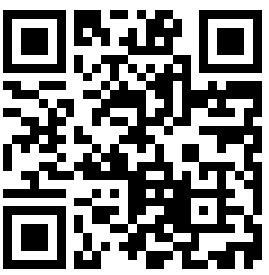

TM 11-975

WAR DEPARTMENT TECHNICAL MANUAL

POWER UNIT PU-35/U

WAR DEPARTMENT · *17 NOVEMBER 1944*

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WAR DEPARTMENT • 17 NOVEMBER 1944

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(See also paragraph 23b, AR 380-5, 15 March 1944.)

WAR DEPARTMENT,

WASHINGTON 25, D. C., 17 NOVEMBER 1944.

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[A. G. 300.7 (5 Aug 44).]

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For explanation of symbols, see FM 21–6.

TABLE OF CONTENTS

REPAIR (contd)

LIST OF ILLUSTRATIONS

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—Cylinder head, radiator, fuel pump, carburetor, governor, magneto, generator, switch-box, muffler, commutator, fuel tank, armature and other parts.

2. Cut —Ignition cables, wires, fan belt, leads.

3. Burn —Technical manual.

4. Bend —Fuel lines.

5. Bury or scatter—All parts after destroying their usefulness.

DESTROY EVERYTHING

SAFETY NOTICE

This unit generates voltage which may cause severe and possibly fatal shock. Always open the circuit breaker before making or changing load connections or before attempting any adjustments or doing any work within the control cabinet.

Provide ample ventilation when operating the unit in a confined space. Make sure that all exhaust connections are gas tight. Locate the unit so that exhaust gases will be carried away from operating personnel. EXHAUST GASES CONTAIN CARBON MONOXIDE, A DEADLY POISON WHICH IS TASTELESS AND ODORLESS.

Do not service with gasoline while the unit is running or is in close proximity to an operating radio transmitter. Avoid spilling gasoline when filling the fuel tank.

SECTION I
DESCRIPTION

1. GENERAL.

a. Description. Power Unit PU-35/U is a complete 120-volt, combination 60- and 400-cycle electric generating plant. It consists of an engine and two alternators (a-c generators) with the necessary controls.

b. Capacity. The two alternators are rated at 2½ kilovolt-amperes (kva), at unity power factor (pure resistive load).

c. Purpose. Power Unit PU-35/U furnishes single-phase power for 60- and 400-cycle operated equipment.

2. COMPONENTS.

a. Engine. The engine (figs. 3 and 4) is a 4-cylinder, 4-cycle, L-head, liquid-cooled, automotive type. It furnishes power to drive the generators at a speed of 1,714 revolutions per minute (rpm). The engine develops approximately 14 horsepower.

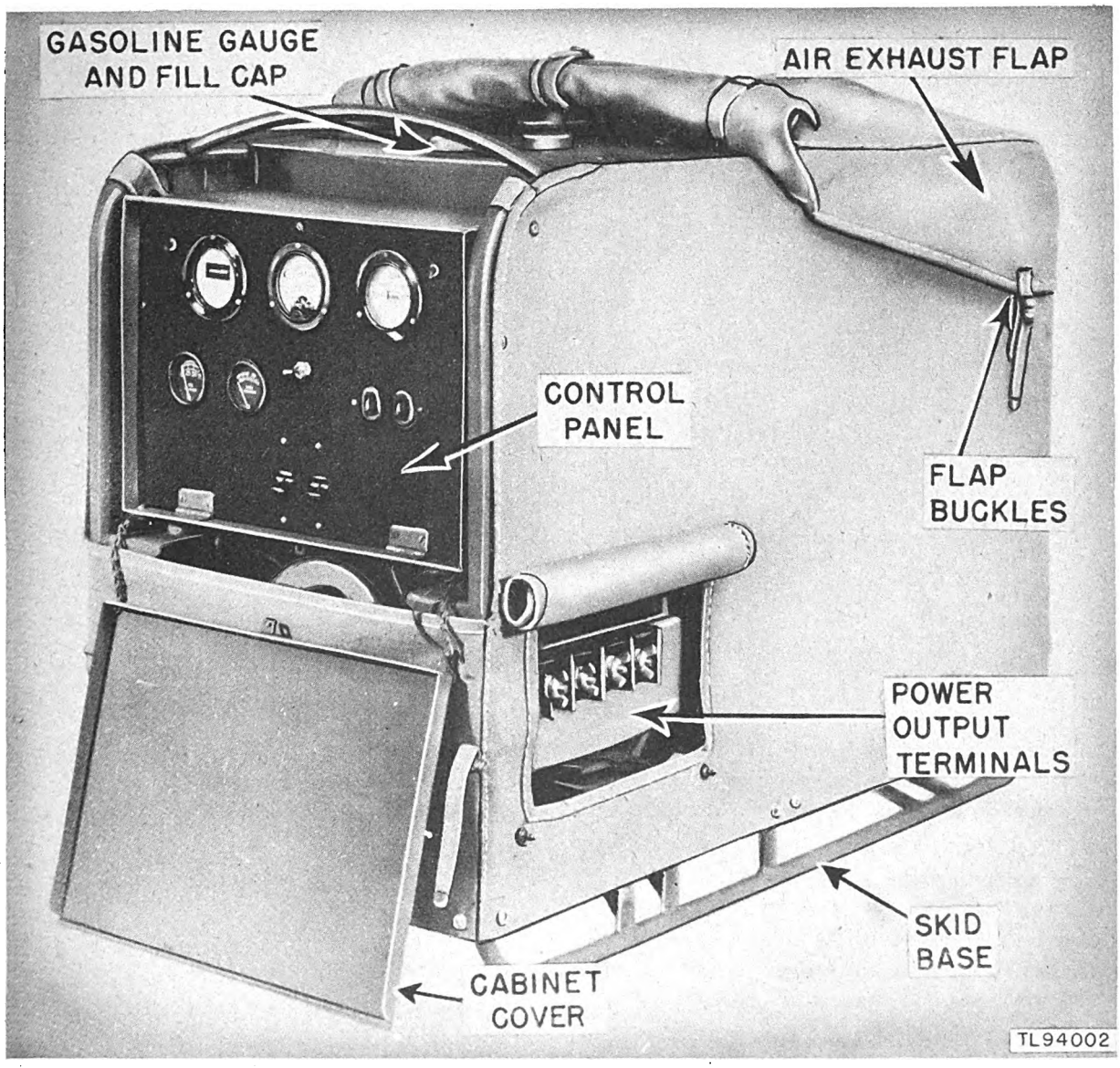


Figure 1. Power Unit PU-35/U, front quarter view.

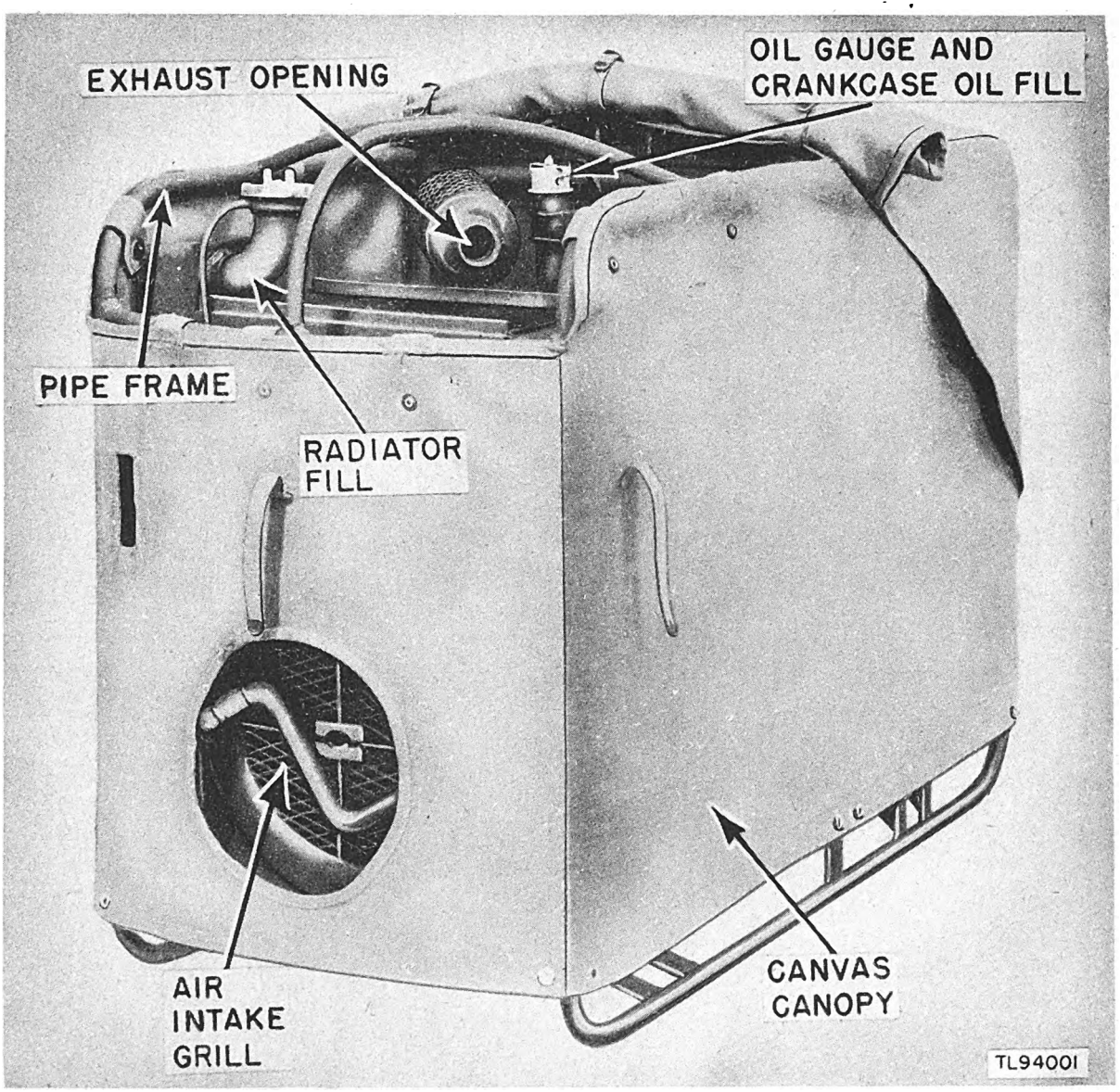


Figure 2. Power Unit PU-35/U, rear quarter view.

The piston displacement is 64.9 cubic inches, the bore is 2⅝ inches, and the stroke is 3 inches. A description of some of the engine parts follows:

(1) COOLING SYSTEM. The 7-quart liquid-cooling system includes a radiator, blower fan, and water pump (fig. 3 (e)). The fan is directly connected to the front end of the crankshaft by means of a flexible coupling assembly. A thermostat automatically controls the engine temperature.

(2) OILING SYSTEM. Main, connecting rod, and camshaft bearings are lubricated with oil supplied under pressure by a gear-driven oil pump. Other internal parts are spray-lubricated. An oil-bath-type breather filters the air which enters the crank case through the oil-filler pipe (fig. 3 (H)). A bayonet-type oil level gauge is mounted on the right side of the engine, and extends above the cylinder block for easy access.

(3) FUEL SYSTEM. The fuel system includes the following parts:

(a) Gasoline tank (fig. 3 (U)).

(b) Diaphragm-type fuel pump (fig. 3 (J)).

(c) Fixed-jet-type carburetor (fig. 4 (E))

(d) Oil-bath-type air cleaner (fig. 4 (F)).

(4) IGNITION SYSTEM. A magneto, which is mounted on the right side of the engine, is gear

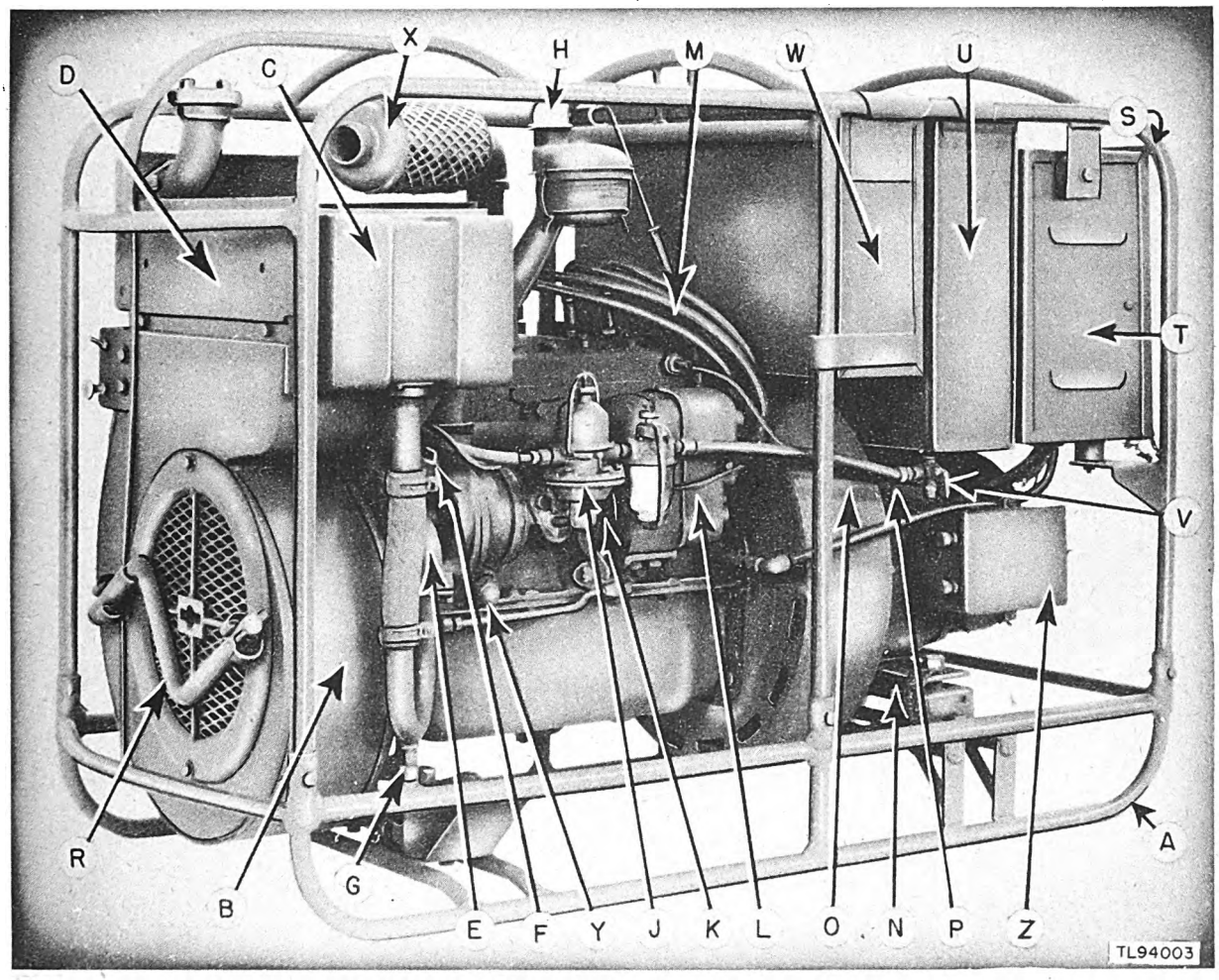


Figure 3. Power Unit PU-35/U, right side view.

A Skid frame.
B Blower housing.
C Radiator.
D Radiator housing.
E Water pump
F Grease cup.
G Water drain.
H Oil filler and breather.
J Fuel pump.
K Impulse coupling.
L Magneto.
M Spark plug wires.
N Shock mounts.
O 400-cycle generator.
P 60-cycle generator.
R Crank
S Cover frame.
T Control cabinet.
U Gasoline tank.
V Three-way valve.
W Tool and spare parts box.
X Muffler.
Y Oil pressure adjustment.
Z Filter box.

driven from the engine camshaft. This unit includes the breaker mechanism, capacitor (condenser), and rotor assembly. All three parts are contained within the magneto casing. The magneto (fig. 3 (L)), spark plugs (fig. 4 (G)), and ignition wiring are shielded to minimize their interfering with radio equipment.

(5) ENGINE CONTROLS. The ON-OFF ignition switch is mounted on the front of the fan housing on a small control panel. The hand choke, which is below the ignition switch, is also located on this panel.

(6) STARTING SYSTEM. The engine is started with a hand crank.

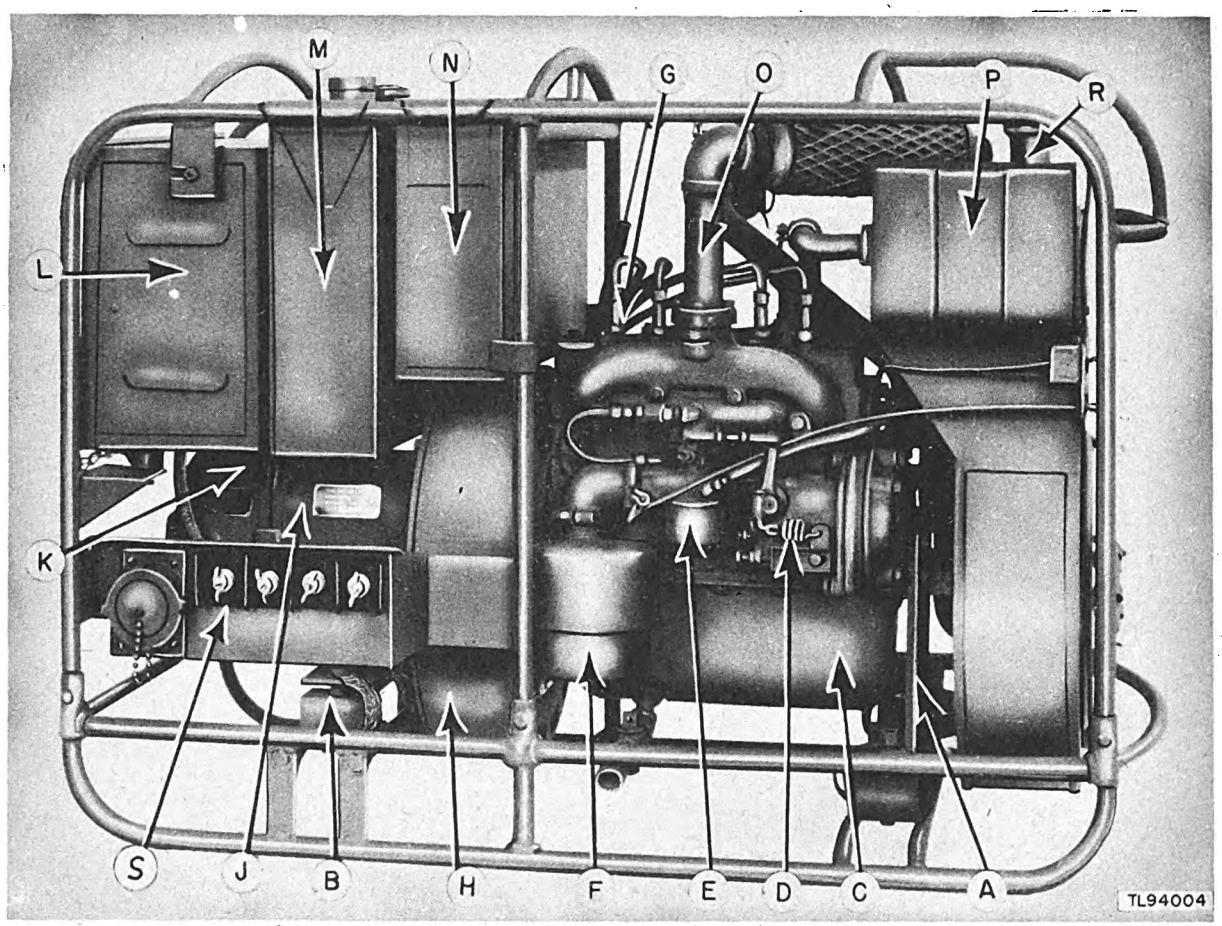


Figure 4. Power Unit PU-35/U, left side view.

A Engine support.
B Shock mounts.
C Oil pan.
D Governor.
E Carburetor.
F Air cleaner.
G Spark plugs.
H 400-cycle generator.
J 60-cycle generator.
K Brush housing cover.
L Control cabinet.
M Gasoline tank.
N Tool and spare parts box.
O Exhaust pipe.
P Radiator tank.
R Radiator filler pipe.
S Terminal strip.

b. Alternators. The alternators consist of two single-phase units. One is a 400-cycle permanent-magnet type, and the other is a 60-cycle, self-excited type. The rotor of the permanent-magnet generator is directly connected to the engine crankshaft through a flange coupling. The permanent-magnet rotor serves as the engine flywheel. The 60-cycle generator has a single bearing and is directly connected to the permanent-magnet rotor through a flexible coupling.

c. Control Cabinet and Instrument Panel. Equipment necessary for controlling the electrical output of Power Unit PU-35/U is mounted on the control cabinet at the rear of the unit. The control cabinet (fig. 3 (T)) is furnished complete with a recessed steel instrument panel which is covered for protection. The instrument control panel, mounted within the control cabinet, is hinged at its bottom so that it may be swung into a position to permit access to the rear and inside of the cabinet.

d. Base (fig. 3 (A)). The engine and alternators are mounted on a welded skid fabricated from pipe. The control panel, gasoline tank (fig. 4 (M)), and tool box (fig. 4 (N)) are mounted in a detachable pipe frame located above the generator unit (H).

e. Spare Parts. Spare parts furnished with Power Unit PU-35/U are as follows:

1 water pump repair kit.
1 set expansion plugs.
1 fuel pump diaphragm.
1 sediment bulb.
3 sets spark plugs.
1 set gaskets (complete).
2 extra cylinder head gaskets.
1 set exhaust valves.
1 spring and retainer for valve.
1 set magneto points.
2 magneto capacitors.
1 set radiator hose and clamps.
2 sets alternator brushes.
2 sets exciter brushes.
2 sets brush capacitors.
1 15-foot length flexible gas hose.

f. Tools. The tools furnished with the unit are as follows:

Wrench, spark plug.
Pliers, gas.
Wrenches, tappet, set.
Gauges, feeler, set.
Wrench, 8-inch crescent-type.
Hammer, machinist's, 1 pound.
Pins, assorted cotter, box.
Wrenches, open-end, set.
Sandpaper, #00.
Wire, soft iron, spool.
Lifter, valve.
Kit, valve grinding.
Screwdriver.
Seal, gasket, bottle.

3. WEIGHTS AND DIMENSIONS.

a. Weight. The weight of the uncrated power unit containing water and oil and empty gasoline tank, is 585 pounds.

b. Dimensions. The over-all dimensions are shown in figure 5.

