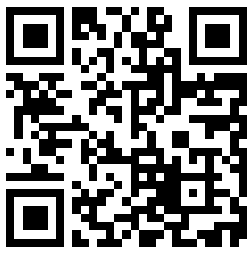

TM 11-980

WAR DEPARTMENT TECHNICAL MANUAL

POWER UNIT PU-58/G

WAR DEPARTMENT *19 JANUARY 1945*

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TM 11-980

POWER UNIT
PU-58/G

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WAR DEPARTMENT,
WASHINGTON 25, D. C., 19, JANUARY 1945.

TM 11-980, Power Unit PU-58/G, is published for the information and guidance of all concerned.

[A. G. 300.7 (1 Sep. 44).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
J. A. ULIO,
Major General,
The Adjutant General.

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(For explanation of symbols see FM 21-6.)

DESTRUCTION NOTICE

WHY —To prevent the enemy from using or salvaging this equipment for his own 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, foxholes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE

FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT—1. Smash—Cylinder head, cylinder, spark plugs, magneto, carburetor, generator, gas tank, battery, meters, and gauges.

2. Cut—All connecting wires and cables.

3. Burn—Instruction books, canvas cover, and shipping case.

4. Bend—Base, housing, control cabinet, etc.

5. Bury or scatter—Any or all of the above pieces after breaking.

DESTROY EVERYTHING

SAFETY NOTICE

1. DO NOT ATTEMPT ADJUSTMENTS OR CHANGES ON WIRING WHILE POWER UNIT PU-58/G IS IN OPERATION, OR WHILE BATTERY IS CONNECTED. THIS UNIT GENERATES HIGH VOLTAGE. SEVERE AND POSSIBLY FATAL SHOCKS MAY BE ENCOUNTERED, ESPECIALLY WHEN POWER UNIT IS OPERATING ON WET OR DAMP GROUND.
2. SUFFICIENT AND PROPER VENTILATION MUST BE PROVIDED, IF THE POWER UNIT IS OPERATED IN A CONFINED SPACE. EXHAUST GASES PRODUCED ARE POISONOUS, AND EXCESSIVE INHALATIONS MAY RESULT IN SEVERE SICKNESS OR DEATH.
3. DO NOT SERVICE WITH GASOLINE WHILE POWER UNIT IS RUNNING OR IF A RADIO TRANSMITTER IS OPERATING IN CLOSE PROXIMITY TO POWER UNIT.
4. OPERATOR SHOULD OBSERVE EVERY STANDARD REGULATION WHILE OPERATING THIS POWER UNIT.
5. STOP THE UNIT BEFORE REMOVING THE GASOLINE TANK FILLER CAP. AVOID SPILLING GASOLINE ON A HOT ENGINE.

NOTE

IF THIS POWER UNIT IS USED FOR EMERGENCY SERVICE, IT WILL BE OPERATED NOT LESS THAN ONE HOUR EACH WEEK CARRYING THE FULL CONNECTED LOAD.

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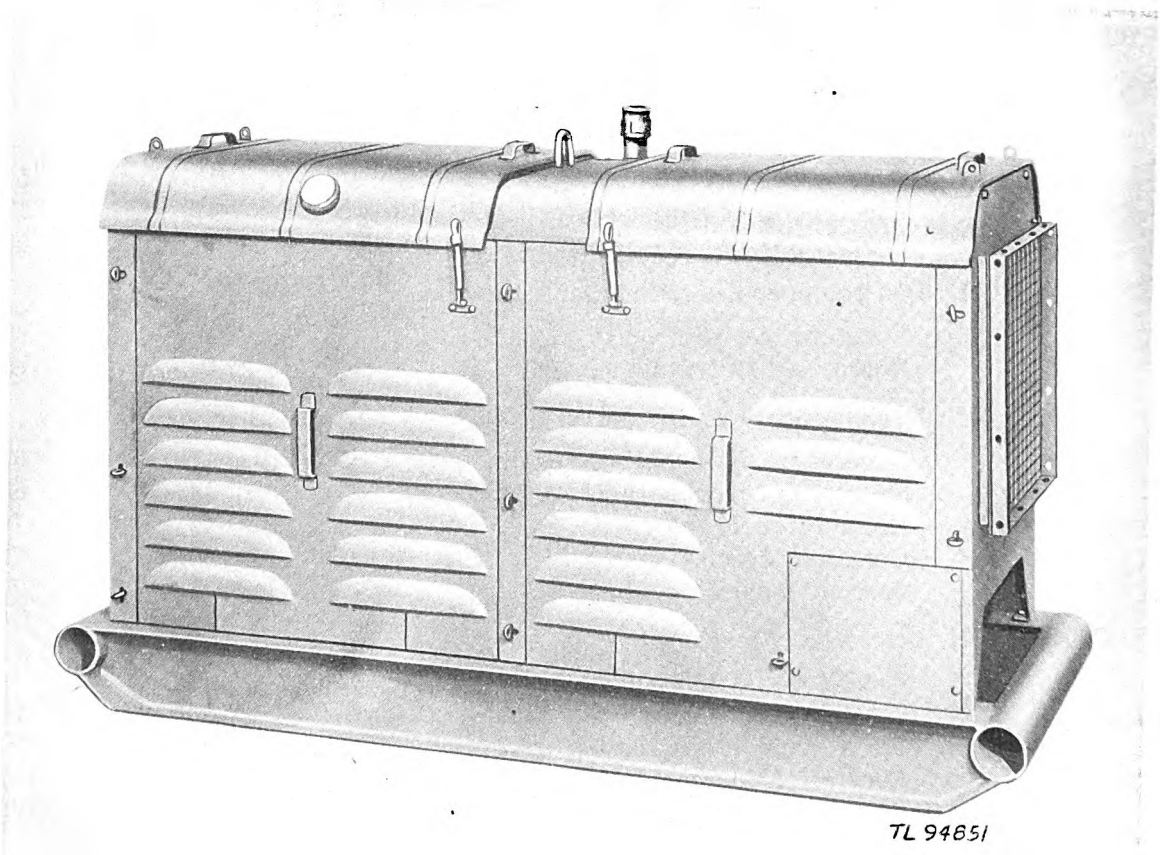


Figure 1. Power Unit PU-58/G.

PART ONE
INTRODUCTION

SECTION I
DESCRIPTION OF POWER UNIT PU-58/G

1. GENERAL.

Power Unit PU-58/G (figs. 2 and 3) is a complete, 120/240-volt, 60-cycle, electric generating plant. It consists of an engine and a generator with the necessary accessories and controls, all mounted in a metal housing (fig. 1) which serves also as a skid frame.

a. Capacity. The rated capacity of the power unit is 5 kilowatts (kw) at unity power factor and 6.25 kilovolt-amperes (kva) at 80 percent power factor.

b. Engine. The engine (figs. 4 and 5) is of the four-cyclinder, four-cycle, L-head, water-cooled, automotive type, and is designed to operate on regular gasoline of 60 to 70 octane. It furnishes the power which drives the main generator to which it is direct-connected. It also drives certain necessary accessory equipment. The engine is rated 22 horsepower at normal operating speed at 1,200 revolutions-per-minute (rpm).

c. Generator. The alternating-current (a-c) generator (figs. 2 and 3) supplies single-phase ac at 60 cycles. The voltage may be either 120 or 240, the change from one standard voltage to the other being made by changing jumper connections at the terminal block mounted on the rear of the control panel. The generator is designed to operate with a full load temperature rise of less than 40° C.

2. PERFORMANCE CHARACTERISTICS.

a. The following table is for 120-volt output.

Approximate load	100% Power Factor			80% Power Factor		
	Volts	Amperes	Kilowatts	Amperes	KVA	Frequency (cycles)
Light	123	4.1	0.50	5.1	0.63	60.3
1/4	123	10.2	1.25	12.7	1.56	60.3
1/2	122	20.5	2.50	25.6	3.13	60.2
3/4	121	31.0	3.75	38.7	4.68	60.1
Full	120	41.6	5.00	52.0	6.25	60.0
Maximum 125%	118	53.0	6.25	70.5	8.32	59.8

b. The following table is for 240-volt output.

Approximate load	100% Power Factor			80% Power Factor		
	Volts	Amperes	Kilowatts	Amperes	KVA	Frequency (cycles)
Light	246	2.0	0.49	2.5	0.63	60.3
1/4	245	5.1	1.25	6.3	1.56	60.3
1/2	244	10.25	2.54	12.8	3.18	60.2
3/4	242	15.5	3.75	19.3	4.69	60.1
Full	240	20.8	5.00	26.0	6.25	60.0
Maximum 125%	236	26.5	6.25	35.3	8.32	59.8

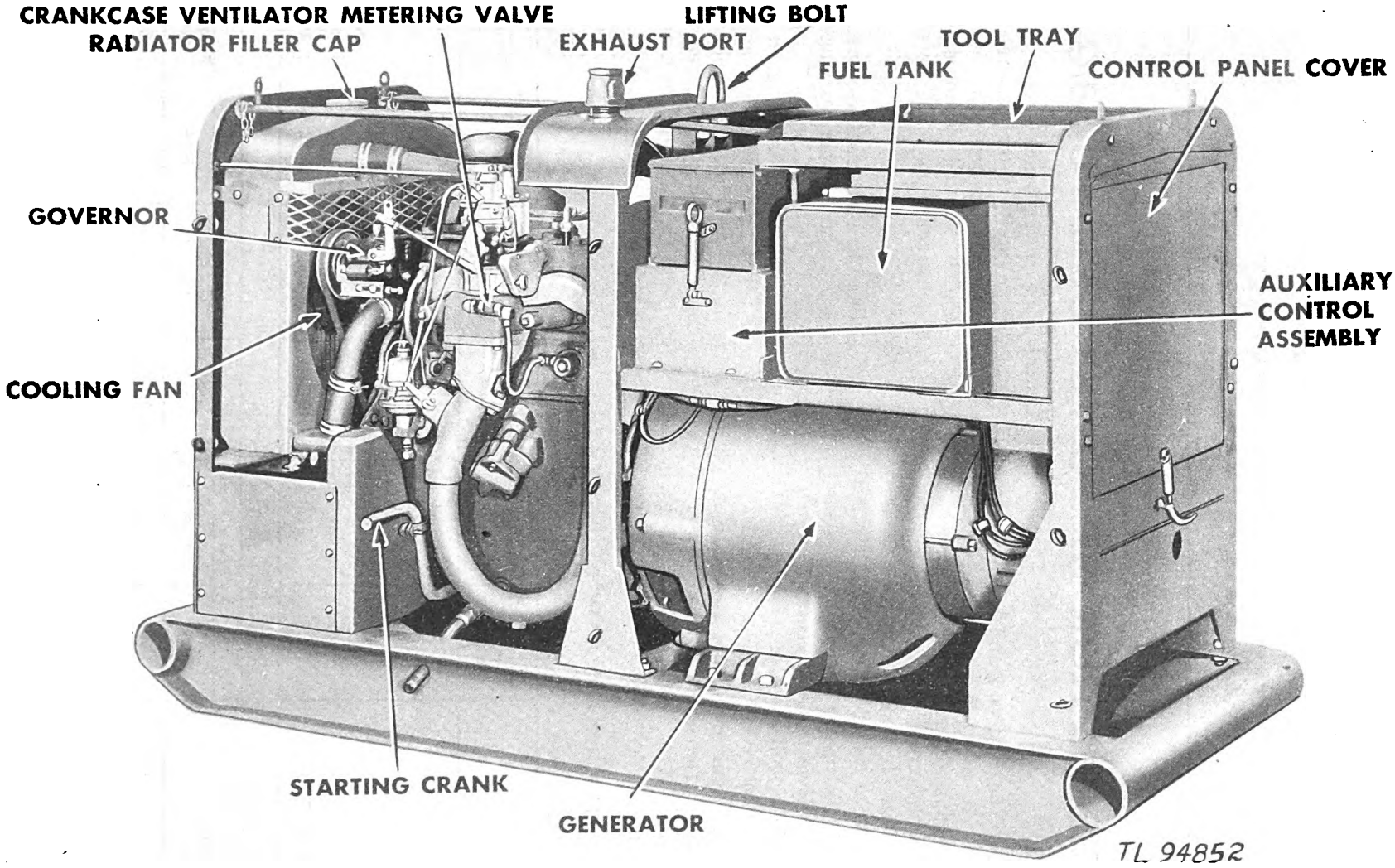


Figure 2. Power Unit PU-58/G, right side.

3. TABLE OF CONDENSED SPECIFICATIONS.

Engine . . . Willys Overland Motors.
Model . . . MB Cycle . . . 4.
Type of cylinder head . . . L.
Number of cylinders . . . 4.
Valve arrangement . . . Vertical valve-in-block.
Bore . . . 3-1/8" Stroke . . . 4-3/8".
Cylinder head . . . Cast iron.
Piston displacement . . . 134.2 cu. in.
Taxable horsepower . . . 15.63.
Compression ratio . . . 6.48 to 1.
Standard compression pressure (pounds)
At cranking speed . . . 111 @ 185.
Engine operating speed . . . 1200 rpm.
Horsepower . . . 22 at 1200 rpm.
Piston . . . Aluminum LO-EX lyanite.
Wrist pin . . . Carbon manganese steel.
13/16" diam x 2-25/32" (.8117-.8119).
Compression rings (2 per piston) . . . 3/32" (0.0925"-0.0935").
Oil ring (1 per piston) . . . 3/16" (0.1860"-0.1865").
Maximum wall thickness . . . 0.135"-0.145".
Maximum wall thickness . . . 0.130"-0.140".
Spark plug . . . Champion C-10-S.
Main bearing . . . Steel back babbitt-slip in-0.001" clearance.
Journal diam No. 1 . . . 2.3340"x1.920" and length No. 2 . . . 2.3340"x1.8125".
(front bearing takes thrust) No. 3 . . . 2.3340"x1.75".
Rod lower bearing . . . Steel back babbitt.
Clearance 0.0008" to 0.0023".
End play 0.005" to 0.009".
Timing chain . . . . 47 link belt 1" with 1/2" pitch.
Intake valve . . . Aluminum industries (Rich Mfg. SAE No. 3140).
Stem diam . . . 0.373", lift . . . 0.3594".
Stem to guide clearance . . . 0.0015" to 0.00325".
Exhaust valve . . . Rich Mfg. (Chrome nickel).
Stem diam . . . 0.3725", lift . . . 0.3594".
Stem to guide clearance . . . 0.002" to 0.00375".
Tappet clearance for valve timing . . . 0.020".
Operating tappet clearance (cold) intake . . . 0.014", exhaust 0.014".
Lubrication system pressure . . . Planetary gear type pump.
Type of cooling . . . Fan belt centrifugal pump.
Air cleaner . . . Oil bath type.
Oil filter . . . Purolater model No. 27078.
Crankcase oil, dry . . . 5 quarts, refill . . . 4 quarts.
Fuel tank capacity . . . 10-1/2 gal.
Cooling system capacity . . . 14 quarts.
Fuel feed . . . A-c camshaft pump model AF.
Carburetor . . . Carter model WO-450-S 1-1/8" down-draft.
Battery . . . 6 volts. Ampere hours . . . 100.
Ignition . . . Autolite model IGC-4705.
A-c generator . . . O'Keefe & Merritt No. 10000-36.
Rating . . . 6.25 kva at 80% power factor 120/240 volts, 60 cycles at 1200 rpm.
General brushes . . . Ac, 7/8"x1/4"x1-1/8" Dc, 1-1/4"x1/2"x1-1/4".
Generator bearing . . . Hoover No. 7306.

4. TABLE OF MAJOR COMPONENTS.

Quan	Name	Width (In.)	Length (In.)	Height (In.)	Weight (dry) (lb)
1	Power Unit PU-58/G	28-1/4	69-1/4	41	1586
1	Engine with accessories	22-1/2	27	30-1/2	413
1	Generator with adaptor ring	19	29-3/4	19-1/2	564
1	Radiator assembly	20	8-1/2	23-1/2	35
1	Battery	7	10	9	48
1	Fuel tank	11-3/4	24-1/2	14	20
1	Tool box	8-1/4	22-1/4	6-1/4	11
1	Control panel assembly	20-1/4	5-1/2	16-1/2	31
1	Auxiliary control assembly	9-1/2	24-1/4	8	30
1	Housing and skid base	28-1/4	69-1/4	41	434

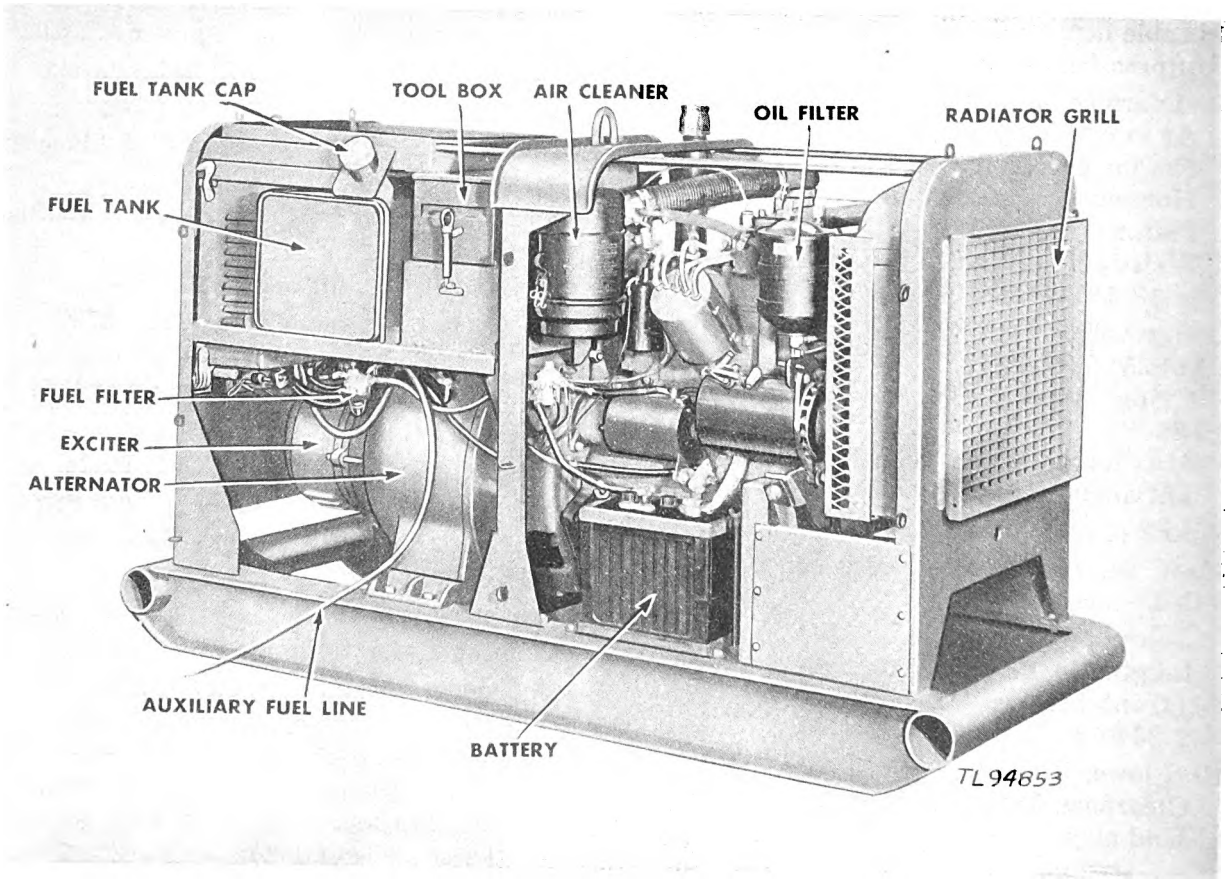


Figure 3. Power Unit PU-58/G, left side.

