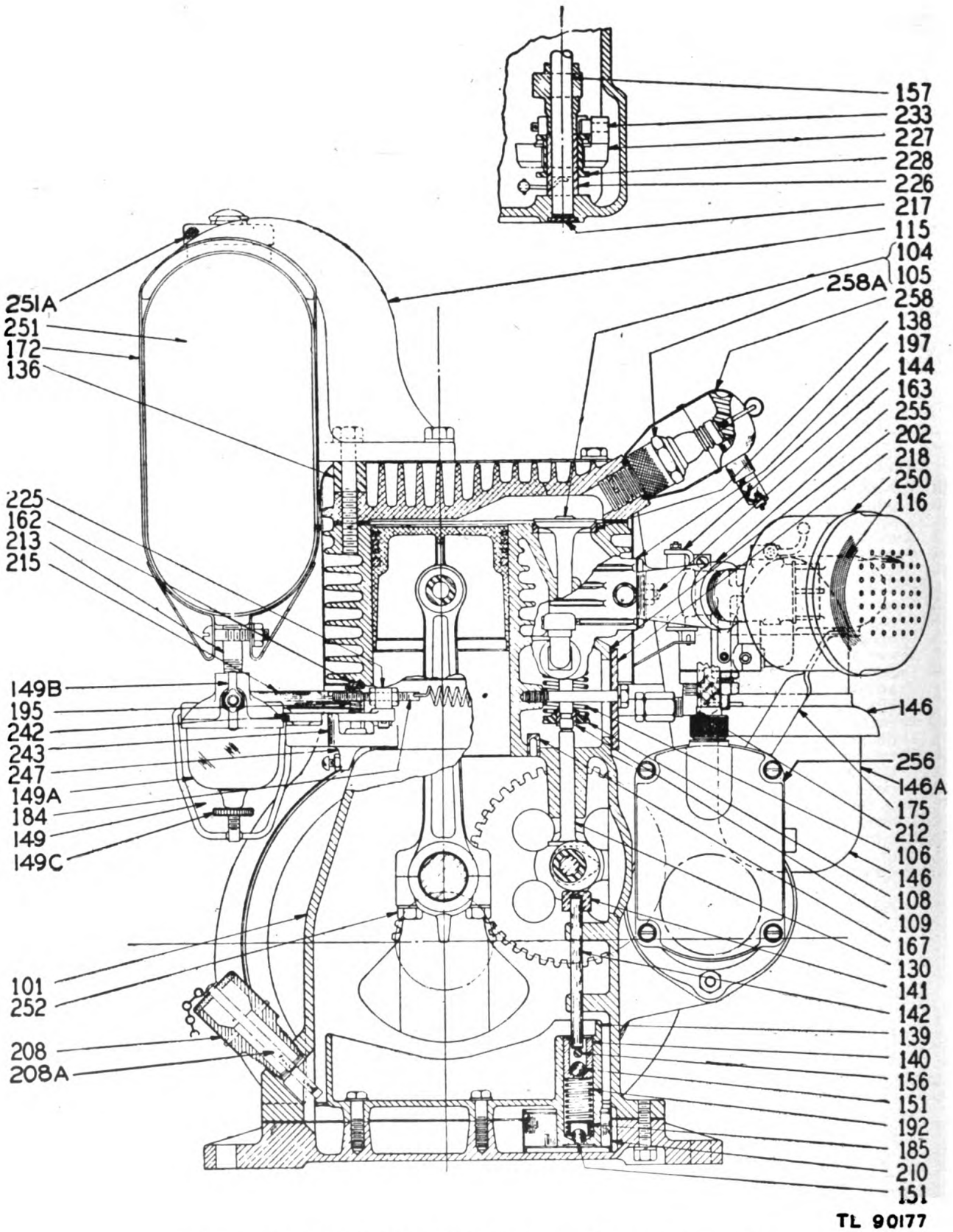


Figure 87. Engine GE–9–D or GE–9–F—cross-sectional view from end.

(Figure 87 continued)

101. Cylinder and crankcase.
104. Exhaust valve.
105. Inlet valve.
106. Valve springs (2).
108. Valve-spring seats (2).
109. Valve-spring locks (4).
115. Fuel-tank bracket.
116. Air-filter bracket.
130. Valve tappets (2).
136. Spacer for fuel-tank bracket (2).
138. Valve-seat insert (2).
139. Oil pump body and splash trough.
140. Oil-pump plunger.
141. Oil-pump plunger push-rod cap.
142. Oil-pump plunger push rod.
144. Carburetor.
146. Oil-bath air filter.
146A. Air-filter cup.
149. Fuel strainer.
149A. Gas sediment bowl.
149B. Shut-off valve.
149C. Knurled thumbscrew.
151. Steel ball in oil pump (2).
156. Straight pin for oil pump plunger.
157. Camshaft support pin.
162. Stud for speed control lever.
163. Special studs for mounting carburetor (2).
167. Breather in valve tappet spring compartment.
172. Fuel-tank straps (2).
175. Support strap for air-cleaner bracket.
184. Governor spring adjustment screw.
185. Oil-pump ball retainer.
192. Oil-pump plunger spring.
195. Spring for governor control.
197. Gasket for carburetor flange.
202. Gasket for valve tappet inspection plate.
208. Oil sabre assembly.
208A. Bayonet gauge.
210. Oil-pump strainer.
212. Elbow in carburetor fuel line.
213. ⅛-inch pipe nipple for fuel strainer to tank.
215. Fuel line assembly.
217. Welch plug for camshaft pin hole in case (2).
218. Valve tappet inspection plate.
225. Pin for governor spring adjusting screw.
226. Governor spacer.
227. Governor flyweight (2).
228. Governor thrust sleeve.
233. Governor flyweight pins (2).
242. Speed-control lever.
243. Speed-control bracket.
247. Speed-control-bracket support.
250. Muffler.
251. Fuel tank.
251A. Fuel-tank cap.
252. Connecting-rod bolts (2).
255. Street ell for exhaust muffler.
256. Magneto.
258. Spark-plug shield assembly.
258A. Spark plug.

100. Motor MO–37–A

a. GENERAL. Maintenance of the motor (fig. 7) should be a comparatively simple matter if proper precautions are observed during operation. (See par. 31.) However, since almost any kind of trouble may develop during operation, it is necessary to know in detail how to locate and correct troubles that may arise. The motor has been ruggedly constructed to stand up under field operation with a minimum of attention and maintenance. Do not attempt repairs or adjustments if it is not certain they can be done in the field. If competent personnel is not available, return the motor generator set to the proper echelon of repair.

b. BRUSHES AND BRUSH HOLDERS (fig. 88). (1) The brushes carry practically no current except during starting. Therefore they have a very slow rate of wear and should not require frequent replacement.

(2) Make a periodic inspection of the brushes and brush holders. Accumulation of carbon dust on the brush holders is an unavoidable result of brush wear. Should this accumulation become excessive, it may interfere with the movement of the brushes in the brush holders and thereby cause improper functioning of the short-circuiting device. It is therefore good practice to blow out the carbon dust when the motor is inspected or serviced. Wiping off the dust with a cloth saturated with dry-cleaning solvent (SD) is also recommended.

(3) Do not remove the brushes from the brush holders (fig. 88) unless it is absolutely necessary for replacement or major cleaning operations. If brushes are removed and found to be still in good condition, put them back in the same holders and in the same position they originally occupied.

(4) To replace a worn or broken brush, disconnect the pigtail from the brush holder, lift the pressure finger, and pull the brush out of the brush-holder box. Place a new brush in the box. Before connecting the pigtail, be sure the brush can move freely in the box.

(5) Proper contact of brushes on the commutator is very essential for proper operation. It is advisable, therefore, to sand in the contact surfaces of new brushes when they are installed. (See par. 101*e*.)

(6) The brush rocker is marked with a paint line. A similar line is painted on the inside of the motor bearing-bracket. When these two lines coincide, the rocker is in proper operating position. If for any reason it is necessary to shift the rocker or remove it, return it to the correct position indicated by the painted lines for proper operation of the motor.

c. MOTOR COMMUTATOR. (1) The commutator (fig. 88) of Motor MO–37–A is equipped with a short-circuiting starting device. (See *e* below.)

(2) To insure good contact with the brushes and proper operation of the short-circuiting device, the commutator should be maintained in the same manner as described in paragraph 101.

Caution: Never touch the commutator, the brushes, or the brush holders with the bare hand or with noninsulated tools while the motor is running.

d. MOTOR ARMATURE. (1) If the motor does not operate properly or fails to start, there may be an open or short circuit in the armature winding. (See fig. 88.)

(2) If an open circuit should occur in the armature winding, it will usually cause severe burning on a commutator bar and the motor will not run at proper speed under load.

(3) The short-circuiting starting device mounted on the commutator end of the armature shaft can be removed, if necessary. (See *e* below.)

(4) If it becomes necessary to replace the motor armature, proceed as outlined in paragraph 102.

e. SHORT-CIRCUITING. (1) Keep the short-circuiting device (fig. 88) free from dirt and dust. The best way to do this is with a jet of low-pressure air or with a hand bellows.

(2) If the starting device fails to function, too strong a spring tension is indicated.

(3) When it is necessary to remove or replace the short-circuiting device for any reason, proceed as follows:

(*a*) Remove the strap cover, bearing bracket, and ball bearing.

(*b*) Loosen the nuts with a wrench, and remove them from the rotor shaft.

(*c*) Remove the short-circuiting device over the end of the shaft.

(*d*) Check the bevel on the commutator where the short-circuiter makes contact. It should be clean and smooth. Any dirt or roughness on the bevel should be removed with #00 or finer sandpaper, and the surfaces wiped with a cloth moistened with dry-cleaning solvent (SD).

(*e*) To replace the short-circuiting device and reassemble the motor, reverse the procedure for disassembly. (See (*a*) through (*c*) above.)

f. STATOR COILS. The stator coils of the motor have been well insulated and varnish-impregnated to withstand the most severe service conditions. In case an excessive amount of dirt or dust accumulates on or around the coils, blow out with dry air to prevent possible trouble. A hand bellows is ideal for this purpose. If a hand bellows is used, be careful not to damage the insulation by jabbing it with the nozzle of the bellows.

g. MOTOR BEARINGS. The motor armature shaft rotates in two ball bearings (fig. 88) of exactly the same type as those used in Generator GN–39–F. They are located in the brackets at each end of the motor. If it becomes necessary to replace the commutator end bearing or coupler end bearing of the motor, follow the procedure as outlined in paragraphs 103 and 104.

101. Generator Service

a. The rotating armature (figs. 90 and 91(802)) of the generator is mounted on grease-sealed ball bearings at each end. (See figs. 90 and 91(828).) If unusual wear or damage occurs, replace the bearings. (See pars. 103 and 104.)

b. To inspect the high-voltage generator brushes, remove the high-voltage end cover. (See figs. 90 and 91(825).) Unscrew the two insulated brush caps and remove the brush and spring assemblies. (See figs. 90 and 91(820).) Check to see that the brushes move freely in their holders and that they are not excessively worn. Check the brush contact surface and if the contact surface is badly worn or