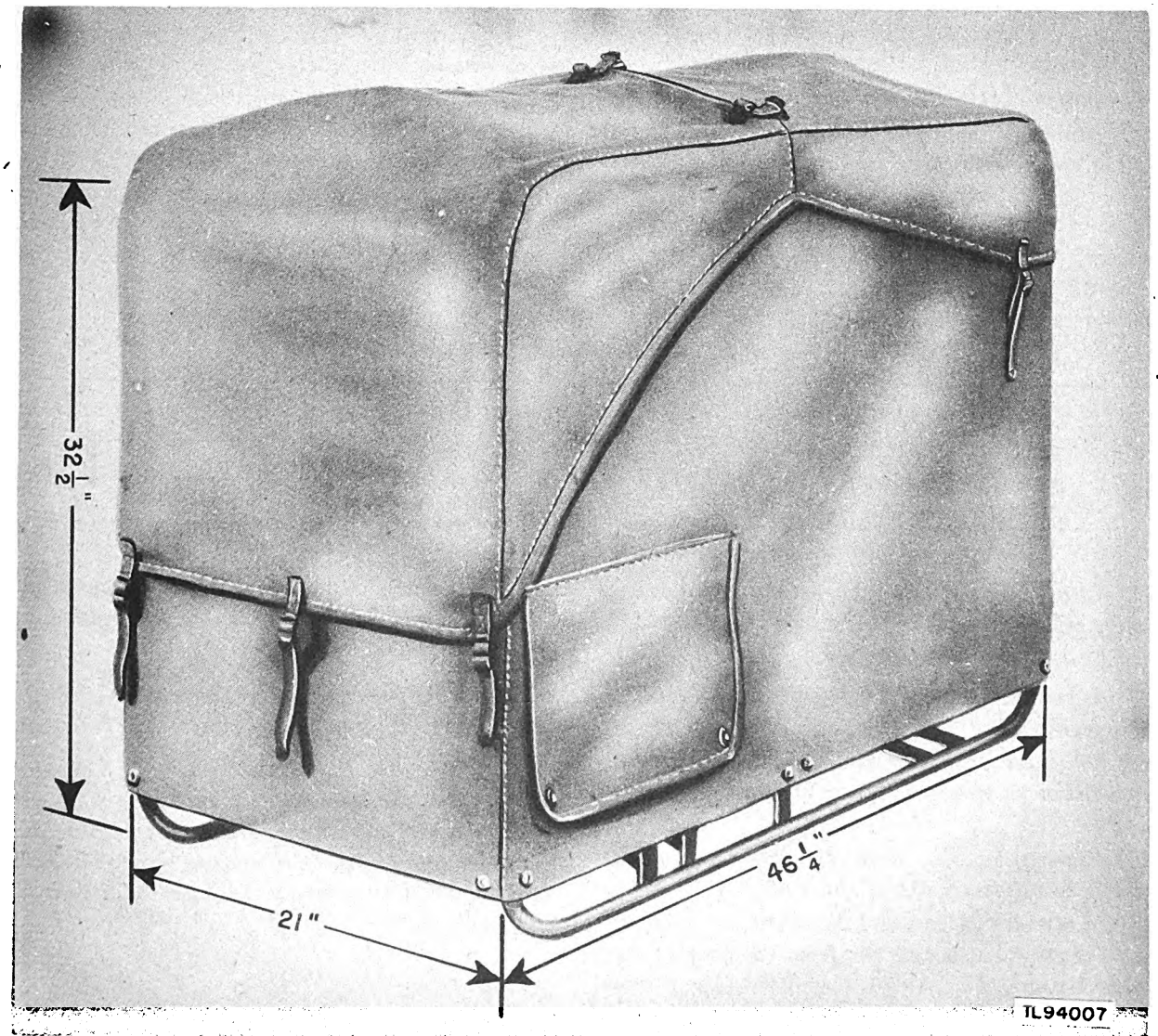


Figure 5. Over-all dimensions.

SECTION II
INSTALLATION AND OPERATION

4. GENERAL.

Power Unit PU-35/U is packed for export shipment by a process which includes the use of a vapor barrier packing. Do not uncrate the unit until ready to use it. Avoid puncturing or damaging the lead envelope before the unit is to be used.

a. Unpacking the Unit. Uncrate the unit carefully, checking all components against the attached packing list. The unit is packed completely assembled.

b. General. The engine generator components are mounted on rubber shockmounts. The unit may be placed in the desired location without a special foundation. Gasoline-engine exhaust gas is deadly. When operating within a confined space, care must be taken to run the exhaust to the outside. Pitch the exhaust line so that condensed water in the exhaust system will not flow back into the engine.

c. Fuel System. A three-way stop cock allows the gasoline to be piped from the 5-gallon tank to the engine fuel pump or from an outside tank. When piping from an outside source, connect the 15 feet of supplied gasoline hose to the appropriate opening in the three-way stop cock (fig. 3 (V)). Connect the opposite end of the hose to the outside gasoline supply tank.

d. Power Connections. Connect the power leads to the terminal strip (fig. 4 (S)) at the appropriate terminal studs provided for 60- and 400-cycle operation. A remote power cable connecting with the power receptacle on the terminal strip may be used if desired.

5. PREPARATION FOR USE.

a. Procedure. (1) Check all spare parts against the packing list. Put away parts not currently needed.

(2) Check all fuel and wire connections to see that they are secure. Tighten any loose screws, nuts, or bolts.

(3) Make sure all parts move freely. With the ignition OFF, crank the engine a few times with the hand crank.

(4) Remove all seals from the carburetor air intake, exhaust outlet, and crankcase breather.

(5) Open the front hinged panel over the exhaust outlet, withdraw the bayonet oil gauge and insert it into its place (fig. 2). Close the oil drain cock below the air filter on the left side of the unit. Fill the crankcase with 3½ quarts of oil. Use the following table to determine the proper viscosity.

TABLE I

TEMPERATURE	VISCOSITY (U. S. Army Spec No. 2-104B)
Above 32° F	OE-SAE 30
Between 0° F and 30° F	OE-SAE 10
Below 0° F	OE-SAE 10(diluted). See paragraph 23d.

NOTE: Do not put diluted oil in the engine until ready to start it. Mix well just before pouring into the engine.

(6) Check the water pump grease cup. Fill it with water pump grease, (WP). Replace the grease cup and turn it down one full turn.

(7) Lubricate all exposed moving control parts with light engine oil (OE).

(8) Wipe the entire unit with a clean cloth. Clean all radiator air passages and cooling fins of foreign matter.

(9) Remove the base of the air cleaner and clean it. Fill up to mark with oil (OE).

(10) Blow out all dust and dirt from the inside of the control cabinet, and also from the back of the control panel.

(11) Assemble all connecting cables. Make necessary load connections. Place the circuit breaker in the OFF position.

(12) Fill the fuel tank with 5 gallons of CLEAN gasoline. Make sure the air vent in the fuel tank cap is clear.

(13) Fill the radiator with 7 quarts of CLEAN water. If the unit is to be operated in freezing temperatures, protect the cooling system against freezing by adding antifreeze. Use the following table as a guide.

TABLE II

ANTIFREEZE SOLUTION

Type of antifreeze			Antifreeze to add at temperatures shown (qt)
Ethylene glycol	Alcohol	Glycerine	
	27° F	29° F	.7
16° F	19° F	21° F	1.4
3° F	10° F	12° F	2.1
−11° F	−2° F	0° F	2.8
−31° F	−18° F	−15° F	3.5

NOTE: Check antifreeze daily with a special hydrometer. Add antifreeze as needed. Check hose connections frequently.

(14) Maintain the proper operating temperature which is between 140° and 180° F. Regulate cooling air flow by the proper adjustment of the radiator and end openings (fig. 1).

b. Recheck. Before turning on the ignition switch, check all the previous operations. Make sure nothing has been overlooked. This is especially important when starting the engine for the first time.

NOTE: Be sure circuit breakers are in the OFF position before starting the unit.

6. STARTING THE UNIT.

Operations to start the unit are as follows:

a. Remove the hand crank from the clips on the blower housing. Insert it in the hole in the screen on the front end of the unit.

b. Rotate it slowly until it engages the starting pin on the end of the crankshaft.

c. Place the ignition switch in the ON position.

d. Pull out the choke at the front of the fan blower housing.

e. Pull up quickly on the starting crank. The unit should start. If it does not start on the first or second attempt, push the choke about halfway in and try again. Gradually push in the choke as engine warms up. Avoid its excessive use. Never push down on the crank. Serious injury to the operator may result if the engine should backfire If the unit fails to start after several attempts, refer to the trouble chart (par 29a) for the possible cause. Never operate the unit with the choke partially closed.

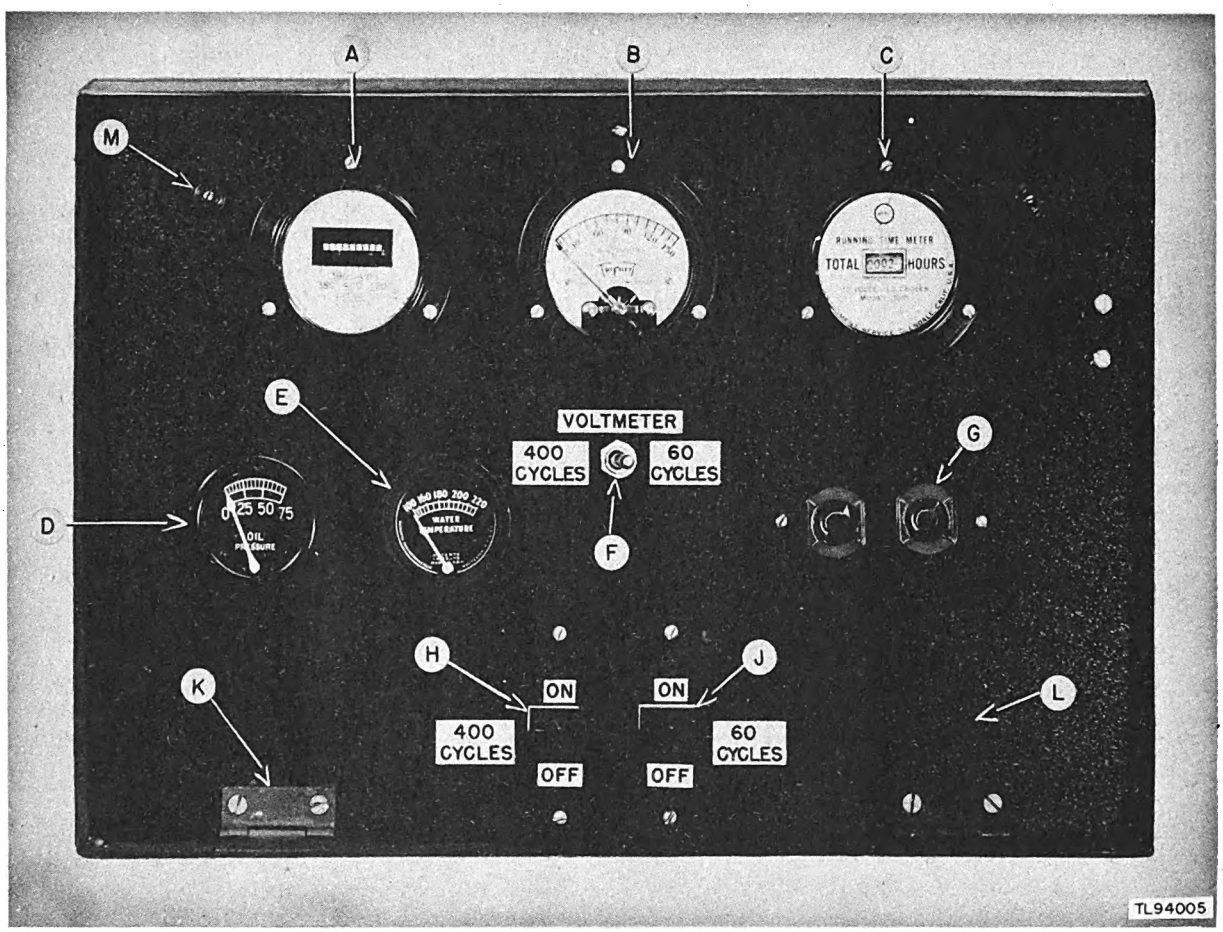


Figure 6. Instrument panel, front view.

A Frequency meter.
B Voltmeter.
C Elapsed time meter.
D Oil pressure gauge.
E Water temperature gauge.
F Voltmeter switch.
G Duplex receptacle.
H Circuit breaker, 400 cycle.
J Circuit breaker, 60 cycle.
K Hinges.
L Steel panel.
M Knobs.

7. OPERATION AFTER ENGINE STARTS.

a. Connecting the Load. As soon as the unit starts, check the oil pressure gauge on the control panel. The oil pressure gauge should indicate about 15 pounds. The frequency meter should read between 400-405 cycles. The voltmeter should read 122 volts without load, or 120 volts with load. See paragraph 19 for voltage adjustment. Allow about a 10 to 15 minute warm-up period before applying the load. Only in cases of extreme emergency should the load be applied before the unit has been properly warmed up. If load connections have not been previously made, stop the unit and make them.

CAUTION: Place the circuit breakers in the OFF position, then make or change load con-

nections. Restart the unit and close the circuit breakers.

If the current breakers should kick off or trip, it indicates an overload and the load must be checked and corrected before the circuit breakers are closed again.

b. Adjusting Engine Speed for Full-Load Operation. (1) Throw the circuit breakers to the OFF position.

(2) Loosen the two setscrews in the governor spring plate (fig. 10).

(3) Adjust the spring tension with screw B (fig. 10) for an engine NO LOAD speed of 1,750 rpm or 410 cycles per second (cps) as indicated on the frequency meter (fig. 6 (A)).

(4) Apply the full load by throwing the circuit breakers to the ON position.

(5) The governor should maintain an engine speed of 1,714 rpm or 400 cycles.

c. Adjusting Engine Speed for Light-load Operation. (1) Adjust the governor for an engine speed of 1,714 rpm or 400 cycles for a light load connected to the alternators.

NOTE: Check the free operation of the linkage rod and the ball joints between the governor and the carburetor. Binding will prevent proper throttle control and cause poor engine speed regulation. Test the linkage for binding, occasionally, by manually operating the throttle. See paragraph 12 for a description of the governor.

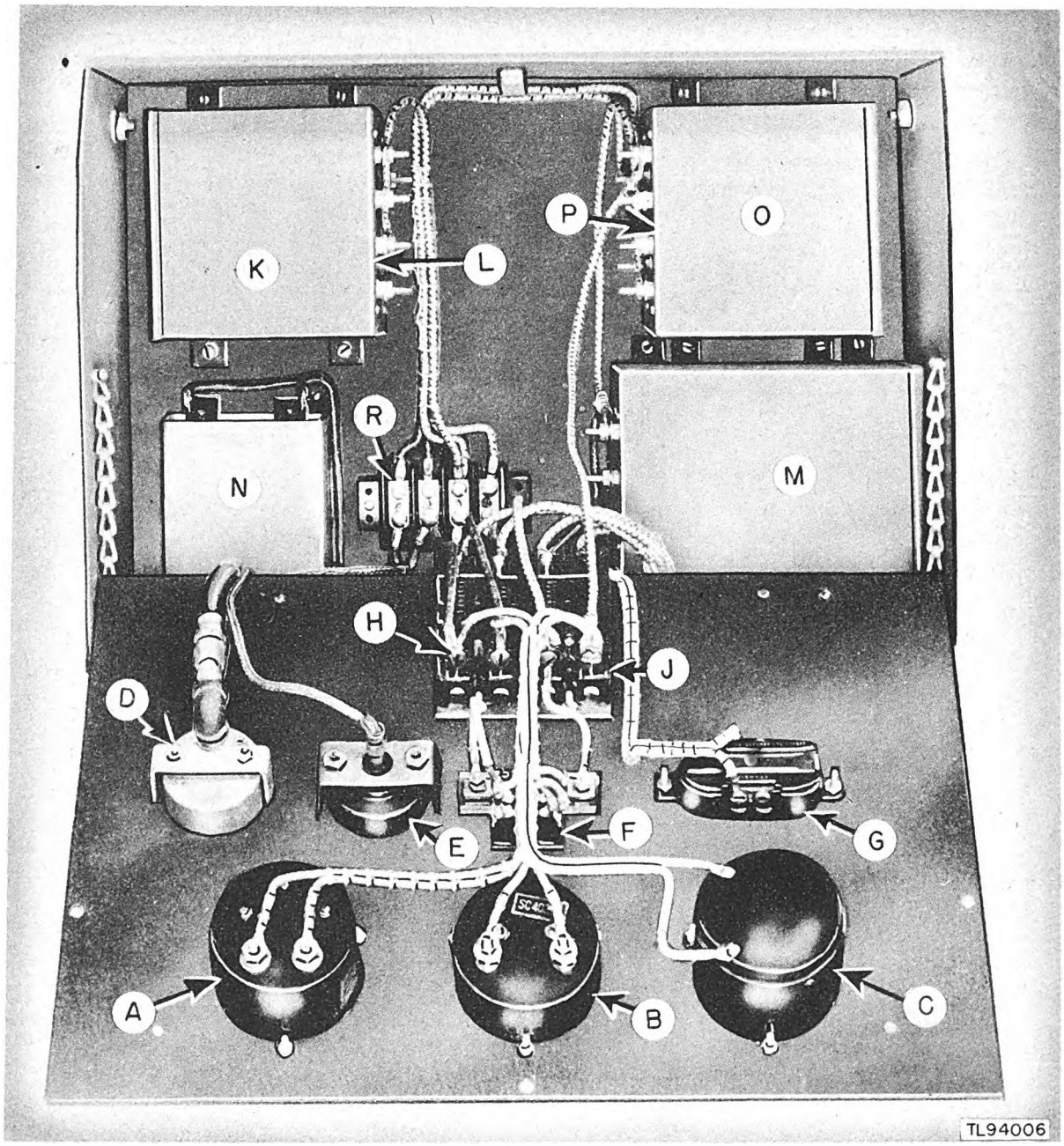


Figure 7. Control cabinet, open.

A Frequency meter.
B Voltmeter.
C Elapsed time meter.
D Oil pressure gauge.
E Water temperature gauge.
F Voltmeter switch.
G Duplex receptacle.
H Circuit breaker, 400 cycle.
J Circuit breaker, 60 cycle.
K Booster transformer, 400 cycle.
L Booster transformer terminal strip, 400 cycle.
M Generator compensator transformer, 400 cycle.
N Compensator capacitor.
O Booster transformer, 60 cycle.
P Booster transformer terminal strip, 60 cycle.
R General terminal strip.

d. Control Panel Adjustments of Voltage. The 60- and 400-cycle generators are designed to operate on the load range (within the rated capacity of 2.5 KW) without material change in terminal voltage. The using equipment generally has a definite value of terminal voltage for best operation, which may vary somewhat for different equipments. Also, connecting cables of considerable length, and having considerable voltage drops, may be used. To permit adjustment of the actual voltage at the equipment to the desired value, booster transformers are provided (fig. 7), permitting a variation of plus or minus 10 volts in the output voltage of each generator, in 2-volt steps. The taps and arrangements are shown in Table III.

(1) By placing the black terminal (15) below the red terminal (14) on the terminal posts B, C, D, or E, the 400-cycle output voltage may be raised in a corresponding amount to the values shown in table III.

(2) By reversing the position of the terminals and placing the black terminal (15) above the red terminal (14), the 400-cycle output voltage may be lowered in the values of the amounts as shown in table III.

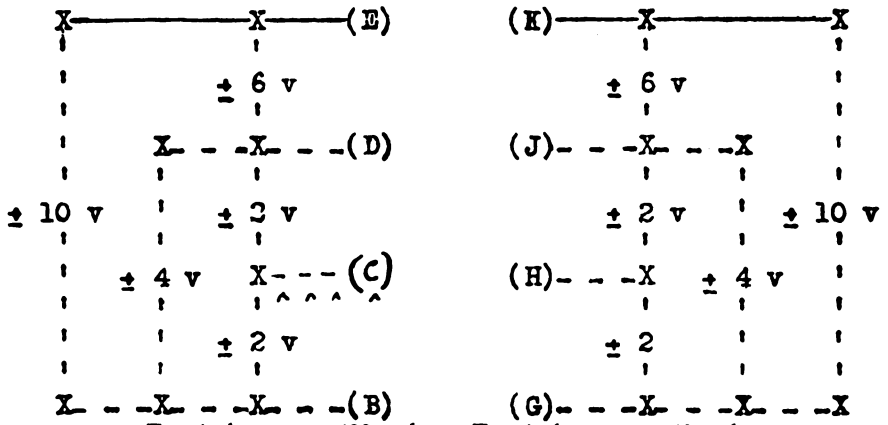
(3) The 60-cycle booster transformer is provided with similar terminals which are used in the same manner.

NOTE: To raise the voltage in the 400- or 60-cycle circuits, place the red terminals above the black terminals. To lower the voltage in the 400- or 60-cycle circuits, place the black terminals above the red terminals.

(4) The normal position of the terminals in the 400-cycle transformer circuit is on terminal posts A and B. The normal position of the terminals on the 60-cycle transformer circuit is on terminal posts F and G. With the terminals in this position, the output voltage will be the same as the generator voltage.

CAUTION: Before changing the position of any terminals, throw the circuit breaker (on the circuit being changed) to the OFF position.

TABLE III



Terminal posts on 400-cycle booster

Terminal posts on 60-cycle booster

Ranges of voltages obtainable by the use of the booster transformers.
To raise voltage: Place red terminal above black terminal.
To lower voltage: Place black terminal above red terminal.

8. STOPPING THE UNIT.

a. Circuit Breaker. Throw the circuit breakers to the OFF position.

b. Ignition Switch. Push the ignition switch off.

c. Fuel and Oil. Check the gasoline and oil levels. Replenish if necessary.

d. Storage. If the engine is to be shut down for a long period, drain the crankcase and the radiator.

SECTION III
FUNCTIONING OF PARTS

9. GENERAL.

Complete information on the functioning of the magneto as used with the ignition system of Power Unit PU-35/U may be found in TM 10-580, Automotive Electricity. Additional information on carburetion, fuels, and lubrication, may be found in TM 10-550, Fuels and Carburetion.

10. IGNITION SYSTEM.

High-ignition voltage is generated by a high-tension magneto (fig. 8) mounted on the left side of the engine. The spark plug, in part, consists of a highly insulated center electrode which conducts this high voltage to the base where it jumps the preset gap to another electrode which is part of the metal base and grounded to the engine block, (return path for the current). The entire ignition system is shielded to prevent its interfering with radio equipment in the vicinity.

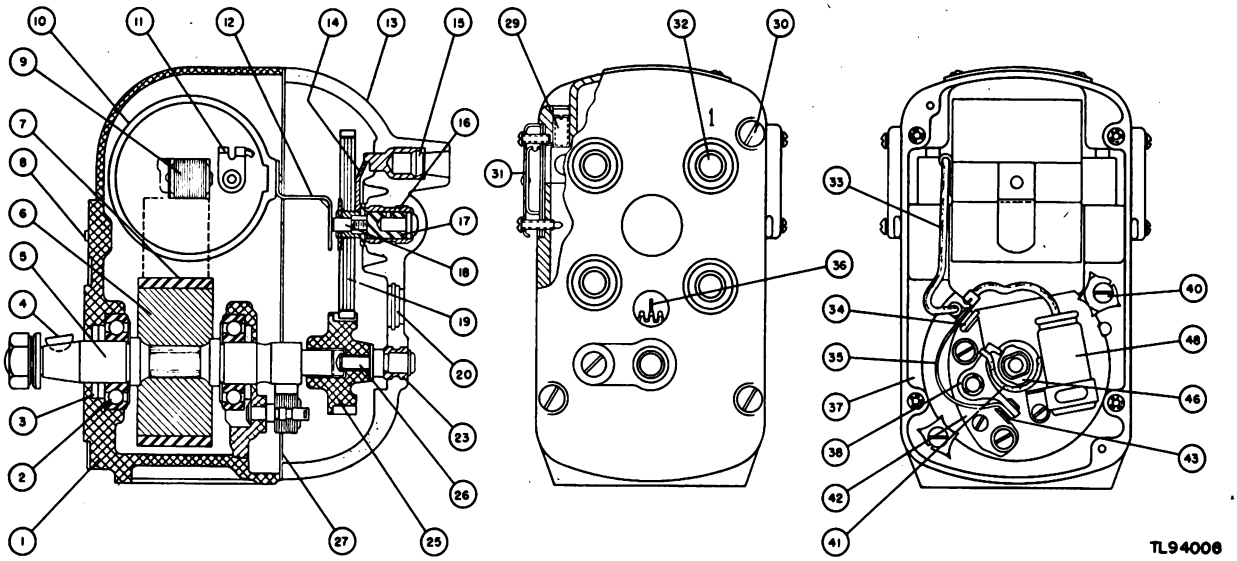


Figure 8. Magneto details.