5. DESCRIPTION OF MAJOR COMPONENTS.

Power Unit PU-58/G consists of the following major components:

a. Engine. The engine is of the four-cylinder, four-cycle, L-head, water-cooled, automotive type, and is designed to operate on regular gasoline of 60 to 70 octane. It furnishes the power which drives the main generator to which it is direct-connected. It also drives certain necessary accessory equipment. The engine is rated 22 horsepower at normal operating speed of 1,200 rpm.

(1) IGNITION SYSTEM. A battery ignition system is used. An ignition unit is mounted on the left side of the engine and is driven through a shaft by a gear on the camshaft. This unit includes the breaker mechanism, capacitor, high-tension distributor, and ignition coil. A metal shield encloses the distributor to reduce radio interference. Shielded aircraft-type spark plugs are used (figs. 10 and 13).

(2) FUEL SYSTEM. The fuel supply system includes a 10-1/2 gallon fuel tank mounted over the main generator, a diaphragm type fuel pump, and a down-draft type carburetor fitted with an automatic electric choke. A fuel filter screen, glass sediment bowl, and shut-off valve are mounted under the fuel tank. This shut-off valve is a two-way type which permits the carburetor fuel feed line to be connected either to the main fuel tank or to the auxiliary fuel tank, as desired. An air cleaner cleans the air which enters the carburetor intake.

(3) SIX-VOLT BATTERY SYSTEM. A belt-driven charging generator supplies current to recharge the 6-volt storage battery. This generator also supplies current to the ignition system and to certain control circuits while the plant is in operation. The storage battery supplies power for electric cranking, automatic choking, and ignition during the starting period. A combination voltage-regulator and reverse-current relay controls the charging rate.

(4) COOLING SYSTEM. The water cooling system includes an automotive type radiator, fan and pump. The fan is mounted on the extended pump shaft and both fan and pump are driven by a V-belt from a pulley on the engine crankshaft. Cooling air is discharged forward through the radiator. A thermostat in the water outlet elbow at the top of the cylinder head controls water circulation.

(5) OILING SYSTEM. Main, connecting rod, and camshaft bearings are lubricated by oil pressure supplied by a gear type oil pump. Other internal parts are spray lubricated. An oil filter is mounted on the left side of the engine. A bayonet type oil level gauge is mounted in the oil filler pipe.

(6) GOVERNOR. The engine governor is of the conventional fly-weight type, driven by a V-belt from a pulley on the crankshaft. It controls the engine speed and, thus, the frequency of the a-c generator.

(7) HOUSING. The complete engine-generator unit (fig. 1), with controls, is inclosed in a steel housing mounted on a steel skid base. The housing serves as radio shielding, helps direct cooling air currents, and provides some protection against mechanical and other damage. Top and side panels are removable to permit inspection and servicing the plant. A grille at the front end protects the radiator. The radiator grille frame is drilled to permit attaching a canvas duct to convey the heated air to the outside of a building, if desired. The control panel is inset at the rear end of the housing and is protected by a hinged door.

b. Generator. The a-c generator supplies the a-c power output of the power unit. This generator assembly really consists of two individual generators—the alternator, and the exciter.

(1) ALTERNATOR. The alternator is attached to, and supports, the rear end of the engine. It consists of two major parts, the revolving field and the stationary armature. It is in the two windings of the stationary armature that the ac is generated. These windings are connected directly to the a-c terminal block on the control panel. One winding supplies 120 volts and the other supplies 240 volts.

(2) EXCITER (figs. 28 and 29). The exciter is attached to the outer end of the alternator and supplies the dc used to excite the revolving field. An automatic voltage-regulator controls the exciter voltage and this, in turn, controls the alternator voltage. The revolving field of the alternator and the revolving armature of the exciter are mounted on the same shaft. This shaft is driven by a steel disk connected to the shaft and to the engine flywheel. The rear end of the shaft is carried by a ball bear-

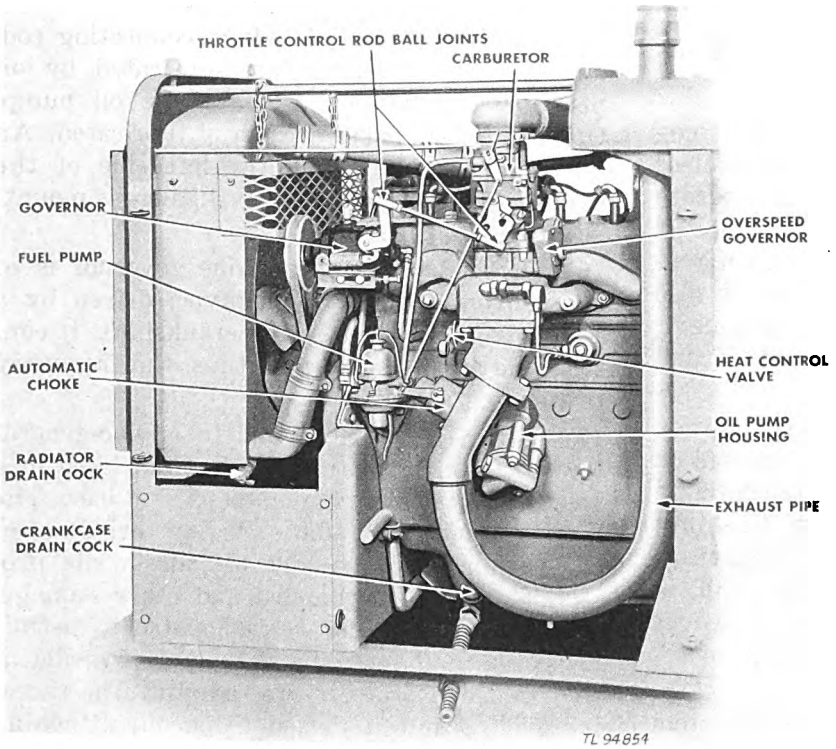


Figure 4. Engine for Power Unit PU-58/G, right side.

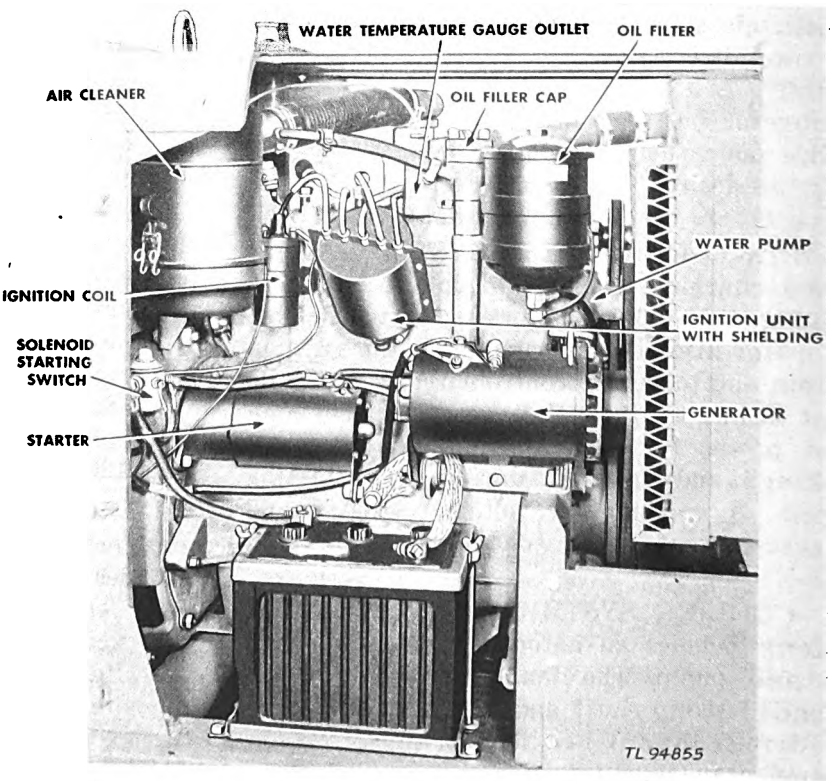


Figure 5. Engine for Power Unit PU-58/G, left side.

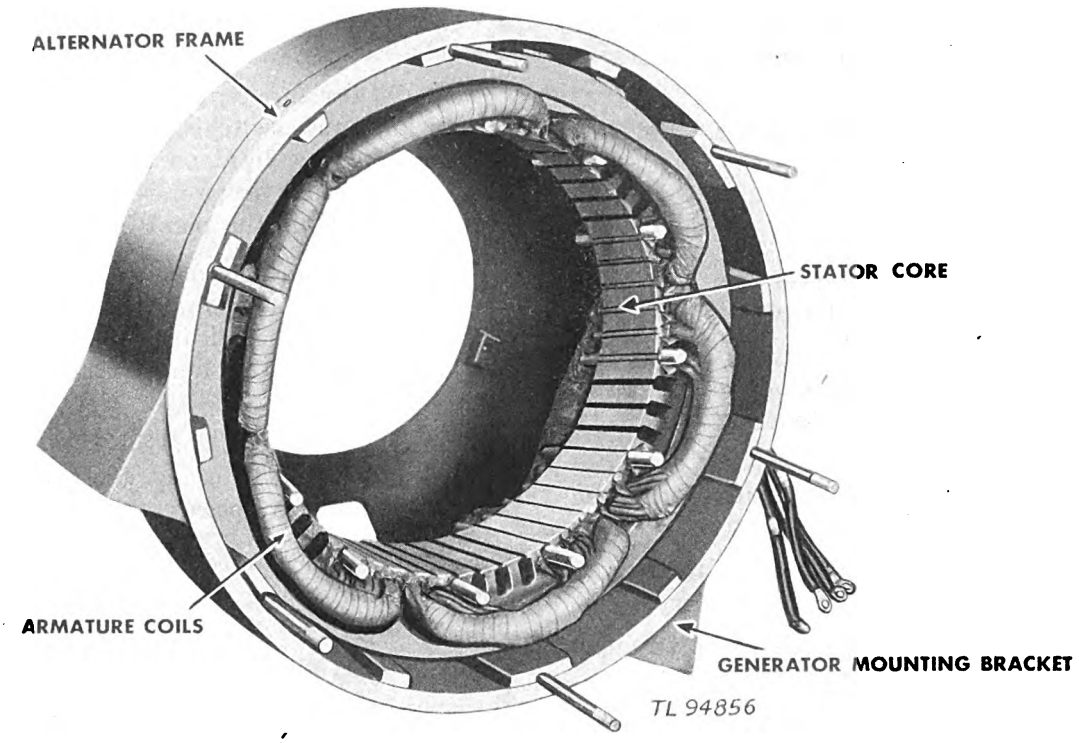


Figure 6. Alternator frame and stator winding.

ing. A fly-wheel blower circulates cooling air.

(3) REGULATION. The output voltage of the generator is controlled by an automatic voltage regulator and the engine speed.

(*a*) *Voltage.* The voltage regulator (fig. 30) maintains the output voltage within 2 percent, plus or minus, of the adjusted value while the plant is in normal operation. The voltage regulator is mounted on the auxiliary control assembly panel (fig. 27), and the rheostat is mounted on the main control panel (figs. 11 and 12). A hand-operated field rheostat mounted on the control panel may be used instead of the automatic voltage regulator.

(*b*) *Frequency.* Frequency regulation depending on the regulation of the engine speed, is within one-half to one cycle.

c. Controls. Certain controls are used to start and stop the power unit. Others regulate it automatically under normal operating conditions and protect it against heavy overload, high water-temperature and low oil-pressure. Much of the control equipment is mounted on the control panel for convenient use. Other controls are necessarily located at different places on the power unit.

(1) CONTROL PANEL ASSEMBLY. The control panel assembly contains the following equipment:

(*a*) *A-c voltmeter.* 0-150 volt scale, indicates the output voltage.

(*b*) *Two A-c Ammeters.* 0-50 ampere scale, indicate the load amperes in each leg.

(*c*) *Fuel Gauge.* Indicates supply of fuel in tank on the unit.

(*d*) *Momentary Contact Switch.* Lever contact switch to energize fuel gauge when unit not in operation.

(*e*) *Battery Charge Rate Ammeter.* Indicates the rate of battery charge and discharge.

(*f*) *Engine Oil Pressure Gauge.* Indicates the operating pressure of the engine lubricating system.

(*g*) *Oil Pressure Failure Indicating Light (red).* Lights if oil pressure drops below 8 pounds per square inch.

(*h*) *Engine Water Temperature Gauge.* Indi-

cates the temperature within the engine water jacket.

(*i*) *Excess Water-Temperature Indicating Light (amber)*. Lights if water temperature rises above 206° F.

(*j*) *Running-time Meter*. Shows the total operating hours.

(*k*) *Frequency Meter*. Indicates the output frequency.

(*l*) *Circuit Breaker*. Serves as the load switch, trips automatically when the power unit is heavily overloaded.

(*m*) *Manual Voltage Control Rheostat*. Serves to regulate the output voltage of the generator manually.

(*n*) *Two Panel Lamps*. Illuminate the control panel.

(*o*) *Panel Light Toggle Switch*. Serves to connect the panel lamps to the battery.

(*p*) *Trouble-lamp Receptacles*. For connecting a 120-volt trouble lamp.

(*q*) *Start-stop Switch*. Serves to start and stop power unit.

(*r*) *Hand Cranking—Normal Operating Ignition Switch*. Serves to switch the ignition circuit to the battery as required for hand starting.

(*s*) *Voltage Regulator Rheostat*. Used for controlling the output voltage when using the voltage regulator.

(*t*) *Voltage Regulator Switch*. Connects the voltage regulator into or out of the circuit.

(*u*) *A-c Terminal Block with Jumper Links*. Change output voltage from 120 volts to 240 volts, or vice versa.

(2) AUXILIARY CONTROL ASSEMBLY (fig. 27). This auxiliary panel contains the following:

(*a*) *Automatic Voltage-Regulator*. Automatically controls the a-c voltage output.

(*b*) *Battery Voltage Regulator*. Controls the voltage of the battery-charging circuit and protects the generator against overload.

(*c*) *Relay Panel*. Controls the ignition, cranking, and automatic shut-down circuits when the unit is operated in a normal operating condition.

(*d*) *Oil Pressure Safety Switch*. Stops the power unit and switches on the oil pressure failure indicating light on the control panel if the oil pressure drops below 8 pounds per square inch while the plant is operating.

(*e*) *High Water-Temperature Switch*. Stops the power unit and switches on the excess water-temperature indicating light on the control panel if the water temperature rises above 260° F.

(3) MISCELLANEOUS CONTROL EQUIPMENT. The following control devices are located at different places on the power unit:

(*a*) *Automatic Choke* (fig. 4). Chokes the engine during the starting and warm-up period.

(*b*) *Engine Governor* (fig. 4). Regulates the speed of the engine and the frequency of the output voltage.

(*c*) *Overspeed Governor* (fig. 4). Limits the speed of the engine if the main governor fails.

(*d*) *Heat Control Valve* (fig. 4). Diverts hot exhaust gas to heat the intake manifold during the warm-up period.

(*e*) *Crankcase Ventilator Metering Valve* (fig. 2). Controls the flow of ventilating air from crankcase to manifold.

(*f*) *Solenoid Starting Switch* (fig. 5). Serves to connect the starting motor to the battery during the cranking period.

(*g*) *Manual Choke* (fig. 3). Located on the front engine panel and permits manual choking of the engine when hand cranking is necessary.

d. Tools and Installation Material. A list of tools and installation material furnished with Power Unit PU-58/G may be found in the appendix.

SECTION II
APPLICATION OF POWER UNIT PU-58/G

6. USE WITH OTHER EQUIPMENT.

Power Unit PU-58/G is used to generate electricity to operate radios, lights, motors, and other appliances where power line service from a large power station is not available or upon failure of such power line service.

7. OUTSIDE WIRING SIZES.

When the power unit is situated away from the equipment to be operated, consult the following tables for the correct wire sizes to be used in connecting the unit to the equipment.

a. Outside Wiring, Unity Power Factor Load, 120-volt System. The wire sizes given in the following tables are based on B & S wire gauge sizes.

Load in watts	A-c amperes	Distance in feet									
		100	200	300	400	500	600	700	800	900	1000
500	4.17	10	10	10	10	10	10	10	8	8	8
1000	8.34	10	10	10	8	8	6	6	6	6	4
1500	12.5	10	10	8	6	6	6	4	4	4	2
2000	16.7	10	8	6	6	4	4	4	2	2	2
3000	25.0	10	6	6	4	2	2	2	2	1	0
4000	33.4	8	6	4	2	2	1	1	0	0	
5000	41.7	8	4	2	2	1	0	0			

b. Outside Wiring, 80% Power Factor Load, 240-volt System.

Load in watts	A-c amperes	Distance in feet									
		100	200	300	400	500	600	700	800	900	1000
1000	5.2	10	10	10	10	10	10	10	10	8	8
1500	7.8	10	10	10	10	10	8	8	8	8	6
2000	10.4	10	10	10	10	8	8	6	6	6	6
3000	15.6	10	10	8	8	6	6	6	4	4	4
4000	20.8	10	10	8	6	6	4	4	4	2	2
5000	26.0	10	8	6	4	4	2	2	2	2	1

NOTE: No. 4-0 wire is the largest size practical for commercial use. Do not use wire smaller than No. 10, supported every 75 feet, for outside leads, because it does not have sufficient strength to withstand bad weather conditions although it may be large enough to carry the electrical load.