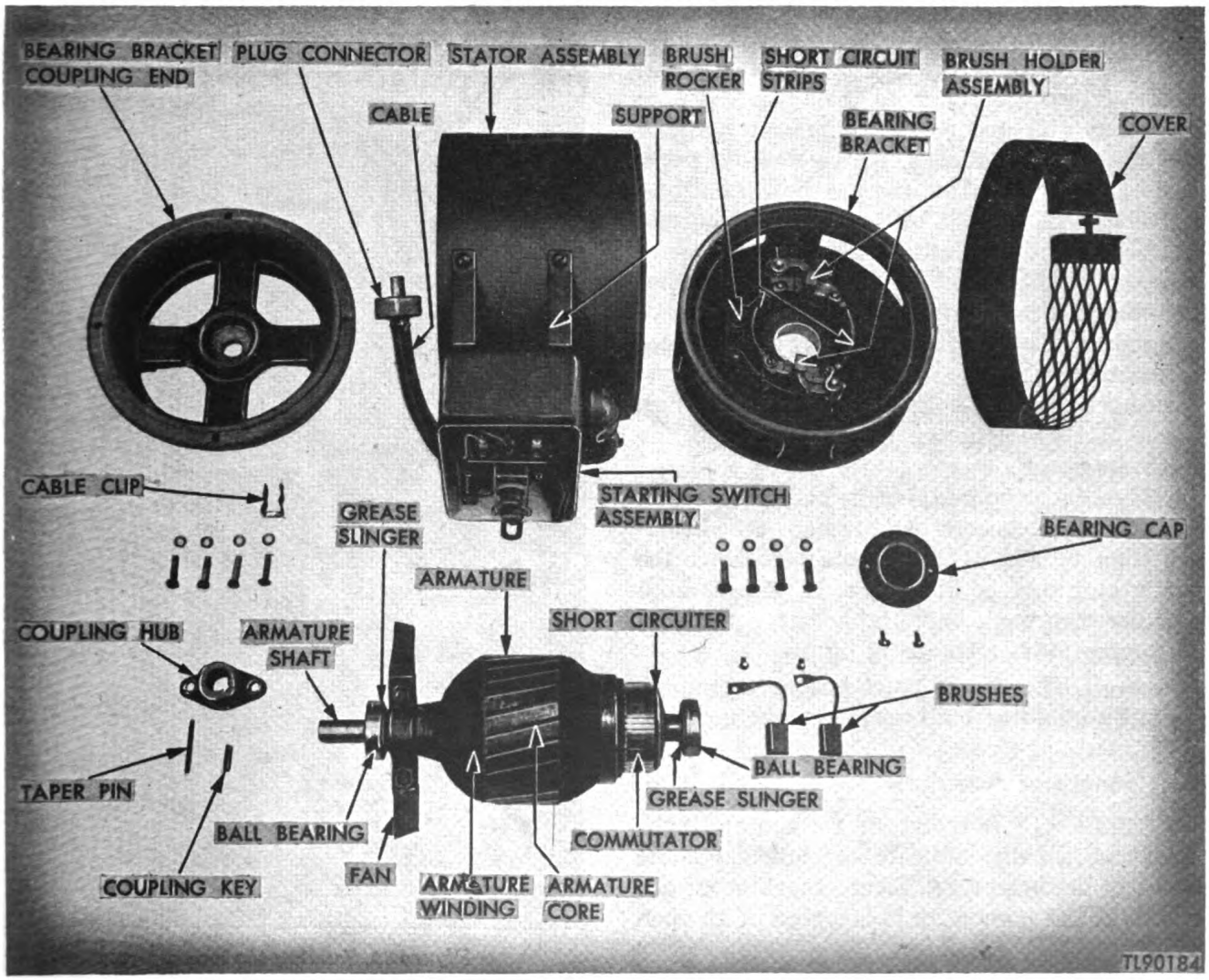


Figure 88. Motor MO–37–A—disassembled.

pitted, replace the brush. Run in new brushes by operating the unit under full load for 6 to 8 hours.

c. Check the high-voltage commutator (figs. 90 and 91(85)) and see that it is clean and free from pits. If the commutator is slightly dirty, clean it with dry-cleaning solvent (SD). If it is slightly pitted, clean the surface of the commutator with #00 sandpaper. (See fig. 89.)

Caution: Do not attempt any work on the generator while it is in operation.

d. Remove the ventilating band (figs. 90 and 91(826)) at the engine end of the generator and inspect the low-voltage brushes (figs. 90 and 91(824)). These brushes are held in box-type brush holders and the brushes may be easily removed. Check the brushes in the same manner as in checking the high-voltage brushes and replace any that are not in serviceable condition. If the brushes must be replaced, disconnect the pigtail connector before removing the brush.

e. Sand in the contact surfaces of the new brushes for proper seating. Wrap a strip of sandpaper, #00 or finer, of the same width as the commutator around the commutator, rough side toward the brushes, before inserting the brushes. After inserting the brushes, the armature should be turned by hand in the normal direction of rotation, allowing the sandpaper to wear away the contact surfaces of the brushes until the desired radius is obtained. Remove the sandpaper and blow or wipe away all traces of carbon dust.

f. Check the low-voltage commutator (figs. 90 and 91(886)) in the same manner as the high-voltage commutator.

g. If either commutator is badly pitted or burned, it will be necessary to remove the armature (figs. 90 and 91(802)) and turn down the commutator surface in a lathe. If there is high mica between the commutator bars, undercut the commutator as shown in figure 70.

Caution: This work must not be attempted except by qualified maintenance personnel.

102. Generator Armature

a. TESTS. (1) Low output voltage and poor regulation usually indicate an internal short circuit in the armature. Severe sparking at one or both of the commutators is a sign of an open circuit.

(2) If sparking occurs, examine the brushes to make sure they are properly fitted and are making good contact with the commutators.

(3) If no fault can be found with the brushes, measure the resistance of the armature between the high-voltage brushes or the low-voltage brushes, and also from bar to bar. In checking this resistance value, see paragraph 115.

b. REPLACEMENT OF ARMATURE. (1) If it is necessary to replace the armature, remove the back-end (coupling or low-voltage end) bearing. (See par. 104.)

(2) Remove the strap cover and the brush-holder caps. (See fig. 90.)

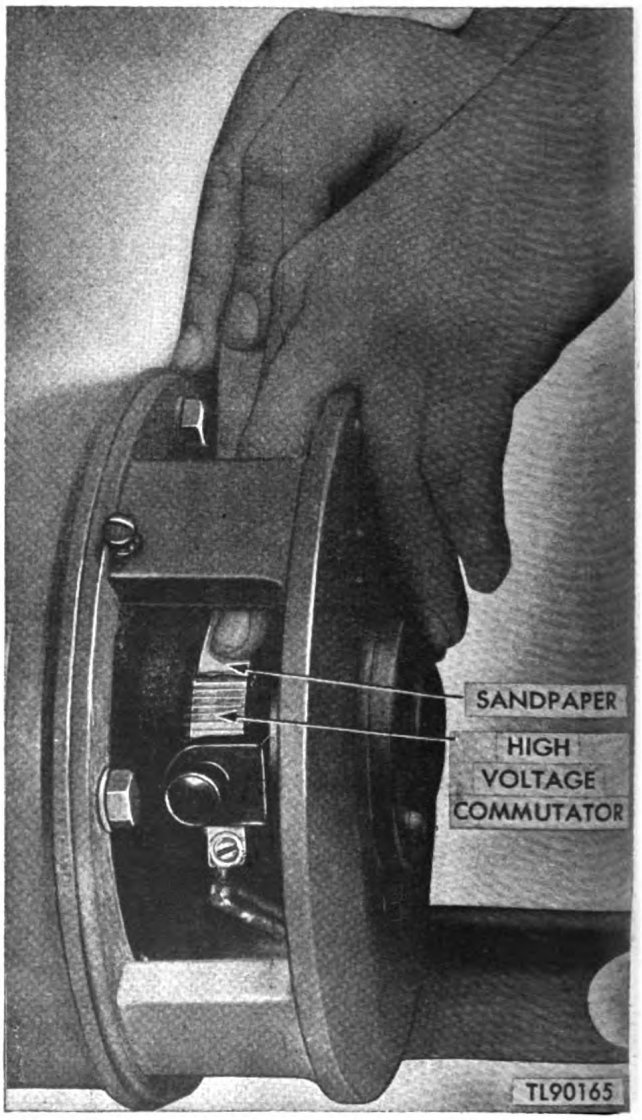


Figure 89. Sanding the commutator.

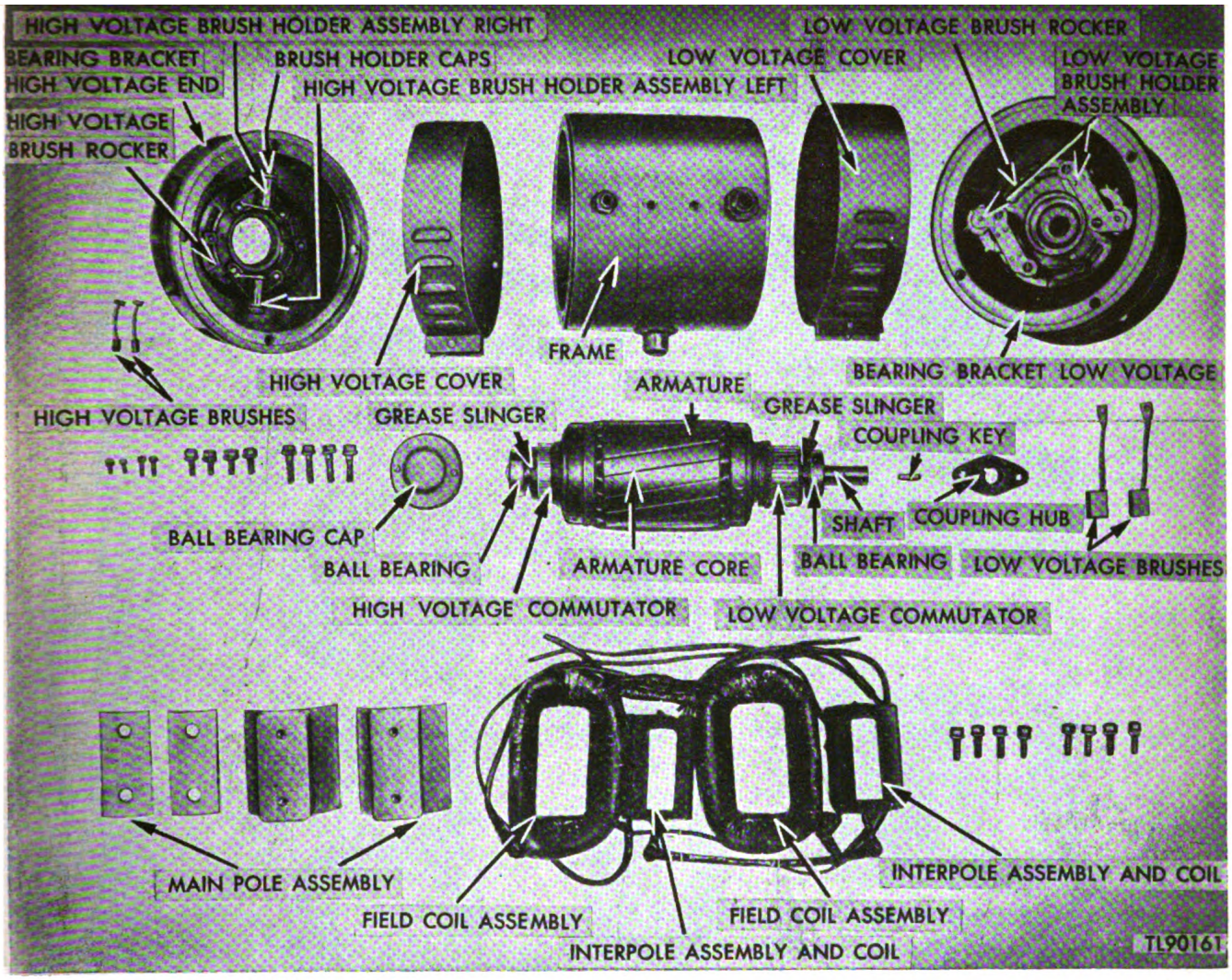


Figure 90. Generator GN–39–D or GN–39–F—disassembled.

(3) Before removing a high-voltage brush, mark one side of the brush, or note which side is up, so it can be replaced in the same way in the same holder. Remove the high-voltage brushes and lay them carefully away so that the brush faces will not be damaged or scratched.

(4) Remove the armature by pulling it out through the low-voltage bracket end. (See fig. 90.)

(5) Remove the ball bearing. (See par. 103.)

(6) Obtain a new armature and replace the bearing on the high-voltage end. Check the original bearing before using it again. If the outer race can be turned smoothly while the inner race is held stationary, and no unusual play or looseness between the inner and outer races can be noticed, the original bearing may be used again on the new armature. If a new bearing is available, and there is any doubt about the original bearing, always use a new bearing.

(7) Replace the new armature in the frame. Locate the bearing on the high-voltage end with the bearing housing and push the low-voltage end of the armature until the bearing enters the housing.

(8) Replace the bearing on the low-voltage end. (See par. 103*b*.)

(9) Reassemble the generator and connect it to the engine. (See par. 104*b*.)