1 Magneto housing
2 Ball bearings
3 Felt sealing washer
4 Woodruff key
5 Magnet rotor shaft
6 Alnico magnet
7 Steel pole shoe
8 Indicating mark on housing
9 Coil core
10 High-tension coil
11 Terminal clip
12 High-tension conductor
13 Distributor plate
14 Electrode
15 Cable clip
16 Distributor gear bearing
17 Distributor gear shaft
18 Distributor gear brush and spring
19 Distributor gear
20 Observation window
23 Lever shaft bearing
25 Magnet rotor gear
26 Magnet rotor gear shaft
27 Distributor plate gasket
29 Coil mounting screw
30 Distributor plate fastening screw
31 Ventilator
32 Cable tower
33 Coil cable
34 Insulated bracket
35 Interrupter operating spring
36 Line on distributor gear
37 Pole shoes
38 Interrupter lever
40 Interrupter holding bracket screw
41 Felt wick
42 Adjustable contact bracket
43 Tungsten contacts
46 Cam
48 Capacitor (condenser)

11. FUEL SYSTEM.

The fuel system consists of a fixed-jet, float-feed carburetor, fuel pump, fuel strainer, and a three-way fuel valve. This valve permits the drawing of fuel from either the built-in fuel tank which is located on top of the unit, or a remote fuel tank located at a distance within the length of the supplied flexible fuel line. The carburetor is provided with an air filter of the oil-bath type to prevent the entry of dust and dirt.

a. Gasoline Tank. This container for fuel is connected to the fuel pump by a flexible line.

b. Fuel Pump (fig. 9). This is a diaphragm-type pump which operates continuously while the engine is in operation. The diaphragm is moved up and down by the action of a lever which rides on the camshaft. As the diaphragm is drawn down, pressure in the fuel line is reduced, thus permitting fuel to flow from the tank through the fuel line into the sediment bowl. From the sediment bowl the fuel is drawn into the pump, and, as the diaphragm is pushed up, the fuel is forced into the carburetor float chamber through the needle valve contained therein.

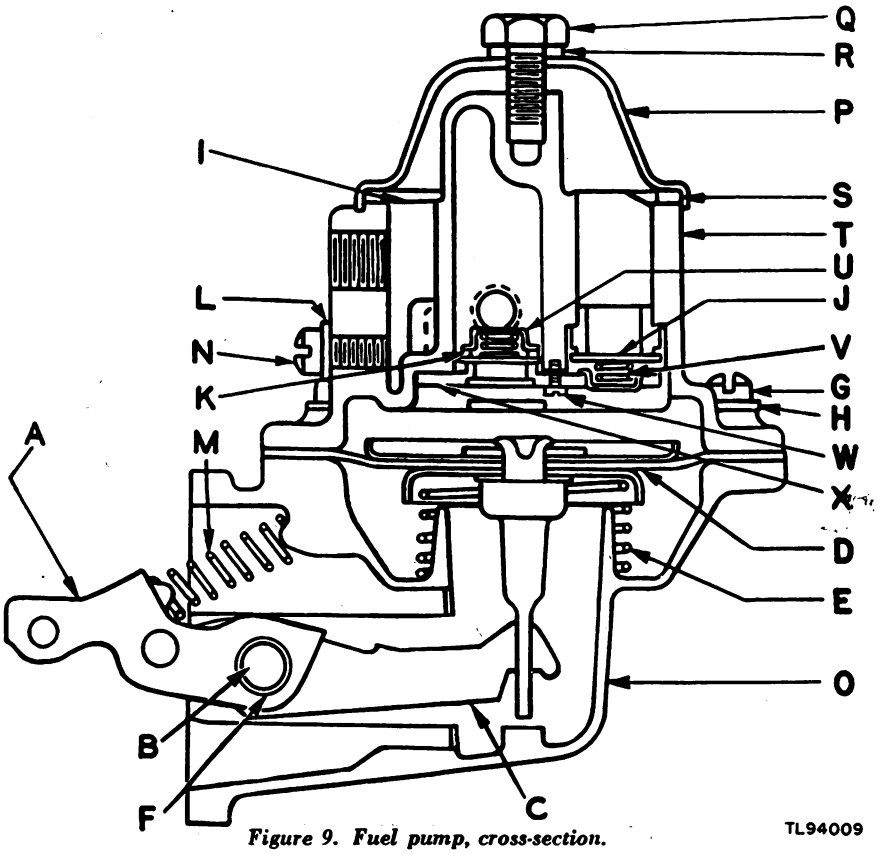


Figure 9. Fuel pump, cross-section.

A Rocker arm
B Rocker arm pin
C Link
D Diaphragm assembly
E Diaphragm spring
F Rocker arm pin bushing
G Cover screw
H Cover screw lock washer
I Screen
J Valve
K Valve plate gasket
L Drain screw gasket
M Rocker arm spring
N Drain screw
O Body
P Cover plate
Q Cover plate cap screw
R Cover plate cap screw gasket
S Cover plate gasket
T Cover and valve seat assembly
U Outlet valve spring retainer
V Valve spring
W Valve retainer screw
X Valve plate (outlet)

c. Carburetor (fig. 4 (E)). The carburetor is of a fixed-jet type. The gasoline in the float chamber is sucked into the manifold tube through a system of ducts and valves which mix air with the gas spray in the proper proportion. The choke controls the air supply thus producing a richer fuel mixture needed to start a cold engine. The throttle stop screw is used to set the position of the throttle fly to permit a minimum passage of fuel mixture to the cylinders. The idling setscrew is used to set the carburetor for idling speed by providing a suitable gas-air mixture for low-speed operation. Further details on carburetion will be found in TM 10-550, Fuels and Carburetion.

12. GOVERNOR (fig. 4 (D)).

The governor maintains fairly constant engine speed under fluctuating load conditions. It is of the flyball type, lubricated by the crankcase oil and connected to the camshaft by a gear. Briefly, the governor operates as follows:

a. When the engine speed decreases as a result of a heavier-than-usual load, the fly weights rotate at a lower speed and collapse accordingly. The collapse of the fly weights causes a spring to pull an arm which is connected to the throttle fly in the carburetor. The throttle opens wider allowing more fuel to enter the carburetor thus increasing engine speed. When the engine speed reaches a point at which the rapidly expanding fly weights again exert a force equal to the tension of the adjustable governor spring, the throttle is opened enough to produce the desired engine speed.

b. A hexagonal screw (fig. 10) is connected to the governor spring, and by turning the screw to the right (increasing spring tension), the engine speed is increased. Turning this screw to the left (decreasing spring tension), decreases engine speed. The governor is adjusted for an engine speed of 1,714 rpm.

13. LUBRICATING SYSTEM.

Lubrication is provided within the engine by a pump which forces oil from the oil sump in the crankcase to the main, connecting rod, camshaft bearings, and the timing gears. The piston pins are lubricated by oil vapor. A bayonet-type oil gauge is used to indicate the oil level in the crankcase. The oil pressure of the engine at idling speed is 10 to 15 pounds. Pressure at governed speeds is 25 to 50 pounds. An adjustable oil-pressure relief valve is provided. See figure 18 (oil pressure adjustment). The pump is driven by a gear from the camshaft.

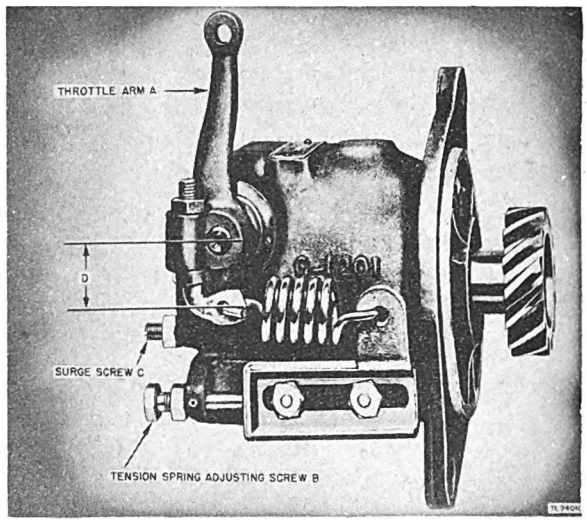


Figure 10. Governor adjustment.

14. COOLING SYSTEM.

Water is circulated around the cylinders, valve ports, and combustion chamber to conduct heat away from the engine. The water flows from the outlet at the top of the cylinder to the radiator where it is cooled. It is then returned to the water jacket by the water pump. Temperature is controlled by a thermostat located at the outlet of the water jacket.

15. ENGINE CONTROL PANEL.

The following are mounted on the engine fan housing.

a. Ignition Switch. The ignition switch, when pushed on, opens the magneto grounding circuit permitting the magneto to function and furnish spark for the ignition. When pushed off, this switch grounds the circuit of the magneto. This action grounds the ignition spark and stops the engine. Use the choke only while starting and during the warm-up period.

b. Hand Choke. The hand choke is used to choke the engine to permit easier starting in cold weather.

16. ALTERNATOR (400-CYCLE).

The 400-cycle generator is of the permanent-magnet type and does not use a conventional exciter, collector rings, and brushes. The generator consists of an outer shell which is the fly wheel housing. The frame of the generator holds the laminations and windings. The generator leads are brought directly from these windings to the control panel. The rotor of this generator is used as the flywheel of the engine. The magnet assembly consists of a slot wheel which holds the magnets with

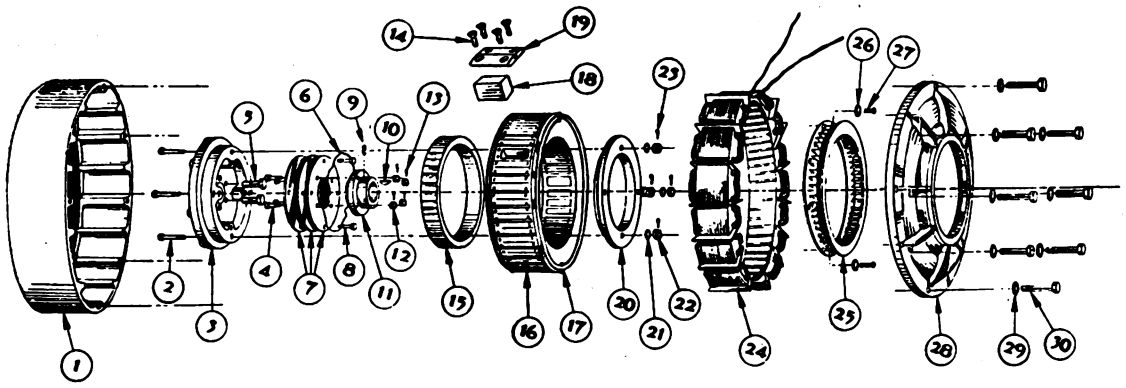


Figure 11. Alternator (400-cycle).

1. Main bell.
2. Cap screw.
3. Hub.
4. Cap screw.
5. Cap screw.
6. Staking head wire.
7. Coupling plates.
8. Wire staking head cap screw.
9. Allen Head setscrew.
10. Woodruff key.
11. Coupling hub.
12. Castellated nut.
13. Cotter pin.
14. Flathead machine screw.
15. Inner magnetic ring.
16. Magnet retainer wheel.
17. Rotor damper winding.
18. Alnico magnet.
19. Pole shoe.
20. Hub clamp ring.
21. Flat washer.
22. Standard castellated nut.
23. Cotter pin.
24. Stator.
25. Fan.
26. Lockwasher.
27. Stove bolt.
28. End bell.
29. Washer.
30. Cap screw.

a steel inner ring on the inside, and the special steel pole pieces on the outside. This assembly maintains the magnetism.

17. ALTERNATOR (60-CYCLE) (fig. 12).

a. Exciter (fig. 12 (1)). Located behind the alternator, the four-brush, 60-cycle, d-c, exciter generates direct current to excite the revolving field of the alternator. Connection between the exciter brushes and the alternator field slip rings is made by the connecting wiring. The d-c exciter operates in the following manner:

(1) Residual magnetism remains in the magnetic circuit of the exciter when the engine is not in operation. When the engine is started, the armature revolves and carries its conductors by the field poles. The cutting of magnetic lines of force by these conductors as they pass poles of alternate polarity induces alternating currents in the conductors. These conductors are connected with commutator bars (segments), which are in contact with any two given brushes of the same polarity. Direct current will flow in the exciter circuits when it is connected to a load.

(2) A small portion of this current passes through the exciter field winding and increases the field strength which, in turn, greatly increases the voltage induced in the conductors. The maximum exciter voltage has been built into the exciter operating with a saturated field. This design eliminates the need for a rheostat or voltage regulator.

b. Alternator. The single-phase, 60-cycle, alternator (called a-c generator) receives mechanical power from the engine and converts it into electrical energy or power. It consists of a d-c exciter (d-c generator) and an alternator of the revolving field type. The revolving field of the alternator is magnetized by direct current which is generated in the exciter. The field poles, of alternate polarity, revolve by the conductors of the stator and induce voltages (120 volts) in them. The conductors are connected in one group (one phase). The wires from this group are connected to the control panel terminal strip (fig. 7 (R)). If the exciter circuit is completed (circuit breaker closed on a loaded line), alternating current will flow in this circuit.

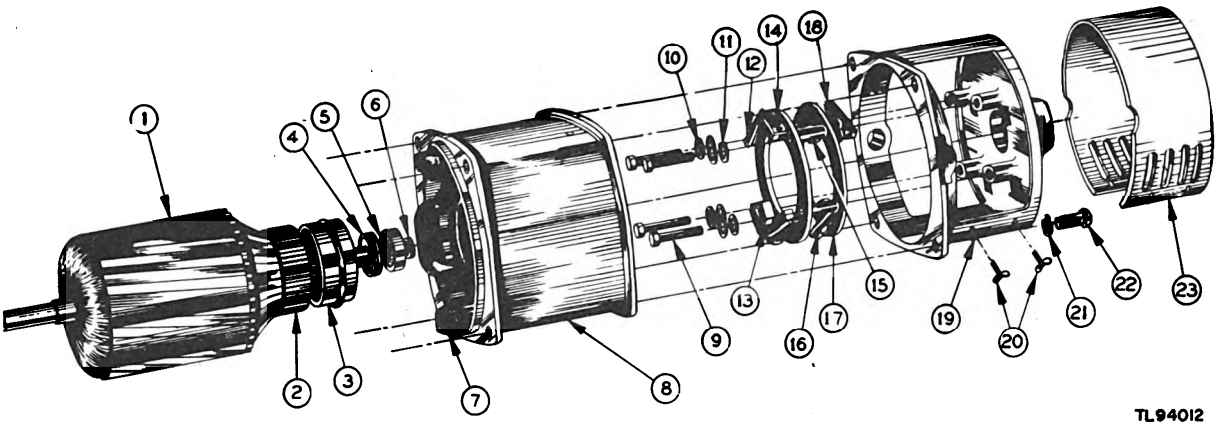


Figure 12. Alternator (60-cycle).

1. Armature.
2. Commutator.
3. Slip rings.
4. Thrust bearing.
5. Ball bearing.
6. Felt washer.
7. Field coils.
8. Stator block assembly.
9. Cap screw hex. head.
10. Lockwasher.
11. Flat washer.
12. D-c brush tension spring.
13. D-c brush-holder and brush.
14. D-c brush rig ring.
15. Brush rig spacer.
16. A-c brush tension spring.
17. A-c brush rig ring.
18. A-c brush-holder and brush.
19. End bell.
20. Wing screws.
21. Lockwasher.
22. Machine screw, roundhead.
23. Cover plate.

18. CONTROL CABINET (fig. 6).

a. Frequency Meter. The frequency meter indicates the frequency of the alternator output current. A vibrating-reed type of meter is used.

b. Voltmeter. The voltmeter is calibrated to indicate the voltage of both the 60- and 400-cycle generators. A switch is provided to enable reading either the voltage of the 60-cycle or the 400-cycle generator at will. A switch is used to transfer the voltmeter circuit to either the 400- or 60-cycle generator outputs. A double-pole, double-throw switch is used.

c. Time Meter. A time meter records the total elapsed hours the unit has operated. A synchronous motor type of meter is used.

d. Oil-pressure Gauge. The oil-pressure gauge indicates the pressure of oil being circulated by the gear-driven pump. The gauge is calibrated in pounds per square inch.

e. Water-temperature Gauge. The water-temperature gauge indicates the temperature of the cooling-system fluid in degrees Fahrenheit.

f. Duplex Receptacle (fig. 6 (G)). The duplex receptacle supplies 60-cycle current for small 60-cycle loads.

g. Circuit Breaker, 400-cycle. The circuit breakers are provided for switching the electrical load ON and OFF. It is a two-pole, single-throw switch which in the event of an overload automatically opens the single-phase line. The switch may be reset for further use by throwing the arm to the reset position. If the overload persists, the circuit breaker will again open the circuit. No fuses are used.

h. Circuit Breaker, 60-cycle. The functions of the 60-cycle circuit breaker are the same as the 400-cycle circuit breaker described above.

19. VOLTAGE CONTROL TRANSFORMERS (fig. 13).

a. General. Because of the different lengths of cables that may be used to supply the power output of the generators to the using equipment, means have been provided to maintain the correct working voltage at the far end of the line. Booster transformers connected across the outputs of the

60- and 400-cycle generators have tapped secondaries which permit voltage adjustments, as desired, to obtain the correct output value (fig. 7 (L) (P)).

b. Booster Transformer. Booster transformers are used in the output circuits of the 60- and 400-cycle alternators (fig. 13). The primary of the transformer is connected across the 125-volt generator output circuit. The 10-volt secondary is connected in series with the load and being tapped into three sections of 2-2-6 volts, the generator output may be raised or lowered through a range of about 10 volts thus supplying a current of 115 to 135 volts. The secondary taps terminate on the booster transformer panel. By making the necessary connections as outlined in paragraph 7d, the desired voltages may be supplied to the using equipment which may be located at the end of a long supply line (cable).

c. Compensating Transformer. A compensating transformer is connected in series with one side of the 400-cycle alternator output circuit. It is an autotransformer with a turn ratio of 10 to 1. A capacitor is connected across the secondary winding. The inherent inductive reactance of the alternator is substantially reduced or neutralized as a result of the capacitive reactance of the compensator unit and the inductive reactance of the alternator being in series and practically equal. This arrangement permits efficient operation of the alternator under different types of loads (power factors).

d. Voltage Regulation. The 60- and 400-cycle alternators are designed to supply current to the using equipment (within the rated capacity of 2½ kva) without any material change in output voltage under load fluctuations.

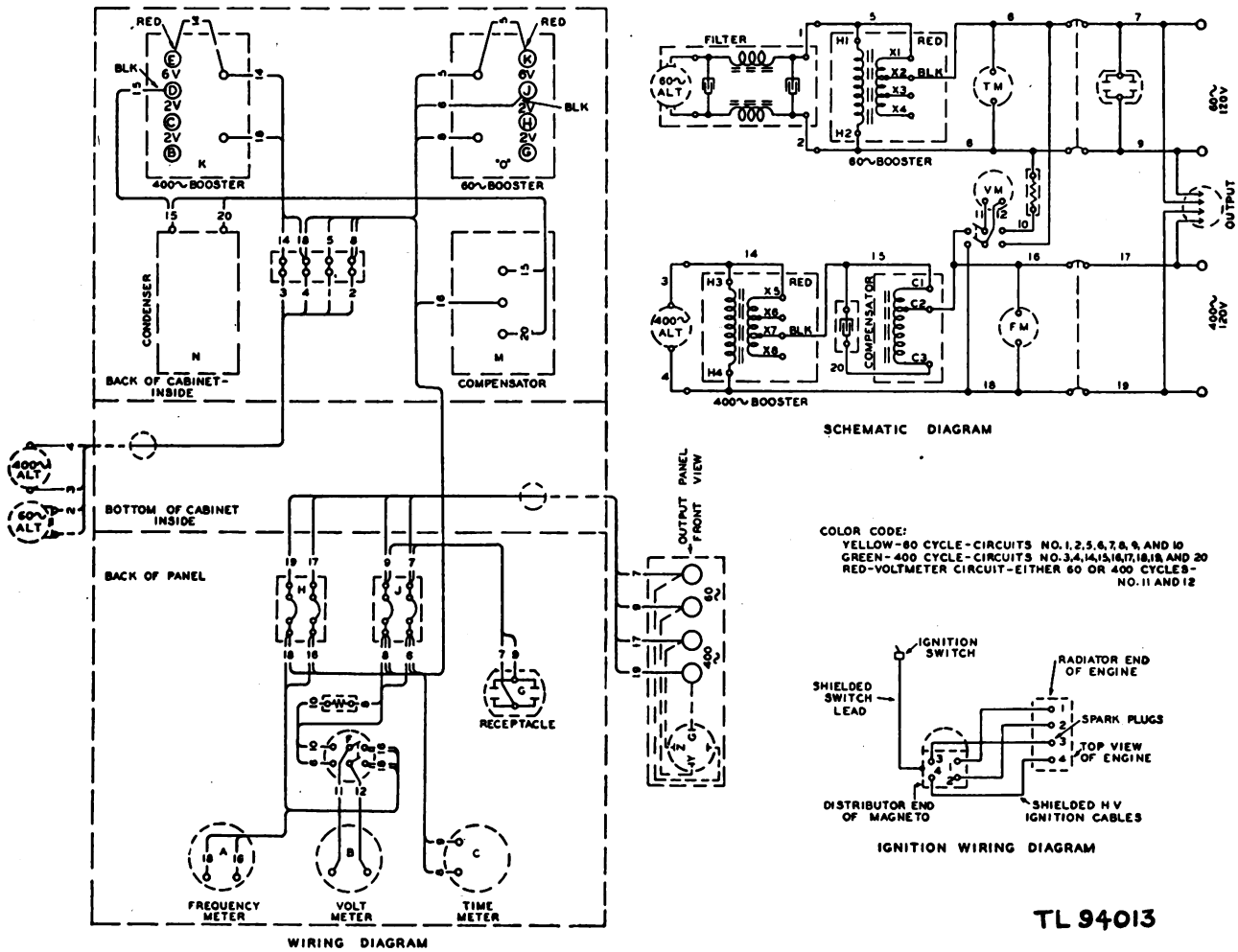


Figure 13. Schematic and wiring diagrams.

SECTION IV
MAINTENANCE AND REPAIR

NOTE: Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on W.D., A.G.O. Form No. 468 (Unsatisfactory Equipment Report). If Form No. 468 is not available, see TM 38-250. Failure or unsatisfactory performance of equipment used by Army Air Forces will be reported on Army Air Forces Form No. 54 (unsatisfactory report).

PREVENTIVE MAINTENANCE

20. LUBRICATION.

a. General. A definite schedule of maintenance operations must be applied to Power Unit PU-35/U in order to maintain a high level of operating efficiency. The necessary operations of cleaning, tightening, lubricating, and adjusting are applied because under everyday operating conditions, dust, grit, vibration, and friction affect the smooth running of the power unit. The useful life of this power unit may be prolonged or shortened by the amount and type of care it receives. Overlubrication and excessive adjusting will shorten the life of the unit; therefore routine periodic checks must be made (par. 27). Lubrication procedures are contained in the following paragraphs covering preventive maintenance on Power Unit PU-35/U. Where use of lubricants is indicated, the time intervals must be used as a guide. For a complete description of the recommended lubricants see table III below.

b. Recommended Lubricants. The following table lists the lubricating and cleaning material necessary in servicing the equipment.