SECTION III
INSTALLATION AND ASSEMBLY OF POWER UNIT PU-58/G

8. UNCRATING AND UNPACKING.

The crated power unit is completely sealed and contains a dehydrating substance to prevent moisture condensation within the unit. Therefore do not uncrate until ready to use.

a. Procedure. Remove the metal band which fastens the treated paper on the top of the crate. Remove this paper from the top edges. Remove the metal straps from the corners and around the bottom. Remove the top and ends from the crate, then remove the two sides. Cut the cord and remove special wrapping by opening seams. Remove the cardboard cover. The power unit may then be lifted from its wooden base by removing the square nuts from the six studs protruding through the skid base.

b. Accessories. Remove silica jel plugs from cylinder head and replace with spark plugs packed with spare parts. Remove seals attached to engine manifold, air cleaner, oil intake, crank opening, crankcase breather, distributor, and generator housing. Remove the two dehydrating bags on top of the engine. Attach muffler and exhaust piping which will be found fastened beneath the engine.

9. EQUIPMENT CHECKS.

Refer to the lists of tools, installation material, and major components as a check to determine that the unit is complete.

10. INSTALLATION.

The skid base (fig. 1) permits towing the power unit short distances over firm ground with truck or tractor. In very sandy or soft, muddy soil, it may be necessary to lay down planks over which to skid it. Attach the tow rope or chain at one end of the skid base by looping it through the pipe which forms the end cross member. Use a long hitch and tow slowly. To hoist the power unit, attach a hoisting chain to the inverted U-bolt (fig. 2) which extends above the top of the housing. Rollers may be used under the metal skid base.

a. Leveling. When the power unit is mounted in a vehicle, and is to be operated for several hours at a temporary location, locate the vehicle so that the power unit is reasonably level.

b. Importance of Proper Installation. Although Power Unit PU-58/G is built to rigid specifications and carefully tested and inspected before leaving the factory, it cannot function properly and give the best service unless operating conditions are reasonably favorable. Many of these conditions depend entirely on the installation. The instructions which follow apply under usual conditions. When they cannot be followed exactly, use them as a guide and make the best installation that circumstances permit.

c. Choice of Location. Locate the plant as near the center of the load as practicable. This assures lower line loss with a given size of wire and improves the control of voltage at the remote end of the lines. The size of line wires required depends largely upon the distance from the power unit to the load, the amount and kind of load and permissible voltage drop between power units and load. Be sure to use wire that is large enough for the purpose. If you do not know the proper size of wire, refer to the wiring tables in paragraph 7.

(1) SURROUNDING CONDITIONS. The circumstances under which power units are used vary greatly, but for the best results it is most desirable to provide the most favorable operating conditions that circumstances permit. The housing on Power Unit PU-58/G so protects it that it can be operated out-of-doors, if necessary, but rain, snow, dust, grit, and extremely cold weather are very unfavorable to satisfactory operation and long life. If circumstances permit, install the power unit, indoors.

(2) INDOOR INSTALLATION (fig. 7). If the power unit is to be permanently installed, provide an indoor location. This is particularly important in cold climates. The unit requires a floor space 9x12 feet, or larger. Install the unit lengthwise in the space and at least 2-1/2 feet from the nearest wall or partition, for easy access in servicing. Provide ventilation, at

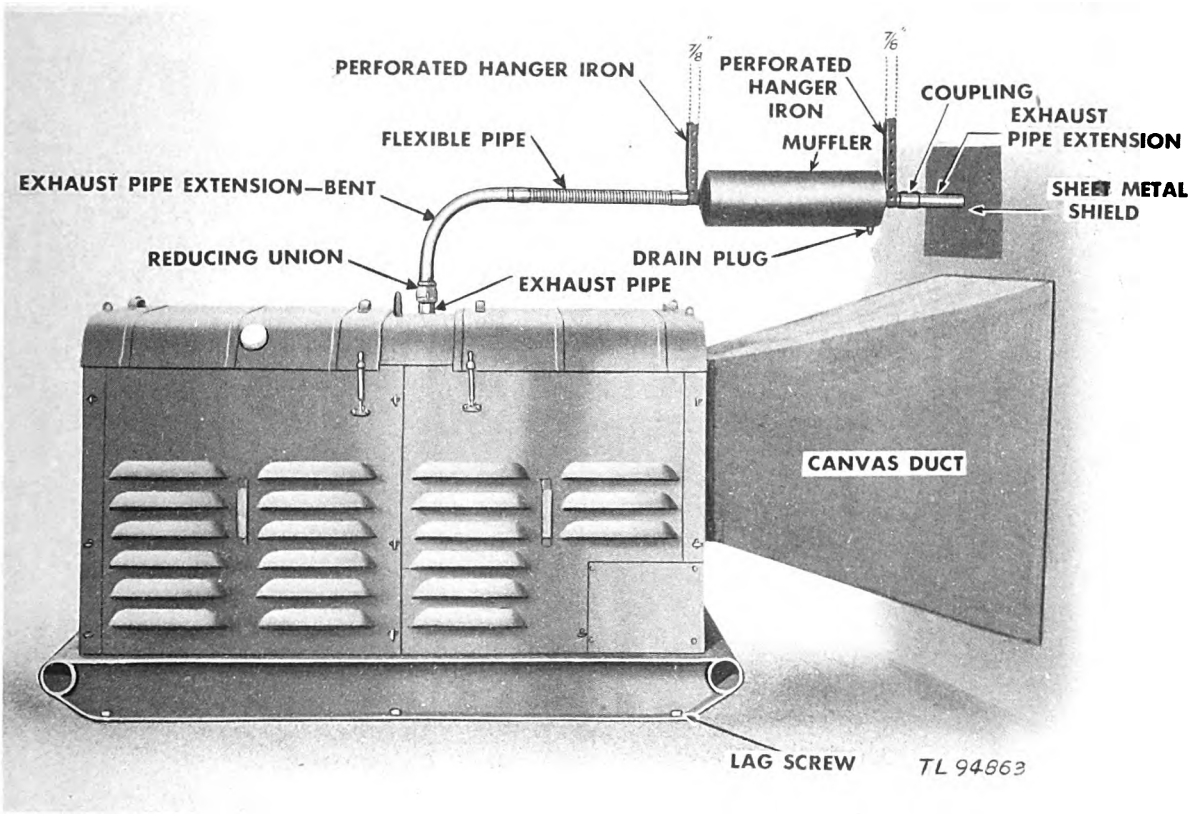


Figure 7. Muffler and exhaust pipe assembly.

least a door and a window on different sides of the room, so that the room temperature may be controlled. If necessary, in order to prevent too great a rise in room temperature, attach a canvas duct to the radiator grille and to a wall opening at least as large, so that the heated air will be conducted to the outside of the room.

d. Foundation. Attach the power unit to a firm, level base. The base must be strong enough to permanently support the weight of approximately 1,800 pounds. It may be made of concrete or heavy timbers and should extend about 10 inches above the floor level for convenience. Shock absorbing material may be used between the plant and the base, if desired.

e. Exhaust. Exhaust gases are deadly poisonous. Pipe them to the outside of the building. Three 4 foot lengths of threaded steel pipe and one 20 inch piece of flexible exhaust pipe are furnished with each unit. This additional pipe permits adequate extension of the muffler unit to pipe the exhaust gases out of the building. If additional pipe is necessary, increase the pipe by one pipe-size for each additional 10-foot length. The additional pipe may be any suitable pipe of the proper size. *Be sure that all connections are mechanically secure and gas tight.* Avoid unnecessary turns. Pitch the pipe downward from its connections at the power unit, if possible. If necessary to pitch the pipe upward, install a condensation trap in the line at the point where the upward pitch starts. This trap may be assembled of suitable pipe fittings. Its purpose is to catch water that condenses in the exhaust line and prevent its running back into the muffler of the power unit. The trap must be drained periodically to perform this function. In addition, a drain plug is provided in the muffler, which permits periodical drainage of this unit. An exhaust line becomes hot. If it passes through an inflammable wall, partition or floor, install it in metal collars to separate it at least several inches from the inflammable material. These collars are furnished as part of the installation material shipped with the power unit. Support the pipe securely at necessary points.

f. Auxiliary Fuel Tank (fig. 8). Provision is made for connecting an auxiliary fuel tank, if desired. Use the 20-foot length of copper

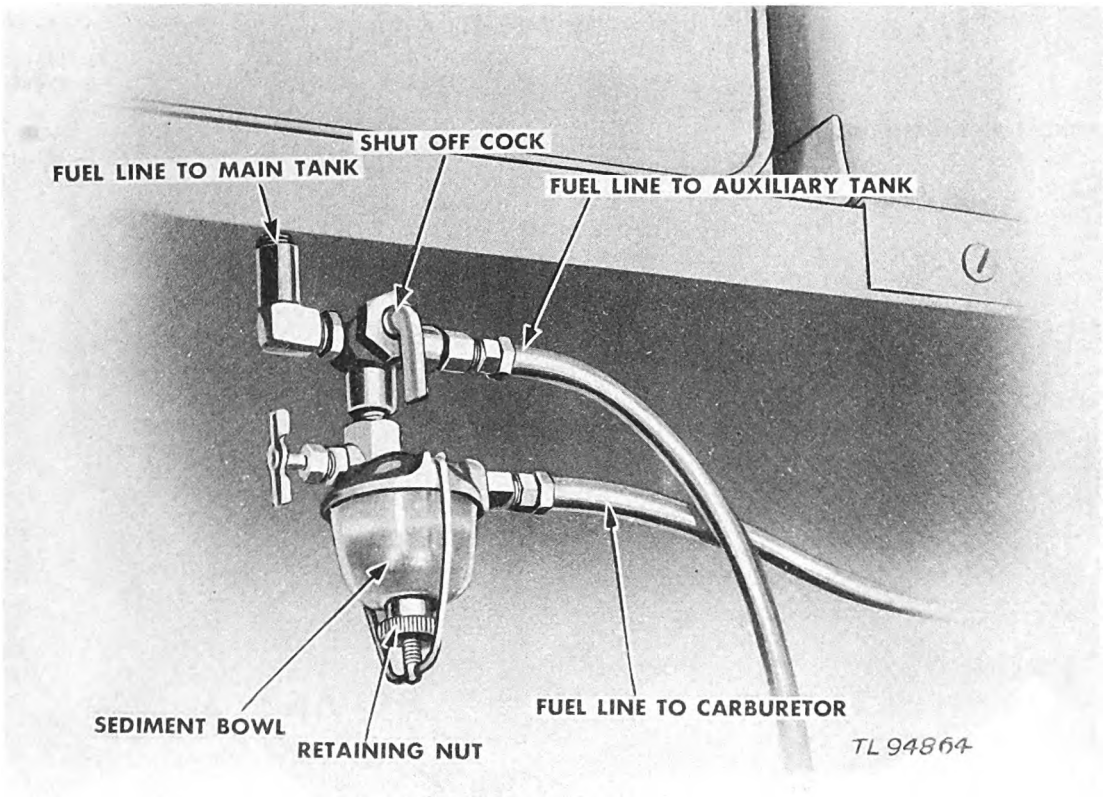


Figure 8. Fuel filter assembly and shut-off cock.

tubing furnished. Install the fuel tank out-of-doors, if possible, but not farther from the power unit than the 20-foot line will permit. If a longer fuel line is used, the pump may fail to keep the carbuertor supplied with fuel. The bottom of the fuel tank should not be more than 6-feet below the fuel shut-off valve at the power unit. Be sure that the fuel line has a continuous downward pitch from power unit to tank.

If the fuel line attaches to a fitting at the top of the auxiliary tank, there must be a suction tube inside the tank extending from the fitting to within an inch or two of the bottom of the tank so that the fuel may be drawn from the tank by the pump. Do not install the tank near the exhaust line. The tank must be vented.

11. INSTALLATION IN SHELTER WITH WOODEN FLOOR.

To install Power Unit PU-58/G in a shelter with wooden floor, remove the sides of the shipping crate, allow the crate base to remain bolted to the engine base. The unit may then slide onto the floor of the shelter. Four wooden planks bolted to the floor of the shelter hold the planks of the crate base in place and prevent the unit from sliding because of engine vibration.

12. CONNECTIONS.

a. Electrical Connections. Make sure that all electric wires entering the room, and within the room, are properly supported and insulated. Connect the load wires to the A.C. OUTPUT terminals (fig. 11), beneath the control panels. For 120-volt two-wire service, connect the load wires to the NEUTRAL, and right hand A.C. OUTPUT terminals. The links on the A.C. OUTPUT terminal block (fig. 12) should connect terminals 5 and 6 and terminals 7 and 8.

NOTE: The left hand A.C. OUTPUT terminal should never be used for 120-volt service, as this terminal is shorted to the NEUTRAL by one of the links on the A.C. OUTPUT terminal block.

For 240-volt two-wire service, connect the load wires to the outside A.C. OUTPUT terminals.

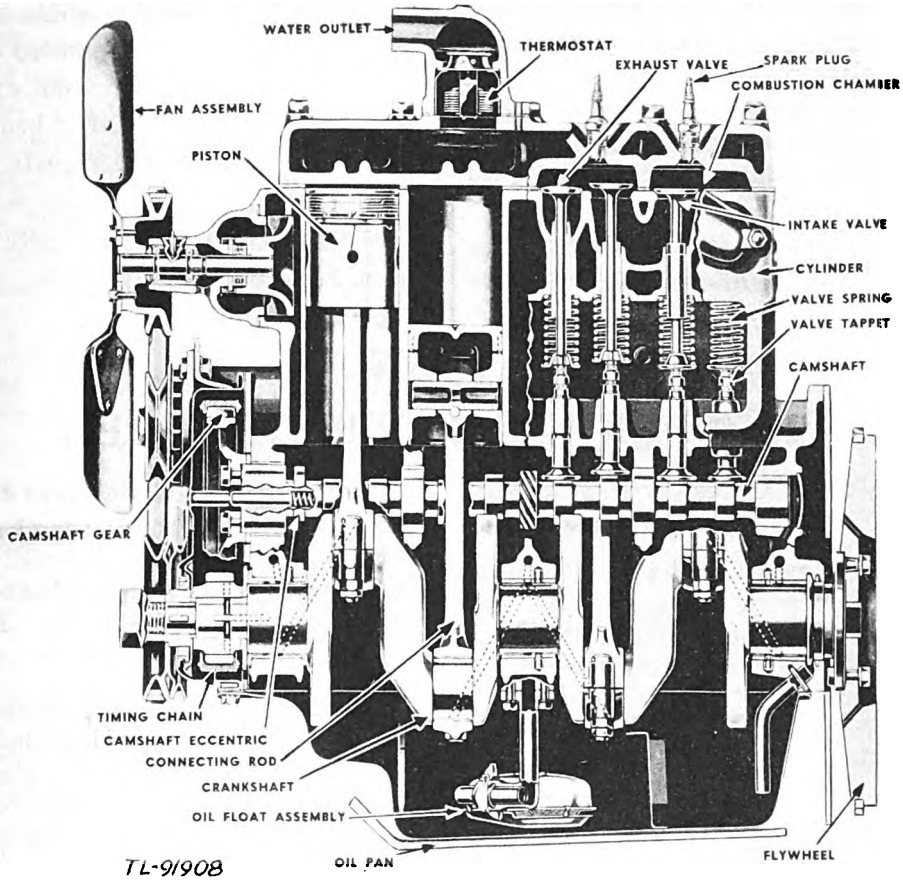


Figure 9. Side-sectional view of engine.

The links for this position should connect terminals 6 and 7 on the A.C. OUTPUT terminal block. If it is desired to use a 240-volt, three-wire system, connect the third wire to the NEUTRAL output terminal (fig. 33). The size of insulated wire to use within the room for connecting the load to the power unit depends on the load amperes and the type of insulation on the wire. The following sizes are recommended as the smallest safe sizes for use within the room to carry the full load of the power unit: Use No. 2 for 120-volt service, if the insulation contains rubber, or No. 4 if the insulation does not contain rubber; use No. 8 for 240-volt service, if the insulation contains rubber, or No. 10 if the insulation does not contain rubber. Be sure that all connections are mechanically and electrically secure.

b. **Remote Control Connections.** If it is desired to start and stop the power unit from one or more remote points, it will be necessary to install remote start and stop switches at each of the remote points and to connect them with the REMOTE control terminals (fig. 11), below the control panel of the power unit. Use two-pole, normally open, push-button type switches, one for starting and one for stopping. Connect the insulated terminal of the starting switch to the REMOTE start control terminal. Connect the insulated terminal of the stopping switch to the REMOTE stop control terminal. Connect the REMOTE ground return terminal through one wire to both remaining terminals of the two switches. No. 16 wires will serve for these connections up to 150 feet. Support them properly. These wires are connected with the 6-volt battery circuit.

13. REPACKING INSTRUCTIONS.

When a power unit is not to be used for 30 days or more, or is to be transported to a remote point, prepare the unit as follows:

a. **Engine.** Wash, clean, and completely lubricate the engine (fig. 9).

b. **Governor.** Drain the lubricating oil from the governor and refill with new oil.

c. **Oil Filter.** Drain the oil from the filter.

d. Valves. Remove the valve housing cover and spray oil over the valves and rocker mechanism. Replace cover.

e. Exhaust and Intake. If the exhaust system has been dismantled, cover the manifold opening. Also cover intake openings and generator vents.

f. Rust Prevention. Apply a thin but complete coating of Compound, Light, Rust Preventative, U. S. Army Spec No. 2-84, or equivalent, to all exposed unpainted parts such as threads, nuts, silencer and exhaust piping. Apply the compound with a brush, being careful not to wet any rubber parts.

g. Covering. Completely wrap or otherwise cover the power unit with whatever material is available and suitable.

SECTION IV
PREOPERATION PROCEDURES

14. CHECKING AND CHARGING STORAGE BATTERIES.

The storage battery (fig. 3) is of the wet-dump type, shipped with charged plates and moist wood separators, but without the electrolyte. Vent plugs or filler caps must be screwed down tightly. Adhesive tape seals are pasted on top of the caps and remain so until ready to be filled with electrolyte and prepared for service.

a. Vent Holes. To prepare the battery for use, remove the tape seals and open vent holes.

b. Electrolyte. Fill cells to 3/8-inch above separators with electrolyte of diluted sulphuric acid. Specific gravity of the electrolyte should be 1.280 at 80° F (32° Be). In tropical climates use 1.240 specific gravity at 80° F (28° Be). Temperature of the filling acid must not exceed 90° F (32° C).

c. Filler Caps. Place the filler caps on the battery and tighten them securely. Allow battery to cool by allowing to stand from 4 to 8 hours before placing on charge.

d. Charging. Charge the battery on a series line using only dc. Charge at a rate of 5.5 amperes. Charge battery unil specific gravity shows no increase for 4 consecutive hourly readings. At this point the terminal voltage of each cell should be a minimum of 2.5 volts. Minimum charging time should be 24 hours.

e. Temperature. Extreme care should be taken that the temperature of the electrolyte does not exceed 110° F (43.30° C) while the battery is on charge. If the temperature exceeds 110° F reduce the charging rate until the temperature begins to drop.

f. Specific Gravity when Fully Charged. Final specific gravity of the electrolyte should be adjusted to 1.270 to 1.285 (31° to 32° Be) at 70° F (21.1° C). In tropical climates adjust to 1.225 to 1.240 (27° to 28° Be) at 70° F (21.1° C).

g. Placing in Service. Wash off top of battery and tighten vent plugs before placing in service. The negative battery strap is grounded to the starting motor support bracket with an additional ground strap to the battery generator support bracket. Connect this strap to the negative (N) post of the battery. Place this strap in a position that will avoid its interference in removing a vent cap by having to route it around the generator support bracket (fig. 5). Connect the positive (P) battery cable, which is attached to the left terminal of the solenoid starting switch, to the positive (P) post of the battery. Place all the strap and cable connectors well down around the battery posts and tighten the bolts securely.