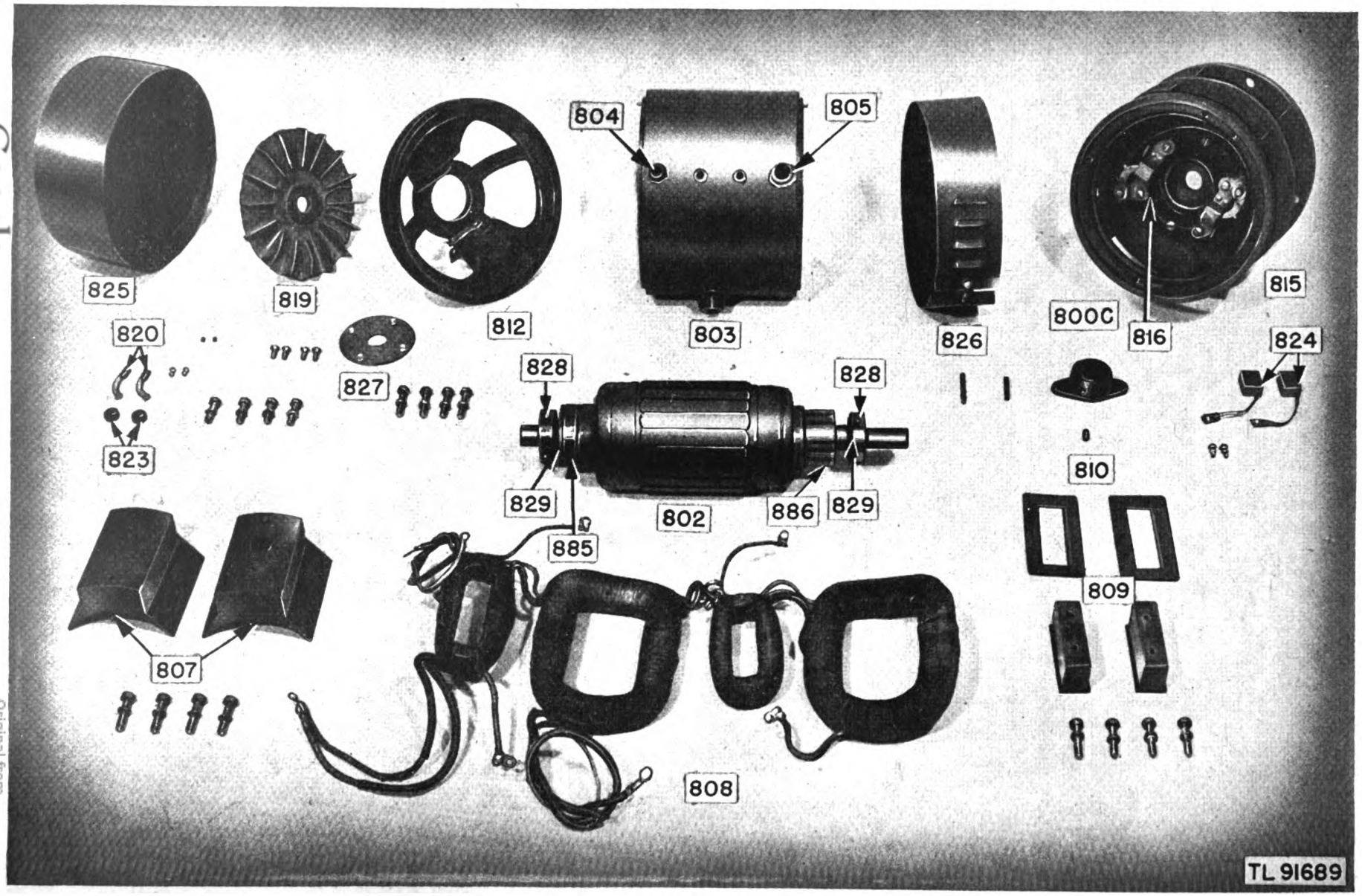


Figure 91. Generator GN–39–G—disassembled.

103. Front-End Bearing

a. REMOVAL. If it becomes necessary to replace the front-end (high-voltage end bearing opposite the coupling end), proceed as follows:

(1) Leave the generator coupled to the engine in its regular operating position.

(2) Remove the fan and plate assembly (fig. 52(819)), by taking out the fan pin and the eight screws that hold the fan to the plate (figs. 90 and 91(827)).

(3) Remove the brush-holder caps. (See fig. 52(823).)

(4) Before removing the high-voltage brushes either mark one side of the brush or note which side is up so they can be replaced in the same way in the same holder.

(5) Remove the high-voltage brushes (figs. 90 and 91(820)) and lay them carefully away so the brush faces will not be damaged or scratched.

(6) Remove the four cap screws that hold the bracket (fig. 52(812)) to the frame (fig. 52(803)).

(7) Tap the outside rim of the bracket casting with a hammer in such a way that the bracket will come away from the frame.

(8) Insert a large screw driver between the frame and the bracket and by prying evenly from side to side, pull the bracket clear of the ball bearing. (See figs. 90 and 91(828).) Be careful not to drop the bracket on the commutator (fig. 52(885)) or armature winding (fig. 52(802)).

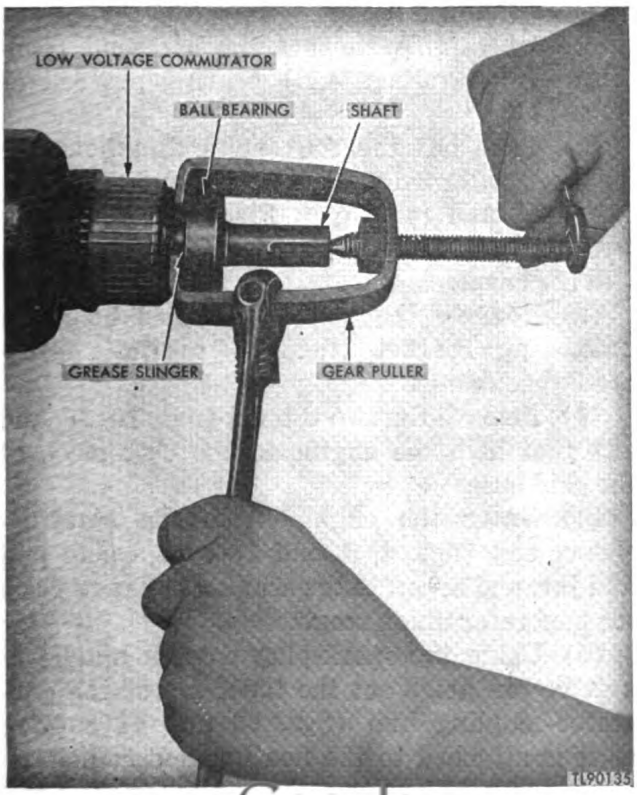


Figure 92. Removing the generator bearing.

(9) Insert the gear puller behind the bearing. (See fig. 92.) Be careful not to damage the commutator mica insulation. Note that one side of the gear-puller clamp has been made thinner than the other in order to easily insert the clamps behind the bearing. The bearing has a grease slinger (figs. 90 and 91(829)) between the inside inner race and the shoulder on the shaft. Do not damage the slinger by carelessly inserting the gear puller behind the bearing. Turn the setscrew by hand until the point is in the center hole of the armature shaft. Use an open-end wrench on the head of the setscrew and while holding the gear puller from turning, screw in the setscrew until the bearing is removed. Do not lose the grease slinger. Wipe it clean before proceeding with the replacement of the bearing.

b. REPLACEMENT. To install a new front-end bearing proceed as follows:

(1) Carefully clean the shaft and inspect all bearing surfaces for burs or raised surfaces. If any burs or raised surfaces are noted, remove them with a file.

(2) Carefully clean the bearing housing and cap. (See figs. 90 and 91(812).) If any burs are found remove them with a file or the edge of a screw driver.

(3) Clean the rabbet fits of the frame and the bracket by running the edge of a screw driver around the machined surfaces. The projecting part of the armature and shaft should be covered with a clean rag during this operation as considerable grit usually accumulates around the rabbet joint between the frame and bracket.

(4) Check all the parts that were removed during the process of removing the bearing and see that they are in good condition and ready to be put back.

(5) Remove the cardboard box that incloses the new bearing, but do not unwrap the greased paper surrounding the ball bearing.

(6) Be sure hands, the hammer, and the large screw driver are wiped clean.

(7) Partially open the paper wrapping of the new ball bearing and pick up a little grease with the end of one finger. Spread this grease very thinly over the bearing surface of the shaft and on both sides of the grease slinger.

(8) Replace the grease slinger (figs. 90 and 91(829)) on the shaft and push it firmly against the shoulder of the shaft that locates the ball bearing.

(9) Unwrap the ball bearing and push it on the shaft as far as it will go by hand. The inner race should just start on the ball-bearing surface of the shaft.

(10) Place a piece of pipe or bushing against the inner race only of the ball bearing and lightly tap the end of the pipe or bushing with the hammer so that the bearing begins to move on the shaft. Repeat this on the opposite (180° apart) side of the inner race until the bearing moves farther onto the shaft. Always keep as much of the end of pipe or bushing on the inner race as possible and hold the pipe parallel with the shaft. By hitting the inner race from side to side and increasing the power of the hammer blows on the pipe, the bearing will finally be seated against the shoulder of the shaft. Spin the outer race of the ball bearing to see that everything is free.

Caution: Never strike the outer race or shield of the ball bearing as this will cause damage beyond repair.

When driving on a bearing always keep it square with the shaft. Do not be afraid of damaging the inner race of the bearing by hitting it with the end of pipe or bushing, as the inner race is much harder than the pipe.

(11) The double-seal bearing is packed with sufficient grease for several years of operation.

Caution: Never oil the bearing or try to clean it with solvents of any kind. If necessary, wipe off the outside surfaces with a clean lintless cloth.

(12) Before replacing the bracket (figs. 90 and 91(812)), take a last look at the bearing housing to make sure it is clean and the edges free from burs. Push the bearing-housing bore over the ball bearing. Keep the bracket square with the shaft but wiggle the bracket slightly from side to side until the bearing has entered into the housing. Sometimes it helps to strike the bracket evenly on opposite sides of the back, with the heels of the hands until the bracket strikes the frame. Line up the holes of the bracket with the holes in the frame, check to see that the strap-cover ground hole is in the right quadrant, and insert the four cap screws by hand until all are thumbtight. With a wrench, tighten one screw one-half turn and then the opposite screw. Repeat until the bracket is home against the frame and finally tighten all four screws evenly.

(13) Rotate the armature (fig. 52(802)) by twisting the rope-starter sheave (figs. 4, 5, and 6) back and forth to see that everything is free. Replace the bearing cap.

(14) Replace the brushes (figs. 90 and 91 (820)) very carefully in the brush holders (fig. 52(823)). The same brush must go back in the same brush holder with the same side up as before. If there is any doubt that the brushes have not been replaced as before, start the engine and connect the generator to the transmitter. After the transmitter tubes have had a chance to warm up, note the ammeter. (See figs. 10, 11, and 12.) If it reads steady, the brushes are all right. If it fluctuates, the brushes are not properly seated against the commutator.

(15) Open the field switch. (See fig. 28.) Use a small piece of #00 sandpaper and hold it against the high-voltage commutator (fig. 52 (885)) while the armature is rotating. After sanding the brushes (fig. 89) in this manner, blow away the dust. Close the field switch and check the ammeter again. If the trouble was caused only by poor brush contact, the meter indicator should remain steady provided the tubes of the transmitter have been allowed to heat up.

104. Back-End Bearing

a. REMOVAL. To replace the back-end (coupling or low-voltage end) bearing proceed as follows:

(1) Take out the four bolts that hold the floating center (fig. 53) of the coupling to the two hubs and remove it. Place the four bolts with the nuts in the floating center, so that they will not be misplaced.

(2) Remove the four bolts that hold the union-ring bracket (fig. 53) to the engine-crankcase flange.

(3) Remove the two U-bolts (figs. 10, 11, and 12) that hold the engine to the crosspiece of the skid base.

(4) Grasp the engine from the starting-sheave end (figs. 4, 5, and 6) with a side pull and jar, and separate the crankcase flange from the generator union ring.

(5) Using the spark-plug wrench handle as a drive pin drive out the taper pin of the generator-coupling hub (figs. 90 and 91(800C)) as it is attached to the floating-center disk assembly (fig. 53), with a sharp blow of the ham-

mer. Be sure to strike the smaller end of the taper pin. The small end can be easily identified as the end that projects out of the hub farther than the larger end.

(6) Loosen the safety setscrew over the coupling-hub key with a special wrench in the tool bag.