TABLE III

Approved symbol	Standard nomenclature	Spec No.
OE	Oil, Engine	U. S. Army 2-104-B
WB	Grease, General Purpose, No. 2	U. S. Army 2-108 (Amend. 2)
WP	Grease, Water Pump	U. S. Army 2-109
PS	Oil, Lubricating Preservative, Special	U. S. Army 2-120
SD	Solvent, Dry Cleaning	Federal P-S-661a (Amend. 1)
DA	Oil, Fuel, Diesel	U. S. Army 2-102-C

21. BEFORE-STARTING CHECKS.

Before starting the power unit for the day's operation, complete the following routine.

a. Radiator. Check the cooling-liquid level. Keep filled to about 2 inches below the top of the filler. Never allow the level to fall below the top of the upper hose. For antifreeze information, see paragraph 5.

b. Oil Level. Check the oil level. Fill up to the FULL mark on the oil gauge. Use the proper viscosity as shown in table I, paragraph 5.

c. Fuel Supply. Check the level of the fuel by the gauge in the tank.

d. Cleanliness. Remove dirt and grease by wiping with a clean cloth. Use a dry-cleaning solvent (SD) if necessary.

e. Tightness. Check joints in the oil and fuel lines. Also check the hose in the cooling system for leaks. Look for carbon streaks at the exhaust pipe joints and on the couplings at the muffler ends. Tighten securely and check again when the unit is operating.

f. Electrical Connections. Check the control panel rear wiring lugs for corrosion and loose connections. Tug gently on the wires and lugs; inspect for frayed wire insulation. Check the tightness of the four terminal wingnuts, located on the carburetor side of the power unit (fig. 4 (S)).

22. AFTER EVERY 8 HOURS OF OPERATION.

After the power unit has been operating for 8 hours, proceed as follows:

a. Check Crankcase Oil Level. Bring the level up to the full (4/4) mark on the bayonet gauge.

b. Lubricate Water Pump. Turn the grease cup cap ¼ turn to the right (clockwise). Refill cup with water pump grease (WP) only.

c. Check Air-cleaner Oil Level. Bring oil up to the mark on the bowl. Use engine oil (OE) as currently used in the crankcase. If the temperature ranges from 0° to −40° F, use preservative oil (PS). Do not use oil below −40° F.

d. Crankcase Breather. Check the oil level in the cup. Refill if necessary. Use engine oil (OE) of the same grade used in the crankcase. For cold weather operation, see paragraph 24e.

23. AFTER EVERY 64 HOURS OF OPERATION.

a. Routine. Check all the points covered under the 8-hour check (par. 22).

b. Sediment Bowl. Close fuel valve. Remove the glass bowl by unscrewing the thumbscrew located under the bowl. Clean bowl interior and the filter. Immerse the filter in cleaning fluid and dry by blowing through it. Replace filter and bowl. Open shut-off valve and check for gas leaks at the gasket on top of the glass bowl. Replace the gasket if it leaks. Remove and clean the strainer in the fuel pump.

c. Throttle Rod Joints. Apply a few drops of oil (OE) to the joints (PS for below 0° F). Check to make sure the mechanism moves freely.

d. Crankcase Drain. Drain and refill the crankcase with oil (OE) of the proper viscosity (table I). The crankcase capacity is about 3½ quarts. Drain the crankcase only when the oil is warm. Do not flush with solvent. Use oil (OE) of a lighter grade. Be sure the crankcase drain cock is tightly closed before refilling. When the temperature is 0° F, and below, proceed as follows:

(1) Drain the crankcase of all the old oil. Close the oil drain cock.

(2) Refill the crankcase with 2½ quarts of oil (OE) SAE-10.

(3) Check the level on the oil level gauge, and mark this level with an "X".

(4) Add 1 quart of gasoline to the crankcase contents and check the level again. Add enough gasoline to the crankcase contents to bring the level up to the full mark on the gauge.

(5) During operation, maintain the "X" level by adding oil (OE) SAE-10.

(6) Just before shut down, fill up to the "X" mark with oil (OE) SAE-10 and enough gasoline to reach the full mark on the gauge. Start the engine again, and run for about 5 minutes. Shut engine down again.

24. AFTER EVERY 256 HOURS OF OPERATION.

a. Spark Plugs. Remove the spark plugs from the engine head. Scrape the hard carbon deposits from the inside of the plug, being careful not to scratch the porcelain center. Wash the plugs in dry-cleaning solvent (SD) and dry them. Adjust the gaps to 0.025 inch (about 1/32 inch). Check the porcelain for cracks and chipping. Replace if damaged. Replace damaged gaskets. Be sure to tighten the plugs securely when replacing them in the cylinder head. Check for compression leaks after the engine is started.

b. Cooling System. Open the drain on the cooling system and drain it completely. Dissolve ½ package of Compound, cleaning, Federal Stock No. 51-C-1568-500 in seven quarts of water and place this solution in the cooling system.

NOTE: The cleaning compound comes in a package containing two containers. One container is the cleaner and the other container is a neutralizer. Be sure to use the right container.

Operate the unit for about 10 minutes after it has reached operating temperature and drain the cleaning compound from the cooling system.

CAUTION: This cleaning compound is a strong acid. Avoid getting it on painted surfaces or parts of the body.

Now dissolve half of the package of neutralizer in seven quarts of water and place the solution in the cooling system. Operate the unit for about 15 minutes after reaching operating temperature and drain the system. Close the drain and flush the system with clean water. Drain the system again and refill it with clean water. Add anti-freeze if the unit is being operated in freezing temperatures. Check all hose connections as well as the water pump for leaks. See paragraph 5a(13) for cold weather care and antifreeze chart.

CAUTION: Never pour hot water into a cold engine, and never pour cold water into a hot engine. The contraction or expansion that occurs may crack the engine block.

c. Alternator Bearing. The 60-cycle alternator (power generator) bearing is lubricated in the following manner:

(1) Remove and fill the grease cup with grease (WB2).

(2) Replace the grease cup and turn ½ turn clockwise.

(3) Keep the area around the grease cup clean. Use dry-cleaning solvent (SD) if necessary.

d. Air Cleaner. Remove and wash all parts of the air cleaner with dry-cleaning solvent (SD). Dry all parts, and refill the bowl with oil (OE). If the temperature is within a range of between 0° to _40°F, use preservative oil (PS) in the bowl. Below -40° F, remove oil and operate the air cleaner dry. At this temperature, the element must be dry to admit air to the carburetor.

e. Crankcase Breather. Remove the oil cup and the element of the crankcase breather and clean with dry-cleaning solvent (SD). Dry thoroughly. Refill the cup to the marked level with oil (OE). From 0° to _40°F, use preservative oil (PS) in the cup. Below _40° F, remove the oil and operate dry.

f. Generator Slip Rings, Commutator, and Brushes. Clean the exciter commutator and alternator slip rings. Hold a piece of clean canvas against the slip rings while the generator is rotating. For safety, attach the canvas over the square end of a narrow piece of wood to serve as a handle. In normal service, the commutator and slip rings acquire a mahogany-colored (red-brown) surface. If the surface is smooth, it requires no attention. **Do not attempt to maintain a surface that appears bright and newly machined.** Check the brushes for good seating contact, free fit in holders, and uniformly good spring tension. Replace brushes that are worn to a ¾-inch length or less. New brushes must be properly fitted at the time replacement is made. Fit the brush to the commutator or slip ring in the following manner:

(1) Draw a strip of #00 sandpaper around the commutator or slip ring with the abrasive side up so that the brush rests on the sanded surface. Make sure that the sandpaper contacts a large area of the commutator or slip ring in both directions from the brush. Draw the sandpaper in the same direction the armature rotates. Raise the brush for the return stroke. Repeat until a proper seating surface is obtained. Slip rings and commutators sometimes become pitted and grooved. In such case, place a piece of #00 sandpaper (applied with wood as described in f. above) on the commutator or slip ring while the generator rotates. Avoid excessive use of sandpaper.

(2) If the commutator or slip rings are badly pitted or grooved, refinishing on a lathe may be necessary. The copper segments of the commutator wear down and may reach the level of the mica insulation which is located between the segments. If this happens, excessive sparking will occur between the brush and commutator. Undercut the mica to a level 1/32 inch below the surface of the copper segments. THIS SHOULD NOT BE ATTEMPTED BY UNAUTHORIZED PERSONNEL. After servicing the commutator, slip rings, and brushes, blow the sand, copper, and carbon dust from the alternator.

CAUTION: Never use emery paper or cloth to clean the commutator. Emery contains conductive material which, when lodged between the segments of the commutator, will cause a short circuit.

g. Carburetor. The carburetor is of the fixed-jet type and no jet adjustment is necessary. Because the speed of the unit is governor-controlled and the speed is normally maintained at 1,714 rpm, no idling speed adjustment is needed. If it has been determined that trouble with the unit is due to a faulty carburetor, replace the entire carburetor unit. Be sure the carburetor choke valve does not stick in the air horn of the carburetor when it is in the closed position.

h. Ignition System. Remove the distributor plate (fig. 8 (13)) and wipe it inside and outside. Replace the breaker contacts if badly pitted. Turn the engine with the hand crank until the contacts are wide open. The gap should be 0.020 inch. Check with a feeler gauge and adjust if necessary. If contacts are even slightly pitted, they should be resurfaced with a hone before adjusting. Check the magneto timing (fig. 14). Remove the distributor plate and proceed as follows:

(1) Crank the engine slowly by hand. Stop cranking when the breaker contacts begin to separate

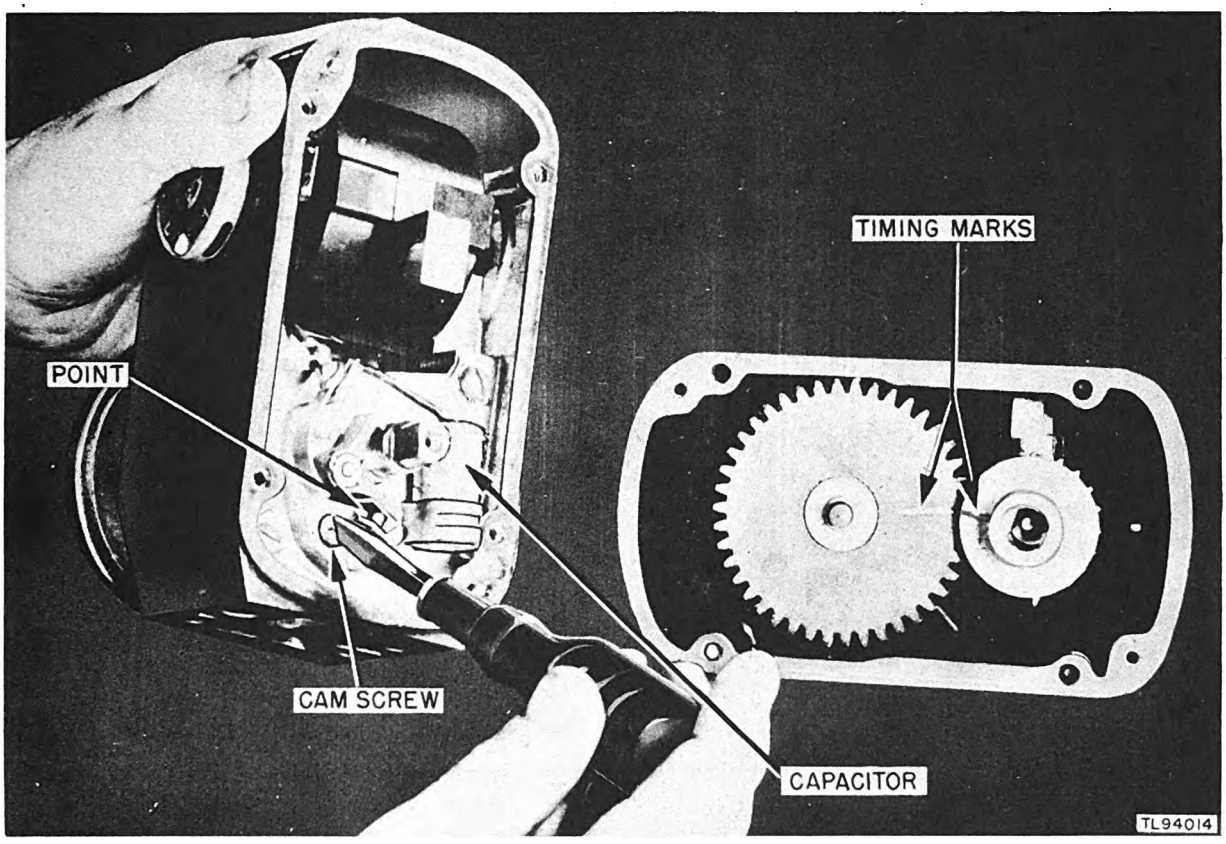


Figure 14. Magneto timing.

at firing position for No. 1 cylinder (the cylinder nearest to the radiator).

(2) Check the markings on the permanent-magnet rotor through the peep hole in the housing. Timing is correct when the mark IGN is directly under the pointer visible through the peep hole and the mag neto breaker points are just starting to break. Check this two or three times to allow for backlash.

(3) If the timing requires correction, proceed as follows: (a) Locate the timing marks as instructed in (2) above.

b. Remove the magneto from the engine and rotate the impulse coupling until the line (36 fig. 8) on the distributor gear (19 fig. 8) is visible in the observation window (20 fig. 8). This operation is best performed by turning the impulse coupling in the opposite direction of rotation to that in which it is driven by the engine.

c. Mesh the impulse coupling with the engine drive. Approximate timing is now obtained. Carefully align the magneto with the engine drive and fasten the magneto in place.

d. Remove the distributor plate which will expose the interrupter assembly.

e. To obtain exact timing, the interrupter points must be just beginning to open. It may be necessary, to get this adjustment, to loosen the drive and turn the impulse coupling in a clockwise or counter-clockwise direction.

f. Reinstall the distributor plate and insert the cable between the outlet number 1 and the spark plug of number 1 cylinder.

g. Complete the installation by connecting the remaining cables to their respective spark plugs and terminals. The firing order of the engine is 1-2-4-3. The firing sequence on the distributor follows an opposite direction of rotation to that indicated by the arrow on the magneto and must be considered when connecting the cables between the magneto and spark plugs.

25. AFTER EVERY 1024 HOURS OF OPERATION.

Check all the points covered in paragraph 24. In addition, check the following:

a. Fuel Tank. Clean inside of fuel tank and fuel lines with dry-cleaning solvent (SD). Open hole in vent cap.

b. Magneto Breaker Cam and Pivot. Wipe the magneto breaker cam with a small quantity of grease (CG). Avoid smearing the breaker points and other adjacent parts. Clean the hands before touching the distributor plate. Place 2 drops of oil (OE) (PS for below 0° F) on the breaker arm pivot. Wipe the entire magneto assembly with a clean cloth.

c. Magneto Shaft and Impulse Coupling. Disassemble the magneto. Clean the impulse coupling with dry-cleaning solvent (SD) or Diesel fuel oil (DA). Dry, and oil with PS. Reassemble.

26. AFTER EVERY 2,048 OPERATING HOURS.

Check all points covered in paragraph 25, and proceed:

a. When the magneto is disassembled for servicing or other lubrication, saturate the cam wick with engine oil (OE).

b. Repack the ball bearings with grease (WB). wipe grease from all areas adjacent to the bearings with a clean cloth and dry-cleaning solvent (SD). Do not allow the solvent to penetrate the magneto windings.

NOTE: The engine governor and the fan shaft support bearing should not be lubricated by maintenance personnel.

27. PREVENTIVE MAINTENANCE SCHEDULE.

a. Description. The preventive maintenance schedule below tabulates the information covered in paragraphs 22 to 26 inclusive, by listing the maintenance jobs and the time intervals between these jobs. Modifications may be necessary because of unusual conditions. For example, severe dust storms may clog the air cleaner so that cleaning becomes a daily necessity instead of after every 256 hours. The schedule is to be used as a guide and, if possible, it should be followed.

NOTE: Before-starting checks (par. 21) are not included in the following schedule.

b. Preventive Maintenance Schedule.

Job to be done	Every 8 hrs	Every 64 hrs	Every 256 hrs	Every 1024 hrs	Every 2048 hrs	Paragraph reference
Water pump.	x					22b
Air cleaner, oil level.	x					22c
Crankcase, oil level.	x					22a
Crankcase breather.	x					22d
Throttle rod joints.		x				23c
Crankcase (drain).		x				23d
Sediment bowl.		x				23b
Spark plugs (clean and adjust).			x			24a
Cooling system (flush).			x			24b
Alternator bearing.			x			24c
Air cleaner (wash).			x			24d
Crankcase breather (wash).			x			24e
Generator brushes and commutator.			x			24f
Carburetor.			x			24g
Ignition system.			x			24h
Ignition timing.			x			24i
Fuel tank (cleaning).				x		25a
Magneto breaker cam.				x		25b
Magneto breaker pivot.				x		25b
Magneto shaft and impulse coupling.				x		25c
Magneto cam wick.					x	26a
Magneto ball bearings.					x	26b

TROUBLE SHOOTING

28. DESCRIPTION.

Trouble shooting deals with the locating of power unit defects and the application of remedies to correct the defect. A listing of symptoms, possible causes, checks, and remedies are contained in the engine trouble and remedy chart in paragraph 29. A similar listing will be found in the generator trouble and remedy chart in paragraph 30. Paragraphs 31 through 44 inclusive describe the operations necessary to disassemble, reassemble, adjust, and repair the parts found defective.

29. ENGINE TROUBLE AND REMEDY CHART.

a. Engine Will Not Start.

Possible cause	Check	Remedy
(1) Fuel tank empty.	Check fuel supply.	Add fuel.
(2) Fuel line clogged.	Check fuel strainer.	Clean or replace strainer screen if dirty. Remove and clean fuel line.
(3) Fuel not drawn freely from tank.	Check fuel tank filler cap vent. Check fuel line for air leaks.	Clean out vent. Tighten joints in fuel line.
(4) Improper or dirty fuel.	Check condition and grade of fuel.	Use fresh fuel.
(5) Carburetor clogged.	Check carburetor jet and float valve.	Clean or replace.
(6) Excessive choking.	Check for bent choke or valve stem.	Replace defective parts.
(7) Defective fuel pump.	Try spare fuel pump.	Replace pump.
(8) Dirty or cracked spark plug.	Check for spark at spark plug.	Clean plugs or replace.
(9) Improper spark gap.	Check with gauge.	Adjust points.
(10) Improper timing.	Check timing.	Correct timing (par. 25i).
(11) Incorrect valve adjustment.	Check valve clearance.	Adjust clearance.
(12) Faulty magneto.		
(a) Breaker points pitted or worn.	Inspect points.	Clean breaker points or replace.
(b) Breaker points improperly adjusted.	Check breaker point gap.	Adjust gap to 0 018 to 0.020 in.
(c) Loose or defective cables.	Examine cables.	Replace if worn or oil soaked.
(d) Burned-out capacitor.	Test capacitor.	Replace capacitor.
(e) Dirty rotating disk, collector rings, or brushes.	Inspect parts.	Clean or replace defective parts.
(f) High-tension wire shorted.	Check for short.	Replace if broken, or insulation damaged.
(13) Water in cylinder.	Check cylinder head gasket. Check head and block for cracks. Check exhaust pipe for water.	Tighten head cap screws or replace gasket. Adjust downward pitch of exhaust pipe.
(14) Air or compression leaks.	Check for oil or air leaks.	Tighten cap screws or replace gaskets (par. 31).

b. Engine Kicks Back When Being Cranked.

Possible cause	Check	Remedy
(1) Magneto advanced too far.	Check magneto timing.	Adjust timing.
(2) Crankshaft and camshaft gears improperly meshed.	Check timing.	Adjust gear meshing (par. 33b).

c. Engine Starts But Misfires.

Possible cause	Check	Remedy
(1) Loose electrical connections.	Check connections.	Tighten connections.
(2) Defective spark plugs.	Check plugs for cracked insulation, cleanliness, and correct gap.	Clean or replace. Adjust spark gap.
(3) Defective ignition cables.	Examine cables.	Replace worn cables.
(4) Poor compression.		
(a) Leaky valves.	Check valve condition.	See paragraph 33.
(b) Improper valve clearance.	Check clearance.	
(c) Leaky spark plug gasket.	Check plug gasket.	
(d) Loose head and gasket	Check head bolts. Check for air leaks.	
(e) Valves not seating properly.	Check valves for warp and valve seat for carbon.	

Possible cause	Check	Remedy
(f) Worn or sticking piston rings.	Check compression.	
(g) Scored cylinders, worn pistons.	Check engine compression.	
(h) Broken valve springs, bent stems.	Inspect valve springs and stems.	
(5) Mixture too lean.	Check compensating jet.	Set jet in center of venturi tube.
(6) Mixture too rich.	Check choker rod position.	Push choke in.

d. Engine Backfires Through Carburetor.

Possible cause	Check	Remedy
(1) Fuel contains water or dirt.	Check fuel and strainer.	Use fresh fuel. Replace strainer screen.
(2) Air leak between carburetor and cylinder head.	Check intake manifold gasket.	Replace worn gasket.
(3) Improper mixture.	Check cleanliness and position of compensating jet in carburetor.	Clean out jet. Correct position. (Should be in center of venturi tube.)
(4) Leaky or improperly adjusted valves.	See subparagraph c(5)(a) above.	
(5) Improper timing.	See subparagraph a(10) above.	
(6) Float level too low.	Check position of float level.	Adjust position.
(7) Weak or broken valve, springs.	Remove cylinder head cover and inspect.	Replace faulty springs.

e. Engine Knocks.

Possible cause	Check	Remedy
(1) Improper fuel.	Check grade of fuel.	Replace with correct fuel.
(2) Carbon in cylinders.	Remove plugs and check for carbon.	Clean out carbon.
(3) Loose piston pins or bushings.	Remove and examine pistons.	Replace defective parts.
(4) Lack of oil.	Check oil level.	Add oil.
(5) Magneto timing advanced too far.	Check magneto timing to engine.	Correct timing.
(6) Loose main bearing.	Check for oil leaks.	Fit new bearing.
(7) Worn rod bearing.	Short plug to see if noise disappears.	Replace bearing.
(8) Loose generator, bearing.	Check alignment and fit in housing.	Replace defective bearing. Correct alignment.
(9) Broken piston ring.	Check compression, remove piston.	Replace broken ring.
(10) Engine overheated.	See subparagraph g below.	

f. Engine Lacks Power.

Possible cause	Check	Remedy
(1) Cold motor.	Check engine temperature with thermometer.	Remove load and allow engine to warm up.
(2) Mixture to rich.	See subparagraph c(7) above.	
(3) Mixture too lean.	See subparagraph c(6) above.	
(4) Improper fuel.	See subparagraph e(1) above.	
(5) Poor compression.	See subparagraph c(5) above.	
(6) Excessive carbon.	See subparagraph e(2) above.	
(7) Obstruction in exhaust or muffler.	See subparagraph g(10) below.	
(8) Lack of lubrication.	Check oil supply.	Add oil, repair oil pumps.
(9) Improper timing.	See paragraph 25i.	Replace.
(10) Defective spark plugs.	See subparagraph c(2) above.	
(11) Improper valve adjustment.	See subparagraph a(11) above.	
(12) Valve tappets sticking.	Turn engine with crank to check operation.	Clean carbon from tappets or replace springs, if weak.
(13) Tight bearings.	Turn engine over with crank. Observe sticking.	Replace bearing.
(14) Improper governor adjustment.	Check engine rpm with tachometer.	Adjust governor as in paragraph 12.

g. Engine Overheats.