15. SERVICING THE UNIT BEFORE OPERATION.

Recheck to be sure that all instructions for installation (section III) have been complied with.

a. Side Panels. Remove the side panels of the housing.

b. Ignition Switch. Open the control panel door and be sure the ignition switch is on the NORMAL OPERATING POSITION. This switch must be on the NORMAL OPERATING POSITION at all times except while starting the power unit by hand cranking.

c. Crank Manually. Crank the engine over a few times with the hand crank to be certain that the pistons are free, and that the generator turns freely. The hand crank is attached in front of the engine oil pan inside the housing (fig. 2). Keep it there when not in use.

d. Electrical Connections. Check all electrical connections to ensure their being tight and clean, including those of distributor and spark plugs.

(1) CIRCUIT BREAKER (fig. 11). The CIRCUIT BREAKER handle should be in the OFF position so that the load is not connected to the alternator.

(2) LOAD WIRES. Check the load wires for proper connections.

(3) AC TERMINAL JUMPERS (fig. 12). The terminal jumpers at the a-c terminal block on the rear of the control panel are connected properly for an output of 120 volts and will need no attention if that is the desired voltage. If an output of 240 volts is desired it will be necessary to change the jumper connections in accordance with paragraph 12 a.

e. Close Fuel Shut-Off Valve. Close the two-way fuel shut-off valve located under the main fuel tank. The lever handle extends rearward when the valve is closed (fig. 8).

f. Fuel Tank. Fill the main or the auxiliary fuel tank, or both, with a good grade of unleaded gasoline, 60 to 70 octane rating, *observing the usual safety precautions in the handling of this fuel.* Avoid the use of highly leaded fuel if possible. The action of the lead in the combustion chambers on the valve seats and on the spark plugs results in rapid deterioration of engine performance.

g. Open Fuel Shut-Off Valve. Open the two-way fuel shut-off valve to the position corresponding with the fuel tank which is to be used. The lever handle must extend down if the main tank is to be used, forward if the auxiliary tank is to be used. Make sure the fuel shut-off valve at the top of the sediment bulb is open.

h. Fuel Pump (figs. 4 and 24). By means of the lever on the side of the fuel pump, pump the carburetor bowl full of fuel. If the engine camshaft sets so that the pump diaphragm is in its lowest position, the lever will not operate the pump. In that case insert the hand crank and crank the engine one complete revolution. Then the pump can be operated by the lever. Always push the lever down after pumping. If left up, the pump will not be operated by the engine. Examine the entire fuel system for leaks and correct any that may be found.

i. Water Drain Cocks. Close the water drain cock at the lower radiator connection and the water drain cock on the left side of the cylinder block (fig. 4).

j. Radiator. Fill the radiator to 1-inch below the bottom of the radiator neck with clean, alkali-free water. Distilled or rain water may be used. If there is danger of freezing use a standard antifreeze solution in proper proportion. Carefully check all connections for water leaks, correcting any that may be found. The capacity of the cooling system is 14 quarts.

k. Crankcase Lubrication (figs. 5 and 16). Fill the crankcase with oil to the FULL level, as indicated by the bayonet gauge (4 quarts). Use U. S. Army Spec No. 2-104-A oil of the proper SAE number according to the lowest temperature to which the power unit will be exposed, as indicated in the following table:

Temperature	*Oil*
Above 32° F	OE SAE No. 30
Between 0° F and 32° F	OE SAE No. 10
Below 0° F	See cold weather instructions below

When operating the power unit in subzero temperatures, drain the engine crankcase thoroughly. Refill the crankcase with 3 quarts of Oil, OE, SAE No. 10. Check the oil level and mark this level "X" on the gauge. Add 1 quart of gasoline to the crankcase to bring the level from "X" to the FULL mark. During operation, maintain the oil level at the "X" level mark by adding Oil, OE, SAE No. 10. Immediately before shutdown, fill the crankcase to the "X" level mark with Oil, OE, SAE No. 10, then add gasoline to the FULL mark. Run the engine for 5 minutes.

1. Air Cleaner (fig. 3). Remove the oil cup from the intake-air-cleaner and fill to the proper level as marked on the cup, with oil of the same grade as used in the crankcase. Replace the cup, making sure the snaps hold it securely in place.

m. Throttle Control Rod Ball Joints (fig. 4). Place a drop of light cylinder oil in each ball

joint of the throttle control rod and check to make sure the throttle mechanism moves freely.

n. Ignition Unit (figs. 5 and 10). Place 5 drops of light oil in the oil cup on the side of the ignition unit.

o. High Water Temperature Safety Switch (figs. 27 and 31). Set the dial of the high-water temperature safety switch to indicate temperature several degrees Fahrenheit below the boiling point of the liquid used for cooling. For water, at sea level, the setting should be 206° F. This should be decreased 3 degrees for each 1,000 feet above sea level.

16. VISUAL INSPECTIONS.

Check shelter and power unit for general cleanliness and see that waste material has been removed.

a. Fuel and Exhaust Lines. Check for leaks.

b. Foundation. Check to see that the base of the unit rests solidly on the ground, or floor, at all points.

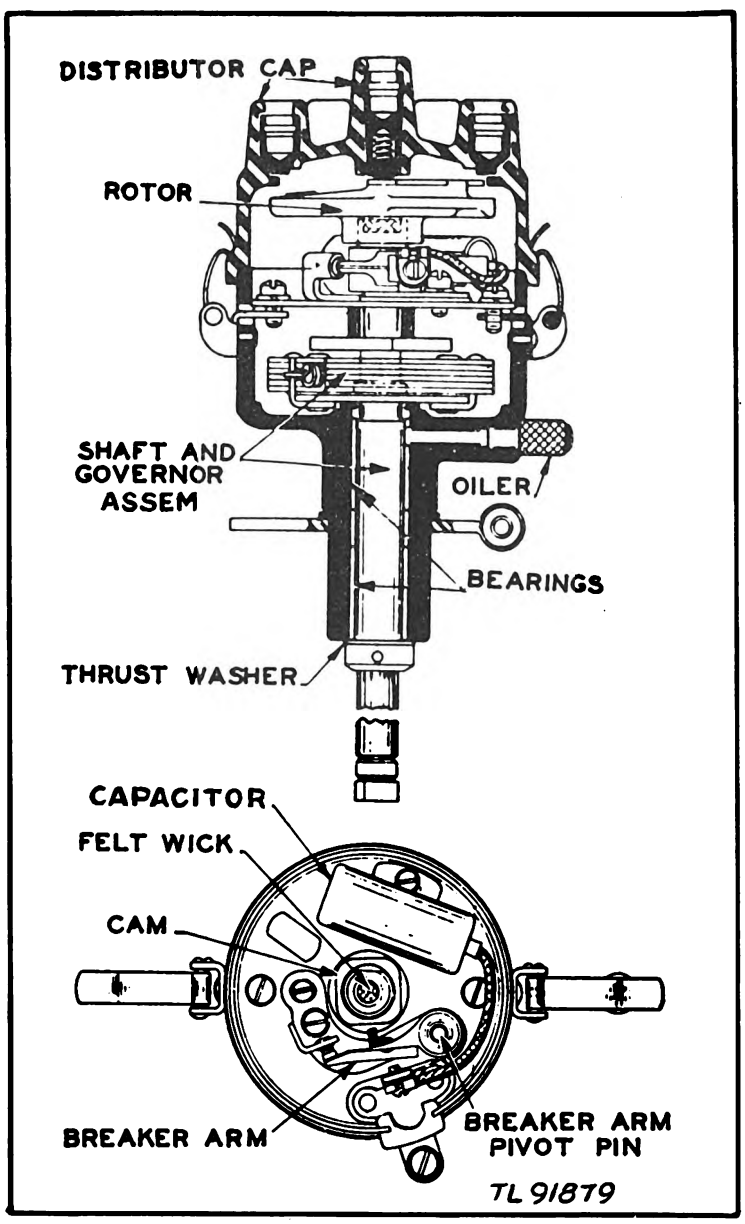


Figure 10. Ignition unit, cross section.

PART TWO
OPERATING INSTRUCTIONS

SECTION V

OPERATION

NOTE: For information on destroying the equipment to prevent enemy use, refer to the destruction notice at the front of the manual.

17. STARTING POWER UNIT PU-58/G.

When the instructions for Installation and Preparation for use (part one), have been complied with, the power unit is ready for use and may be started. If the power unit was prepared for cold-weather operation, the initial filling with diluted oil may have been delayed until immediately before starting the power unit. Check the oil level by means of the bayonet gauge. Make sure that the crankcase is filled with proper oil to the FULL mark on the gauge before attempting to start the power unit.

a. Starting the Power Unit Electrically. The CIRCUIT-BREAKER must always be in the OFF position (fig. 11).

(1) HAND CRANKING—NORMAL OPERATING IGNITION SWITCH. Make sure that this switch is in the NORMAL OPERATING POSITION.

(2) START BUTTON (fig. 11). Press the START button firmly and hold down until the engine starts and builds up oil pressure, but not for more than 10 or 15 seconds. Choking is automatic and the unit should start at once. If it fails to start, wait 10 seconds and then repeat the procedure. If the START button is released before adequate oil pressure is built up, the ignition will be cut off and the engine will stop. If the unit does not start after a few attempts, check the fuel supply and the ignition wires and then repeat the starting procedure.

b. Starting the Power Unit Manually. In case the starting battery does not furnish sufficient cranking power, the unit may be started by hand cranking. However, the battery must furnish enough power for ignition. If it does not, it must be recharged from a separate source or replaced with a charged battery. To start the unit manually, proceed as follows:

(1) CIRCUIT BREAKER (fig. 11). The CIRCUIT-BREAKER must be in the OFF position.

(2) HAND CRANKING-NORMAL OPERATING IGNITION SWITCH (fig. 11). Throw the ignition switch to the HAND CRANKING POSITION.

(3) CRANKING. Insert the hand crank and crank the engine. Do not spin or push down on the crank. Use a strong, quick, upward pull. Repeat as necessary.

(4) CHOKING. Choke as necessary by means of the choke control at the front of the housing (fig. 3). Release the choke gradually as soon as the engine starts.

(5) RUNNING POSITION. After the engine has been started, throw the ignition switch to the NORMAL OPERATING POSITION. This is necessary in order to be able to stop the engine by pressing the STOP button.

18. ADJUSTMENTS AND CHECKS AFTER STARTING.

Check the oil pressure gauge immediately after starting the engine. Pressure will be high until the engine warms up. Observe the readings of gauges and meters on the control panel as a check on the normal operation of the power unit. Normal readings for the various instru-

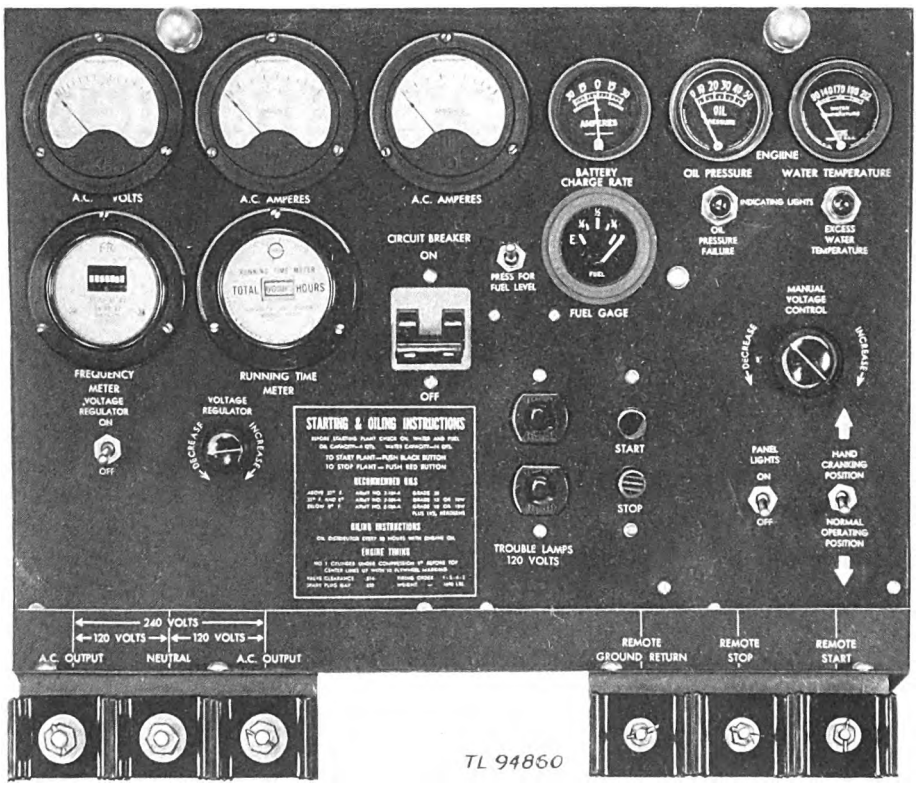


Figure 11. Control panel.

ments after the unit reaches normal operating temperature are as follows:

a. Engine Water Temperature. About 175° F.

b. Engine Oil Pressure. About 20 pounds.

c. Battery Charge Rate. From 3 to 30 amperes, depending on the state of charge of the battery.

d. A-C Voltmeter. Indicates the voltage from the NEUTRAL terminal to the left-hand AC OUTPUT terminal and should be approximately 120 volts.

e. A-C Ammeters. These indicate the ac output in amperes. The actual reading depends on the amount of load in each leg, the power factor of the load, and the operating voltage. At 120 volts and a unity power factor load, the full load amperage is 42 (21 in each meter). At 120 volts and an 80 per cent power factor load, the full load amperage is 52 (26 in each meter). For the 120-volt two-wire system, the total output load is the sum of the readings of the two ammeters. At 240-volts, unity power factor, the full load amperage is 10.5 amperes in each meter (fig. 33). For the 240-volt, three-wire system, the ammeter on the right indicates the amount of load connected to the right hand AC OUTPUT terminal. The ammeter on the left indicates the amount of load connected to the left-hand AC OUTPUT terminal.

f. Frequency Meter. Indicates the output frequency and should vibrate at 60 cycles.

19. OPERATION OF POWER UNIT PU-58/G.

Keep the side panels and top plates on the housing except while servicing. They help to direct the cooling air properly and to reduce radio interference.

a. Connecting the Load. Throw the CIRCUIT-BREAKER control handle to the ON position to connect the load. The CIRCUIT-

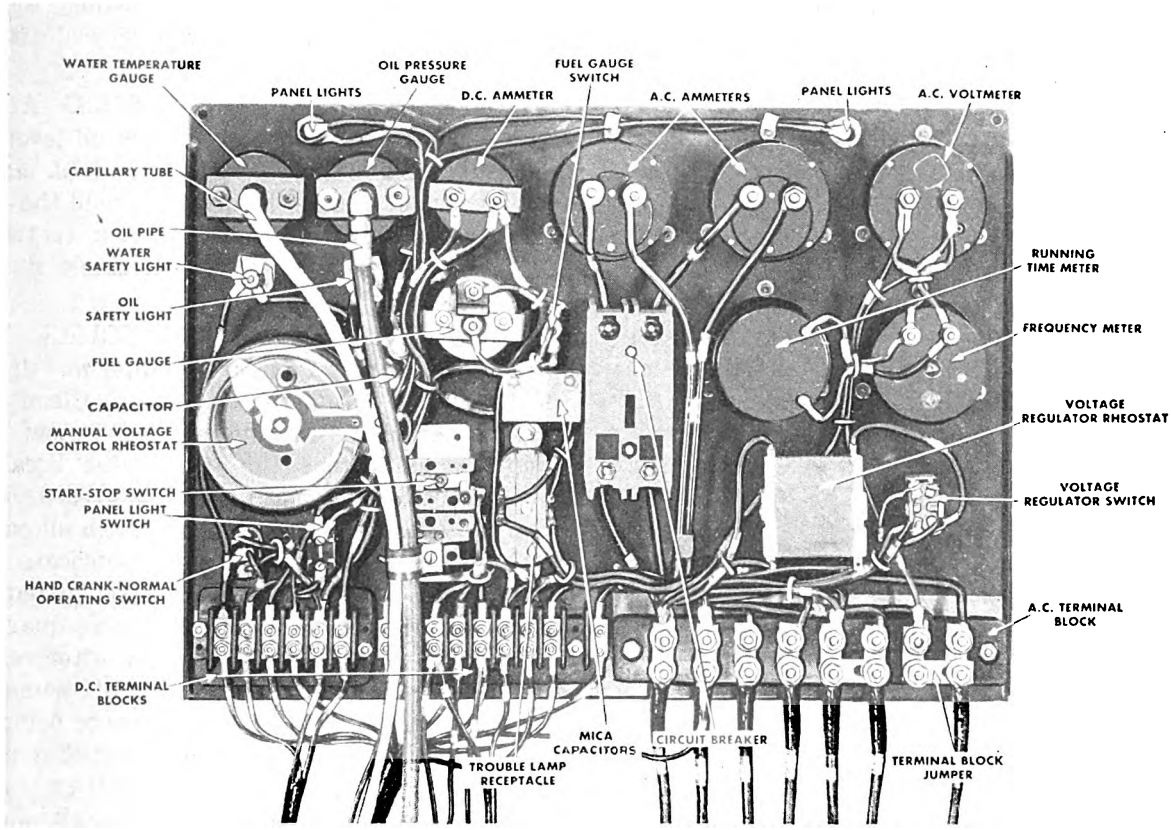


Figure 12. Control panel, reverse side.

BREAKER will open and disconnect the load automatically if the power unit is heavily overloaded, or if any external trouble develops. To reset the CIRCUIT-BREAKER, throw the switch to the extreme OFF position and then to the ON position. It will throw out again if the trouble has not been cleared. The trouble, generally a short circuit in the line, should be corrected before further use. Throw the control handle to the OFF position to disconnect the load when desired.

b. Emergency Operation. In case of failure of the start relay or the ignition relay to close the ignition circuit, the engine cannot be operated with the ignition switch in the NORMAL OPERATING POSITION. Under this condition, the power unit may be operated with the ignition switch in the HAND CRANKING POSITION. It will be necessary to switch to the NORMAL OPERATING POSITION before the engine can be stopped by pressing the STOP button. When operating with the switch in the HAND CRANKING POSITION, the high water temperature cut-off switch and the low-oil pressure cut-off switch do not operate. Every effort should be exerted to avoid overheating, and low oil pressure.

c. Dust and Dirt. When the power unit is operated under dusty conditions it is necessary to check and service it more frequently than otherwise.