(7) Remove the coupling hub with the gear puller.

(8) Remove the strap cover. (See fig. 53.)

(9) Before removing the low-voltage brushes, either mark one side of the brush or note which side is up so that they can be replaced in the same way.

(10) Remove the bearing in the same manner the front-end bearing is removed. (See par. 103*a*.)

b. REPLACEMENT. (1) Replace bearing as described in paragraph 103*b*.

(2) Rotate the armature to see that everything is free.

(3) Replace the coupling hub and spread a little crankcase oil on the shaft. Use a block of wood and the hammer to drive the hub on the shaft. Be careful to line up exactly the holes of the hub and shaft before replacing the taper pin. Tap the taper pin lightly with the spark-plug wrench handle and hammer to properly seat it. Tighten the setscrew over the key, and make sure the key does not stick out beyond the end of the shaft.

(4) Clean the rabbet fits of the union ring and crankcase flange.

(5) Rest the engine on the crosspiece of the skid base and replace the four bolts and nuts in the flange holes. Loosen the bolt of the generator stud support several turns to permit realignment without strain on any part and tighten evenly on opposite bolts until the union-ring bracket (fig. 53) is home against the crankcase flange.

(6) Replace the two U-bolts. (See figs. 10, 11, and 12.)

(7) Replace the floating center of the coupling. (See fig. 53.)

(8) Turn the engine over by hand to be sure that everything is free.

(9) Check all nuts and bolts to see that they are firm and tight.

105. Field Windings (figs. 90 and 91(808))

Low output, poor regulation, or sparking at the commutator may be caused by defective field coils. When such conditions arise, first investigate the armature (figs. 90 and 91(802)) and related parts to see if they are in good condition. If trouble in the field windings is indicated, they must be checked in accordance with information given under Service Data (par. 115) to determine if they are open, short-circuited, or grounded. When the defect is found, repair or replace, depending on the nature of the fault.

106. Battery Cut-Out (fig. 66)

Flow of reverse current from the battery to the generator is prevented by the battery cut-out installed in the lower right-hand corner of the control box. Primarily, its action is to close the circuit to the battery and permit charging when the low-voltage output has reached the required potential of 13.5 volts. If, for any reason, this voltage falls below the required minimum, or the units stop, the battery cut-out acts to open the circuit and protect the generator windings. Two contact points are used, one on a movable arm. These are closed or opened to make or break the circuit to the battery. After considerable use, these points may become burned or pitted and will then require attention. To correct this condition proceed as follows:

a. Smooth the contact surfaces where necessary with #000 sandpaper, finishing by drawing clean glossy paper between them.

b. See that the contact surfaces are reasonably flat, close, parallel, and in line with each other.

c. If the action of the battery cut-out (fig. 66) is impaired for any reason, adjustment may be needed; before adjusting, obtain a meter reading of the low voltage. This potential must be 13.5 volts for battery charging, the cut-out being wound accordingly.

d. If the voltage is too high or too low, change the setting of the field rheostat (figs. 11 and 12) for Power Units PE–49–F and PE–49–G, or the voltage regulator (fig. 65) for Power Unit PE–49–D, to correct it. Adjust the setting to 13.5 volts.

e. Increase or reduce the spring tension to bring about good closing action to coincide with the closing of the field switch (figs. 10, 11, and 12) while the unit is in operation.

f. When the field switch (figs. 28 and 46) is opened, the battery cut-out (fig. 46) must open, too. Test this action repeatedly to make sure the adjustments are satisfactory.

107. Starting Relay

The starting relay (fig. 46) generally does not require any close adjustments. The contact arms should move freely to make or break the circuits with speed. No precision setting is necessary for this opening or closing action, nor should unnecessary adjustments be attempted. If the contact-point surfaces become roughened or pitted, they should be smoothed with a fine abrasive paper until the surfaces are clean and even. The contact points should be in line, and the surfaces parallel to each other. These conditions also apply to the auxiliary-contact points located just below the main contacts. If the action of the starting relay is impeded or unsatisfactory, it must be examined for mechanical or electrical faults. The spring tension of the movable arm may be increased or reduced if necessary, by adjusting the position of the spring-tension nut. When electrical trouble is indicated, make tests of the magnetic coil and the relay resistor, which, if unserviceable, must be replaced.

108. Filter System

Choke coils and capacitors installed in the center of the control box are used to eliminate any objectionable ripple and radio-frequency voltage from the generator output. If such disturbances appear in the signals of the transmitter, first make a check of the wiring connections to these filter parts, and then investigate their condition. The capacitors are inclosed and oil-filled; if leakage of oil occurs, replacement must be made.

Caution: Any electrical trouble in this filter system must be handled by personnel experienced in radio maintenance.

109. Voltage Regulator for Power Unit PE–49–D

If it is necessary to readjust the voltage regulator on Power Unit PE–49–D (fig. 65), proceed as follows:

a. Disconnect all loads from Power Unit PE–49–D.

b. Connect a voltmeter, with a range of 0 to 15 volts, between the generator terminal on the control panel and the negative (—) battery-charging terminal. (See fig. 44.)

c. Check the setting of the lower (adjustable) regulator contact screw. When the regulator armature is pressed up against the magnet core, the contact opening should be approximately 0.010 inch. Use the feeler gauge to check this setting. If it is necessary to adjust the contact screw, use the wrenches which are included in the tool bag. Lock the adjustment. (See fig. 65.)

d. Connect a load of 15 amperes to the low-voltage contacts in the low-voltage socket. (See fig. 48.)

e. Start the unit with the field switch in the open position. Close the field switch after the unit has reached normal speed.

f. Adjust the tension of the regulator spring by turning the adjustment screw (see fig. 65) in either direction until the voltmeter indicates 14.6 volts. If a load of 15 amperes cannot be obtained, adjust the regulator for 14.9 volts with no load. If the output voltages become erratic, the regulator contacts may be dirty or pitted and need cleaning.

g. Clean the regulator contacts by drawing a piece of crocus cloth between them while pressing the contacts together slightly. Blow out all cleaning dust, then draw a strip of clean bond paper between the contact points to remove any remaining loose particles.

h. If the contacts are only slightly dirty, clean them by drawing one of the feeler gauges, which are packed in the tool bag, between the contacts. Make sure that the feeler gauge is clean and free from oil and grease.

i. The original crowned surface of the stationary contact (fig. 65) should be maintained as long as possible.

j. If both the low- and high-voltage generator outputs are steady but too high, and if at the same time the voltage regulation is excessive, the regulator contacts may be frozen in the closed position, thus allowing the generator to build up to full strength regardless of load. The freezing may be due to a bent hinge pin (fig. 65), or to dirt or excessive friction in the hinge pin bearings. Remove and examine the pin and its bearings for binding. To do this, loosen the small screw which holds the hinge pin retainer clamp, and swing the retainer clamp far enough to remove the hinge pin. Straighten the pin or replace it if necessary. A drop of oil on the pin when replacing it will reduce bearing friction. The regulator armature should move smoothly, without friction or binding, when moved by hand.

k. Another cause of frozen contacts is sparking or arcing, which may weld the regulator contacts together. This condition results from

an open circuit in the regulator resistor. To correct this condition, it is first necessary to replace the resistor. (See fig. 65.) The contacts can be pried apart and refaced by filing with the magneto file packed in the tool bag. After careful filing, finish the contacts with sandpaper and then with crocus cloth.

Section XVII. OTHER REPAIR PROCEDURES

110. Painting and Refinishing

a. When the painted surfaces of the power unit or motor generator are scratched or the finish has been damaged, rust and corrosion may be prevented by thoroughly cleaning and then touching up the damaged surface. The extent of the treatment will depend upon time available and the amount of damage.

b. If only small portions have been scratched, prepare the surface of the spots by removing all traces of oil or grease with dry-cleaning solvent (SD) and thoroughly sandpaper the spots to be painted. Apply the paint in light, even coats with a small paint brush. Two light coats of paint are better than one heavy coat.

c. If the painted surfaces are blistered from overheating, remove all of the old paint and thoroughly clean all surfaces to be repainted. Apply a smooth, even priming coat; sand the priming coat lightly with fine sandpaper; and complete the job with two light, even coats of paint.

d. Refinish the entire unit, whenever it is completely overhauled.

e. If all the painted surfaces are in bad condition, remove what paint remains, thoroughly clean, and repaint the entire unit.

Caution: Avoid getting paint on moving parts so that their movement will be hindered. Do not paint electrical contacts.

111. Rustproofing

a. GENERAL. When Engine GE–9–D or GE–9–F of Power Unit PE–49–(*) is to be in storage for 30 days or longer, or is to be transported to a remote point, it must be rustproofed. This treatment provides maximum protection from rust and corrosion during periods of idleness.

b. MATERIALS REQUIRED.

Solvent, Dry Cleaning (SD), Federal spec No. P–S–661a.
Oil, Engine, Preservative, Ordnance spec No. AXS–934 grade 1.
Compound, Insulation, Ignition, Ordnance spec No. AXS–858.
Tape, Nonhygroscopic, Adhesive, Ordnance spec No. AXS–871.
Compound, Gum Preventive, Federal stock No. 51–C–1587–225.

c. PROCEDURE. (1) Complete repairs and tests. Then rustproof the engine while it is still warm.

(2) Add 1 ounce of gum preventive compound to 1 gallon of clean, fresh gasoline. Put enough of the treated gasoline in fuel tank to operate the engine for at least 5 minutes. Run the engine for at least 5 minutes; then drain the fuel system, including carburetor, fuel strainer, and gasoline line.

(3) Drain the lubricating system and insert a full charge of preservative engine oil (AXS–934) grade 1.

(4) Remove the spark plug.

(5) Rotate the engine several times by means of the rope starter to insure complete distribution of the preservative oil.

(6) Remove the cylinder head (par. 95) and spray preservative engine oil (AXS–934) grade 1 into the cylinder while the engine is rotating. This will protect the cylinder wall, valve head and stem, and valve guide.

(7) Remove the valve cover (fig. 71(14)) and spray preservative engine oil over push rod, interior of valve cone, and the space between the cylinder block and side plate.

(8) Spray engine preservative oil into the oil filler opening and crankcase breather. (See fig. 26.)

(9) Spray the interior of the air cleaner with engine preservative oil.

Note. Do not allow any preservative oil to enter the carburetor.

(10) Reassemble all parts that have been removed and replace the spark plug.

Note. If the engine is to be moisture-vapor packed, including a dehydrating agent, replace the spark plug with a dehydrating plug.

(11) Drain the preservative oil from the crankcase.

(12) Attach a red tag to the oil filler cap reading:

Caution: This engine has been rustproofed. Date: ..... Use engine oil conforming to U. S. Army Specification 2–104, Seasonal Grade, when placing engine in service.

(13) After the engine has cooled, remove all grease and dirt from the engine exterior with dry-cleaning solvent (SD).

(14) Seal the crankcase breather, air intake, and exhaust openings with tape (AXS–981).

(15) Allow all surfaces to dry thoroughly, then spray all *exterior* surfaces of the engine and accessories, including wiring and electrical equipment with ignition insulation compound (AXS–858).

Section XVIII. REPAIR AND ANALYSIS DATA

112. Test Data

a. FOR POWER UNIT PE–49–D.

Low-voltage		output (rms ripple)	High-voltage		output (rms ripple)	(rpm)
(volts)	(amps)		(volts)	(amps)		
14.75	0	0.15	990	0.0	12	2,700
14.7	0	0.15	930	0.350	9	2,680
14.7	5	0.15	1,010	0.0	11	2,700
14.6	5	0.15	950	0.350	10	2,680
14.6	10	0.15	1,030	0.0	12	2,700
14.6	10	0.15	960	0.350	10	2,690
14.6	15	0.15	1,040	0.0	12	2,690
14.5	15	0.15	975	0.350	12	2,690
14.6	20	0.15	1,050	0.0	12	2,680
14.4	20	0.15	985	0.350	12	2,680
14.5	25	0.15	1,060	0.0	14	2,680
14.4	25	0.15	1,000	0.350	12	2,670
14.7	0		970	0.350		2,700
14.7	5		990	0.350		2,700
14.65	10		1,010	0.350		2,700
14.6	15		1,020	0.350		2,700
14.5	20		1,030	0.350		2,680
14.5	25		1,040	0.350		2,680

b. FOR POWER UNIT PE–49–F.