Possible cause	Check	Remedy
(1) Low water in radiator.	Check radiator.	Add water.
(2) Radiator clogged.	Check amount of scale in radiator.	Flush out radiator.
(3) Lack of lubrication.		
(a) Insufficient oil.	Check oil level.	Add oil.
(b) Oil pressure low.	Check through observation hole.	Check condition of oil pump.
(c) Oil too light.	Check grade of oil.	Drain and refill with oil of proper grade.
(4) Air cleaner clogged.	Inspect air cleaner.	Clean out element.
(5) Excessive carbon.	See subparagraph e(2) above.	
(6) Improper timing.	See subparagraph a(10) above.	
(7) Cooling air passages obstructed.	Check radiator grille, and generator vents.	Remove dirt or obstruction.
(8) Lack of ventilation in shelter.	Check ventilation openings.	Open window, provide more air vents.
(9) Overload on generator.	Check load.	Reduce load.
(10) Exhaust obstructed.	Check exhaust pipe and muffler.	Remove obstructions. Replace muffler if necessary.

h. Excessive Smoking at Exhaust.

Possible cause	Check	Remedy
(1) Improper fuel.	Check grade of fuel.	Replace with correct fuel.
(2) Mixture too rich.	Check choker.	Adjust choker.
(3) Pistons pumping oil.	Check compression.	Replace rings.
(a) Loose or worn rings.	Examine rings.	
(b) Scored cylinder walls.	Remove pistons and inspect cylinders.	Regrind cylinders.
(c) Oil too light.	Check grade of oil.	Replace with heavier oil.
(d) Oil level too high.	Check oil level. (Should not be above top mark on gauge.)	Drain excess oil.
(4) Worn rod bearings.	See subparagraph e(7) above.	
(5) Worn cylinders, pistons.	Check engine compression.	Replace worn parts.

i. Engine Operates with Varying Speed.

Possible cause	Check	Remedy
(1) Clogged fuel line, dirty fuel.	See subparagraph a(2) above.	
(2) Governor stuck.	Check governor operation.	Correct alignment. Replace faulty parts.
(3) Faulty choke operation.	Check choker button.	Replace defective or bent rod.
(4) Motor cold.	Check engine temperature.	Remove load, allow engine to warm up.

30. GENERATOR TROUBLE AND REMEDY CHART.

a. Failure to Generate.

Possible cause	Check	Remedy
(1) Short or open in wiring system.	Check leads in generator.	Solder connections. Replace defective wires.
(2) Ground or open in armature or coils.	Test armature and coils.	Replace defective parts.
(3) Residual magnetism weak.	Pass current from battery through field coils.	Connect positive battery pole to positive lead of field.
(4) Brushes not contacting.	Check to see if stuck or unevenly worn.	Adjust or replace brushes.
(5) Shorted armature.	Check commutator bars for dirt and material in slots.	Clean bars and slots.
(6) Reversed field coils.	Check to see that coils are alternate north and south.	Change position of coils if necessary.
(7) Capacitor shorted.	Disconnect capacitor and see if current flows.	Replace capacitor.
(8) Shorted commutator bars.	Check for rim fire indicating high mica. Inspect slots for dirt.	Undercut mica. Clean out slots.

b. Sparking at Brushes.

Possible cause	Check	Remedy
(1) Dirty brushes or commutator.	Check condition of each.	Clean brushes and commutator with dry-cleaning solvent.
(2) Improper brush contact.	Check to see if brushes are stuck. Check spring tension.	Correct spring tension. Replace brush if necessary.
(3) Loose armature lead.	Check leads.	Connect lead properly.
(4) Commutator rough.	Inspect for uneven places.	Dress with #00 sandpaper.
(5) Load too heavy.	Check load.	Reduce load.
(6) Grounded, open or shorted field coils.	Test.	Replace defective coils.
(7) High mica between commutator bars.	Check for rim fire.	Undercut mica.

c. Voltage Too High or Too Low.

Possible cause	Check	Remedy
(1) Engine speed incorrect.	Check engine rpm with tachometer.	Adjust governor. Proper engine speed (1,714 rpm).
(2) Load Shorted.	Check external wiring.	Correct deficiencies.

d. Armature Too Hot.

Possible cause	Check	Remedy
(1) Armature coil shorted.	Check for breaks.	Replace coil.
(2) Poor ventilation.	Check air space around generator.	Provide 2-foot clearance all around unit.
(3) Excessive load.	Check load.	Reduce load.
(4) Foreign matter in air passages.	Check.	Remove obstructions.

REPAIR

31. REMOVING AND REPLACING CYLINDER HEAD.

Remove the cylinder head for removing carbon, grinding valves, or other operations, as follows:

a. Drain the cooling system.

b. Remove the oil filler pipe (fig. 3 (H)).

c. Remove the spark plug cables and spark plugs.

d. Remove the water outlet pipe after disconnecting it from the hose.

e. Using a 9/16-inch hexagonal socket wrench, remove the cap screws and nuts that fasten the cylinder head to the cylinder block.

f. Lift the head from the block, being careful not to damage the gasket. If the cylinder head does not come away freely, do not attempt to pry it off. Replace a few of the cap screws loosely and, with the ignition off, crank the engine. The force of compression should loosen the head so that it can be lifted off.

g. When replacing the head, coat both sides of the gasket with cup grease and place it on the cylinder head. Use a new gasket if the old one is damaged or otherwise unfit for use.

h. Line up the holes in the gasket with those in the top of the cylinder block, and lower the cylinder head into place.

i. Replace the cylinder head cap screws, and screw them down as far as possible by hand.

j Using a 9/16-inch hexagonal socket and torque wrench, tighten the cap screws. Do not pull any one screw down all the way, but tighten first one screw and then another, a little at a time. It is best to tighten a screw on one side of the head, and then the opposite screw on the other side of the head. Take up on them gradually until the torque wrench shows a tension of 42 foot-pounds or 504 inch-pounds. If no torque wrench is available, follow the same procedure until all of the screws are moderately tight. Do not use too much force on the wrench as this might result in stripping the threads in the cylinder block or twisting off the head of the screw.

k. Run the engine for a few minutes after replacing the head, and then take up any slack by

taking another turn or two on each of the cap screws and nuts.

32. GRINDING VALVES.

Remove the valves as follows:

a. Remove the cylinder head as described in paragraph 31, and proceed as follows:

b. Remove the air filter assembly (fig. 4(F)) from the engine.

c. Disconnect the gasoline line from the sediment bowl.

d. Disconnect the throttle link from the governor arm.

e. Remove the choke cable from the carburetor choke fly shaft.

f. Remove the carburetor from the engine.

g. Disconnect the breather line from the valve cover plate to the inlet manifold pipe.

h. Remove the valve cover plate. Valve springs are now exposed.

i. Using the valve spring lifter, lift the springs and remove the keys from the valve stems.

j. Lift the valves up and out of the guides.

k. Clean the inside of the cylinder head; the top of the piston and around the valve seats with a carbon scraping tool and wire brush. Have each piston at the top of its stroke with both valves closed when doing this. Blow away all loose foreign matter.

l. Select a valve from either end of the cylinder block. It is best to proceed from one end to the other instead of selecting valves at random.

m. Place a light, even coating of fine valve-grinding compound on the face of the valve.

n. Slip a light coil spring over the valve stem This spring must be heavy enough and long enough to push the valve up from its seat when pressure on the valve head is released.

o. Place the valve in position in its seat. The light spring on the valve stem should be below the head of the valve and resting on the valve stem guide boss. Be sure that the valve is in its original seat.

p. Using a valve grinding tool or screwdriver, rotate the valve to the right and left while pressing it lightly on its seat. Permit lifting of the valve by the spring every few rotations, and half-turn the valve while it is clear of the seat. Bear down again and continue the semi-rotating action. Keep this up until a satisfactory seat has been ground. It may be necessary to renew the grinding compound from time to time.

q The valve may be assumed to be properly ground when both the valve face and valve seat present a smooth, silvery color. A bright polished surface is not desirable.

r. Remove the valve, remove the spring from its stem, and wipe off both the valve face and valve seat with a cloth dampened with Diesel oil or solvent (SD).

s. Check the seat by placing pencil marks at close intervals around the face of the valve and then rotating it a half turn on its seat. If the pencil marks are evenly smudged all around the valve, it may be assumed to be properly ground.

t. Follow the same procedure, (subpars. b to h above) until all of the valves have been properly ground.

u. Be sure to remove any valve-grinding compound that may have found its way into the valve pockets below the valve seats or other parts of the engine.

v. Reassemble the valves in their seats by reversing the operations for removal. Be sure that each valve is returned to the seat from which it was originally removed and to which it has been ground.

w. Replace the cylinder head.

33. ADJUSTING VALVE TAPPET CLEARANCE AND TIMING (fig. 15).

a. The tappets are of the barrel type. Three wrenches are needed for adjustment. If a tappet face scores from too close adjustment or if breakage results, replace it. The adjusting screw clearance for both intake and exhaust valves on this engine is 0.006 inch with the engine hot. The tappet screws should not be set closer than 0.006 inch because, when the engine becomes heated and normal expansion takes place, the valves will hold open. Tappet and cam faces will then become badly scored or cut; the head of the valve becomes warped and burns. If the tappet face is badly scored, replace it. If not too badly damaged, marks

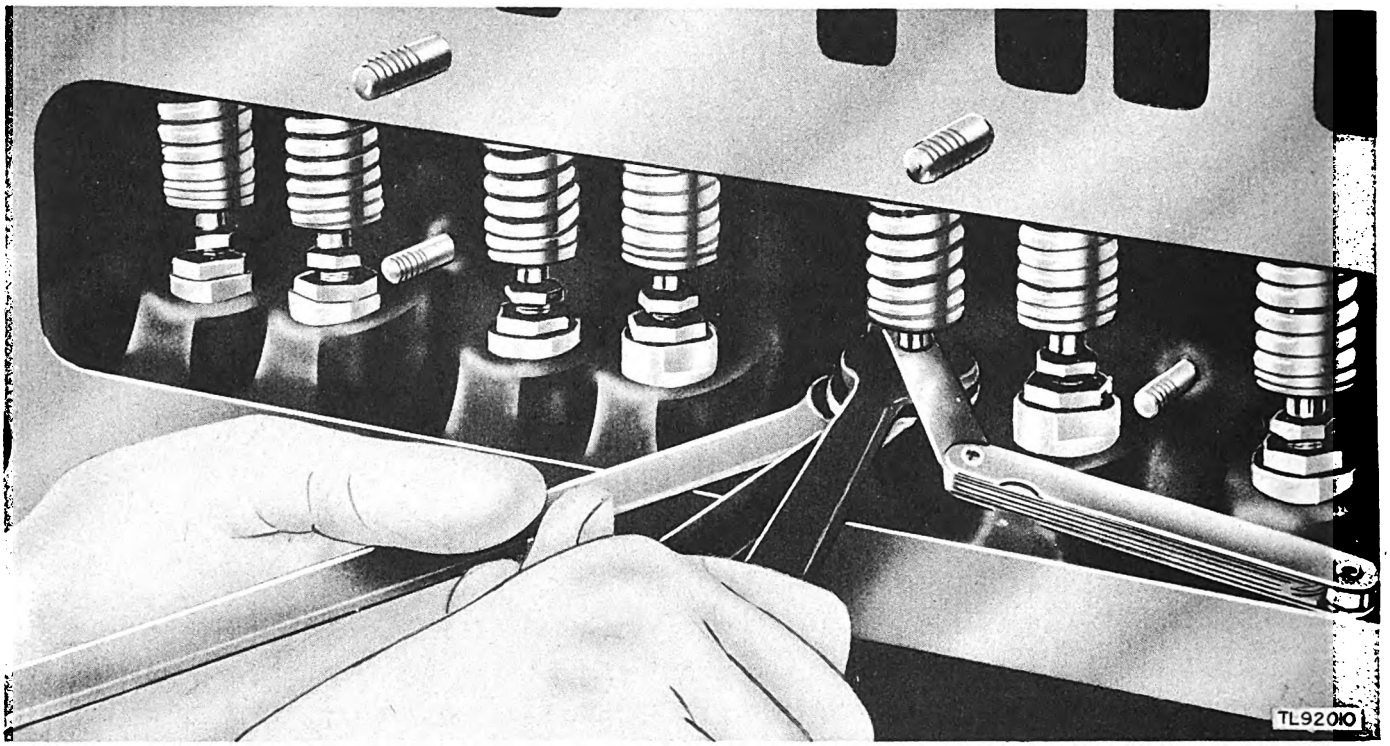


Figure 15. Adjusting valve tappets. **TL-92010**

on the cams of the camshaft can often be smoothed out by honing them with an oilstone.

b. Proper setting of the valves with relation to the crankshaft (valve timing) is important. Do not alter the original factory setting. The practical method of setting the camshaft is to use the markings located on the rim of the generator rotor. These stamped markings can be seen through the flywheel housing inspection hole as the crankshaft is rotated. When they appear under the pointer, IGN indicates ignition, and D.C. indicates top dead center of No. 1 and No. 4 pistons which are about to descend on the intake stroke. The timing of the top center of the crankshaft used in this engine is: exhaust valve closing on dead center.

34. FITTING NEW PISTONS, PISTON RINGS, AND PINS.

a. Pistons. Pistons may be fitted in the following manner:

(1) Procure two steel feeler strips 10 inches long, ½ inch wide and 0.002 inch thick.

(2) Procure a fish scale of about 25 pounds capacity.

(3) Attach the spring end of the scale to one end of each of the feeler strips alternately.

(4) Place both feeler strips along the length of the piston, diametrically opposite to each other.

(5) Insert the whole assembly into the cylinder so that the feeler strips are between the piston and the cylinder wall.

(6) Push the piston halfway down the length of the bore.

(7) Pull up on the fish scale, and as the piston begins to rise, note the reading on the scale face. It should normally be about 12 pounds. If the reading is between 10 and 15 pounds, the piston is of the correct size.

(8) Repeat the above procedure with the feelers in different positions, always diametrically opposite to each other. Any variation in roundness of the cylinder will become apparent with a change in the fish scale readings.

b. Piston Rings. Each piston uses three rings; all are located above the piston pin. The two top rings are plain compression types 1/8 inch wide, and the lower ring is an oil control ring 3/16 inch wide.

35. BEARINGS.

The bearings are adjusted in the usual manner by removing just enough shims to take up excessive clearance due to wear, and at the same time provide enough clearance to insure free running bearings. The bearings in these engines are extra large and it is important that they do not bind or drag in the least. Binding or drag would result in a sluggish engine and possible damage to the bearings. Take out enough shims from each bearing so that a slight drag is felt when an effort is made to turn the crankshaft. Then add sufficient shimming to each side (par. 45), to eliminate drag.

36. TIMING GEARS.

With the gear cover removed, the camshaft and gear can be pulled forward out of the case. This must be done while the valves are removed so the tappets can be lifted up out of the way of the camshaft bearings. Camshaft removal is best accomplished when the engine is placed bottom up. The idler gear and shaft are easily removed by pulling them forward out of the case. Each of these gears is pressed on from the rear against a shoulder at the front of its respective shaft and is keyed on to the shaft with a Woodruff key. There is a bronze thrust washer between each of these gears and the case. The crankshaft gear is necessarily fitted tightly on the shaft. If replacement becomes necessary, heat the new gear and coat the shaft with white lead to make assembling easier.

37. CAMSHAFT AND IDLER SHAFT.

The camshaft is supported on four bearings in the crankcase. These bearings are of the removable babbitt-lined type, lubricated through suitable oil holes which admit oil from the valve spring compartment. The spiral gear is in the center of the camshaft and it meshes with the oil pump shaft gear which drives the oil pump. A thrust washer is placed between the cam gear and the crankcase. The idler gear is supported on a shaft pressed into the gear. This shaft is supported by and turns in a babbitt-lined bushing pressed into the crankcase. A thrust washer is placed between the idler gear and the case.

38. CONNECTING RODS AND PISTONS (fig. 16).

The babbitt bearings are poured directly into the steel of the rod and cap of the connecting rod assembly. These two parts are held together by two connecting rod bolts of conventional design. The piston pin is clamped in the top of the rod the construction of which prevents the piston pin from working loose and scoring the cylinder walls. The cast iron pistons (commonly used) have bronze bushings in the pin bosses. Each piston is equipped with two compression rings and one oil control ring. The aluminum alloy pistons sometimes used do not have bushings in the pin bosses because the metal of the piston forms a suitable bearing for the pin.

39. OIL PUMP REMOVAL.

The oil pump is located within the engine base. Remove the base to work on the pump. For convenience, place the engine upside down.

a. Remove the cap screws that hold the engine base to the flywheel bell housing. Use a 9/16-inch wrench, or a crescent wrench. Using a crescent wrench or a 1/2-inch socket wrench (the latter will be most convenient), remove the cap screws that fasten the base to the cylinder block.

b. Grasp the oil drain outlet and pull the base loose from the cylinder block.

c. With the base removed, disconnect the oil pump discharge pipe from the pump. Remove the cap screws that hold the pump to the bottom of the cylinder block and lift out the pump.

40. WATER PUMP REMOVAL.

Before attempting to disassemble the water pump from the engine, make sure that all piping to other parts of the engine have been disconnected. Then proceed as follows:

a. Remove the cap screws that hold the water discharge pipe flange to the side of the cylinder block.

b. Remove the crank support.

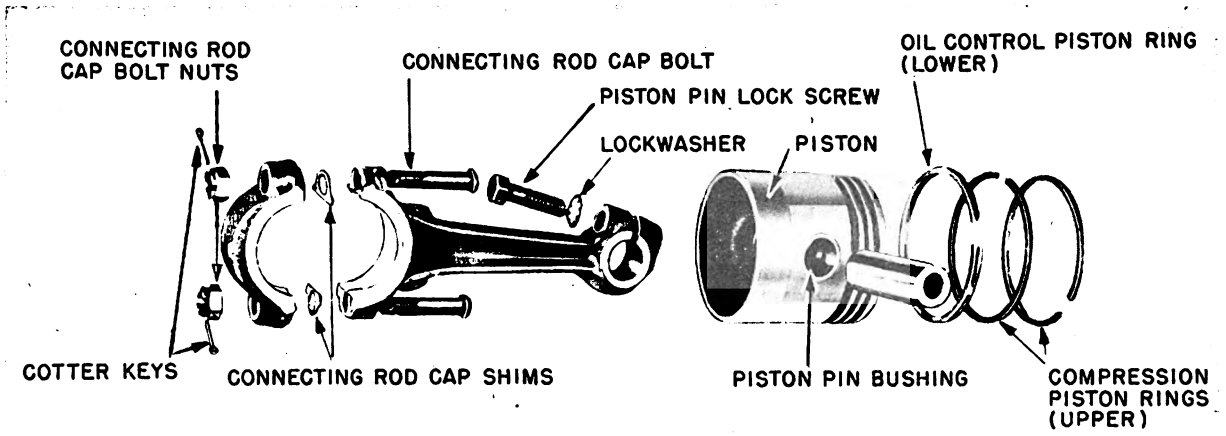


Figure 16. Connecting rod and piston assembly.

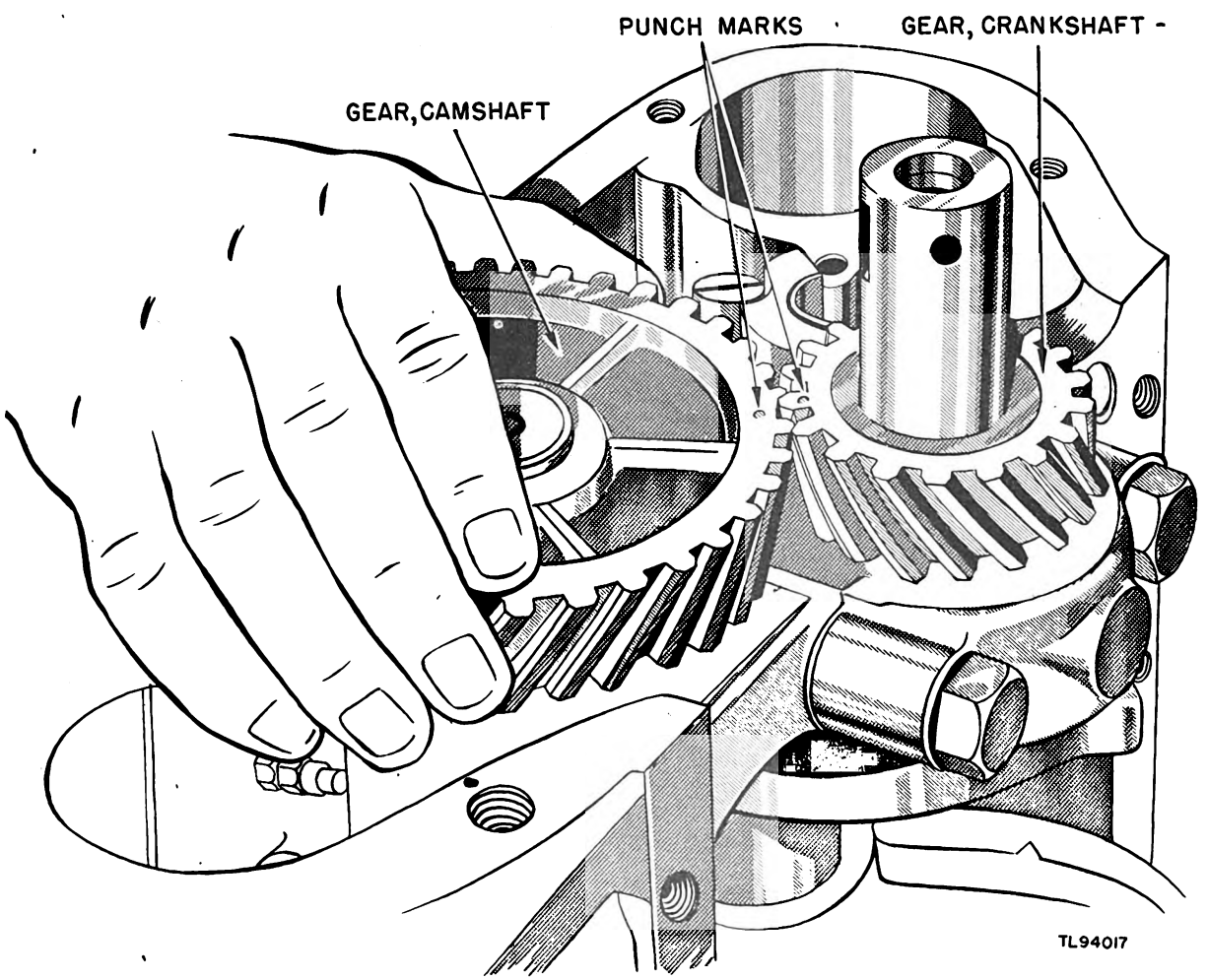


Figure 17. Aligning timing gears.

c. Remove the blower wheel.

d. Remove the blower shroud housing.

e. Loosen hose clamps screws (screwdriver) on the water pump discharge hose.

f. Remove the two water pump mounting stud nuts and lockwashers (use a 1/16-inch open end wrench). To prevent breaking the water pump discharge bracket, the bottom should be removed first and replaced last.

g. Lift the water pump and the attached water pump inlet elbow, drain cock, and drain tube from the engine.