(1) PLANT. Keep as clean as possible.

(2) FUEL AND OIL. Keep supplies in airtight containers.

(3) AIR CLEANER. Clean the air cleaner and refill the oil cup as often as is necessary.

(4) BRUSHES. Clean the generator commutator and brushes often (figs. 28 and 29). See that the brushes ride easily in their holders.

d. Engine Water Temperature. The normal engine WATER TEMPERATURE gauge reading after the power unit reaches operating temperature is about 175° F. Under very cold operating conditions, cover a lower portion of the radiator surface with cardboard, if necessary, in order to raise the engine water temperature to at least 160° F (fig. 11).

e. Parallel Operation. Two or more Power Units PU-58/G may be operated in parallel where a greater power output is required than can be obtained from a single unit. Satisfactory parallel operation may be obtained if the governors are readjusted to allow reasonable load division.

(1) GOVERNOR ADJUSTMENT. The units are shipped with governors adjusted for close frequency regulation. For satisfactory parallel operation, the governors must be readjusted to give even closer frequency regulation (greater stability) and also to give each unit the same speed under a given load. The regulation adjustment is made by screwing out the governor sensitivity adjusting screw to give the spring maximum lever arm effect. This will increase the speed, so the slide adjusting screw must be backed out to reduce the speed to normal. The regulation with this adjustment should be about two or three cycles.

(2) LOAD CONNECTIONS. With the circuit breakers in the OFF position, connect similar terminals together between the two terminal blocks on the control panels. Connect the left-hand A. C. OUTPUT terminal on one unit to the left-hand A.C. OUTPUT terminal on the second unit. Likewise, connect the NEUTRAL terminal on one unit to the NEUTRAL terminal on the second unit, and the right-hand A.C. OUTPUT terminal on one unit to the right-hand A.C. OUTPUT terminal on the second unit.

CAUTION: DO NOT CONNECT TERMINALS WITH DISSIMILAR MARKINGS TOGETHER BETWEEN THE TWO TERMINAL BLOCKS.

(3) PARALLEL OPERATION. With the governors properly adjusted and the units running at rated speed, the generators may be connected in parallel to the load simply by closing the respective circuit breakers on the control panels without regard to exact synchronism. Sets operating in parallel should have their governors adjusted for the same regulation. The final speed adjustment, which determines the sharing of the load, should be made under load after the units have been paralleled.

20. SPECIAL OPERATING PROCEDURES.

Operation in extreme climatic conditions may be handled as follows:

a. Abnormal Conditions. Temperatures below 0° F require special attention in regard to lubrication and cooling liquids. Unusually dirty and dusty operating conditions, which sometimes cannot be avoided, require special attention.

(1) AFTER 8 OPERATING HOURS. After every 8 operating hours, check the oil level in the crankcase and add oil up to the FULL mark on the bayonet gauge. Empty and refill the oil-bath air cleaner. Refill the air cleaner twice daily when operating under extremely dusty conditions.

(2) AFTER 128 OPERATING HOURS. Remove the drain plug from the oil filter and drain off the sludge. Drain the crankcase. Clean the inside of oil filter thoroughly and renew the filter element. Wipe the distributor breaker cam lightly with general purpose grease. Remove the oil bath air cleaner and wash all parts thoroughly in Diesel fuel oil. Lubricate all control links, hinges, locks, and hood fasteners with engine oil. Refill the crankcase (4 quarts) and operate the unit for 5 minutes after refilling to allow the oil filter to assimilate some of the oil; then add oil to the crankcase to bring it up to the FULL mark on the bayonet gauge.

(3) AFTER 256 OPERATING HOURS. Put three to five drops of engine oil in the oil cup at the side of the distributor and one drop on the breaker-arm pivot.

(4) AFTER 512 OPERATING HOURS. Remove the generator end cover and repack the generator bearing approximately half full with general purpose grease No. 2. **Under subzero conditions, fill the oil-bath air cleaner with special preservative lubricating oil (PS).**

b. Cooling System. The liquid in the cooling system must be protected if there is any possibility of its freezing. Use any good antifreeze preparation. Common ones are alcohol, glycerine, and ethylene glycol. Never use kerosene or distillate in the cooling system.

(1) FLUSHING. If the power unit has been used, drain and flush the cooling system with running water or a special flushing agent. Run the unit until warm before draining. Never flush a very cold unit with water or any solution which may freeze upon contact with the cold metal and cause damage.

(2) ANTIFREEZE SOLUTION. Close the drain cocks and fill the cooling system to a point 1 inch below the bottom of the radiator neck with water and antifreeze in proper proportion, depending on the kind of antifreeze and the de-

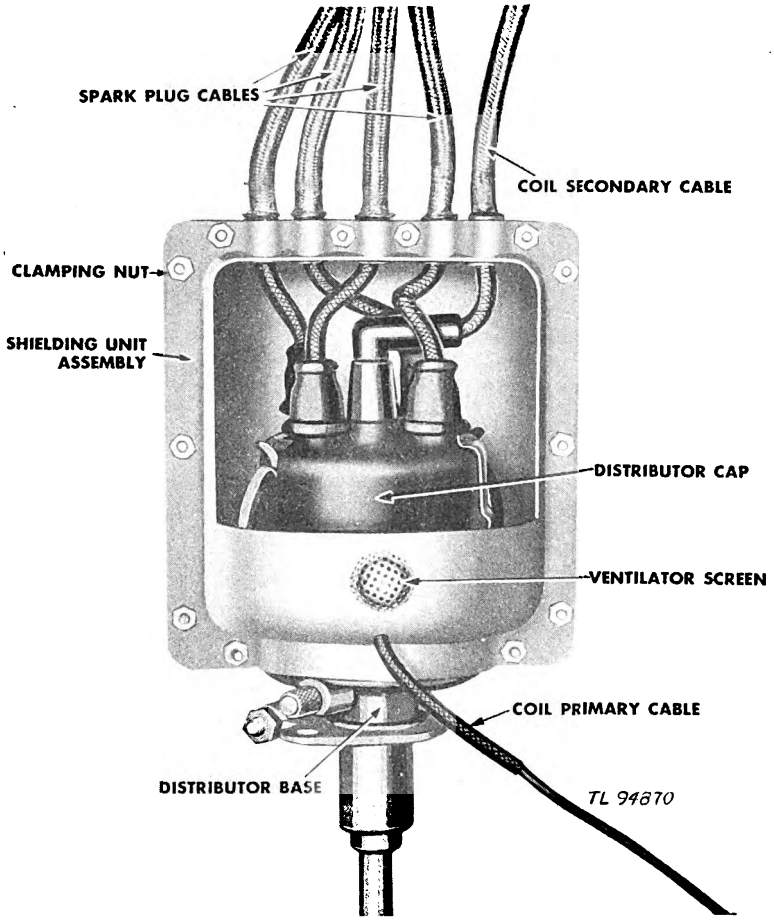


Figure 13. Ignition shielding unit.

gree of protection needed. *Do not fill to overflowing.*

21. STOPPING POWER UNIT PU-58/G.

To stop the power unit, press the STOP button on the control panel. The ignition switch must be in the NORMAL OPERATING POSITION before the power unit can be stopped by means of the STOP button. It is good practice to disconnect the load by throwing the CIRCUIT-BREAKER control handle to the OFF position before stopping the power unit unless the unit is to be controlled from a remote point.

SECTION VI
EQUIPMENT OPERATION CHECK SHEET

22. PURPOSE AND USE OF EQUIPMENT CHECK SHEET.

The equipment operation check sheet for Power Unit PU-58/G (par. 23) may be referred to when preparing the unit for operation, when starting it, when operating it, and when stopping it. Items listed in the column marked "Item" are those points on the unit to be checked during each of these steps. "Normal indications" given in the check sheet are those conditions which must exist if the unit is to perform properly. A corrective action to be applied to each item to obtain the normal indication required, is listed in the column headed "Corrective measures."

23. EQUIPMENT OPERATION CHECK SHEET FOR POWER UNIT PU-58/G.

	Item No.	Item	Action or condition	Normal Indication	Corrective measures
PREPARATORY	1	Fuel tank	Check fuel gauge	Full	Add fuel
	2	Crankcase	Check oil gauge	Full	Add oil
	3	Air cleaner	Check oil reservoir	Oil up to bead	Add oil
	4	Radiator	Check level of water	Two inches below top of filler tube	Add water. See cold weather operation (par. 20b)
	5	Circuit breaker	Check that it is OFF	OFF	Place in OFF position
STARTING	6	HAND CRANKING, NORMAL OPERATING ignition switch	Check that it is in the NORMAL position	In NORMAL position	Place in NORMAL position. See par. 17
	7	START button	Press and hold in	Engine starts	If engine does not start, see par. 19b
	8	Check oil pressure gauge	Should read between 15 and 20	20 when engine is warm	If pressure is abnormal, see pars. 5c(1) (*g*) and 5c(2) (*d*)
	9	Check frequency meter	Should read 61 cycles	60 cycles when unit is under load	If reading is abnormal, see par. 52b
	10	Check battery ammeter	Should read 10	Between 8 and 10 amperes	If reading is abnormal, see par. 14
PERFORMANCE	11	Circuit breaker	Place in ON position	ON while running	If breaker throws OFF, see par 19a
	12	Voltmeter	Hand steady	Between 118 and 121 volts	If voltage is abnormal, see par. 50
	13	Ammeter	Hand steady	Between 7.5 and 26 amperes	If amperage is abnormal, see par. 50
	14	Frequency meter	Steady at 60 cycles	60 cycles	If frequency is abnormal, see par. 52
	15	Oil pressure gauge	Steady at 20 pounds	20 pounds	If oil pressure is low, see par 49 Check oil in base of engine
	16	Temperature gauge	Should read between 140° F and 180° F	175° F when engine is warm	If temperature is high or low, see par 41
STOPPING	17	Circuit breaker	Place in OFF position	Voltage rises. Amperage drops to 0	
	18	Governor control	Lock in idle position. Idle engine for 15 minutes	Engine slows down. Frequency and voltage drop	
	19	Press STOP button. Hold in until engine stops turning	Engine will stop firing	Oil pressure gauge, voltmeter, and frequency meter drop to zero	If engine does not stop, shut off fuel supply

NOTE: For operating trouble-shooting information refer to pars. 44, 45, and 46.

PART THREE
PREVENTIVE MAINTENANCE

SECTION VII
OPERATOR'S PREVENTIVE MAINTENANCE TECHNIQUES

24. MEANING OF PREVENTIVE MAINTENANCE.

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

25. PURPOSE OF OPERATOR'S MAINTENANCE.

a. To insure mechanical efficiency, the power unit should be systematically inspected at intervals each day of operation, and at other specified intervals. Defects may thus be discovered and corrected before they result in serious damage or failure. Certain scheduled mantenance services will be performed at these designated intervals. The services set forth in this section are those performed by the operator before operation, during operation, during stop periods, after operation, and at other specified intervals.

b. The operator of the power unit should have available War Department Form No. 48 (Driver's Trip Ticket and Preventive Maintenance Service Record) (fig. 14). Adapt the form to Power Unit PU-58/G by elimination of items pertaining only to vehicles. Items peculiar to the power unit, but not listed on Form No. 48, are covered in procedures which are listed in this manual under items to which they are related. Certain items listed on the form, which did not pertain specifically to Power Unit PU-58/G, are crossed out. The operator must be thoroughly trained in performing all maintenance procedures set forth in this manual, whether or not the procedures are listed specifically on Form No. 48.

c. The items listed on Form No. 48 that apply to the power unit are expanded in this manual to provide specific procedures for accomplishment of the inspection and services. These services are arranged to facilitate inspection and to conserve the time of the operator, and are not necessarily arranged in the numerical order in which they are shown on Form No. 48. The item numbers, however, are identical with those shown on that form.

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

(1) Inspection of the unit for **good condition** is usually an external visual inspection to deter-

War Department Form 48
Approved April 12, 1943

Serial No. PE-75-W 5103

Driver's name John Smith Date 5 NOV 44

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

Report to _____ Time out _____

Organization 1st Sig Bn Time in _____

Department or address _____

Kind of work (or route) TC-3

Requested by _____
(Organization or individual)

_____
(Dispatcher's signature)

	SPEEDOMETER	HOUR METER
Fuel added (gals.) 1½ In		
Oil added (qts.) 0 Out		
Total: Miles—Hour		

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

(Driver's signature) John Smith

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

(Dispatcher's, etc., signature) _____

TRIP OR LOAD RECORD	PASSENGERS OR WEIGHT	SPEEDOMETER OR HOUR METER
From 0001 to 0800		8 hrs.
To 0930 to 1230		3 hrs.
To 1300 to 1530		2½ hrs.
To		13½ hrs.
To		
To		
To		
To		
To		

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

Official user _____ _____
(Signature) (Grade)

16—35600-1

(SEE REVERSE SIDE)

TL95416

Figure 14. Front of War Department Form No. 48, adapted for use with power units. (Solely vehicular items are lined out.)

DRIVER'S DAILY PREVENTIVE MAINTENANCE SERVICES

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

BEFORE OPERATION SERVICE

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

ELECTRICAL CONTROLS

DURING OPERATION SERVICE

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

AT HALT SERVICE

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

AFTER OPERATION SERVICE

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

ELECTRICAL CONTROLS
POWER CONNECTIONS

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

Record any accident and all deficiencies, indicating if corrected:

16—85560-1

TL 95417

Figure 15. Back of War Department Form No. 48, adapted for use with power units. (Solely vehicular items are lined out.)

mine whether the unit is damaged beyond safe or serviceable limit. The term "good condition" is explained further by the following terms: Not bent or twisted, not chafed or burned, not broken or cracked, not bared or frayed, not dented or collapsed, not torn or cut.

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

(3) Inspection of the unit for **secureness** is usually an external visual examination, with the aid of wrench, a hand-feel, or prybar to check for looseness. Such an inspection should cover brackets, lockwashers, locknuts, locking wires, or cotter pins used in assembly.

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

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

26. BEFORE-OPERATION SERVICE.

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

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

27. BEFORE-OPERATION SERVICE ITEMS (fig. 15).

a. Item 1, Tampering and Damage. Check for injury to the power unit or items of special equipment. Check for damage that may have resulted from falling debris, shell fire, sabotage, collision, or presence of booby traps. Open engine compartment doors and look for signs of tampering or sabotage, such as loosened or damaged accessories or drive belts. To facilitate starting, dry wet spark plugs, distributor and wiring.

b. Item 3, Fuel, Oil and Water. Check the amount of fuel in the tanks, noting any indications of leaks or tampering. Add fuel if necessary and check spare fuel cans. Check oil level. Add oil if necessary. Check level and condition of coolant. Add antifreeze with water if required.

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

c. Item 4, Accessories and Drives. Check all accessories, such as the carburetor, generator, voltage regulator, starter, fan, etc., for loose connections or mountings. Check the belts for looseness and wear.

d. Item 6, Leaks, General. Check under the power unit and in the engine compartments for indications of fuel, oil, water, or gear oil leaks. Check the cooling system for indications of leaks, paying particular attention to radiator core and connecting hose. Check the engine crankcase, oil filter, and lines for indications of oil leaks. Check the fuel system for indications of leaks. Trace all leaks to their source and correct or report them to designated authority.

e. Item 7, Engine Warm up.

CAUTION: As a precaution against fire or explosion, before starting the engine open the ventilators or hatches to be sure that the engine compartment is clear of fuel drippings and gas fumes.

Start the engine and note the action of the starter mechanism. Note particularly whether the starter has adequate cranking speed and engages and disengages properly without unusual noise when the starting control is operated.

f. Item 8, Choke or Primer. While starting the engine, check the operation of the choke or primer. When manual starting is used, reset the choke as required as the engine warms up, to prevent overchoking and dilution of engine oil.

g. Item 9, Instruments. (1) OIL PRESSURE GAUGE. Check the gauge to see whether it indicates properly. Pressure will be high until the engine warms up. Operating pressure is about 20 pounds. If the instrument fails to indicate properly, stop the engine immediately, investigate the cause of the failure, and report it to the proper authority.
(2) BATTERY CHARGE AMMETER. The battery charge ammeter should show a high charging rate for the first few minutes after starting until the generator restores to the battery the current used in starting. After this period, the ammeter should register from 3 to 30 amperes, depending on the state of charge of the battery. Any unusual drop or rise in the reading should be investigated. A high charge reading for an extended period may indicate a dangerously low battery or a faulty generator regulator.
(3) FREQUENCY METER. Observe whether the frequency meter is operating properly. The correct reading is 60 cycles.
(4) FUEL GAUGE. Observe whether the gauge is operating properly. Normally, fuel tanks would be filled before operation, and the gauge should register FULL.
(5) VOLTMETER. Note whether the voltmeter is operating properly. It should register about 120 volts at all times.
(6) WATER TEMPERATURE GAUGE. Engine temperature should increase gradually during the warm-up period. Extremely high temperature after a warm-up period of reasonable length may indicate existing troubles that should be investigated and corrected.

h. Item 21, Tools and Equipment. See that tools and equipment belonging to the power unit are present, serviceable, and properly mounted or stowed.

i. Electrical Controls. Add this item to Form 48 (fig. 15). Note whether electrical controls operate smoothly, and whether their operation is followed by the proper indications. Notify the proper person in authority if there is indication of faulty operation of switches, push-buttons, circuit breaker, rheostat, relays, voltage regulator, or other electrical controls. Refer to the equipment operation check sheet (par. 23).

j. Item 25, During-operation Check. The during-operation services should start as soon as the load is put on the unit.

28. DURING-OPERATION SERVICE.

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

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

29. DURING-OPERATION SERVICE ITEMS.

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

b. Item 32, Instruments. Observe the readings of all instruments frequently during operation to see whether they are indicating properly.
(1) WATER TEMPERATURE GAUGE. See that the gauge reads in normal range (except when operating under unusual conditions). Excessive engine heat may indicate trouble and should be investigated immediately.
(2) OIL PRESSURE GAUGE. In case of an unusual drop or no oil pressure, stop the unit immediately. Report trouble to proper authority for correction. Lack of oil pressure may indicate insufficient oil, leaks, loose bearings, or a defective oil pump; and may result in premature wear or may damage the engine to the extent of failure. The oil pressure failure light should remain off while the engine is operating.
(3) BATTERY CHARGE AMMETER. During operation, the battery charge ammeter

should indicate from 3 to 30 amperes. A discharge reading may indicate a faulty generator or regulator.