Low-voltage		output (rms ripple)	High-voltage		output (rms ripple)	(rpm)
(volts)	(amps)		(volts)	(amps)		
15.10	0	0.10	1,000	0.0	6.0	2,850
14.90	0	0.10	940	0.350	6.0	2,830
14.90	5	0.10	1,000	0.0	6.0	2,840
14.60	5	0.10	950	0.350	6.0	2,820
14.75	10	0.10	1,030	0.0	6.0	2,840
14.50	10	0.10	960	0.350	6.0	2,820
14.60	15	0.10	1,030	0.0	6.0	2,830
14.30	15	0.10	960	0.350	6.0	2,810
14.45	20	0.10	1,040	0.0	6.0	2,830
14.10	20	0.10	960	0.350	8.0	2,800
14.50	25	0.10	1,060	0.0	8.0	2,820
14.00	25	0.10	960	0.350	9.0	2,800
14.90	0		975	0.350		2,825
14.80	5		985	0.350		2,815
14.70	10		1,000	0.350		2,810
14.60	15		1,010	0.350		2,800
14.50	20		1,020	0.350		2,800
14.40	25		1,030	0.350		2,800

c. FOR POWER UNIT PE-49-G.

Low-voltage		output (rms ripple)	High-voltage		output (rms ripple)	(rpm)
(volts)	(amps)		(volts)	(amps)		
15.5	0	0.5	1,010	0.	10	2,770
16.2	0	0.5	990	0.350	9	2,760
14.6	5	0.3	1,000	0.	9	2,750
15.6	5	0.25	990	0.350	8	2,750
14.2	10	0.25	1,010	0.	9	2,755
15.2	10	0.2	1,005	0.350	5.5	2,755
14.2	15	0.25	1,025	0.	9	2,778
15.0	15	0.2	1,005	0.350	6.5	2,745
13.6	20	0.25	1,020	0.	9.5	2,755
14.3	20	0.2	1,000	0.350	6.5	2,740
13.3	25	0.2	1,020	0.	9.5	2,730
13.6	25	0.2	985	0.350	7	2,720

d. FOR MOTOR GENERATOR MG-37-A.

Low-voltage output			High-voltage output			(rpm)	Remarks
(volts)	(amp)	(ripple v rms)	(volts)	(amp)	(ripple v rms)		
15.00	0	0.10	1,000	0.0	7.0	2,990	Steady load on high-voltage
15.00	0	0.10	960	0.350	7.0	2,980	Do.
14.90	5	0.10	1,020	0.0	7.0	2,990	Do.
14.90	5	0.10	970	0.350	7.0	2,970	Do.
14.90	10	0.10	1,050	0.0	7.0	2,980	Do.
14.80	10	0.10	980	0.350	7.0	2,960	Do.
14.90	15	0.10	1,070	0.0	7.0	2,970	Do.
14.70	15	0.10	990	0.350	7.0	2,950	Do.
14.70	20	0.10	1,080	0.0	7.0	2,960	Do.
14.50	20	0.10	1,000	0.350	8.0	2,950	Do.
14.60	25	0.10	1,080	0.0	8.0	2,960	Do.
14.20	25	0.10	1,000	0.350	9.0	2,945	Do.
15.00	0		980	0.350		2,980	Keyed load on high-voltage
14.80	5		990	0.350		2,980	Do.
14.70	10		1,010	0.350		2,970	Do.
14.60	15		1,020	0.350		2,960	Do.
14.50	20		1,030	0.350		2,970	Do.
14.40	25		1,040	0.350		2,960	Do.

113. Table of Engine Specifications, Tolerances, and Clearances

Valve stem diameter (diam) ..... 0.308″ to 0.309″
Valve stem guide diam ..... 0.312″ to 0.313″
Valve tappet stem diam ..... 0.309″ to 0.310″
Valve tappet guide diam ..... 0.312″ to 0. 313″
Valve guide side clearance ..... 0.002″
Valve tappet clearance (cold) ..... 0.010″ to 0. 016″
Valve timing:
- Inlet opens ..... 5° after top center (TC)
- Inlet closes ..... 45° after bottom center (BC)
- Total inlet period ..... 220°
- Exhaust opens ..... 35° before BC
- Exhaust closes ..... 5° after TC
- Total exhaust period ..... 220°

Valve lift ..... 0.1875″
Connecting rod bearing for piston pin diam ..... 0.6252″ to 0.6255″
Connecting rod bearing for crankshaft pin diam ..... 1.0025″ to 1.0028″
Connecting rod bearing for crankshaft pin width ..... 0.992″ to 0.994″
Piston pin diam ..... 0.6245″ to 0.6250″
Bore in piston for pin ..... 0.6247″ to 0.6250″
Crankshaft pin diam ..... 1.000″ to 1.001″
Crankshaft pin width ..... 1.000″ to 1.005″

Camshaft pin diam	0.4375″
Bore in camshaft for pin	0.4395″ to 0.4405″
Oil pump plunger diam	0.6245″ to 0.6255″
Bore in oil trough for plunger	0.6290″ to 0.6305″
Plunger rod diam	0.250″
Plunger rod guide	0.252″ to 0.254″
Governor shaft diam	0.248″ to 0.249″
Governor shaft guide diam	0.250″ to 0.251″
Cylinder bore	2.499″ to 2.500″
Piston diam	2.4940″ to 2.4945″
Piston clearance	0.0045″ to 0.005″
Number and type of piston rings per piston	3 rings, 2 compression, 1 oil
Compression ring grooves diam	2.230″ to 2.235″
Compression ring grooves width	0.095″ to 0.096″
Compression ring outside diam	2.500″
Compression ring width	0.0930″ to 0.0935″
Oil ring groove diam	2.190″ to 2.195″
Oil ring groove width	0.188″ to 0.189″
Oil ring outside diam	2.500″
Oil ring width	0.1855″ to 0.1865″
Spark advance	28°

114. Motor Specifications

Size	$12\frac{15}{16}$″ long, $9\frac{7}{8}$″ high, $9\frac{3}{4}$″ wide.
Key seat	$\frac{3}{32}$″ deep, 1″ long.
Stator core	8.750″ OD.
ID	4.750″.
Length	2.250″.
Armature	4.700″ OD.
Shaft	$12\frac{5}{8}$″ long.
Slots	25.
Commutator	$2\frac{13}{16}$″ diam.
Segments	49.
Mica separation	0.030″.
Short circuiter	$2\frac{23}{32}$″ diam.
Bore	0.9375″.
Segments	49.
Brushes	$\frac{3}{8}$″ thick, $\frac{5}{8}$″ wide, $1\frac{1}{2}$″ long.
Bearings	1.8504″ OD, 0.7874″ ID, 0.5512″ wide.
Fan blades	$\frac{3}{32}$″ thick, $\frac{7}{8}$″ wide, 45° pitch.
Stator coils	No. 16 wire.
Armature winding	No. 14 insulated wire.
Motor leads	4, No. 14 wire.

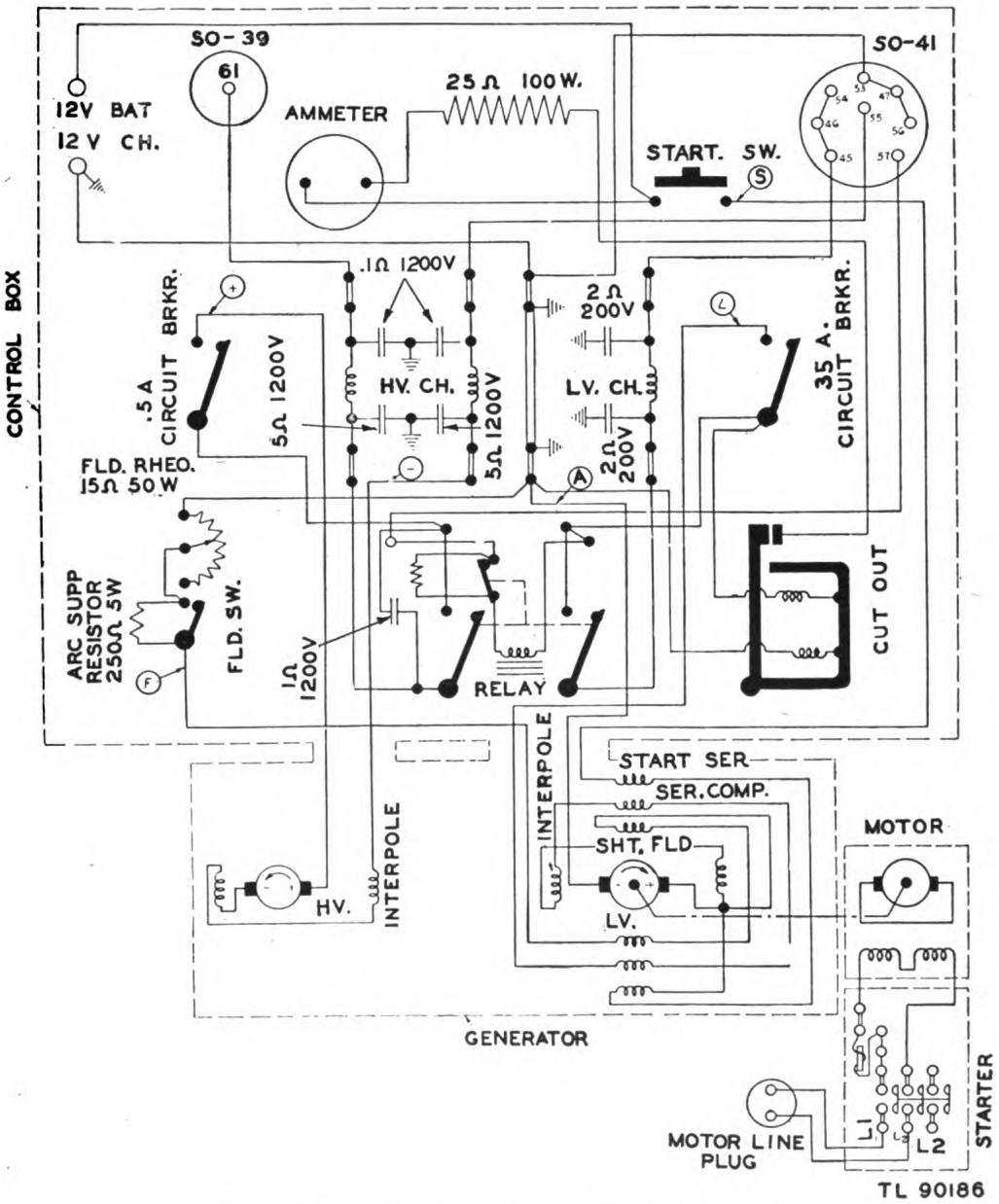
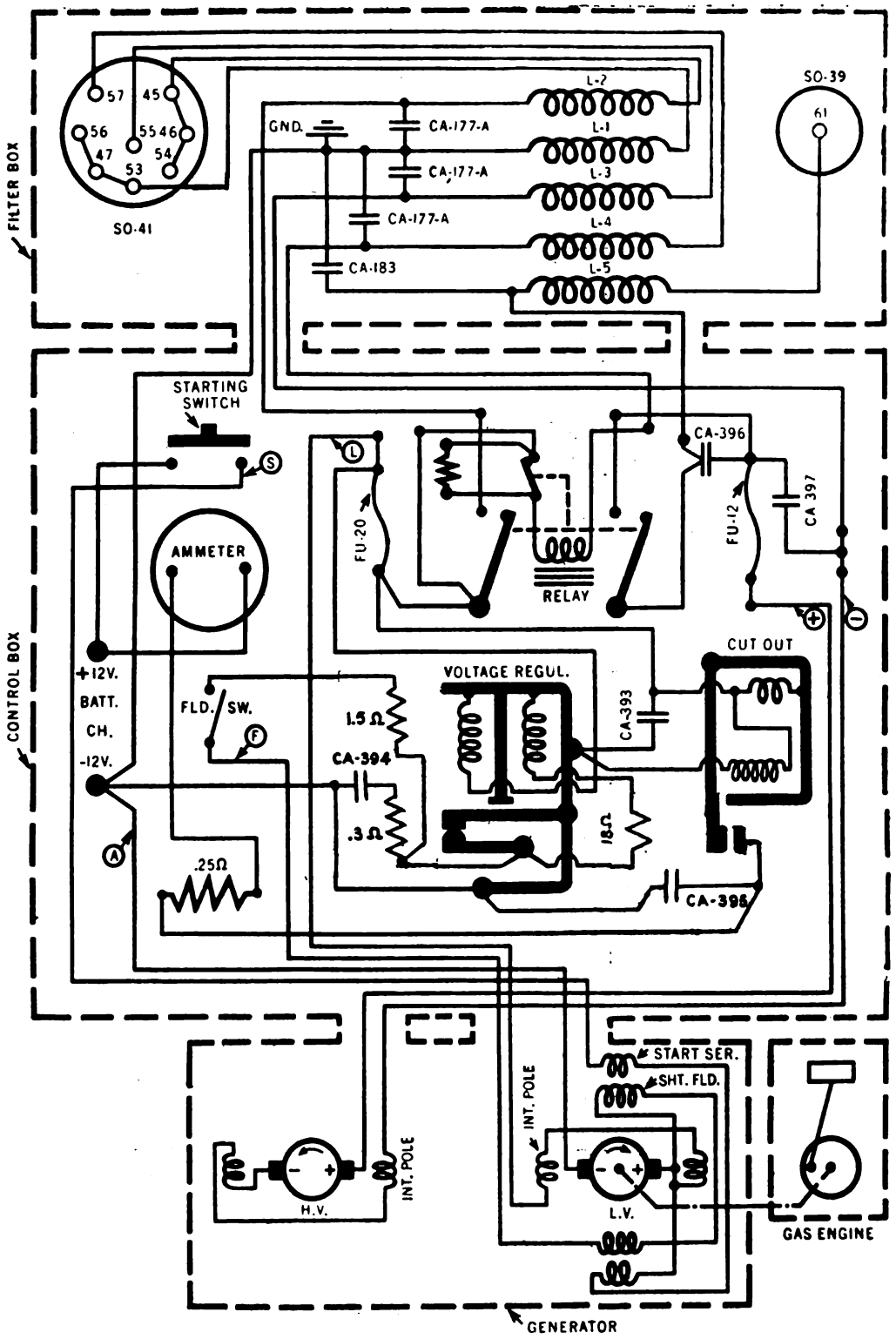