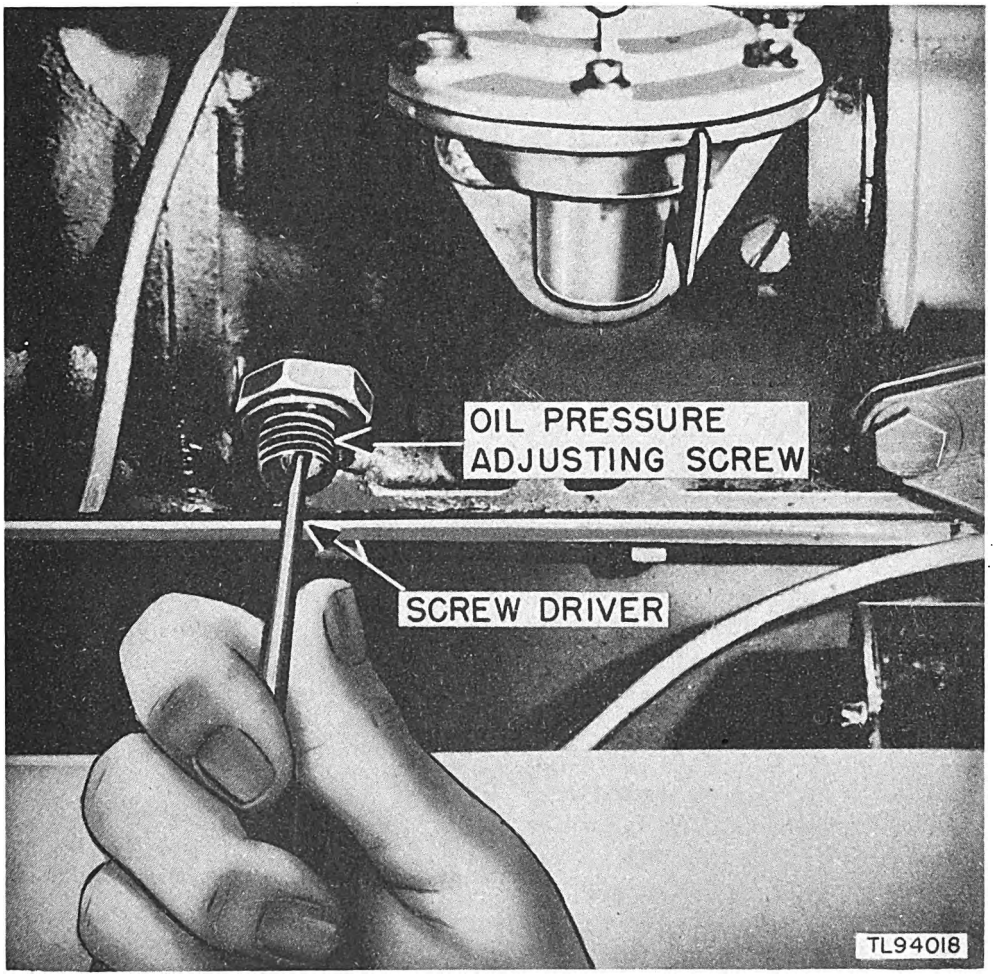


Figure 18. Oil pressure adjustment.

41. TIMING OF CRANKSHAFT AND CAMSHAFT GEARS (fig. 17).

The camshaft gear is center-punched at the bottom of two teeth. The crankshaft gear is center-punched at the bottom of one tooth. Before removing the gears, align the crankshaft gear with the camshaft gear as shown in figure 17. After repairs are made, realign the crankshaft and the camshaft with the punch marks at the identical position.

42. GENERAL CARE OF 60-CYCLE ALTERNATOR (fig. 12).

a. Armature Removal. (1) Remove louvre cover from the exciter head using a screwdriver and a ½-inch end wrench.

(2) Raise the commutator and slip ring brushes.

(3) Remove the four ⅜-inch cap screws that hold the exciter head to the generator body. Use a 9/16-inch socket wrench.

(4) Tap the head on the edge of the housing to disengage the seat from the stator body.

(5) Remove the head, then grasp the exciter armature and lift slightly and pull out.

b. Removal and Replacement of Brush Holders.

(1) Remove the exciter head as described above.

(2) Remove the exciter-coil lead from the brush holder.

(3) Remove the four ⅜-inch cap screws that hold the exciter-field pole pieces. Use a 9/16-inch wrench. Use care in handling the coils; note the exact position and relationship of coils and leads.

(4) Remove the capacitor lead.

(5) Loosen the brush-holder mounting screws on both sides of the head. (When replacing the outer slip-ring brush holder, place it at the bottom of the exciter head, the commutator brush sockets with brushes should be in a position halfway between the adjacent exciter field poles.)

(6) Tighten setscrews on sides of head.

(7) Mount the capacitor on the exciter head just to the right of the hole out of which comes the exciter leads. Connect the capacitor lead to the commutator brush nearest this location.

(8) Connect the short lead of the exciter coil to the lower left-hand commutator brush (when facing the large opening of the housing).

(9) Set the coils so their connections face the operator. With the first coil connected to the brush-holder set at the bottom of the head, progress counterclockwise around the head.

(10) Wrap the pole pieces with insulation board. Insulate the coils from the flux ring and insulate between the pole-piece ear and coil.

(11) Bring the long lead of the last coil over the last coil and out through the hole in the head.

c. Replacing Generator Bearings. (1) Follow steps outlined in subparagraph **a** above for the removal of the exciter head.

(2) Remove the bearing from armature shaft using a bearing puller.

(3) Replace the bearing so that its sealed side is next to the slip ring.

(4) Use a soft hammer or brass punch, and tap the bearing onto the armature shaft.

(5) Pack the bearing with grease (WB). Replace the head.

d. Slip Rings. The rings should be kept smooth and true. Sand or turn them if necessary to restore a smooth and true surface. Occasionally ring trouble will arise from a ring which is not of uniform hardness, and as a result wears unevenly. Replace such a ring. Slip ring trouble is seldom due to high-current density since the maximum current density, 40 amperes per square inch or less, is well below the maximum density specified for the brushes. The brushes used should be light in weight, with a fairly high-current capacity, and should contain a slight amount of abrasive material. A suitable brush is furnished with the alternator, and for best results, this grade should always be used.

e. Brushes. The brushes should make good contact with the slip rings, along the whole face of the brush. If necessary, grind in the new brushes with fine sandpaper. Maintain a free sliding fit between the brushes and the brush holder by cleaning both thoroughly when necessary.

f. Flashing Exciter Field. Restore the exciter field residual magnetism by passing a 12-volt direct current through the field winding. A 12-volt battery may be used for this purpose.

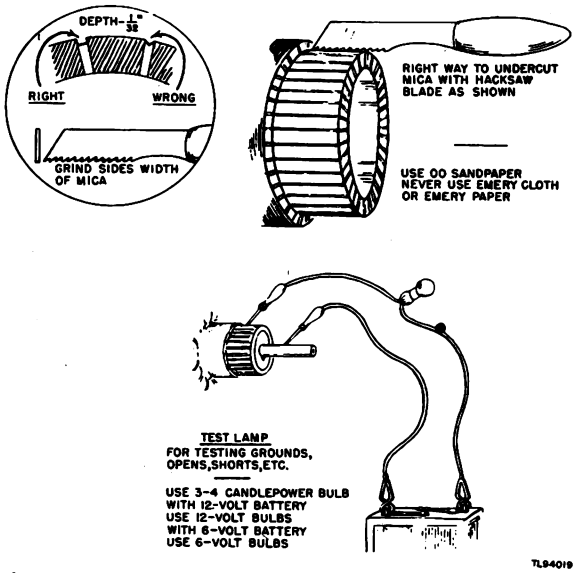


Figure 19. Undercutting and testing commutator.

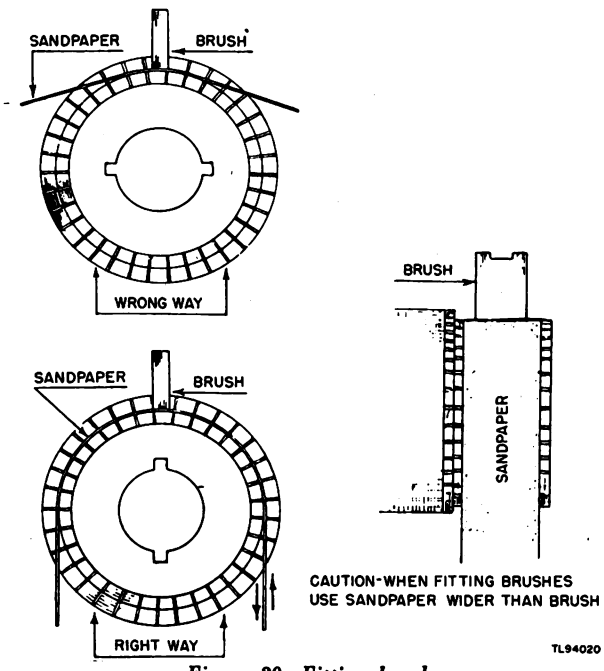


Figure 20. Fitting brushes.

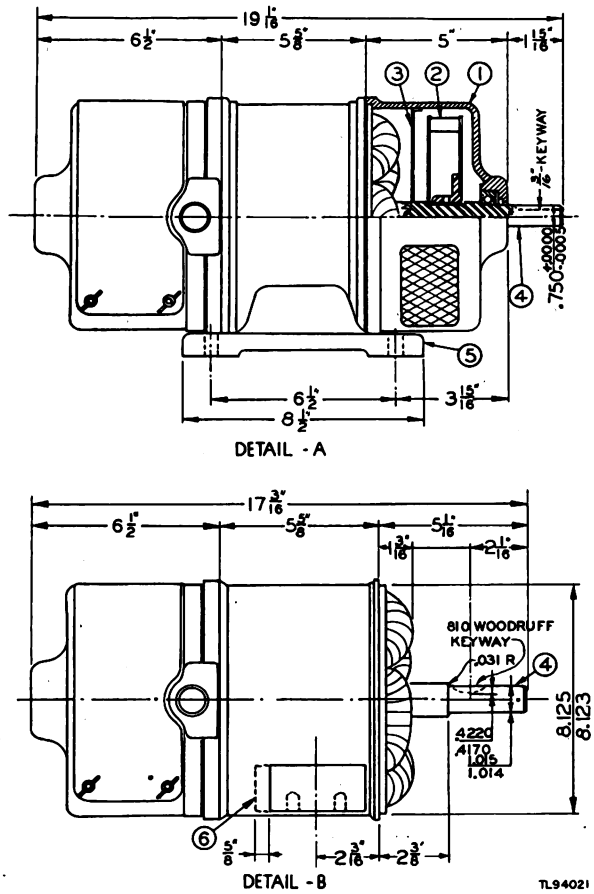


Figure 21. Replacement of 60-cycle alternator with generator from Power Unit PE-75.

43. GENERAL CARE OF 400-CYCLE ALTERNATOR (fig. 11).

a. Removal. The 400-cycle generator does not use an exciter, collector rings, or bearings. It will require little attention other than keeping it clean. The rotor of the alternator is attached to the driving hub of the engine and is removed by loosening the bolts from the plate. The stator windings may be pulled out of the generator housing after the rotor has been removed. The generator housing is bolted to the crankcase of the engine by studs and through bolts.

b. Reassembling. To reassemble the 400-cycle generator (fig. 11), the engine should be placed in a vertical position with the drive end of the crankshaft up. Then proceed as follows:

(1) Bolt the generator housing (fig. 11 (1)) to the crankcase of the engine.

(2) Position the stator windings (fig. 11 (24)) of the alternator housing so that the leads face out and are in line with the engine manifold.

(3) Replace the rotor (fig. 11 (16)). It is highly magnetized. Use care when placing it within the stator.

(4) Align the dowel holes in the driving hub with the proper holes in the rotor hub (fig. 11 (3)), and carefully lower the rotor into the stator.

(5) Tighten the setscrews which hold the rotor firmly to the engine driving hub.

(6) Bolt the flexible disks (fig. 11 (7)) on the rotor hub (fig. 11 (3)).

c. Mounting the 60-cycle Generator. (1) With the driving hub (fig. 11 (11)) of the 60-cycle armature pressed onto the shaft, bolt it to the flexible drive plates (fig. 11 (7)).

(2) Attach the 400-cycle end bell (fig. 11 (28)) to the alternator housing bringing the leads through the hole provided in the cover.

(3) Place the 60-cycle housing assembly over the rotor, bolting it securely to the 400-cycle end bell cover.

(4) Install the collector rings and exciter brushes. Complete the assembly by placing the exciter cover over the brushes.

44. REPLACEMENT OF 60-CYCLE ALTERNATOR WITH GENERATOR FROM POWER UNIT PE-75 (fig. 21).

If a replacement 60-cycle alternator is not available for Power Unit PU-35/U, it will be possible to use a modified generator from Power Unit PE-75. Figure 21 shows the dimensional changes necessary for this modification. Proceed as follows:

a. Remove the exciter housing cover on the PE-75 generator.

b. Remove the exciter and collector ring brushes.

c. Remove the end bell (fig. 21 (1)) with bearing.

d. Remove the armature shaft assembly (fig. 21 (4)).

e. Remove the fan assembly (fig. 21 (2)).

f. Cut and turn the shaft as shown in detail B.

g. Remove the mounting plates (fig. 21 (5)).

h. Face mounting surface (fig. 21 (6)). Making the above mechanical changes will permit the generator assembly to fit on the frame of Power Unit PU-35/U. Reverse the field leads to complete the electrical changes.

SECTION V
SUPPLEMENTARY DATA

45. CLEARANCES AND TOLERANCES.

The following tables gives, among other technical information, the clearances and tolerances used on Power Unit PU-35/U engine parts.

	INCHES	
	Min	Max
Valve tappet clearance, intake (hot)	0.006	
Valve tappet clearance, exhaust (hot)	0.008	
Valve seat width, intake	0.125	
Valve seat width, exhaust	0.125	
Valve stem clearance in guide, fire and marine, exhaust	0.0025	0.003
Push rod or tappet clearance in guide	0.00075	0.001
Idler bearing clearance	0.001	0.0015
Cam bearing clearance	0.0015	0.0025
Crankshaft main bearing clearance	0.002	0.0025
Crankshaft end thrust	0.002	0.004
Bellhousing on chamfer	0.012	0.025
Connecting rod bearing	0.001	0.0015
Connecting rod bearing end clearance	0.005	0.010
Accessory drive bearing clearance	0.0015	0.002
Accessory drive bearing end clearance	0.002	0.003
Gear cover clearance around crankshaft	0.008	0.015
Oil pan clearance around crankshaft	0.008	0.015
Accessory drive gear backlash	0.002	0.004
Crankshaft gear backlash	0.000	0.002
Idler gear backlash	0.002	0.004

	INCHES	
	Min	Max
Oil pump gear backlash	0.008	0.010
Piston clearance, cast iron	0.002	0.0025
Piston ring clearance in groove (cast iron)	0.0015	0.0025
Piston ring gap	0.015	0.020
Piston ring clearance (cast iron piston)	0.005	
Piston pin clearance (cast iron piston)	0.0005	

46. WRENCH TENSION

	Inch Pounds
Cylinder head	504
Connecting rod	420
Main bearings	924

47. SERVICE RECORD AND LOG SHEET.

To avoid the possibility of missing the service date, a record should be kept of the work done and when it was done. The following form is given as a guide:

Date	Hours run	Hours run to date	Service performed	By whom	Remarks

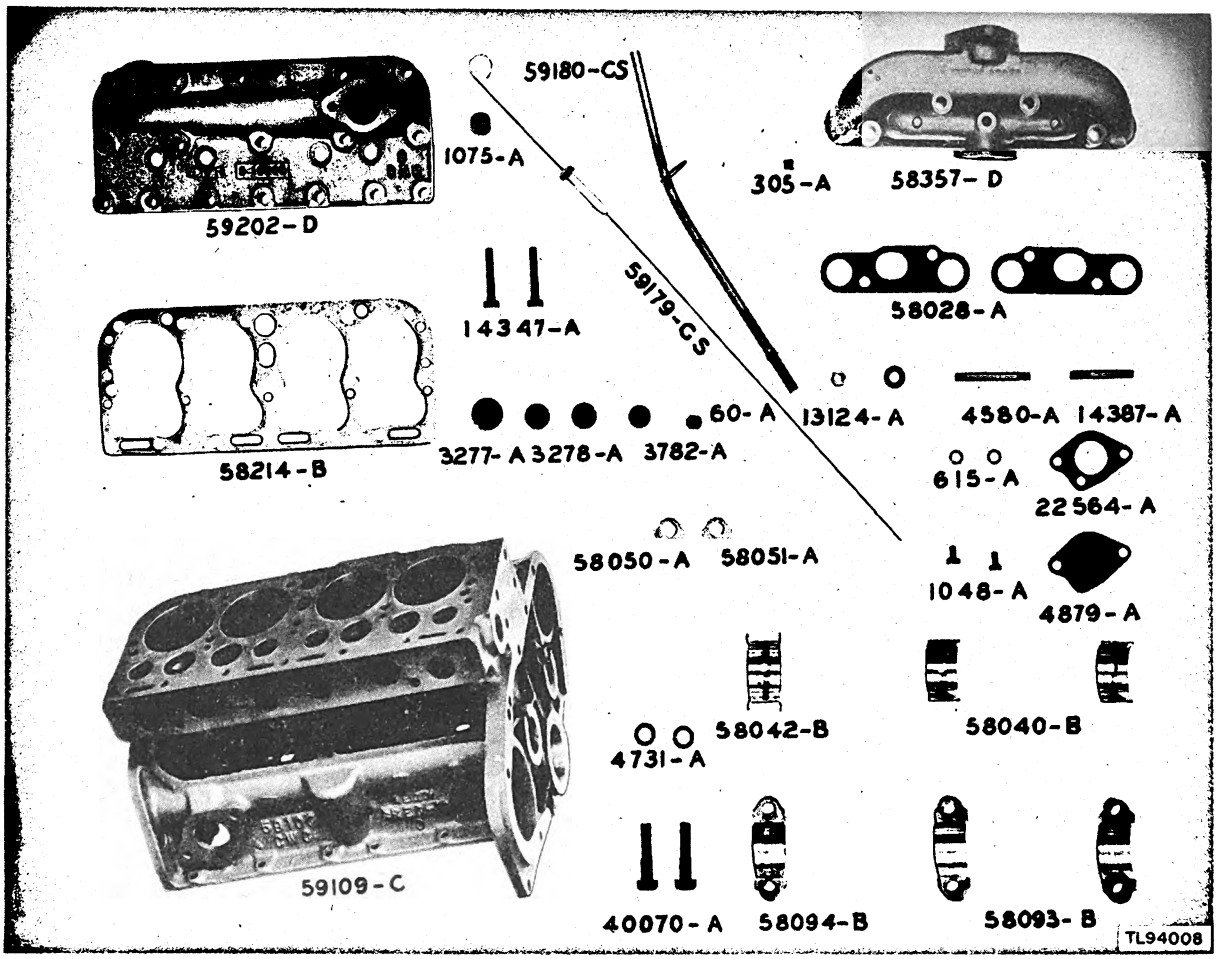


Figure 22. Cylinder block group.

48. MAINTENANCE PARTS LIST FOR POWER UNIT PU-35/U.

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	3H1915-9	ENGINE, gasoline: 13.5 hp; Hercules Motors model ZXB.	1					*	*
		Accessory Drive Group							
	3H1915-9/D40	DRIVE ASSEMBLY: accessory; includes stud nut, attaching screw lockwasher, key, accessory drive key, attaching stud, accessory drive gear key, oil seal, thrust washer, drive bushing, attaching gasket, accessory drive shaft, accessory drive housing, accessory drive gear, water pump shaft sleeve, water pump shaft thrust spring, and drive eccentric. Hercules Motors No. 59807B. S.	1				*	*	*
Fig. 25	3H4552/113	GASKET: accessory drive mounting. Hercules Motors No. 58077-A.	1				*	*	*
Fig. 25	3H1915-9/S21	SEAL: oil; accessory drive. Hercules Motors No. 4626-A.	1				*	*	*
		Air Cleaner Group							
Fig. 4	3H4531-35/3	CLEANER: air, oil-bath type. Vortox Co. No. 555H.	1				*	*	*
	3H4531-35/7	ELBOW: clamping, oil-bath air cleaner. Vortox Co. No. 8238.	1				*	*	*
		Camshaft Group							
Fig. 23	3H4552/27	BEARING: camshaft, front. Hercules Motors No. 58041-A.	1					*	*
Fig. 23	3H4552/28	BEARING: camshaft, rear and interior. Hercules Motors No. 58044-A.	3					*	*
Fig. 23	3H1915-9/7	CAMSHAFT ASSEMBLY: includes thrust plunger and camshaft. Hercules Motors No. 58062AS.	1					*	*
Fig. 23	3H4552/29	GEAR: camshaft; 36 teeth. Hercules Motors No. 58049-A.	1					*	*
Fig. 23	6L995-3	KEY: gear, camshaft; No. 3 Woodruff. Hercules Motors No. 4199 A.	1					*	*
Fig. 23	3H4552/32	PLUNGER: thrust, camshaft. Hercules Motors No. 40068-A.	1					*	*
Fig. 23	3H4552/31	WASHER: thrust, camshaft. Hercules Motors No. 14348-A.	1					*	*
		Carburetor Group							
Fig. 4	3H717-1	CARBURETOR: Marvel Schebler model TCX-39. Hercules Motors No. 10-2387.	1			*	*	*	*
	3H717-1/3	FLOAT AND LEVER ASSEMBLY: Marvel Schebler No. 30-570.	1				*	*	*
	3H717-1/4	FLOAT VALVE AND SEAT: matched; Marvel Schebler No. 233-541.	1				*	*	*
	3H717-1/2	GASKET ASSORTMENT: six gaskets for carburetor TCX-39. Marvel Schebler No. 16-582.	1				*	*	*
Fig. 26	3H4575A/X2	GASKET: carburetor flange. Hercules Motors No. 4980-A. (Same gasket for water inlet pipe.)	2	*	*	*	*	*	*

* Indicates stock available.

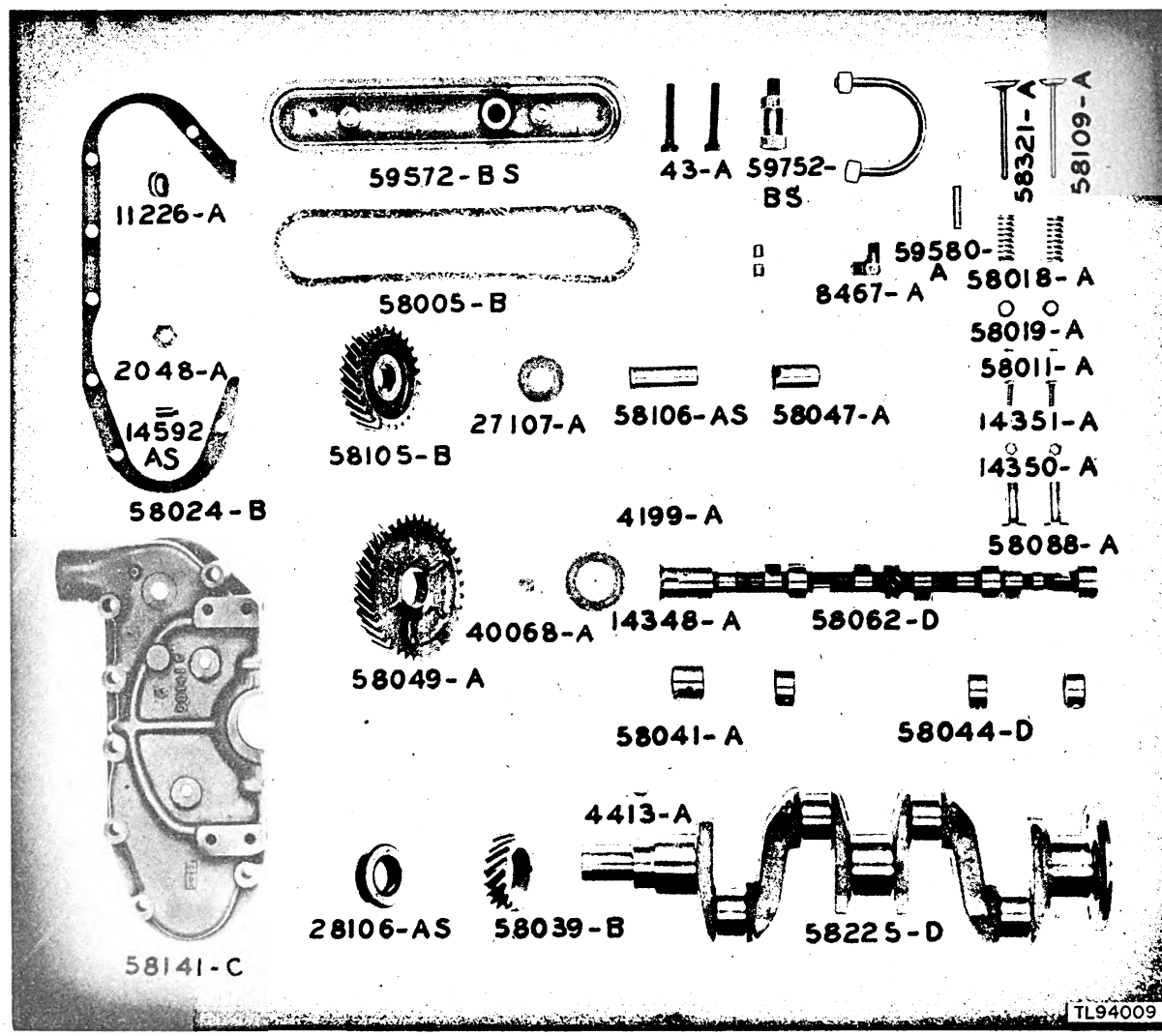


Figure 23. Camshaft and crankshaft group.