(4) FREQUENCY METER. See that the meter indicates the correct frequency at all times when the engine is running.

(5) FUEL GAUGE. See that the gauge continues to indicate the approximate amount of fuel in the tank.

(6) AMMETER. The ammeter will read up to 26 amperes in each leg of the circuit, depending on the load, at unity power factor.

(7) VOLTMETER. The voltmeter reading should be approximately 120 volts.

c. **Item 35, Body.** The operator must be on the alert for looseness of the power unit frame and attachments, or for abnormal tilting of the vehicle in which the unit may be mounted.

30. AT-HALT OR STOP SERVICE.

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

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

31. AT-HALT OR STOP SERVICE ITEMS.

a. **Item 38, Fuel, Oil, and Water.** Check the fuel supply to see that it is adequate to operate the unit until the next refueling time. When refueling, use safety precautions for grounding static electricity, and allow space in the filler neck for expansion. Check the crankcase oil level; if necessary, add oil to the proper level. Remove the radiator filler cap, being careful of steam, since a pressure cap is used. Check coolant to see that it is at the proper level, and replenish the coolant as necessary. Do not fill the radiator to overflowing; leave sufficient space for expansion. If the engine is hot, fill the radiator slowly while the engine is running unloaded.

b. **Item 39, Temperature.** Place a hand cautiously on the generator to see whether it is abnormally hot. If the rear bearing housing is too hot to grasp with the hand, it may be inadequately lubricated, damaged, or improperly adjusted. Regular check of these items will go far to avoid premature failures or possible accidents.

c. **Item 46, Leaks, General.** Check the engine compartment and beneath the unit for indications of leaks. Check to see whether oil is leaking from the crankcase, oil tank filter, or lines. Check the cooling system for leaks, paying particular attention to the radiator core and connecting hose.

d. **Item 47, Accessories and Belts.** Check to see that all accessories, fan, water pump, and generator are secure and that drive belts are in correct adjustment and not damaged.

e. **Item 48, Air Cleaner.** If operating under extremely dusty or sandy conditions, inspect the air cleaner and breather cap to see that they are in condition to deliver clean air properly. Service if necessary.

32. AFTER-OPERATION AND WEEKLY SERVICE.

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

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

the after-operation service that are marked on Form No. 48 by an asterisk require additional weekly service. The procedures for the additional weekly service are indicated in subparagraph (2) of each applicable item that follows.

33. AFTER-OPERATION AND WEEKLY SERVICE ITEMS.

a. Item 54, Fuel, Oil, and Water.

(1) Check coolant level and replenish if necessary, taking care to leave sufficient space for expansion. If an appreciable amount of coolant is required, have the value of the antifreeze checked. Fill fuel tanks, observing safety precautions for grounding static electricity, and bring engine oil to proper level. Refill spare fuel, oil, and water cans. If an unusual amount of oil or coolant is required for the engine, check for leaks and report the condition.

(2) During the period when antifreeze is in use, have hydrometer test made of coolant weekly.

b. Item 55, Engine Operation. Check to see that the engine runs satisfactorily. Accelerate and decelerate the engine, by pushing the throttle control rod back, and note any tendency to miss or backfire, or any unusual engine noise or vibration that might indicate worn parts, loose mountings, incorrect fuel mixture, or faulty ignition. Correct or report any unsatisfactory engine-operating characteristics noted during operation.

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

d. Item 62, *Battery and Voltmeter.

(1) Check the battery to see that it is clean and secure.

(2) Clean dirt from the top of the battery weekly. If terminal connections or posts are corroded, clean them thoroughly and apply a fresh, thin coating of grease. Tighten loose terminal bolts. Remove vent caps and check the level of the electrolyte. Add water if required, taking precatuions not to damage the battery during freezing temperatures. The battery should be secure, and should not be bulging, cracked, or leaking electrolyte. The battery carrier should be secure, clean, free of rust, and well painted. If mountings are loose, tighten them cautiously in order not to damage the battery case. Report any defects to the designated authority.

c. Item 63, *Accessories and Belts.

(1) Check all accessories, carburetor, generator, voltage regulator, starter, fan, etc. for loose connections in couplings or mountings. Check the adjustment of the fan and drive belts. Belts should deflect from 1-1/4 to 1-1/2 inches. Loose or unserviceable belts should be reported to proper authority.

(2) Tighten or adjust weekly any loose connections, linkage, or mountings on accessories. Examine all belts for fraying, wear, cracking, or presence of oil. Check all belts halfway between their respective pulleys to determine whether the belts are properly adjusted. Loose belts may cause improper operation of the unit and may become damaged. Tight adjustment may cause damage to both the accessories and the belts. Ordinarily the operator should not adjust the belts except in an emergency. Improper adjustment or unserviceable belts should be reported.

f. Item 64, *Electrical Wiring.

(1) Check all ignition and control circuit wiring to see that it is securely connected, clean, and not damaged.

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

g. Item 65, *Air Cleaner and Breather Cap.

(1) Check to see that oil in the air cleaner is at the correct level and not excessively dirty. Excessive dirt in the oil may be felt with the fingers. It is not usually necessary to remove the air cleaner from the carburetor air horn to make this inspection. If the oil in the cleaner is excessively dirty, clean and refill the cleaner with fresh oil. If operating in sandy or dusty territory, remove the air cleaner and breather cap, and clean them. In order to keep abrasive dirt out of the engine, the air cleaner and breather cap must be kept clean and properly serviced at all times.

(2) Remove the air cleaner from the engine. To clean, remove the cup and clean it thoroughly in suitable cleaning fluid, gasoline or Diesel

oil. Remove the filter element and clean it thoroughly by flushing it in a suitable fluid. Allow it to dry or dry it by using an air hose. Fill the cup to the level mark with clean oil of the same grade as used in the engine crankcase. Reassemble the air cleaner and reinstall it on the engine. Make sure that all gaskets are replaced and that all connections are airtight and dust tight. If the crankcase breather seems to be obstructed, disassemble it and wash it thoroughly in Diesel oil. Knead the filter element to remove all lumps, wash it in Diesel oil, permit it to dry, and saturate it with engine oil. Replace the filter element in the breather and reassemble it. Replace the breather on the engine.

h. Item 66, *Fuel Filters. (1) Examine the fuel filter for leakage, damage, and loose mounting.

(2) Close the shut-off valve in the fuel line. Loosen the retaining nut, remove the filter bowl, and drain out the water and sediment. Replace the bowl, tighten the retaining nut securely, reopen the shut-off valve in the fuel line, and check for any leaks.

i. Item 67, Engine Controls. Check for worn or disconnected linkage. Also correct or report any unsatisfacory engine control linkage operation noted during the operation.

j. Item 73, Leaks, General. Check the engine compartment and beneath the unit for indications of fuel, oil, or water leaks. Trace all leaks to their source and correct or report them.

k. Item 83, *Lubricate as Needed.

(1) Items such as linkage, hinges, latches, and other points that are lubricated by the operator should be lubricated if inspection indicates the necessity.

(2) Lubricate in accordance with the lubrication order (fig. 16) all points which require weekly lubrication. The need for more frequent lubrication than is provided by the regular lubrication schedule is usually due to abnormally hot, wet, or dusty operating conditions.

l. Item 84, *Clean Engine and Vehicle.

(1) Remove dirt and excess grease from the exterior of the engine.

(2) Wipe greasy surfaces of the unit thoroughly with Solvent, Dry-cleaning, Federal Spec No. P-S-66la. Do not rub lusterless paint enough to create a shine that might cause reflection. If the unit is cleaned, care must be taken to see that solvent or dirt does not get into the bearings, fuel tank, or crankcase.

m. Item 85, *Tools and Equipment.

(1) Check unit packing lists to see that all tools and equipment assigned to the unit are present and properly stowed or mounted.

(2) Clean all tools and equipment of rust, mud, or dirt, and see that they are in good condition. Report missing or unserviceable items to proper authorities.

n. Electrical Controls (Insert this item on Form No. 48).

(1) Check mechanical operation of switches, push-buttons, circuit breaker, rheostat, relays, voltage regulator, and other electrical controls.

(2) Inspect controls for tightness of mounting, condition of wiring, and cleanliness. Tighten loose mounting screws or bolts and terminal connections. Remove any accumulation of dust, dirt, grease, or other foreign matter from control mechanisms and from the control boxes.

o. Power Connections (Insert this item on Form No. 48).

(1) Check output sockets for cleanliness and tightness of mounting, output connection for good connection, and output cable for condition.

(2) Tighten any loose connection or mounting. Clean terminal surfaces if they are corroded or dirty. Notify the person in charge if leads or cables are broken or insulation is frayed, cracked, or stripped from the conductors.

SECTION VIII
LUBRICATION

34. LUBRICATION INSTRUCTIONS (fig. 16).

a. After 8 Operating Hours.

(1) Fill the crankcase with Oil, OE and check the level with the gauge.

(2) Check the oil level in the air cleaners (carburetor and crankcase breather) and refill with Oil, OE to the level mark.

b. After 64 Operating Hours.

(1) Remove and clean the sediment bowl and screen on the fuel pump and also on the fuel strainer. Open the fuel tank shut-off valve and allow the water and sediment to drain out.

(2) Drain the crankcase and refill it with Oil, OE to the FULL mark on the gauge. The capacity is approximatetly 4 quarts. Drain the crankcase only when hot. After refilling, run the engine a few minutes and recheck the oil level.

CAUTION: Be sure that the oil pressure gauge indicates that oil is circulating.

(3) Drain, clean, and refill air cleaner.

(4) Lubricate the governor and throttle control linkage, the hinges, locks, and hood fasteners with Oil, OE.

c. After 128 Operating Hours.

(1) Lubricate the distributor shaft with three to five drops of Oil, OE.

(2) Lubricate the rear bearing on the charging generator with six to eight drops of Oil, OE.

(3) Lubricate the front bearing on the starting motor with two to four drops of Oil, OE.

d. After 256 Operating Hours.

(1) Remove, clean and reinstall the crankcase ventilator valve and screen.

(2) Drain the oil filter, clean the inside of the body, and renew the element. Refill the engine crankcase, run the engine a few minutes and add Oil, OE to the full mark on the gauge.

(3) Wipe the breaker cam lightly with Grease, CG, and lubricate the breaker arm pivot with one or two drops of Oil, OE.

(4) Remove and wash all air cleaner parts. From 0° F to —40° F use OH. Below —40° F wash and operate dry.

e. After 512 Operating Hours.

(1) Remove the cover plate on the exciter end bearing. Repack the bearing approximately one-half full with WB, Grease, General Purpose No. 2. Knead the lubricant into the space between the inner and outer races. Reinstall the cover plate. Do not attempt to lubricate the bearing through the plug hole.

(2) Lubricate the wick under the distributor rotor with 1 drop of OIL, OE.

f. After 1024 Operating Hours. Flush the fuel tank and fuel lines.

35. LUBRICATION UNDER SPECIAL CLIMATIC CONDITIONS. Refer to part two, paragraph 20.

36. RECORDS AND REPORTS.

a. Records. A complete record of lubrication must be kept for each power unit in Duty Roster (W.D., A.G.O. Form No. 6), adapted as explained in paragraph 38 b.

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

SECTION IX

UNIT MECHANICS' PREVENTIVE MAINTENANCE TECHNIQUES

37. SCOPE.

a. Preventive Maintenance Services... Reguglar scheduled maintenance inspections and services are a preventive maintenance function of the using arms, and are the responsibilities of commanders of operating organizations. An efficient control system is an essential aid in determining when power units are due for periodic maintenance services either because of time elapsed or hours operated.

b. Frequency. The frequency of the preventive maintenance services outlined herein is considered a minimum requirement for normal operation of this power unit. Under unusual operating conditions, such as extreme temperatures or dusty or sandy terrain, it may be necessary to perform certain maintenance services more frequently.

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

d. Technical Inspections.

(1) These inspections are performed by technically qualified personnel, under direct supervision of technically qualified officers. Technical inspections are made for the following purposes:

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

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

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

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

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

38. RECORDS AND REPORTS.

a. Unit Mechanics' Maintenance and Technical Inspection. The following War Department forms for use as work sheets, referred to in TM 9-2810 and here modified to Signal Corps requirements for use with power units, are provided to serve as reminders and records of the unit mechanics' preventive maintenance services and technical inspections:

(1) W.D., A.G.O. Form No. 461 (Preventive Maintenance Service and Technical Inspection Work Sheet for Wheeled and Half-Track Vehicles), adapted (by elimination of solely vehicular items) to power units above 2.5 kilowatts, which are used by the Signal Corps (fig. 17 and par. 40).

(2) The columns headed "6000 Mile" and "1000 Mile" on Form No. 461 are comparable to the semiannual and monthly maintenance of power units used by the Signal Corps. Notations to that effect shall be made on this form. The column headed "Tech insp" applies without modification to power units.

(3) The general procedures listed in paragraph 40-b are to be applied in conducting the maintenance services and technical inspection. The manner in which each item listed on the form is to be inspected and serviced is explained in detail in paragraph 40c.

TEMPORARY **NO. 3238**

WAR DEPARTMENT LUBRICATION ORDER

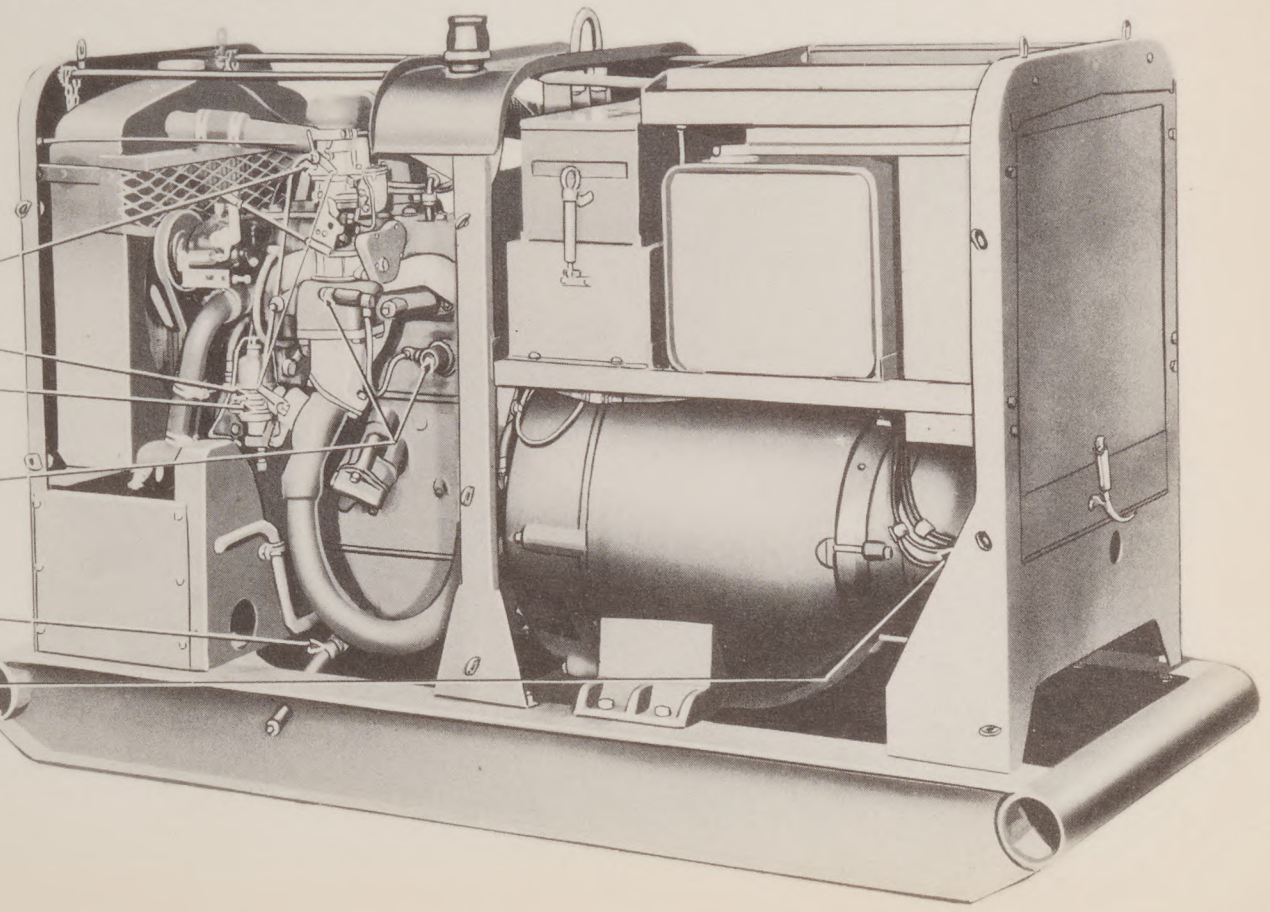
WAR DEPARTMENT, WASHINGTON 25, D. C., 13 DECEMBER 1944

POWER UNIT PU-58/G

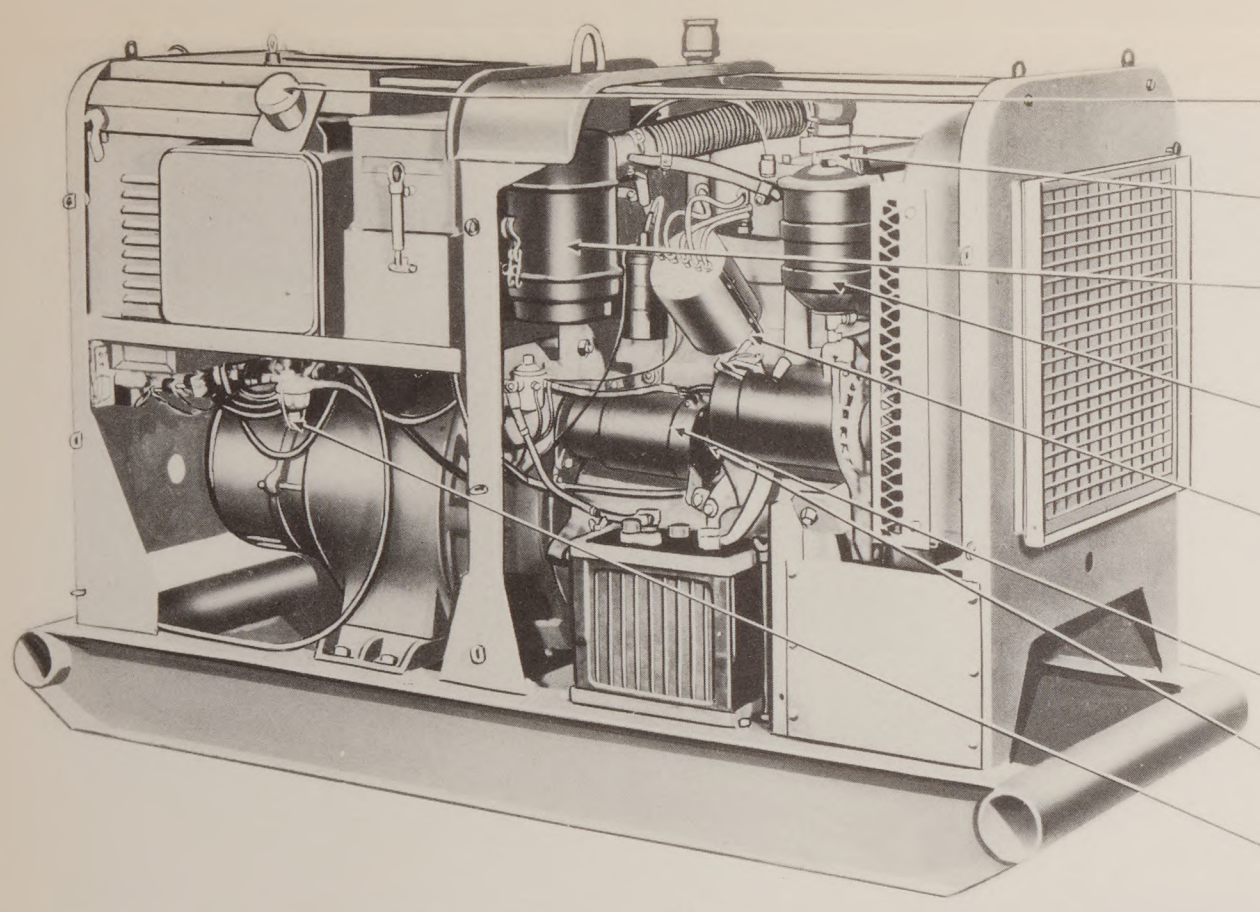
This is a temporary lubrication order; requisition permanent replacement from Philadelphia Signal Depot or from Utah ASF Depot, Ogden, Utah. See list in FM 21-6.