Figure 93. Circuit label for Motor Generator MG–37–A.



LEGEND

CA-177-A	CAPACITOR .5 MF.	400 V.	FU-20 FUSE .30 AMP. 250 V.	
CA-183	CAPACITOR .01 MF.	1250 V.	FU-12 FUSE .5 AMP. 1000 V.	
CA-393	CAPACITOR .01 MF.	600 V.	L-1, L-2	COILS PER SC-D-4164 GROUP 1
CA-394	CAPACITOR 1 MF.	200 V.		
CA-395	CAPACITOR .5 MF.	200 V.	L-3, L-4, L-5	COILS PER SC-D-4164 GROUP 2
CA-396	CAPACITOR .1 MF.	1200 V.		
CA-397	CAPACITOR .01 MF.	1200 V		

Ⓐ Ⓕ Ⓛ Ⓢ ⊕ ⊖ LEAD IDENTIFICATIONS

TL 90170

Figure 94. Circuit label for Power Unit PE-49-D.

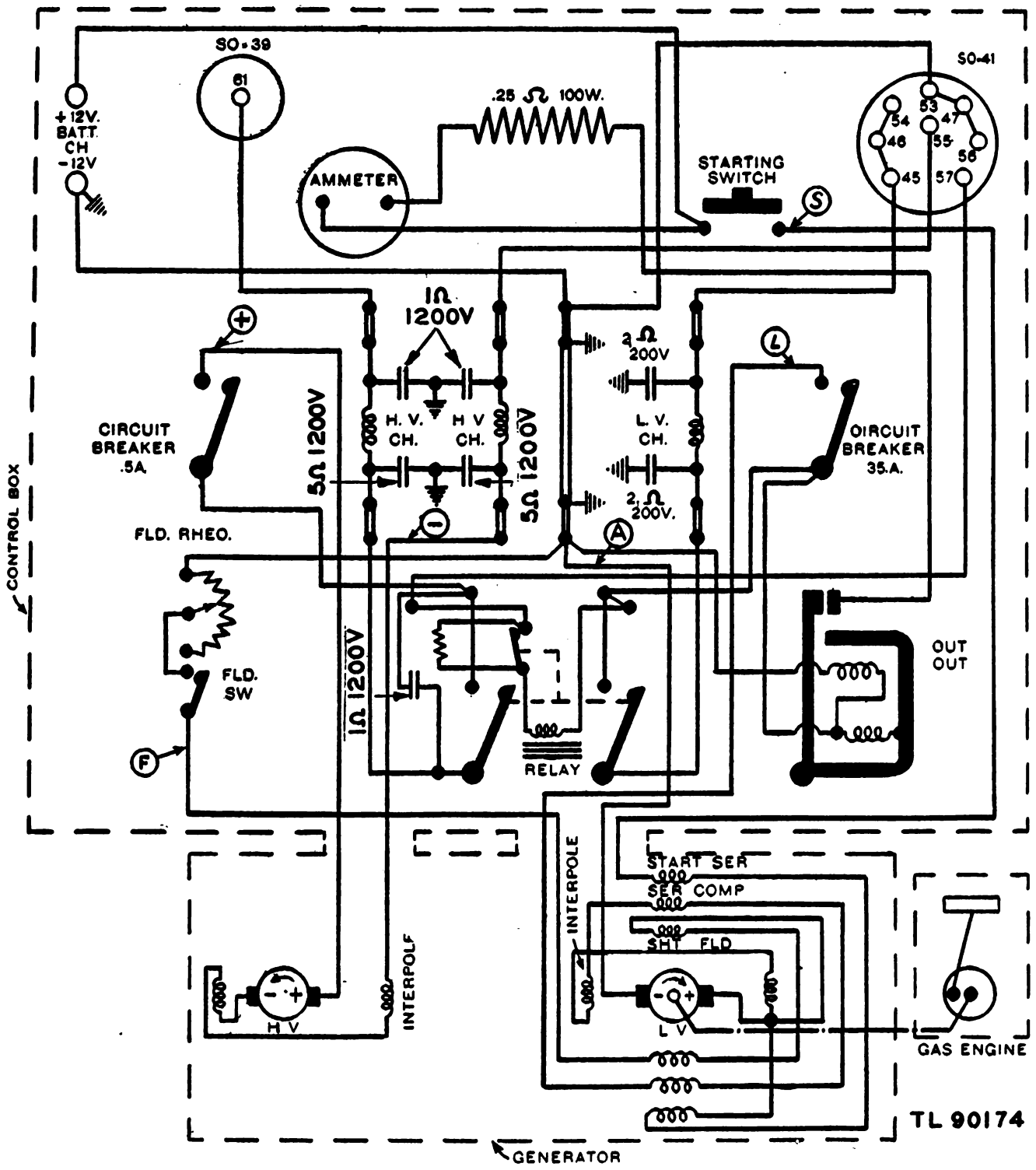


Figure 95. Circuit label for Power Unit PE-49-F.

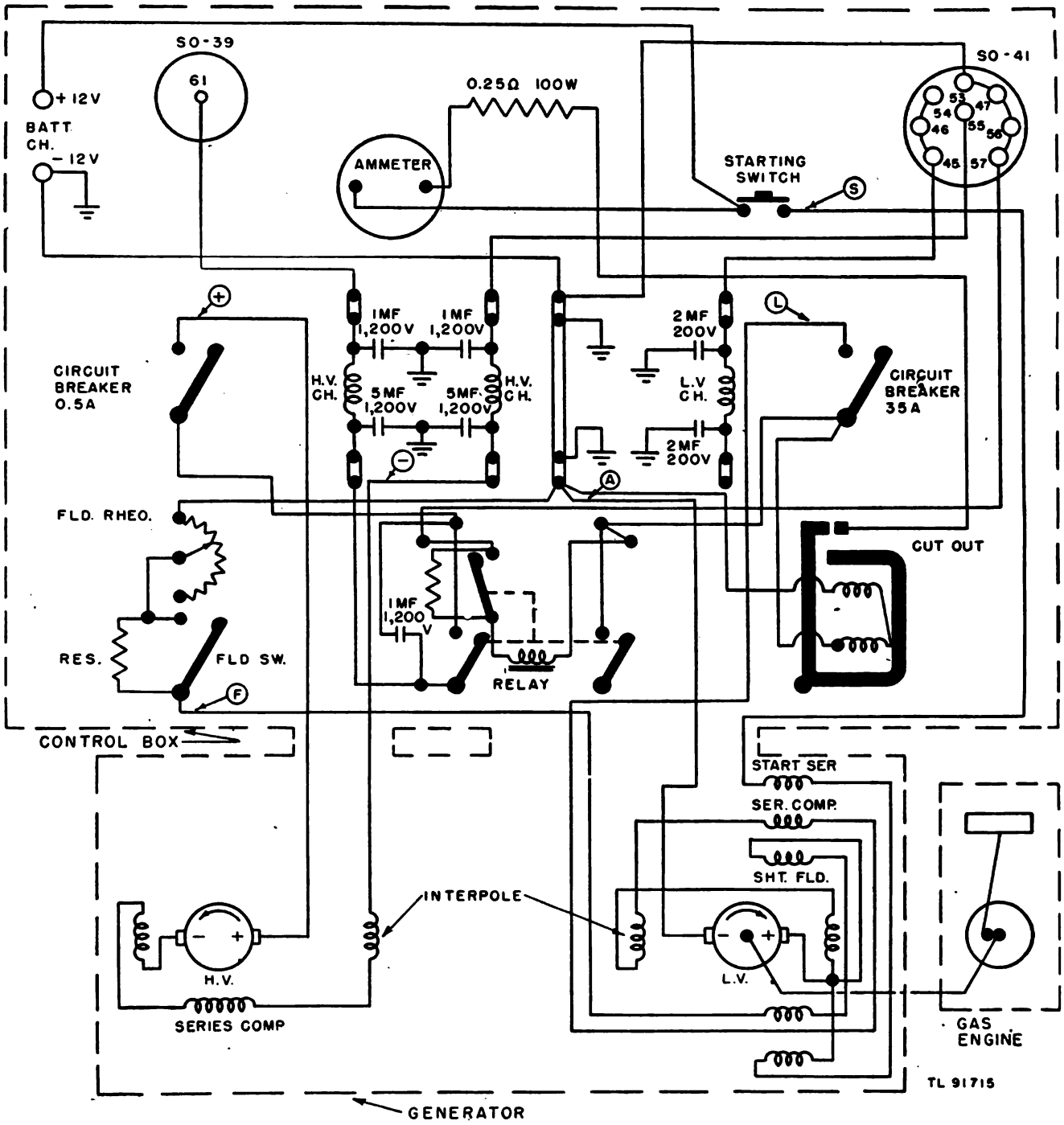


Figure 96. Circuit label for Power Unit PE–49–G.

115. Generator Service Data

The following resistance data may be of assistance in checking the generator windings in case of faulty performance. Values shown are subject to manufacturing tolerances of plus or minus 10 percent.

a. FOR POWER UNIT PE–49–D. (1) Armature resistance measured between brushes including brush drop at 25° C:

High voltage	87 ohms
Low voltage	0.028 ohm

(2) Resistances between adjacent commutator bars at 25° C:

High voltage	4.62 ohms
Low voltage	0.004 ohm (approx)

(3) Resistance of shunt-field coils, 6.5 ohms per pair.

(4) Interpole low voltage, 0.01 ohm per pair approx.

(5) Interpole high voltage, 54.3 ohms per pair.

(6) Starting winding, 0.016 ohm.

Note. All readings taken with a regulator setting giving a spacing between contacts of 0.01 inch with the armature up against the core.

b. FOR POWER UNIT PE–49–F. (1) Shunt field coils, 8.74 ohms per pair.

(2) Compounding series, 0.01 ohm per pair.

(3) All other readings are the same as for Power Unit PE–49–D.

c. FOR POWER UNIT PE–49–G. (1) Armature resistances measured between brushes at 25° C:

High voltage	74 ohms
Low voltage	0.053 ohm

(2) Resistances between bars of the commutators at 25° C:

High voltage	3.55 ohms
Low voltage	0.005 ohm

(3) Resistance of shunt-field coils, 7.1 ohms per pair.

(4) Resistance of low-voltage interpole and series winding, measured from positive brush holder to positive-low-voltage lead, 0.025 ohm.