48. MAINTENANCE PARTS LIST FOR POWER UNIT PU-35/U (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	3H717-1/G5	GASKET: float bowl. Marvel Schebler No. 16-417.	1	*	*	*	*	*	*
	3H716/G1	GASKET: float valve seat. Marvel Schebler No. 16-4.	1		*	*	*	*	*
	3H717-1/6	LEVER: assembly, choker. Marvel Schebler No. 25-633.	1			*	*	*	*
	3H717-1/N20	NOZZLE: carburetor main. Marvel Schebler No. 47-580.	1				*	*	*
	3H717-1/7	SHAFT: float lever. Marvel Schebler No. 32-16.	1				*	*	*
	3H717-1/S10	STUD: flange screw. Marvel Schebler No. 83-392.	1				*	*	*
		Connecting Rod and Crankshaft Group							
Fig. 27	6L7920-7-24.81S	BOLT: crankshaft, flywheel. Carson Machine Co. No. 5-11. Hercules Motors No. 27003A.	4					*	*
	3H4552/39	BOLT: connecting rod cap. Hercules Motors No. 58055-A.	8					*	*
Fig. 23	3H1915-9/C80	CRANKSHAFT: for Hercules ZXB engine. Hercules Motors No. 58225-D.	1					*	*
Fig. 23	3H4552/50	GEAR: crankshaft, 18 teeth. Hercules Motors No. 58039-B	1					*	*
Fig. 23	3H4552/51	KEY: Woodruff No. 61. Hercules Motors No. 4413-A.	1					*	*
Fig. 27	3H4552/40	NUT: connecting rod cap bolt. Hercules Motors No. 58056-A.	8					*	*
Fig. 27	3H1915-9/5	ROD ASSEMBLY: connecting. Hercules Motors No. 58092-ASY.	4				*	*	*
Fig. 27	3H1915-9/S35	SCREW: lock, piston pin, special. Hercules Motors No. 11842-A.	4					*	*
Fig. 27	3H4552/42	SHIM: connecting rod cap; 0.003 in. thick. Hercules Motors No. 58054-A.	24					*	*
Fig. 27	3H4552/43	SHIM: connecting rod cap; 0.002 in. thick. Hercules Motors No. 58067-A.	24					*	*
		Control Panel Group							
Fig. 7-R	2Z9404.34	BOARD: terminal; 4 point Jones HB No. 4-150-F.P.	4			*	*	*	*
Fig. 7	3H900-25-24	BREAKER: circuit; multi-breaker, 25 amp. Square D No. SK3375.	2				*	*	*
Fig. 6	6Z7809-5	CONNECTOR: female contact (receptacle), 2 contact. Hubbell No. 9200.	1			*	*	*	*
	6Z7809-12	CONNECTOR: female contact (receptacle), 4-point, (power output). Hubbell No. 22427.	1			*	*	*	*
Fig. 6	3H4531-35/29	GAUGE: oil; calibrated 0-60. Rochester Manufacturing Co. model OPC.	1			*	*	*	*
Fig. 6	6Z8645-1	GAUGE: temperature, water; complete with capillary tube and connectors. Rochester Manufacturing Co. No. VTCP 100-220.	1			*	*	*	*

* Indicates stock available.

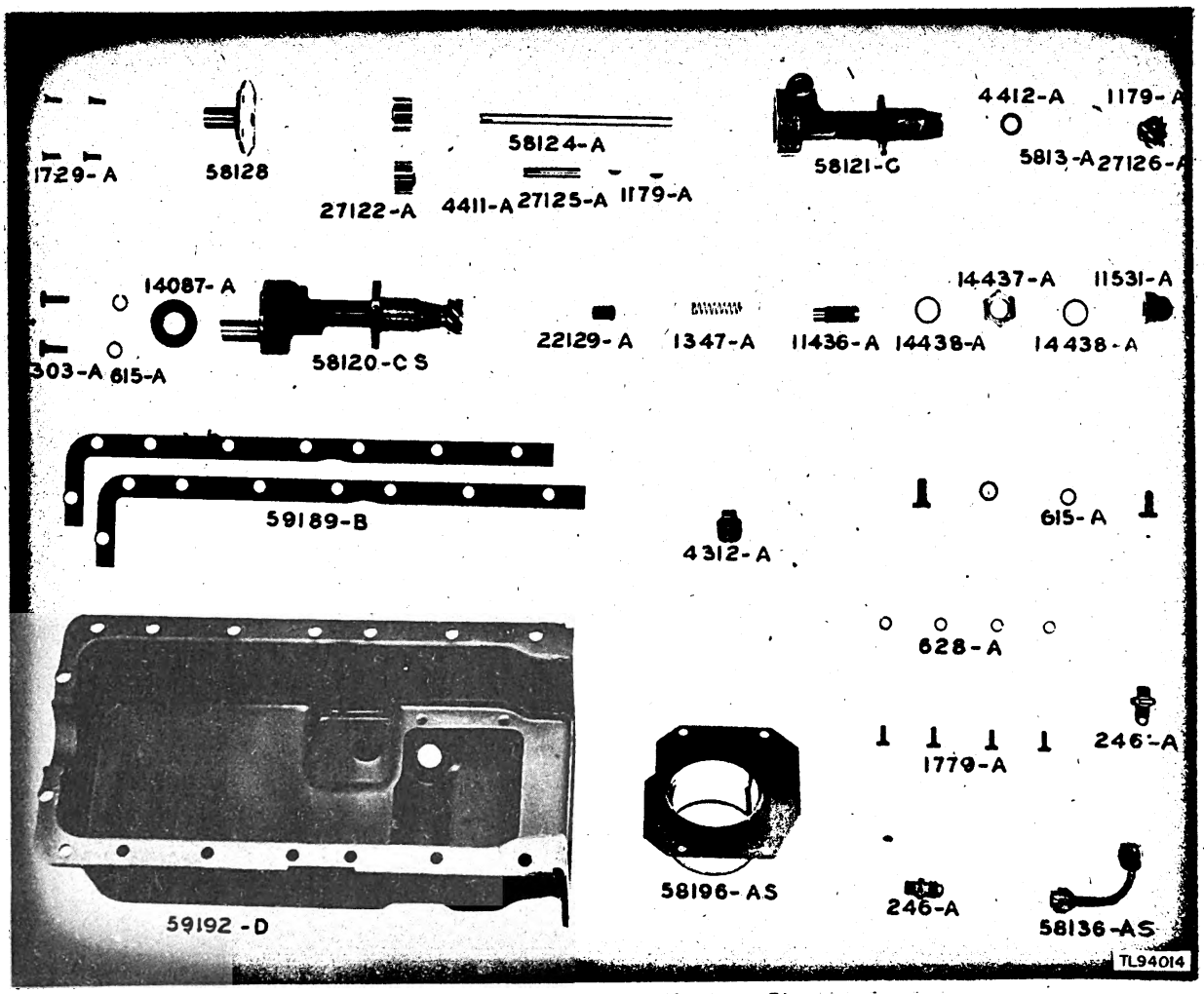


Figure 24. Oil pan and oil pump group.

48. MAINTENANCE PARTS LIST FOR POWER UNIT PU-35/U (contd)

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	3G1772-112	INSULATOR: bushing, 1 in. I.D Carson Machine Co. No. 35-38 (for power outlet).	8					*	*
Fig. 6	3F2745-4	METER: frequency; vibrating reed; 380-420 cycles per second; 100-130 volt. JBT No. 34FX.	1					*	*
Fig. 6	3F3363-2	METER: running time; 170 volt, 50 cycle. Aero Instrument Co. model No. 1001.	1				*	*	*
Fig. 6	3F8150-104	METER: volt; external resistor; American Service Association type MR34W150AF VV; Tripplet No. 331.	1				*	*	*
Fig. 6	3H4531/27	PANEL: control; complete with instruments, transformers wiring and cabinet. Carson Machine Co. No. 35-30.	1					*	*
	3Z6010E5-8	RESISTOR: boot jack; 105 ohms/or- 1%. Tripplet No. T-2603-1-105 (meter shunt).	1			*	*	*	*
Fig. 6	3Z9849.152	SWITCH: toggle, DPDT. Voltmeter circuit transfer switch. Hubbell No. 8824K5.	1				*	*	*
	3H4531-35/30	TERMINAL: power outlet, with 2 insulating bushings. Carson Machine Co. No. 35-20.	4			*	*	*	*
Fig. 7	2Z9613.354	TRANSFORMER: booster; 60-cycle, with terminals. Carson Machine Co. No. 35-17.	1					*	*
Fig. 7	2Z9619-91	TRANSFORMER: booster; 400-cycle. Carson Machine Co. No. 35-17.	1					*	*
Fig. 7	2Z9621-96	TRANSFORMLR: compensator; 400-cycle, complete with terminals and capacitor. Carson Machine Co. No. 35-16.	1					*	*
		Crankcase Ventilation Group							
	3H4576A/K11	FERRULES: ventilation tube, crankcase. Hercules Motors No. 4122A.	2				*	*	*
Fig. 23	3H4576A/K8	FITTING: pipe, elbow; ventilation, crankcase (in valve cover). Hercules Motors No. 8467A.	1				*	*	*
	6Z3663-4	FITTING: pipe, elbow; ventilation, crankcase (in manifold). Hercules Motors No. 13207A.	1				*	*	*
	3H4576A/K10	NUTS: ventilation tube; crankcase. Hercules Motors No. 4121A.	2				*	*	*
	3H4531-35/36	TUBE: ventilation crankcase. Hercules Motors No. 59687A.	1				*	*	*
	3H4531-35/41	UNION ASSEMBLY: crankcase vent tube, metering; includes: crankcase vent tube union metering plug and crankcase vent tube union in vent valve. Hercules Motors No. 13438AS.	1				*	*	*

* Indicates stock available.

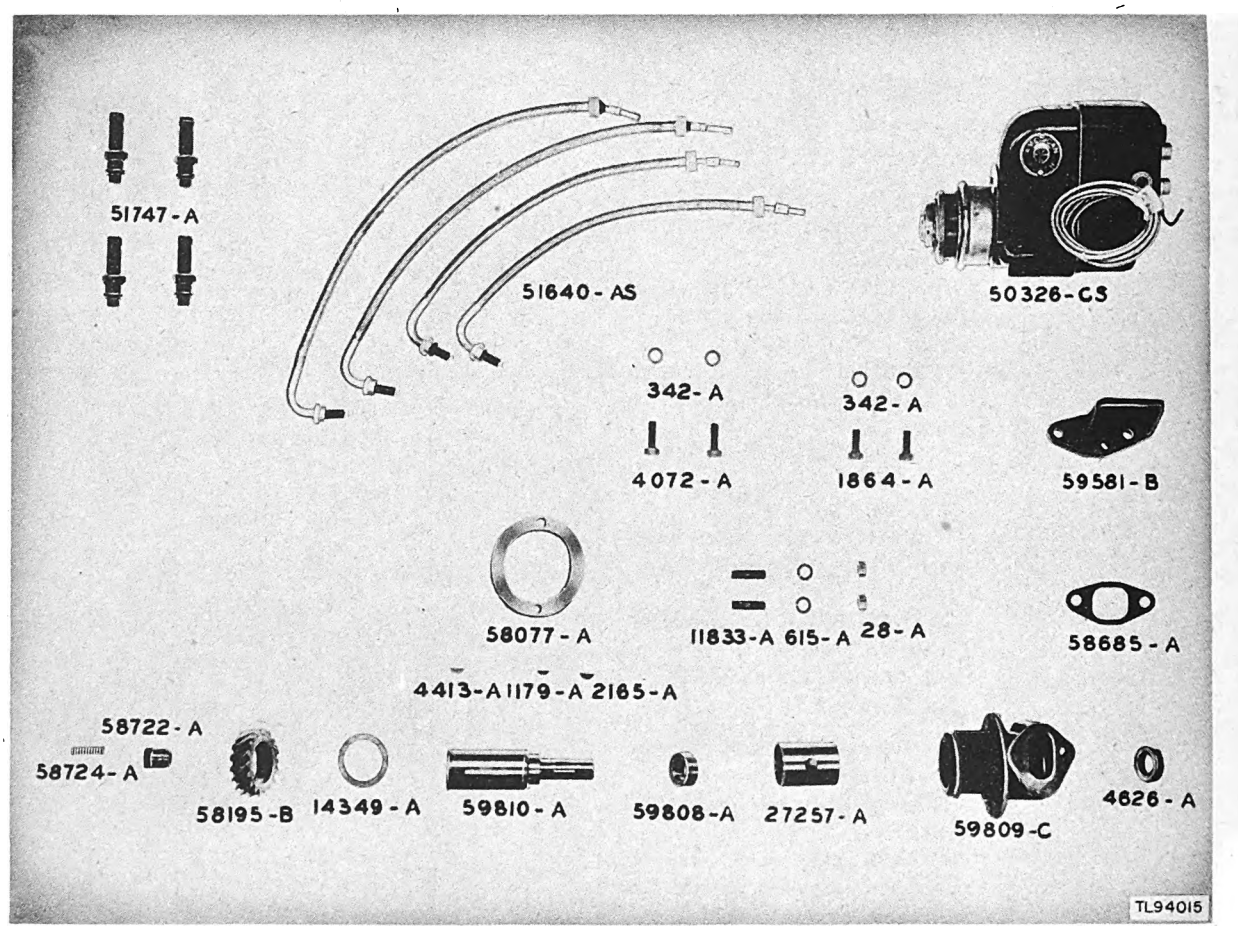


Figure 25. Ignition group.

48. MAINTENANCE PARTS LIST FOR POWER UNIT PU-35/U (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 23	3H4531-35/39	VALVE: ventilation; crankcase. Hercules Motors No. 59752BS.	1				*	*	*
		Cylinder Block and Crankcase							
Fig. 22	3H4552/8	BEARING: main; cap; rear cylinder. Hercules Motors No. 58094-B.	1				*	*	*
Fig. 22	3H4552/7	BEARING: main; cap; front and center cylinder. Hercules Motors No. 58093-B.	2				*	*	*
Fig. 22	3H4552/5	BEARING: main; upper; front and center cylinder. Hercules Motors No. 58040-B.	2				*	*	*
Fig. 22	3H4552/6	BEARING: cylinder; rear main, upper. Hercules Motors No. 58042-B.	1				*	*	*
	3H4552/101	GASKET: bell housing. Hercules Motors No. 58065B.	1				*	*	*
Fig. 22	3H1915-9/G22	GASKET: cylinder head. Hercules Motors No. 58214-B.	1	*	*	*	*	*	*
	3H1915-9/1	GASKET: fuel pump hole cover. Hercules Motors No. 11327A.	1					*	*
	3H4576A/H2	GASKET: water outlet pipe. Hercules Motors No. 4110-A.	2	*	*	*	*	*	*
Fig. 22	3H1915-9/H25	HEAD: cylinder. Hercules Motors No. 59202-D.	1					*	*
	3H4581A/N11	NUT: cylinder head stud, 3/8 in.-24. Hercules Motors No. 752-A.	4		*	*	*	*	*
Fig. 22	3H1915-9/P61	PLUG: cylinder; cup type; 7/8 in. Hercules Motors No. 3782-A.	1	*	*	*	*	*	*
Fig. 22	3H4576A/C10	PLUG: cylinder; cup type; 1 in. O.D. Hercules Motors No. 3278-A.	2	*	*	*	*	*	*
Fig. 22	3H1915-9/P60	PLUG: cylinder; cup type; 1 1/4 in. O.D. Hercules Motors No. 3277-A.	2	*	*	*	*	*	*
Fig. 22	3H4552/128	SCREW: cylinder head. Hercules Motors No. 14347-A.	14					*	*
Fig. 22	3H4552/9	SCREW: cap; main bearing, front and intermediate. Hercules Motors No. 40070-A.	6					*	*
Fig. 22	3H4552/10	SHIM: 0.002 in. thick; main bearing. Hercules Motors No. 58050-A.	12					*	*
Fig. 22	3H4552/11	SHIM: 0.003 in. thick; main bearing. Hercules Motors No. 58051-A.	12					*	*
	3H1915-9/S60	STUD: cylinder head; special 3/4 in. of 3/8-24 thread x 2 1/2 in. long; 1/2 in. of 3/8-16 thread x 2 1/2 in. long. Hercules Motors No. 13246-A.	4					*	*
		Fuel Filter Group							
	3H4531-35/6	BOWL: filter; glass. Carter Carburetor Co. No. 23-27; Zenith No. F8X12.	1	*		*	*	*	*
Fig. 3	3H4531-35/1	CLEANER: fuel filter; complete. Carter Carbuertor Co. No. 445.	1			*	*	*	*
	3H4531-35/4	GASKET: bowl ring; cork. Carter Carburetor Co. No. 23A-16.	1	*		*	*	*	*
	3H4531-35/5	SPRING: retainer; filter. Carter Carburetor Co. No. 61-138.	1			*	*	*	*

* Indicates stock available.

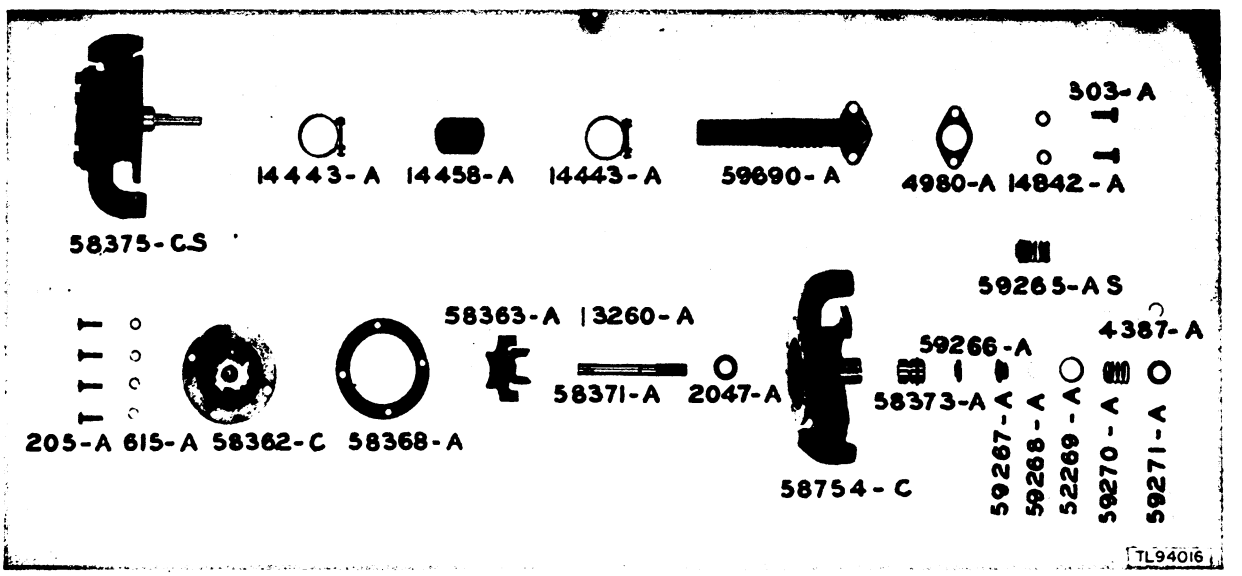


Figure 26. Water pump group.

48. MAINTENANCE PARTS LIST FOR POWER UNIT PU-35/U (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	3H4531-35/2	STRAINER: fuel; ceramic. Carter Carburetor Co. No. 30-27.	1				*	*	*
		Fuel Pump Group							
	3H1915-9/G27	GASKET: fuel pump mounting. AC No. 838263.	1	*		*	*	*	*
	3C4531-35/MP	KIT: repair; fuel pump. AC No. 1538360.	1				*	*	*
Fig. 3	3H1915-9/P86	PUMP: fuel. AC No. 1538697.					*	*	*
		Gear Cover Group							
Fig. 23	3H4552/131	GASKET: gear cover. Hercules Motors No. 58024-B.	1				*	*	*
Fig. 23	3H4563C/G4	SEAL ASSEMBLY: gear cover; includes gear cover seal and gear cover seal sleeve. Hercules Motors No. 28106AS.	1				*	*	*
Fig. 23	3H1915-9/S20	SEAL: oil; gear cover. Hercules Motors No. 11226-A (at water pump).	1			*	*	*	*
Fig. 23	3H4579A/B2	THRUST ASSEMBLY: gear cover; includes thrust screw and fiber plug. Hercules Motors No. 14592AS.	2	*	*	*	*	*	*
		Generator Group, 60-cycle							
Fig. 21	3H2707A/B2	BEARING: ball; Ahlberg No. 6204GG; Fafnir No. 204WDD; 204KDD: Federal No. 1204 MFF and 1204 FF; Hoover No. 77204; M-R-C No. 204SFF; McGill No. 204FF; ND No: 77504; Norma-Hoff No. 204PP; SKF No. 6204ZZ; Torrington No. T77204; Leland Electric No. 1232A; Auto-Lite No. X-378.	1					*	*
Fig. 21	3H106C-L	GENERATOR: D-C, 60-cycle, 120 volt, 2½ kva, single phase. Leland No. M50012.	1					*	*
	3H4575T/S35	SPRING: brush tension, a-c. Leland No. A-3938.	4			*	*	*	*
	3H4575T/S36	SPRING: brush tension, d-c Leland No. A-3939.	4			*	*	*	*
	3H4575C/B14	BRUSH: A-c. Leland Electric No. A-3928-4.	4	*	*	*	*	*	*
	3H4575C/B3	BRUSH: D-c; exciter. Leland Electric No. A-1633-4.	4	*	*	*	*	*	*
	3H4575D/S2	SEAL SET: consisting of 2 steel washers 1⅞ in. O.D. x 1½ in. I.D.; 1 felt washer 1⅜ in. O.D. x ⅝ in. I.D. Climax No. A-3970.	1				*	*	*
	3Z1891-5.1	SUPPRESSOR: electric noise; 60 cycle. Penn Boiler & Burner Mfg. Co.							
	3H4575T/W20	WASHER: felt; ball bearing. Leland Electric No. A-3363-2.	1				*	*	*
		Generator Group, Permanent-Magnet, 400 Cycle						*	*
	3H4531-35/26	END-BELL: generator; aluminum. Carson Machine Co. No. 21-8.	1					*	*

* Indicates stock available.