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

REFERENCE—Technical Manual 11-980



LUBRICANT		OPERATING HOURS
Governor and Throttle Control Linkage	OE	64
Fuel Pump Remove and clean sediment bowl and screen. Also open fuel tank shut-off valve to drain water and sediment.		64
Crankcase Ventilator Valve and Screen Remove, clean, and re-install.		256
Crankcase Drain Drain and refill Cap. approx. 4 qt. (See note)		64
Exciter End Bearing Remove cover plate. Knead lubricant into space between inner and outer races. Re-install cover plate. Do not lubricate through plug hole.	WB	512



OPERATING HOURS	LUBRICANT	
1024		**Fuel Tank** Flush fuel tank and fuel lines. Keep fuel clean and vent in cap open. Cap. approx. 10-1/2 gal.
8	OE	**Crankcase Fill and Level Gauge** Check level (See note)
8	OE	**Air Cleaners** Check level and refill to level mark. Every 64 hrs., drain, clean, and refill. Every 256 hours, remove and wash all parts. From 0° F to —40° F use **OH.** Below —40° F, wash and operate dry.
256		**Oil Filter** Drain, clean inside of filter body, and renew element. Refill crankcase, run engine a few minutes, and add **OE** to FULL mark on gauge.
128	OE	**Distributor Shaft** 3 to 5 drops. Every 256 hours, wipe breaker cam lightly with **CG** and lubricate breaker arm pivot with 1 or 2 drops of **OE.** Every 512 hours, lubricate wick under rotor with 1 drop of **OE.**
128	OE	**Charging Generator Rear Bearing** 6 to 8 drops
128	OE	**Starting Motor Front Bearing** 2 to 4 drops (covered oil hole)
64		**Fuel Strainer** Remove and clean sediment bowl and screen. Also open fuel tank shut-off valve to drain water and sediment.

KEY

LUBRICANTS	LOWEST EXPECTED AIR TEMPERATURE		
OE—OIL, engine	**ABOVE +32° F**	+32° F to 0° F	Below 0° F
Crankcase	**OE** SAE 30	**OE** SAE 10	See Cold Weather Note
Except Crankcase	**OE** SAE 30	**OE** SAE 10	**PS**
CG—GREASE, general purpose	**CG** No. 1	**CG** No. 0	**CG** No. 0
WB—GREASE, general purpose, No. 2. All air temperatures.			
PS—OIL, lubricating, preservative, special.			
OH—OIL, hydraulic.			

COLD WEATHER—Below 0° F, drain crankcase. Refill crankcase with 3 qts **OE** SAE 10, check level and mark this level "X" on the gauge. Add 1 qt gasoline to bring level from "X" to FULL mark. During operation maintain at "X" level mark by adding **OE** SAE 10. Immediately before shut-down, fill to "X" level mark with **OE** SAE 10, then add gasoline to FULL mark. Run engine 5 minutes.

CRANKCASE—Drain only when hot. Refill to FULL mark on gauge. Run engine a few minutes and recheck oil level.

CAUTION: Be sure pressure gauge indicates oil is circulating.

HOURS—Reduce hours under severe operating conditions.

OIL CAN POINTS—Every 64 hours, lubricate hinges, locks and hood fasteners with **OE.**

DO NOT LUBRICATE—Governor, water pump, and fan.

No. 3238

NOTES

LUBRICATED BY MAINTENANCE PERSONNEL—Starting Motor Rear and Outboard Bearings, Exciter End Bearing (complete disassembly service).

Copy of this lubrication order will remain with the equipment at all times. Instructions contained therein are mandatory and supersede all conflicting lubrication instructions dated prior to 13 December 1944.

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
J. A. ULIO,
Major General,
The Adjutant General.

TL-94895

Figure 16. War Department Temporary Lubrication Order No. 3238.

PREVENTIVE MAINTENANCE SERVICE AND TECHNICAL INSPECTION

WD No. 6081

WORK SHEET

FOR

WHEELED AND HALF-TRACK VEHICLES

(See AR 850-15)

Mileage _____ Date 31 NOV 44

Organization 1st SIG B

Vehicle nomenclature PE-95-H (Make) SCR-299 (Model) (Size) (Drive) (Body Type)

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

Legend for marking: √—Satisfactory X—Adjustment required XX—Repair or replacement required O—Defect corrected

SYMBOLS: □ —INSPECT AND CORRECT C—CLEAN T—TIGHTEN A—ADJUST L—SPECIAL LUBRICATION S—SERVE

~~1000-MILE MAINTENANCE~~
~~OR TECHNICAL INSPECTION~~
MONTHLY
~~1000-MILE~~ MAINTENANCE

Line out words and column that do not apply.

OPERATION
~~ROAD~~ TEST

1 Before Operation Inspection
~~2 Air Pressure (build-up) (governor cut-off) (low-pressure indicator)~~
3 Dash Instruments and Gages; (oil pressure) (viscometer) (ammeter) (voltmeter) (speedometer and odometer) (tachometer) (temperature) (fuel) (air pressure)
~~4 Horns, Mirrors, and Windshield Wipers~~
~~5 Brakes; foot, hand, and trailer (braking effort) (feel) (side pull) (noise) (chatter) (pedal travel) (hand control air or electric)~~
~~6 Clutch (free travel) (drag) (noise) (chatter) (grab) (slip)~~
~~7 Transmission and Transfer; (lever action) (declutching) (vibration) (noise)~~
~~8 Steering (free play) (bind) (wander) (shimmy) (side pull) (column and wheel)~~
9 Engine (idle) (acceleration) (power) (noise) (governed speed)
10 Unusual Noises (attachments) (cab) (body) (wheels or tracks)
~~11 Brake Booster Operation~~
~~12 Air Brake System Leaks~~
13 Temperatures (brake drums) (hubs) (axles) (transmission) (transfer)
14 Leaks (engine oil) (water) (fuel)
~~15 Track Tension (final road test)~~
~~16 Gear Oil Level and Leaks (axles) (transmission) (transfer)~~

~~Raise Vehicle Block Safely~~

~~17 Unusual Noises (engine) (bolts) (accessories) (transmission) (transfer) (shafts and joints) (axles) (wheel bearings)~~

ENGINE AND ACCESSORIES

18 Cylinder Head and Gasket
19 Valve Mechanism (clearances) (lubrication) (cover gaskets)
20 Spark Plugs (gaps) (deposits)
21 Compression Test (record)
22 Battery (cables) (hold-downs) (carrier) (record gravity and voltage)
23 Crankcase (leaks) (oil level)
24 Oil Filters, Coolers, and Lines
25 Radiator (core) (shell) (shutters) (mountings) (hose) (cap and gasket) (antifreeze, record) (overflow tank) (steam relief tube and valve)
26 Water Pump, Fan, and Shroud
27 Generator, Starter, and Switch
~~28 Air Compressor (unloader valve) (governor) (lines)~~
29 Drive Belts and Pulleys
30 Tachometer Drive and Adapter
31 Distributor (cap) (rotor) (points) (shaft) (advance units)
32 Coil and Wiring (high and low voltage) (supports)

~~1000-MILE MAINTENANCE~~
~~OR TECHNICAL INSPECTION~~
MONTHLY
~~1000-MILE~~ MAINTENANCE

33 Manifolds and Heat Control (gaskets) (seasonal setting)
34 Air Cleaners (carburetor) (Diesel) (air compressor)
35 Breather Caps and Ventilators
36 Carburetor (choke) (throttle) (linkage) (governor)
37 Fuel Filters, Screen, and Lines
38 Fuel Pump (vacuum and pressure)
39 Starter (action) (noise) (speed)
40 Leaks (engine oil) (fuel) (water)
41 Ignition Timing (advance)
42 Engine Idle and Vacuum Test
43 Regulator Unit (connections) (voltage) (current) (cut-out)
~~44 Power Tire Pump (drive) (lines)~~
45 Diesel Fuel Injector Pump
46 Diesel Fuel Nozzles and Lines

CHASSIS, BODY, & ATTACHMENTS

~~47 *Tires and Rims (valve stems and caps) (condition) (direction) (matching) (spare carriers)~~

ON HALF-TRACKS DO 106 TO 115 NOW

~~48 *Rear Brakes (drums) (supports) (cylinders) (cams and shafts) (magnets and armatures)~~
~~49 *Rear Brake Shoes (linings) (links) (guides) (anchors)~~
~~50 *Torque Rods (bushings) (brackets)~~
~~51 *Rear Spring Seats and Bearings~~
~~52 *Rear Wheels (bearings) (seals) (drive flanges) (nuts)~~
~~53 *Front Brakes (drums) (supports) (cylinders) (cams and shafts) (hose) (air chambers) (push rods and seals) (adjusters)~~
~~54 *Front Brake Shoes (linings) (links) (guides) (anchors)~~
~~55 *Steering Knuckles (joints) (bearings) (seals) (boots)~~
~~56 *Front Springs (slips) (leaves) (U-bolts) (hangers) (shackles)~~
~~57 Steering (arms) (tie rods) (drag link) (seals and boots) (Pitman arm) (gear) (column) (wheel)~~
~~58 Front Shock Absorbers and Links~~
~~59 Knee Action Suspension~~
~~60 *Front Wheels (bearings) (seals) (flange) (axle end play) (nuts)~~
~~61 Front Axle (pinion end play) (seal) (vent) (alinement)~~
~~62 Front Propeller Shaft (joints and alinement) (seals) (flanges)~~
63 Engine (mountings and braces) (ground strap) (side pans)
~~64 Hand Brake (ratchet and pawl) (linkage) (drum or disk) (lining)~~
~~65 Clutch Pedal (free travel) (linkage) (return spring)~~
~~66 Brake Pedal (free travel) (linkage) (return spring)~~
~~67 Brake Master Cylinder (vent) (fluid level) (leaks) (switch)~~
~~68 Brake Vacuum Booster (linkage) (air cleaner and hose) (cylinder)~~

~~1000-MILE MAINTENANCE~~
~~OR TECHNICAL INSPECTION~~
MONTHLY
~~1000-MILE~~ MAINTENANCE

~~69 Air Brake Application Valve~~
~~70 *Air Brake Reservoirs~~
~~71 Transmission (mounting) (seals) (power take-off) (linkage)~~
~~72 Transfer (mountings) (linkage) (seals) (vent) (power take-off)~~
~~73 Rear Propeller Shafts (see 62)~~
74 Center Bearing (seals) (vent) (oil level) (mountings)
~~75 Rear Axles (pinion end play) (seals) (vents) (alinement)~~
~~76 *Rear Air Brake (chambers) (rods and seals) (slack adjusters)~~
~~77 *Rear Springs (slips) (leaves) (U-bolts) (hangers) (shackles)~~
~~78 Rear Shock Absorbers and Links~~
~~79 *Cab and Body Mountings~~
80 *Frame (rails and cross members)
81 *Wiring, Conduits, and Grommets
82 Fuel Tanks, Fittings, and Lines
~~83 *Brake Lines (fittings) (hose)~~
84 Exhaust Pipes and Muffler
85 *Vehicle Lubrication

LOWER VEHICLE TO GROUND

~~86 Tie-In and Turning Stops~~
~~87 Winch (clutch) (brake) (drive) (shear pin) (cable) (guides)~~
~~88 Fifth Wheel (bed plate and bolts)~~
~~89 Trailer to Trailer Brake Hose, Wiring and Connections~~
~~90 Hoist (mounting) (drive) (controls) (pump) (lines) (cylinder)~~
91 *Lamps (head, tail, body, running, directional, stop, and blackout)
~~92 *Safety reflectors~~
~~93 Front (bumpers) (rollers) (tow hooks) (brush guards) (grille)~~
~~94 Hood (hinges) (fasteners)~~
~~95 Front Fenders and Running Boards~~
~~96 Cab or Pass. Body (doors) (hardware) (glass) (top and frame) (curtains and fasteners) (seats) (upholstery and trim) (safety straps and grab rails) (floor boards and mats) (ventilators) (map compartment and tables)~~
~~97 Heater, Fan, and Defroster~~
98 Circuit Breaker and Fuse Block
~~99 *Rear Fenders and Splash Guards~~
100 *Body (panels) (rear doors) (tailgate and chains) (floor) (skidstrips) (stakes) (sockets) (bows) (tops) (tarpaulins) (end curtains) (troop seats) (stowage compartments)
~~101 *Rear Bumper and Pintle Hook (latch and lock pin) (draw bar)~~
~~102 Armor Plate (body) (cowl) (doors) (windshield) (port covers)~~
103 *Paint and markings
104 Radio Bonding (suppressors) (filters) (condensers) (shielding)
~~105 Armament (guns) (mounts) (rails) (spare parts) (covers)~~

*TRAILER ITEMS ALSO COMMON TO OTHER WHEELED VEHICLES

FOLD TO ◄— VEHICLE NOMENCLATURE LINE —► AND FILE

TL 95418

W. D., A.G.O. Form No. 461
April 13, 1943

Figure 17. Front of WD, AGO Form No. 461 adapted for use with power units. (Solely vehicular items are lined out.)

RECORD: Compression pressure: Cylinder No. 1 102 2 110 3 100 4 108 5 ____ 6 ____ 7 ____ 8 ____ 9 ____ 10 ____ 11 ____ 12 ____

BATTERY: Specific Gravity—Cell No. 1 1.225 2 1.227 3 1.226 4 ____ 5 ____ 6 ____ Antifreeze protection to ____ °F

Voltage— Cell No. 1 1.9 2 1.95 3 1.9 4 ____ 5 ____ 6 ____

Man hours required for this 1,000 mile maintenance 2 6,000 mile maintenance ____ or tech. inspection ____

Driver HENRY JONES T/5 (Grade or title) Mechanic or inspector BILL BROWN T/4 (Grade or title)

Repairs by higher echelon entered on Job Order Request No. 403 Supervising officer WILLIAM L. WILLIS, 1st LT. (Grade or title)

Repairs requested 1 DEC 44 WLW (Date) (Initials) Vehicle forwarded 2 DEC 44 BB (Date) (Initials) Vehicle returned 4 DEC 44 BB (Date) (Initials)

Disposition of work sheets: 1000 Mile—May be retained until completion of next 6000 mile, then destroy
6000 Mile—May be retained until completion of next 6000 mile, then destroy
Technical inspection—May be retained until completion of next 6000 mile, then destroy
} EARLIER DESTRUCTION MAY BE ORDERED BY LOCAL COMMAND

Remarks or Recommendations: ____

~~6000-MILE MAINTENANCE OR TECHNICAL INSPECTION~~

~~1000-MILE~~ MAINTENANCE

ITEMS SPECIAL TO HALF-TRACKS

~~106 Tracks (guides) (tread wear)~~
~~107 Sprockets (flanges) (bearings) (seals)~~
~~108 Brake (drums) (supports) (cylinders)~~
~~109 Brakes Shoes (linings) (links) (guides) (anchors)~~
~~110 Idlers (flanges) (bearings)~~
~~111 Idler (posts) (shackles) (shafts) (adjusting rods) (brackets)~~
~~112 Frame Brackets and Cross Tube~~
~~113 Bogie (rear assemblies) (springs and blocks) (guides and slides) (arms and bolts)~~
~~114 Bogie Rollers: Upper and Lower (tires) (bearings) (seals) (bolts)~~
~~115 Track Tension (on ground)~~

ITEMS SPECIAL TO AMPHIBIANS

Note. The following items 116 to 123 are the required minimum maintenance for amphibian vehicles in land operations. For maintenance requirements for water operations, consult the vehicle maintenance manual

~~6000-MILE MAINTENANCE OR TECHNICAL INSPECTION~~

~~1000-MILE~~ MAINTENANCE

~~116 Rudder and Shearpins, Propeller Strut and Bearing~~
~~117 Propeller Shaft Housings (seals) (hoods) (plugs)~~
~~118 Hull (plugs) (sub strakes) (decks) (hatches) (ventilators) (compartments) (bulkheads) (plates) (frame)~~
~~119 Bilge Pumps (drives) (valves) (controls) (lines) (strainers)~~
~~120 Water Propeller (shafts) (joints) (bearings) (stuffing box)~~
~~121 Hand Crank Ratchet and Cover~~
~~122 Rudder (shafts) (arms) (cables) (rod) (brackets) (stuffing box)~~
~~123 Anchor, Hand Bilge Pump and Boat Hook~~

ITEMS SPECIAL TO TRAILERS

~~124 Tow Hitch (king pin) (5th wheel plates) (lunette) (tongue)~~
~~125 Air and Electric Connections~~
~~126 Safety Devices (chains) (switch and battery)~~

~~6000-MILE MAINTENANCE OR TECHNICAL INSPECTION~~

~~1000-MILE~~ MAINTENANCE

~~127 Landing gear (shafts) (wheels) (supports) (lock pin) (gears) (cranks)~~
~~128 Front and Rear Axles~~
~~129 Electric Brake (application controller) (hand control) (resistor)~~
~~130 Parking Brakes (ratchet) (pawl)~~

TOOLS AND EQUIPMENT

131 Tools (vehicle) (pioneer)
132 Fire Extinguishers
~~133 Decontaminator~~
134 First-Aid Kit (if specified)
135 Publications and Form No. 26
~~136 Traction Devices (chains) (plates and connectors) (grousers)~~
137 Tow (chain) (cable) (rope) (block)
138 Spare (shearpins) (fuses) (bulbs)
139 Fuel and Water Cans and Bracket
140 Fuel Can Nozzle and Bucket
141 Modifications (FSMWO's completed)
142 Final Road Test (repeat items 2 to 16)

Note. Correct or report all deficiencies found during final road test

U. S. GOVERNMENT PRINTING OFFICE: 1943 O - 522386

TL 95419

Figure 18. Back of WD. AGO Form No. 461, adapted for use with power units. (Solely vehicular items are lined out.)