(5) Resistance of high-voltage interpole and series winding, measured from negative brush holder to negative-high-voltage lead, 104 ohms.

(6) Resistance of starting-winding, from positive-low-voltage brush holder to positive-starting lead, 0.027 ohm.

d. FOR MOTOR GENERATOR MG–37–A. Generator GN–39–F, used as part of Motor Generator MG–37–A, is identical with the generator used on Power Unit PE–49–F. See resistance readings in *b* above.

116. Unsatisfactory Equipment Report

a. When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, WD AGO Form 468 should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form 54 should be filled out and forwarded through channels.

c. If either form is not available, form 468 (fig. 97) may be reproduced, filled out, and forwarded through channels. When Army Air Forces Form 54 is required, but unavailable, reproduce Form 468 and forward it through channels in accordance with directions on Form 468.

WAR DEPARTMENT
UNSATISFACTORY EQUIPMENT REPORT

FOR	TECHNICAL SERVICE: Signal Corps — MATERIEL		DATE: 21 April 1945
FROM	ORGANIZATION: 579 Signal Repair Co.		STATION: A.P.O. 95. N.Y. N.Y.
TO	NEXT SUPERIOR HEADQUARTERS: Sig O III Army	STATION	TECHNICAL SERVICE

COMPLETE MAJOR ITEM

NOMENCLATURE	TYPE	MODEL	
Power Unit PE-000	Diesel Engine driven	U.D.-9	
MANUFACTURER: V-G Mfg Co.	U. S. A. REG. No.: 000-P-44	SERIAL NO.: 21A531	DATE RECEIVED: 5 Jan 1945
EQUIPMENT WITH WHICH USED (*if applicable*): AN/FRC-1			

DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE

PART No.	TYPE	MANUFACTURER	DATE INSTALLED
R-000	Thrust bearing	E-Z Roll Bearing Co	Original

DESCRIPTION OF FAILURE AND PROBABLE CAUSE (*If additional space is required, use back of form*)
Bearing badly worn due to inadequate dust protection.

DATE OF INITIAL TROUBLE	TOTAL TIME INSTALLED			TOTAL PERIOD OF OPERATION BEFORE FAILURE					
	YEARS	MONTHS	DAYS	YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS
19 April 1945					3	4	5		

BRIEF DESCRIPTION OF UNUSUAL SERVICE CONDITIONS AND ANY REMEDIAL ACTION TAKEN
Desert operation. Extreme sand and dust. Improvised felt washer for added protection.

TRAINING OR SKILL OF USING PERSONNEL			RECOMMENDATIONS (*If additional space is required, use back of form*)
POOR	FAIR	GOOD	
	✓		Additional shields should be provided.

ORIGINATING OFFICER

TYPED NAME, GRADE, AND ORGANIZATION	SIGNATURE
JAMES ROE, CAPT. SIG. C.	James Roe

FIRST ENDORSEMENT

TO CHIEF	TECHNICAL SERVICE	OFFICE	
NAME, GRADE, AND STATION		STATION	DATE

Instructions

1. It is imperative that the chief of technical service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in matériel. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.
2. This form will be used for reporting manufacturing, design, or operational defects in matériel, petroleum fuels, lubricants, and preserving materials with a view to improving and correcting such defects, and for use in recommending modifications of matériel.
3. This form will not be used for reporting failures, isolated material defects or malfunctions of matériel resulting from fair-wear-and-tear or accidental damage nor for the replacement, repair or the issue of parts and equipment. It does not replace currently authorized operational or performance records.
4. Reports of malfunctions and accidents involving ammunition will continue to be submitted as directed in the manner described in AR 750-10 (change No. 3).
5. It will not be practicable or desirable in all cases to fill all blank spaces of the report. However, the report should be as complete as possible in order to expedite necessary corrective action. Additional pertinent information not provided for in the blank spaces should be submitted as inclosures to the form. Photographs, sketches, or other illustrative material are highly desirable.
6. When cases arise where it is necessary to communicate with a chief of service in order to assure safety to personnel, more expeditious means of communication are authorized. This form should be used to confirm reports made by more expeditious means.
7. This form will be made out in triplicate by using or service organization. Two copies will be forwarded direct to the technical service; one copy will be forwarded through command channels.
8. Necessity for using this form will be determined by the using or service troops.

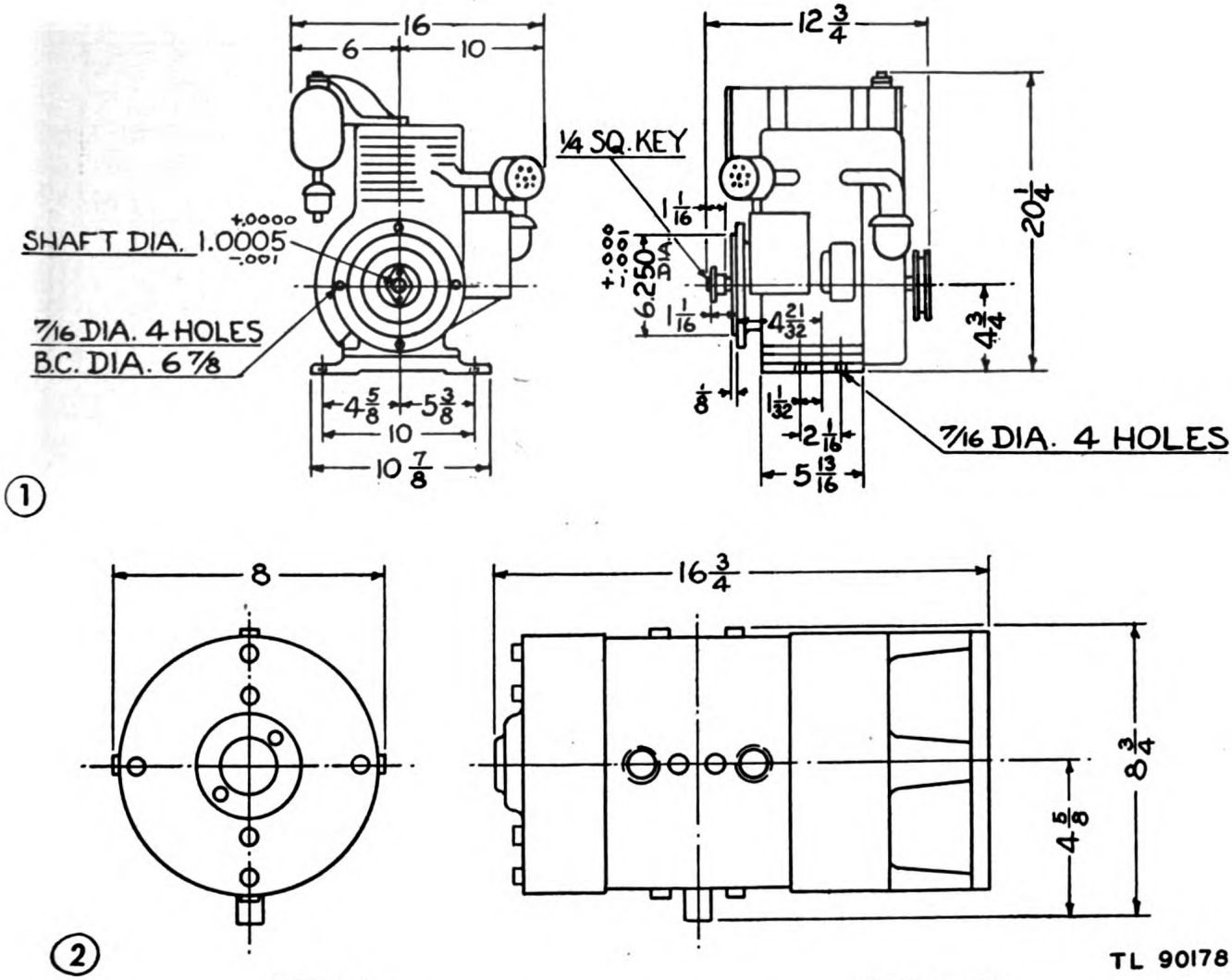
W. D., A. G. O. Form No. 468
30 August 1944

This form supersedes W. D., A. G. O. Form No. 468, 1 December 1943, which may be used until existing stocks are exhausted.

TL96851

U. S. GOVERNMENT PRINTING OFFICE 16—41546-1

Figure 97. Sample Form 468—filled out.



(1) Engine. *(2) Generator.*

Figure 98. Dimensional outline of Power Unit PE–49–D or PE–49–F.

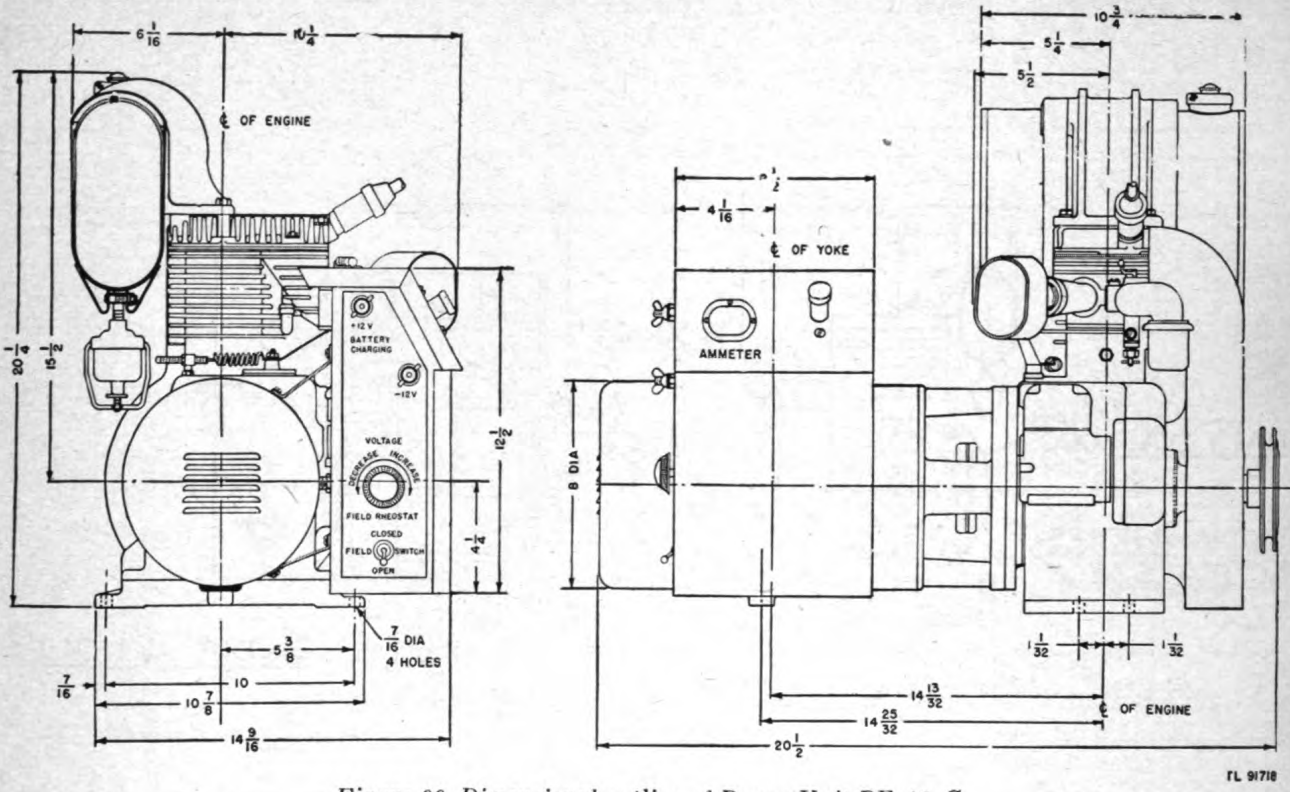


Figure 99. Dimensional outline of Power Unit PE–49–G.