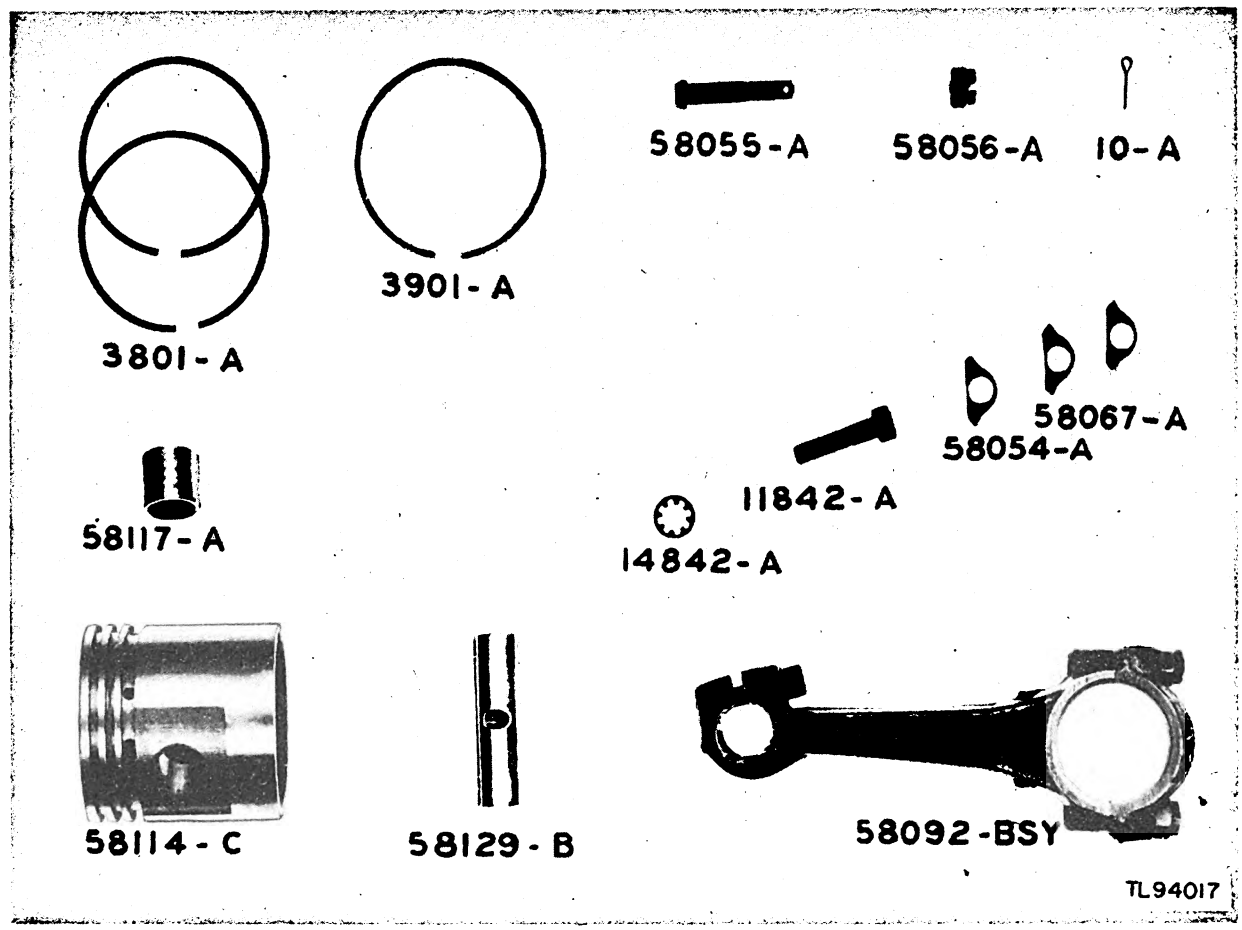


Figure 27. Piston and connecting rod group.

48. MAINTENANCE PARTS LIST FOR POWER UNIT PU-35/U (cont'd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
	3H2565CA	FAN: generator; aluminum. Carson Machine Co. No. 21-9.	1				*	*	*
Fig. 3	3H106C-1	GENERATOR: 2½ kva, 120 volt. a-c, 400 cycle; permanent magnet. Carson Machine Co. No. AC TYPE PM.	1				*	*	*
	3H4531-35/25	HUB: coupling. Carson Machine Co. No. 21-12.	1				*	*	*
	3H4531-35/24	HUB: drive. Carson Machine Co. No. 21-7. (Drives rotor of 400-cycle generator.)	1					*	*
	3H4531-35/23	RING: coupling; flexible steel. Carson Machine Co. No. 21-11.	3				*	*	*
	3H4531-35/22	RING: hub clamp. Carson Machine Co. No. 21-3.	1				*	*	*
	3H5200-4	ROTOR ASSEMBLY: magnetized; includes magnet retainer wheel, 28 magnets, inner magnetic ring, and 28 pole shoes. Carson Machine Co. No. 35-39.	1				*	*	*
	3H4531-35/28	STATOR: complete; winding and lamination. Carson Machine Co. No. 35-40.	1				*	*	*
		Governor Group							
	3H1915-9/G23	GASKET: governor. Hercules Motors No. 27170-A.	1	*		*	*	*	*
Fig. 28	3H2477-5	GOVERNOR: Wirshing No. G-1200.	1				*	*	*
	3H2477-5/1	LINKAGE: governor to carburetor. Wirshing No. G-1200-A.	1			*	*	*	*
		Idler Group							
Fig. 23	3H4552/68	BEARING: idler shaft; babbitt lined. Hercules Motors No. 58047-A.	1					*	*
Fig. 23	3H4552/67	GEAR: idler shaft; 26 teeth. Hercules Motors No. 58105-B.	1					*	*
Fig. 23	3H4552/66	SHAFT: idler; with plunger assembly; includes thrust plunger and idler shaft. Hercules Motors No. 58106-AS.	1					*	*
Fig. 23	3H4552/70	WASHER: idler shaft thrust. Hercules Motors No. 27107-A.	1					*	*
		Magneto Group (fig. 8)							
18	3H4576A/Q70	BRUSH AND SPRING: for distributor gear. American Bosch No. BR529.	1				*	*	*
48	3H2699-1/C4	CAPACITOR: fixed; 0.33 mmf to 0.37 mmf; 8,000 to 12,000 volts. American Bosch No. CW5232.	1	*		*	*	*	*
42	3H2699-1-B10	CONTACT: bracket; adjustable. American Bosch No. BK566 (part of point set).	1	*		*	*	*	*
27	3H1915-9/15	GASKET: distributor cap. American Bosch No. GA524.	1		*	*	*	*	*
19	3H5263C/G30	GEAR: distributor. American Bosch No. GE5282.	1			*	*	*	*

* Indicates stock available.

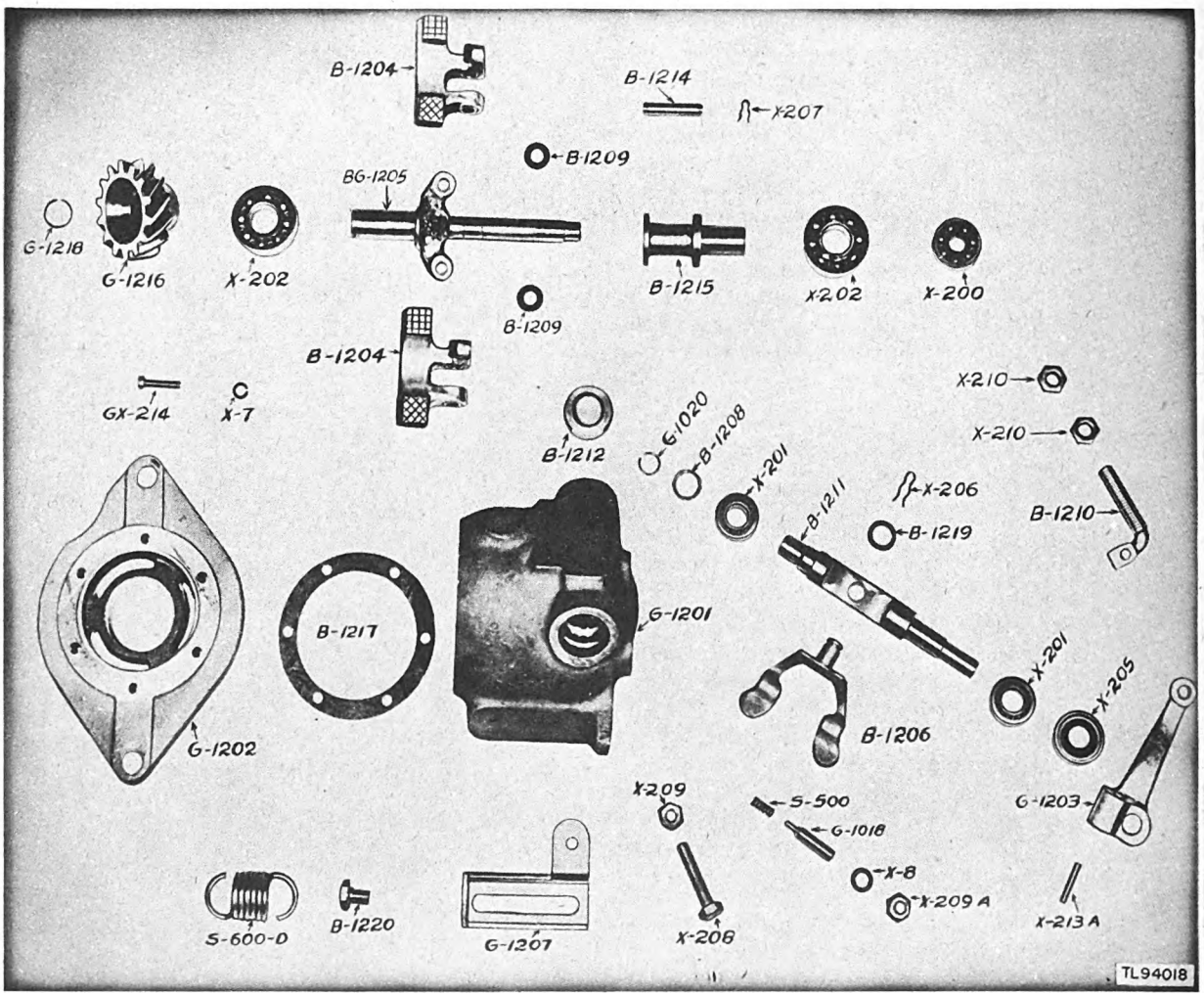


Figure 28. Governor group.

48. MAINTENANCE PARTS LIST FOR POWER UNIT PU-35/U (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
38	3H4576A/Q46	LEVER: interrupter. American Bosch No. LE5236 (part of point set).	1	*	*	*	*	*	*
Fig. 3	3H2699-43	MAGNETO: American Bosch No. MJC-4-146.	1			*	*	*	*
		Manifold Group							
Fig. 22	3H4552/95	GASKET: exhaust and intake nanifold. Hercules Motors No. 58028-A.	1	*	*	*	*	*	*
Fig. 22	3H1915-9/M20	MANIFOLD: exhaust and intake. Hercules Motors No. 58357-D.	1					*	*
Fig. 22	6L3506-24-9.10	NUT: manifold; Seeze-pruf; 3/8-24. Hercules Motors No. 13124-A.	4				*	*	*
Fig. 22	3H4552/96	STUD: manifold; 3 1/8 in. long, x 3/8-24 x 3/4 thread and 3/8-16 x 1/2 in. thread. Hercules Motors No. 4580-A.	2				*	*	*
Fig. 22	3H4552/97	STUD: manifold; 2 1/2 in. long, 3/8-16 x 1/2 in. thread and 3/8-24 x 3/4 in. thread. Hercules Motors No. 14387-A.	2				*	*	*
		Miscellaneous Group							
	3H1915-9/C1	CABLE ASSEMBLY: magneto; set of 4 shielded cables. Hercules Motors No. 51640-AS.	1	*		*	*	*	*
	3H4531-35/21	CAP: fuel tank. Carson Machine Co. No. 35-44.	1			*	*	*	*
	3H1915-9/22	CHOKE ASSEMBLY: hand. Weatherhead No. 8355.	1			*	*	*	*
Fig. 3	6Z2118-9	COCK: shut-off; fuel, 3-way. Weatherhead No. 6737.	1			*	*	*	*
	3H4531-35/38	COVER: canvas duck; waterproof. Carson Machine Co. No. 35-26.	1			*	*	*	*
Fig. 3	3H4531-35/37	CRANK: hand. Hercules Motors No. 59381BS.	1			*	*	*	*
	3H1915-9/G26	GASKET SET: for Hercules Motors engine model ZXB; consists of: 1 Fuel-pump-hole cover gasket; Hercules Motors No. 22564-A. 1 Cylinder head gasket: Hercules Motors No. 58214-B. 1 Water outlet gasket: Hercules Motors No. 4110-A. 1 Gear cover gasket: Hercules Motors No. 58024-B. 2 Oil pan gaskets: Hercules Motors No. 59189-B. 2 Gaskets: oil pressure adjusting screw: Hercules Motors No. 14438-A. Hercules Motors No. 19954. 2 Gaskets: Exhaust and intake manifold Hercules Motors No. 58028A.	1			*	*	*	*

* Indicates stock available.

48. MAINTENANCE PARTS LIST FOR POWER UNIT PU-35/U (contd).

Ref symbol	Signal Corps stock No.	Name of part and description	Quan per unit	Running spares	Orgn stock	3d ech	4th ech	5th ech	Depot stock
		1 Gasket: Bell housing: Hercules Motors No. 58065-B.							
		1 Gasket: Accessory-drive housing: Hercules Motors No. 58077-A.							
		2 Gaskets: Carburetor main-nozzle and bowl-lock plug: Marvel Schebler No. 16-14.							
		2 Gaskets: Carburetor main-nozzle: Marvel Schebler No. 16-28.							
		2 Gaskets: Water-pump discharge: Hercules Motors No. 4980-A.							
		2 Gaskets: Carburetor float-valve seat: Marvel Schebler No. 16-4.							
		2 Gaskets: Carburetor float bowl: Marvel Schebler No. 16-417.							
		1 Governor gasket: Hercules Motors No. 27170-A.							
		2 Fuel filter bowl gaskets: Zenith No. FIX2.							
		1 Water pump cover gasket: Hercules Motors No. 58368-A.							
		2 Gaskets: valve cover: Hercules Motors No. 58005-B.							
		1 Gasket; bearing bracket cap: Hobart No. J110.							
		2 Fuel pump mounting gaskets: AC No. 838263.							
	3H4531-35/34	HARNESS: wiring for panel board: Carson Machine Co. No. 35-46.	1					*	*
	3H4531-35/20	HOSE: oil; 6 in. long, with fittings. Carson Machine Co. No. 35-43.	1			*	*	*	*
	3H4531-35/19	HOSE: fuel, 15 ft. long, with fittings: Carson Machine No. 35-45.	1			*	*	*	*
Fig. 3	3H4531-45/8	MUFFLER: exhaust: Nelson Muffler No. T-2168.	1			*	*	*	*
Fig. 3	3H4543.10/M4	MOUNT: vibration: U. S. Rubber No. C-311 (control panel cabinet).	4			*	*	*	*
Fig. 3	3H4531-35/10	MOUNT: vibration: U. S. Rubber No. 101-C3 (for engine).	4			*	*	*	*
Fig. 4	3H4576A/T15	PLUG: spark, 14 mm special: Champion No. C-1OS.	4	*	*	*	*	*	*
Fig. 3	3H1095	TANK: fuel, with cap: Carson Machine No. 35-23.	1				*	*	*
		Oil Pan Group							
	3H1915-9/9	FILLER: oil, with breather and filter: Donaldson No. S-44.	1			*	*	*	*
Fig. 24	3H1915-9/G20	GASKET: oil pan: Hercules Motors No. 59189-B.	2				*	*	*
Fig. 22	3H1915-9/G75	GASKET: oil; bayonet: Hercules Motors No. 59179-AS.	1			*	*	*	*
		Oil Pump Group							
	3H4552/73	FITTING: pipe union; Hercules Motors No. 246-A. (for discharge pipe).	1				*	*	*

* Indicates stock available.

Ref symbol	Signal Corps stock no.	Name of part and description	Quan per unit	Running spares	orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 24	3H4552/80	GEAR: oil pump drive: Hercules Motors No. 27126-A.	1					*	*
Fig. 24	3H4552/84	GEAR: oil pump: Hercules Motors No. 27122-A.	2					*	*
Fig. 24	3H4552/83	KEY: gear, oil-pump, water-pump, distributor, driving: Hercules Motors No. 1179-A.	3					*	*
Fig. 24	3H4552/74	OIL PUMP: Hercules Motors No. 58120-CS.	1				*	*	*
Fig. 24	3H4552/82	PIN: oil-pump drive gear: Hercules Motors No. 5813.	1					*	*
Fig. 24	3H4552/71	PIPE ASSEMBLY: oil pump discharge; includes 2 nuts: Hercules Motors No. 58136-AS.	1				*	*	*
Fig. 24	3H1915-9/8	RING: felt; oil pump: Hercules Motors No. 14087A.	1				*	*	*
Fig. 24	3H4552/79	SHAFT: oil pump drive: Hercules Motors No. 58124-A.	1					*	*
Fig. 24	3H4552/85	SHAFT: idler, oil pump: Hercules Motors No. 27125-A.	1					*	*
Fig. 24	3H4552/78	RING: snap; oil pump: Hercules Motors No. 4411-A.	2				*	*	*
Fig. 24	3H4552/76	SCREW: 18 thread, 5/16 x 11/16 in. Hercules Motors No. 303-A.	2				*	*	*
		Oil Pressure Regulator Group							
Fig. 24	3H4552/24	GASKET: screw; oil pressure regulator nut: Hercules Motors No. 14438-A.	2	*	*	*	*	*	*
Fig. 24	3H4552/21	PISTON: oil pressure regulating: Hercules Motors No. 22129-A.	1			*	*	*	*
Fig. 24	3H4552/23	SCREW: oil pressure adjusting: Hercules Motors No. 14436-A.	1			*	*	*	*
Fig. 24	3H4552/22	SPRING: oil pressure regulating: Hercules Motors No. 1347A.	1			*	*	*	*
		Piston Group							
	3H1915-9/3	PISTON: cast iron; 0.010 in. oversize; fitted with bushings and pins: Hercules Motors No. 59119AS-010.	4				*	*	*
Fig. 27	3H1915-9/R31	RING: piston, compression; 2⅝ in. x ⅛ in. standard: Hercules Motors No. 3801-A.	8				*	*	*
	3H1915-9/R33	RING: piston; compression, 2⅝ in. x ⅛ in.; 0.010 in. oversize: Hercules Motors No. 3801-A.010.	4				*	*	*
Fig. 27	3H1915-9/R30	RING: piston; oil, ⅝ in. x 3/16 in. standard: Hercules Motors No. 3901-A.	4				*	*	*
	3H1915-9/R34	RING: piston; oil, 2⅝ in. x 3/16 in. 0.010 in. oversize: Hercules Motors No. 3901-A-.010.	4				*	*	*
		Radiator Group							
	3H305-17	BEARING: ball; blower fan: Norma-Hoff No. 3604 MF 966.	1				*	*	*
	3H1915-9/C15	CAP ASSEMBLY: pressure: Stant Mfg. McCord Dwg No. 145812: Hobart Bros. No. 5J173.	1			*	*	*	*

* Indicates stock available.

48. MAINTENANCE PARTS LIST FOR POWER UNIT PU-35/U (contd).

Ref symbol	Signal Corps stock no.	Name of part and description	Quan per unit	Running spares	orgn stock	3d ech	4th ech	5th ech	Depot stock
	6Z1928-16	CLAMP: radiator hose: Carson Machine No. 35-42.	4		*	*	*	*	*
	3H1915-9/C75	COUPLING ASSEMBLY: blower: Hobart Bros. No. 5J307.	1				*	*	*
	3H399-3	FAN: Blower (blower wheel) assembly): Hobart Bros. No. 5J134A.	1					*	*
	3H1915-9/12	HOSE: rubber, radiator; 1 in. x 4 in. long: Carson Machine No. 35-41.	2			*	*	*	*
	3H1915-9/P26	PIN: blower coupling to engine; steel, ¼ in. dia x 2¼ in. long: Hobart Bros. No. 5J183.	1				*	*	*
	3H1915-9/R10	RADIATOR: McCord No. DA-148900.	1					*	*
	3H1915-9/T25	THERMOSTAT: opens at 155°: Fulton Syphon Co. No. 138.	1			*	*	*	*
		Valve and Tappet Group							
Fig. 23	3H4552/64	GASKET: valve cover: Hercules Motors No. 58005-B.	1	*	*	*	*	*	*
	3H1915-9/G80	GUIDE: valve: Hercules Motors No. 59580-A	8				*	*	*
	3H1915-9/6	INSERT: exhaust valve; stellite; Hercules Motors No. 59215-A.	4					*	*
	3H4552/58	PIN: valve spring seat: Hercules Motors No. 58011-A.	8	*	*	*	*	*	*
Fig. 23									
Fig. 23	3H4552/65	SCREW: 5/16 in. x 1¼ in.-18 thread: Hercules Motors No. 43-A (valve cover).	2		*	*	*	*	*
Fig. 23	3H4552/57	SEAT: valve spring: Hercules Motors No. 58019-A.	8		*	*	*	*	*
	3H4552/56	SPRING: valve: Hercules Motors No. 58018-A.	8	*	*	*	*	*	*
Fig. 23									
Fig. 23		TAPPET: valve, standard: Hercules							
	3H4576A/V2	Motors No. 58088-A.	8					*	*
Fig. 23	3H1915-9/4	VALVE: exhaust, stellite: Hercules Motors No. 58109A.	4	*	*	*	*	*	*
Fig. 23	3H4576A/V1	VALVE: intake: Hercules Motors No. 58321-A.	4	*	*	*	*	*	*
		Water Pump Group							
Fig. 26	3H1915-9/18	BUTTON: pump shaft thrust: Hercules Motors No. 58369-A.	1				*	*	*
Fig. 26	3H1915-9/C45	CLAMP: hose, 1⅛ in. I.D.: Hercules Motors No. 14443A.	2	*	*	*	*	*	*
	3H4580A/H28	CUP: water-pump grease: Hercules Motors No. 749-A.	1			*	*	*	*
Fig. 26	3H1915-9/G21	GASKET: water pump cover: Hercules Motors No. 58368-A.	1				*	*	*
Fig. 26	3H4576A/X2	GASKET: water pump: Hercules Motors No. 4980 (discharge pipe).	1			*	*	*	*
Fig. 26	3H1915-9/11	HOSE: water; from water pump to block; 1½ in. long x 1 in I. D.: Hercules Motors No. 14458A.	1	*	*	*	*	*	*
Fig. 26	3H1915-9/13	IMPELLER: water pump: Hercules Motors No. 58363-A.	1				*	*	*
Fig. 26	3H1915-9/P27	PIN: water pump impeller: Hercules Motors No. 3260A.	1				*	*	*

* Indicates stock available.

48. MAINTENANCE PARTS LIST FOR POWER UNIT PU-35/U (contd).

Ref symbol	Signal Corps stock no.	Name of part and description	Quan per unit	Running spares	orgn stock	3d ech	4th ech	5th ech	Depot stock
Fig. 26	3H1915-9/P85	PUMP: water: Hercules Motors No. 58375-CS.	1			*	*	*	*
Fig. 26	3H1915-9/10	RING: snap; water pump shaft: Hercules Motors No. 4387-A.	1				*	*	*
	3H1915-9/20	SEAL ASSEMBLY: water pump; includes: rotary seal carbon washer, spring holder, ring, spring, friction ring, and friction ring band: Hercules Motors No. 59265-AS.	1				*	*	*

* Indicates stock available.

Order No. 3044-MPD-44-32; 2912 copies; November 1944

U. S. GOVERNMENT PRINTING OFFICE O—1945