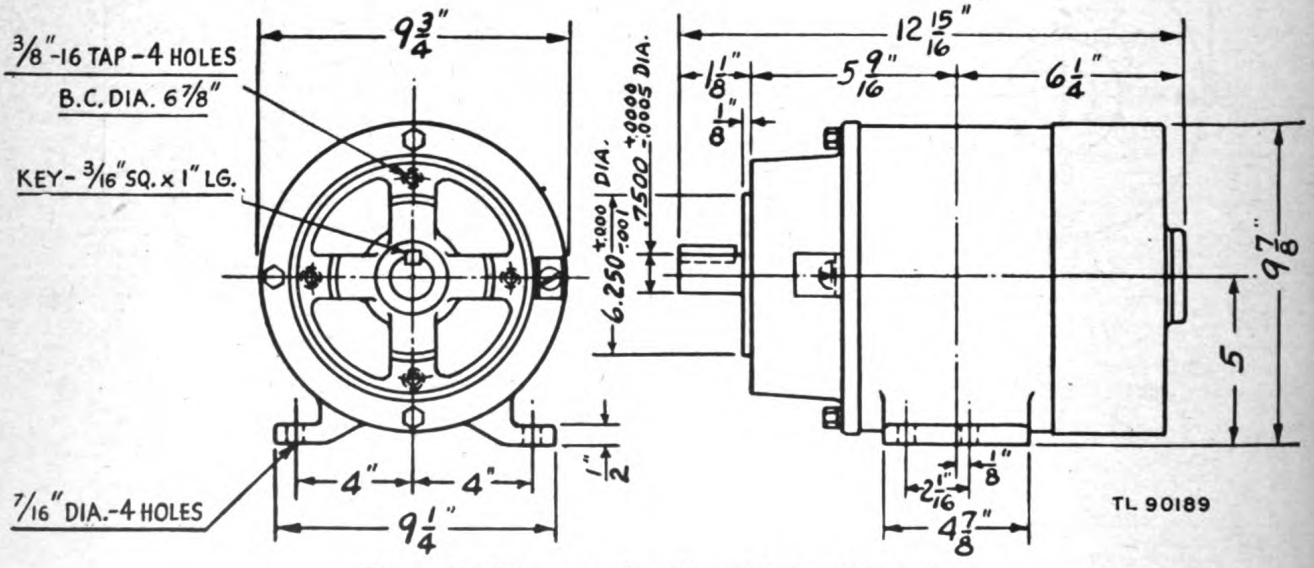


Figure 100. Dimensional outline of Motor MO–37–A.

APPENDIX I

MAINTENANCE PARTS FOR POWER UNITS PE–49–(*) AND MOTOR GENERATOR MG–37–A

The following information was compiled on 13 April 1945. The appropriate sections of the ASF Signal Supply Catalog for Power Units PE–49–D, –F, and –G are:

SIG 7–PE–49, Organizational Spare Parts.

SIG 8–PE–49, Higher Echelon Spare Parts.

The appropriate sections of the ASF Signal Supply Catalog for Motor Generator MG–37–A are:

SIG 7–MG–37–A, Organizational Spare Parts.

SIG 8–MG–37–A, Higher Echelon Spare Parts.

For the latest index of available catalog sections, see ASF Signal Supply Catalog SIG 2.

APPENDIX II

REFERENCES

1. Identification List of Parts for Reference

The following list of parts includes those items indicated by reference numbers on the illustrations but not referred to by reference numbers in the text.

5. Carburetor mounting stud.
10. Oil-sabre assembly.
11. Clip for filler and drain-plug chain.
12. Fuel-line elbow.
15. Muffler.
16. Oil drain-plug with chain.
17. Exhaust elbow.
25. Camshaft with gear.
26. Camshaft pin.
27. Governor flyweight toggle pin.
28. Governor spring.
29. Governor-spring adjusting screw.
33. Governor thrust sleeve.
34. Governor yoke and shaft.
35. Governor-shaft support bracket.
36. Flyweight pin.
37. Governor-control lever.
39. Governor-control assembly.
40. Bearing plate, flywheel end.
41. Bearing plate, take-off end.
44. Connecting rod.
49. Spark-plug wrench.
50. Crankshaft gear.
51. Valve-seat insert.
52. Breather assembly (to relieve crankcase pressure).
53. Main-bearing assembly.
54. Main-bearing cup.
55. Main-bearing cone.
56. Magneto-mounting stud.
57. Piston pin.
58. Breather (to relieve pressure in valve chamber).
60. Main-bearing oil-seal cup.
61. Oil-seal cork.
66. Piston-pin lock ring.
67. Spark-plug shield.
77. Fuel-tank bracket.
78. Fuel-tank bracket spacer.
79. Gasoline-filter assembly.
81. Star lockwasher for locking rope starter.
82. Fuel-tank strap.
83. Fuel-tank cap.
84. Nameplate for engine.
87. Starting sheave.
88. Fuel tank.
89. Air-cleaner bracket.
91. Air-cleaner bracket strap.
93. Bail for spark-plug shield.
94. Body for spark-plug shield.
95. Terminal tension tap.
96. Packing ring.
97. Ignition wire assembly.
98. Support pin for governor-control lever.
100. Governor-spring adjusting-screw pin.
101. Lever for governor-control assembly.
102. Bracket for governor-control assembly.
105. Cover for fuel strainer.
108. Fuel-filter bowl cup clamp.
109. Ball assembly.
115. Plug for idle-discharge hole.
132. Main body of carburetor.
137. Cam felt wick spacer.
138. Stationary contact.
139. Cam felt wick washer.
140. Cam felt wick.
141. Stationary bracket with contact point.
144. Coil assembly.
145. Motor-bearing snap ring.
146. Motor-shaft snap ring.
147. Motor-bearing insulating strip.
148. Motor-shaft oilite bearing.
149. Adjusting screw for stationary arm.
150. Inner retaining washer.
151. Rotor-shaft thrust-bearing shim.
152. Insulating washer for bearing.
153. Rotor-shaft ball bearing.
154. Bearing-seal washer.
155. Bearing and breaker support plate.
156. Magneto rotor.
157. Outer retaining washer.

167. Bushing coupling for gear.
168. Pin-coupling nut.
170. Impulse-coupling nut.
171. Impulse-coupling hub assembly.
172. Impulse-coupling shell.
173. Impulse-coupling drive spring.
174. Magneto gear.
178. Nut for governor-control assembly.
180. Nut for mounting fuel tank.
181. Nut for mounting carburetor.
184. Lockwasher for magneto fixed-contact screw.
186. Lockwasher for main-bearing plate, oil trough, or air shroud.
187. Lockwasher for air shroud.
188. Lockwasher for cylinder-head cap screw.
190. Lockwasher for engine-base mounting screw.
191. Washer for governor-control assembly.
192. Washer for governor-control assembly.
194. Washer for valve-tappet inspection-plate screw.
195. Washer for governor-spring adjusting-screw pin.
196. Washer for main-bearing plate or fuel-tank bracket.
198. Lockwasher for mounting governor-control assembly.
200. Screw for magneto-bearing plate.
201. Screw for mounting governor control.
203. Screw for mounting air cleaner.
207. Screw for mounting air shroud.
208. Screw for fuel-tank support strap.
209. Cam-wick mounting screw.
214. Screw for governor-shaft support bracket or exhaust muffler.
217. Screw for valve-tappet inspection plate.
223. Screw for engine base.
225. Screw for mounting instruction plate.
227. Magneto-coil screw.
228. Cotter pin.
229. Cotter pin for governor-flyweight toggle pin.
230. Cotter pin for governor-control assembly.
231. Plug for timing-inspection peephole.
232. Welch plug for camshaft-inspection peephole.
233. Woodruff key.
234. Woodruff key.
235. Pipe nipple.
804. Pipe nipple.
805. Pipe nipple.
807. Pole shoe assembly.
809. Interpoles.
810. Insulating plate.
815. Low-voltage end bracket.
816. Brush plate assembly.

2. Other Technical Publications

Other technical publications, which pertain to the subject equipment or its associated or auxiliary equipment, and which are referred to at appropriate points in this Technical Manual, are listed below:

FM 21–6, List of Publications for Training.
Instruction Book for Power Unit PE–49–C.
Instruction Book for Power Unit PE–49–D.
TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 99, Preventive Maintenance for Briggs and Stratton, Wisconsin, and Jacobson Engines (air-cooled).
TM 37–2810, Motor Vehicle Inspections and Preventive Maintenance.
TM 10–550, Fuels and Carburetion.
TM 10–580, Automotive Electricity.
TM 11–232, Radio Set SCR–177–B.
TM 11–233, Radio Set SCR–188–A.
TM 11–430, Bateries for Signal Communication Except Those Pertaining to Aircraft.
TM 11–800, Radio Transmitters BC–191–A, BC–191–B, BC–191–C, BC–191–D, BC–191–E, BC–191–F, BC–191–N, and BC–AA–191.
TM 11–920, Power Unit PE–49–F.
TM 11–920G, Power Unit PE–49–G.
TM 11–938, Motor Generator MG–37–A.
TM 37–250, Basic Maintenance Manual.
MWO SIG 2, Modification of Industrial Type, Air-cooled Engines Wisconsin Model, AA, AB, and ABS Engines.

MWO SIG PE–49–D–1, Modification of Power Unit PE–49–D.
MWO SIG 11–920–1, Modification of Power Units PE–49–D and PE–49–F.

3. Parts List

SIG 1, ASF Signal Supply Catalog, Introduction.
SIG 2, ASF Signal Supply Catalog, Index.
SIG 3, List of Items for Troop Issue.
SIG 4–1, Allowances of Expendable Supplies.
SIG 4–2, Allowances of Expendable Supplies for Schools, Training Centers, and Boards.
SIG 5, Stock List of All Items.

4. Decontamination

TM 3–220, Decontamination.

5. Demolition

FM 5–25, Explosives and Demolitions.

6. Camouflage

FM 5–20, Camouflage, Basic Principles.

7. Forms

Forms, mentioned in this manual, used by operating or repair personnel for the purpose of making records and reports, are as follows:

Army Air Forces Form 54 (Unsatisfactory Report).
WD AGO Fom 460 (Preventive Maintenance Roster).
WD AGO Form 462 (Work Sheet for Full-track and Tanklike Wheeled Vehicles).
WD AGO Form 468 (Unsatisfactory Equipment Report).
WD Form 48 (Driver's Trip Ticket and P.M. Service Record).
WD AGO Form 9–76 (old WD OO Form 7362) (Request for Job Order).

8. List of Abbreviations

A	adjust
a	ampere, amperes
a-c, ac	alternating current
A.G.O.	Adjutant General's Office
amp, amps	ampere, amperes
A.P.O.	Army Post Office
approx	approximately
AR	Army Regulation
ASF	Army Service Forces
Aug	August
batt	battery
BC	bottom center
Bn	battalion
brkr	breaker
C	centigrade
C	clean
cap	capacity
Capt	captain
ch	charging
ch	choke
Co	company
comp	compensating
cpl	corporal
cu in.	cubic inches
cyl	cylinder
D.C.	District of Columbia
d-c, dc	direct current
Dec	December
dia, diam	diameter
Do.	ditto
etc	et cetera
F	Fahrenheit
F	fifty-hour
FH	flat head
fig.	figure
Fil H	fillister head
fld	field
FM	Field Manual
fsmwo	field service modification work order
gal, gals	gallon, gallons
gen	generator
gnd	ground
H	hundred

hr	hour, hours
h-v, HV	high voltage
ID	inside diameter
in.	inch, inches
Ind	indorsement
insp	inspection
int pole	interpole
Jan	January
kw	kilowatt
L	lubricate
lb	pound, pounds
lg	long
Lt	lieutenant
l-v, LV	low voltage
mag	magneto
Mar	March
mf	microfarad
mfg	manufacturing
MFP	moisture and fungiproofed
mm	millimeter
No.	number
N.Y.	New York
OD	outside diameter
P	parts
par.	paragraph
Phila	Philadelphia
PM	preventive maintenance
qt, qts	quart, quarts
R	repairs
ref	reference
reg	registration
regul	regulator
res	resistor
RH	round head
rheo	rheostat
rms	root mean square
rpm	revolutions per minute
S	serve
SAE	Society of Automotive Engineers
Sep	September
ser	series
sht	shunt
sig	signal
Sig C	Signal Corps
spec	specification
sq	square
subpar	subparagraph
supp	suppressing
sw	switch
T	tighten
TB	technical bulletin
TC	top center
tech	technical
thk	thick
TM	technical manual
TNT	nitroglycerin
U.S.	United States
U.S.A.	United States Army
u/w	used with
V	volt, volts
W	weekly
w	watt, watts
WD	War Department
WDLO	War Department Lubrication Order

☆ U. S. GOVERNMENT PRINTING OFFICE: 1945—[illegible]