(4) Technical inspections are usually performed by third or higher echelon. The maintenance services are performed by unit mechanics (second echelon).

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

b. Duty Roster (fig. 19).

(1) USE OF W.D., A.G.O. FORM NO. 6. This form (Duty Roster) is the only one authorized for recording lubrication and maintenance service records for power units of the Signal Corps. The right-hand page of the Duty Roster contains 31 columns for 31 days of the month. The adjacent columns on the left-hand page are used to list the use, nomenclature, and serial number of each power unit. The first line of any corresponding three-line group on the right-hand page will be used to list the number of hours of operation of the power unit for each day of the month. The second line will show accumulated hours of operation from day to day. The third line will show the dates on which scheduled maintenance takes place. The third line can also be used for entry of lubrication records based on the hourly intervals specified by the applicable War Department Lubrication Order, with the operating hours totals as guides.

(2) RECORDING FOR POWER UNITS ABOVE 2.5 KILOWATS.

(*a*) Record the actual hours of operation for each day on the first line, and the accumulated hours of operation from day to day on the second line.

(*b*) As each day elapses, or as otherwise convenient, the noncommissioned officer detailed for the purpose will determine which power units are scheduled for weekly, monthly, or semiannual maintenance.

(*c*) As these maintenance services are performed, the lettter W for weekly, M for monthly, or S for semiannual will be entered on the third line in the column representing the date on which the service actually takes place. When W is used, a small numeral written beside it will indicate the number of weeks which have elapsed since the preceding monthly service. W_1 would signify the first weekly service since the preceding monthly service. When M is used, a small numeral written beside it will indicate the number of months since the preceding semiannual service. M_4 would signify the fourth monthly service since the preceding semiannual service.

(*d*) After each service, the date and the nature of the next schedule will be indicated in the appropriate date column in the following system: W_1 W_2 W_3 W_4 M_1; W_1 W_2 W_3 W_4 M_2; W_1 W_2 W_3 W_4 M_3; W_1 W_2 W_3 W_4 M_4; W_1 W_2 W_3 W_4 M_5; W_1 W_2 W_3 W_4 S.

(*e*) If the scheduled service is delayed for any reason, the symbol for that service will be entered on the actual date the service was performed and the symbol will be circled to show on the roster that the service was made out of its normal order. Circling the service symbol on the roster provides a constant check on any irregularity of maintenance.

(*f*) Additional symbols to fill in as applicable are:

P—Unit deadlined for lack of parts.

R—Unit deadlined for repair.

39. GENERAL PROCEDURES.

a. These general procedures are basic instructions which are to be followed when performing the services on the power unit items listed on the preventive maintenance service work sheet.

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

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

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

d. Opposite each item on these work sheets, a rectangle or box is placed either under the periodic maintenance service heading, under the technical inspection heading, or both.

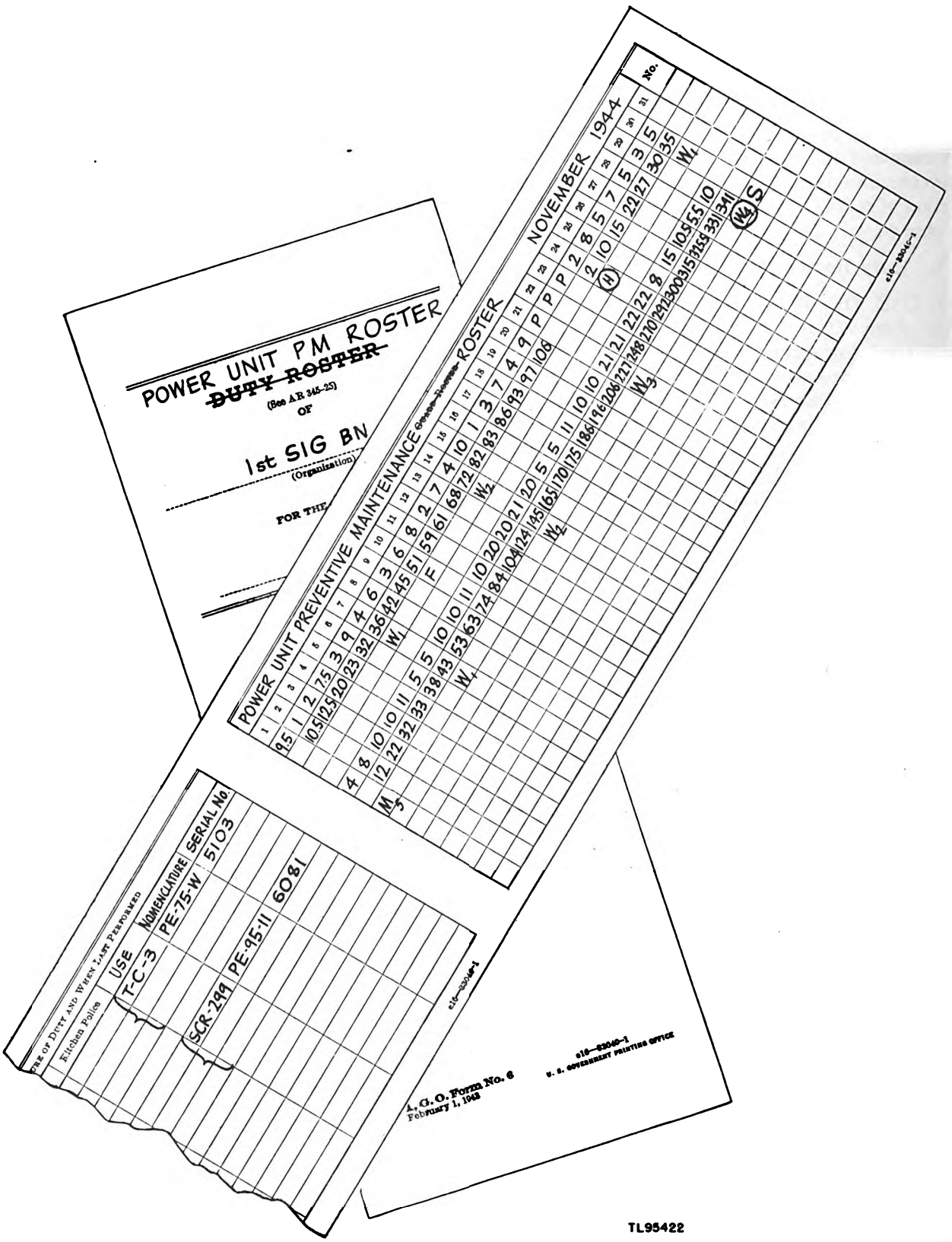


Figure 19. WD, AGO Form No. 6, adapted for use with power units.

These boxes indicate which of the maintenance services or inspection is to be performed for each item. Each box indicates that the item is to be inspected and corrected when necessary. Special-service symbols like C, T, A, L, or S appear in some of the boxes. These symbols indicate that certain additional mandatory services are to be performed, and are explained in detail in subparagraph *m* below.

e. The items in the column not lined out on each of the above forms should usually be performed in the numerical sequence in which they are listed since they have been so arranged for economy of motion.

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

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

(1) Mark the box with a $\surd$ if found satisfactory.

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

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

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

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

(1) Availability of suitable tools.

(2) Availability of necessary parts.

(3) Capabilities of mechanics.

(4) Time available.

(5) Tactical situation.

i. After a technical inspection, the unit should be restored to a safe operating condition, unless it is to be scheduled for wear. Any disassembled parts or assemblies that are damaged in handling during the inspection should be replaced by serviceable ones.

j. The preventive maintenance services should be performed without disassembling units, unless disassembly is prescribed in the procedures. Ordinarily, new gaskets should be used when the parts are reassembled.

k. When new or overhaul subassemblies are installed to correct deficiencies, care should be taken to see that they are clean, and properly lubricated and adjusted.

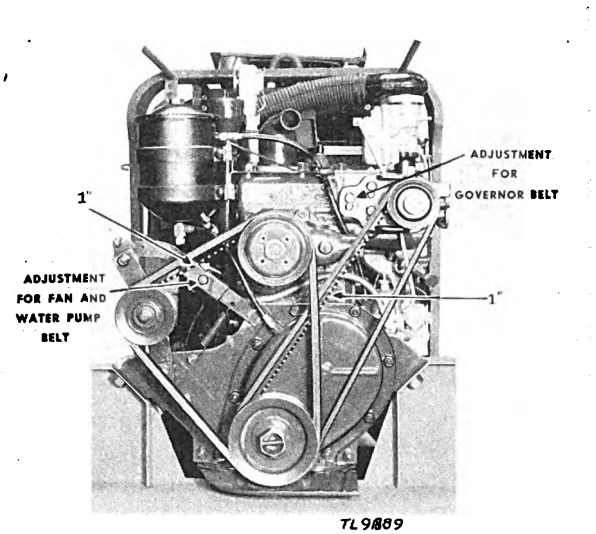


Figure 20. Belt adjustments.

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

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

(2) The inspection of a component to see that it is 'correctly assembled' is usually an external visual inspection to determine whether it is in its normal assembled position in the unit.

(3) The check of a component to determine whether it is "secure" is usually an external visual inspection or a hand-feel, a pry-bar, or a wrench check for looseness in the unit. Such an inspection will always include any brackets, and all lockwashers, locknuts, locking wires, or cotter pins used to secure the tightening. All belts should be checked to insure correct tension (fig. 20).

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

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

(1) A, ADJUST. Make all necessary adjustments in accordance with the technical manual, special bulletins, or other current directives.

(2) C, CLEAN.

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

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

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

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

(5) T, TIGHTEN. All tightening operations should be performed with sufficient wrench torque (force on the wrench handle) to tighten the unit according to good mechanical practice, using the proper tool without additional extension handle. Use torque-indicating wrench where specified. Do not overtighten, as this may strip threads. Tightening will always be understood to include the correct installation of lockwashers, locknuts, and cotter pins or locking wires provided to secure the tightening. The correct sequence for cylinder head tightening is indicated in figure 21.

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

o. If a job order (W.D., O.O. Form No. 7362) is used when the power unit is sent to a higher echelon for the correction of any defect beyond the scope of organization maintenance, the job order number will be inserted in the space provided on the reverse side of the form.

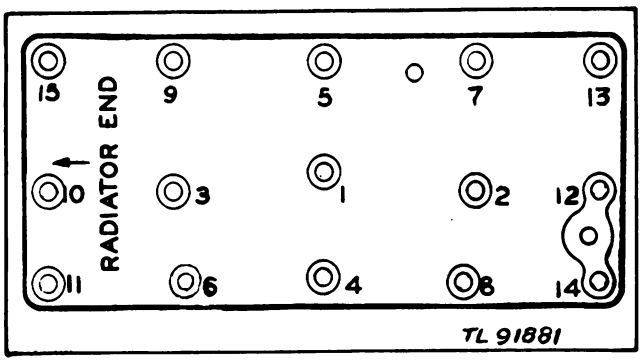


Figure 21. Cylinder head tightening.

p. The forms may be reduced to convenient size for filing by folding up the line marked 'Vehicle Nomenclature' but are to be filed only after all items marked X or XX have been corrected.

40. SPECIFIC PROCEDURES.

a. Use of W.D., A.G.O. Form No. 461.

(1) The items on this form should be performed in the numerical sequence in which they are listed wherever possible, since they have been so arranged for maximum efficiency and

economy of motion. The general order of the listed items is:

(*a*) A running test, and closely related items.

(*b*) Maintenance operations, consisting of operations in the engine compartment and a group of body and attachment items.

(*c*) Tools and equipment.

(*d*) Final running test.

(2) If at any time it is necessary to disassemble a unit, any special services indicated on the semiannual maintenance should be performed on the item.

(3) All monthly maintenance work sheets may be held in the organization file until the next semiannual maintenance work sheet is filed, and then destroyed. The semiannual maintenance work sheet, or technical inspection reports, may be held until the next semiannual maintenance form is filed, and then distroyed.

b. Performing Items on Work Sheet. Specific procedures for performing each item in the monthly and semiannual maintenance services and in the technical inspection are described on the following pages. Each of these pages of specific procedures has three columns at its left edge, corresponding to the monthly maintenance, the semiannual maintenance, and the technical inspection of Form No. 461, respectively. While the semiannual maintenance and technical inspection are both indicated in the same column on the work sheet (Form No. 461), separate columns are provided in the procedure pages of this manual for clarification. The detailed procedures for each maintenance service and technical inspection will be found on the following pages opposite the item numbers in the procedure columns. Very often it will be found that a particular procedure does not apply to both the monthly maintenance, the semiannual maintenance, and to the technical inspection. In order to determine which procedures to follow, it is necessary simply to follow the item number down the appropriate column opposite the paragraphs whenever they are to be applied.

c. Sample. The following sample illustrates the manner in which the specific procedures described in this paragraph are to be used. Assume work is being done on the monthly maintenance service. Item number 20, in this sample, appears in the monthly maintenance column opposite the first paragraph only, indicating the necessary procedure.

SAMPLE

Tech. Insp.	Semi-annual	Monthly		
		20	**Spark Plugs.** Examine the installed spark plugs to see that their insulators are in good condition and clean; note any evidence of leakage around the insulators or gaskets.	Applies to monthly maintenance only.
20	20		Remove the spark plugs and examine for poor condition, paying particular attention to broken insulators, excessive carbon deposits, and to electrodes which are burned thin. Replace unserviceable plugs. Report excessive deposits or damaged insulators, as these conditions may indicate incorrect heat range.	Applies both to technical inspection and semi-annual maintenance.

SAMPLE

Tech. Insp.	Semi-annual	Monthly
	20	
	20	

CLEAN. Clean the deposits from the insulators and electrodes, and check the insulators to see whether they are cracked. If a plug cleaner is not available, install new or reconditioned plugs.

ADJUST. Adjust gaps to 0.030 inch by bending the grounded electrodes. After completing item number 21, reinstall the plugs using new gaskets and taking care not to overtighten them as this may cause distortion and damage.

Applies to semi-annual maintenance only.

Similarly, the number 20 appears both in technical inspection and in the semi-annual maintenance columns opposite the second paragraph, indicating that this procedure is to be performed on both of these operations. The number 20 again appears in the semi-annual maintenance column only opposite the mandatory special services, **clean** and **adjust.** This corresponds with Form No. 461 where the letters C and A are placed in the semi-annual maintenance box opposite item number 20, indicating that the spark plugs must be cleaned and adjusted every 6 months.

41. MAINTENANCE ITEMS.

Tech. Insp.	Semi-annual	Monthly

RUNNING TEST

The operator of a power unit is often unaware of defects in the equipment which have developed gradually, and to which he has become accustomed. The fact that many operators lack the ability to detect the developing causes of failures makes it desirable for the mechanic to test the operation of the unit as part of the periodic preventive maintenance services. During and before this test, any repairs or adjustments necessary to insure safe operation should be made. The appropriate paragraph in the following service procedures should be consulted. If a defect is found during the test which does not require immediate correction, note it on the check sheet and make provisions for securing necessary replacement parts. The defect can be corrected later during the service.

NOTE: If the tactical situation does not permit a complete test, perform items 3, 9, 10, and 14.

Tech. Insp.	Semi-annual	Monthly	
1	1	1	**Before-Operation Service.** Perform the Before-operation Service as a check to determine whether the power unit is in a satisfatory condition to make the running test safely, and that it is adequately supplied with fuel, engine oil, and coolant.
3	3	3	**Dash Instruments and Gauges.** During the warm-up period, push the throttle control rod back and operate the engine at fast idle speed. Observe as follows: OIL PRESSURE GAUGE. Observe oil pressure at frequent intervals and under all conditions of engine speed to see that the oil pressure is about 20 pounds. **CAUTION: If the gauge indicates zero or excessively low oil pressure, stop the engine immediately and investigate the cause.** BATTERY CHARGE AMMETER. Observe the ammeter to see that it is indicating normally. The ammeter should read from 3 to 30 amperes, depending on the state of charge of the battery. FREQUENCY METER. Watch the meter for proper operation. The frequency reading should be 60 cycles. WATER TEMPERATURE. Note the WATER TEMPERATURE gauge to see that it indicates within the normal range. The temperature should increase gradually during the warm-up period and normally should not exceed 175° F. The temperature at which the gauge hesitates indicates the opening of the thermostat. Extremely low temperature after a reasonable warm-up period may indicate that the "open" of the thermostat is jammed. Temperatures above normal may indicate that the thermostat has become jammed in the closed position, or that the cooling system is clogged. FUEL GAUGE. Observe whether the fuel gauge indicates the approximate amount of fuel in the tank. VOLTMETER. The meter should read 120 volts.
9	9	9	**Engine.** Observe engine-operating characteristics as follows: UNUSUAL NOISES. Listen for knocks and rattles as the engine is accelerated and decelerated, and while it is under both light and heavy loads. ACCELERATION AND POWER. Operate the engine at various loads, noting whether the engine has normal pulling power. A slight ping during sudden load application is normal; continued or heavy ping may indicate early timing, heavy accumulation of carbon, or low-octane fuel.
10	10	10	**Unusual Noises.** Be on the alert continually for unusual noises that would indicate looseness of parts or damaged malfunctioning components.

Tech. Insp.	Semi-annual	Monthly	
13	13	13	**Temperatures.** After completing the run, note as follows: GENERATOR HOUSING. Feel the generator housing cautiously for abnormal temperatures as determined by previous experience with the unit. GENERATOR BEARINGS. Feel the bearing housing for evidence of overheating. If the rear bearing appears to be overheated, lack of proper lubrication or excessive wear of the bearing is indicated. Report worn bearings promptly to the proper authority.
18	18	18	**Cylinder Head and Gasket.** Look for cracks or indications of oil, water, or compression leaks around studs, cap screws, and gaskets. **CAUTION:** Cylinder heads should not ordinarily be tightened unless there is a definite indication of looseness or leaks. When a new gasket is installed, tighten three times as follows: First, upon installation, second, after engine is warmed up, and third, after completing final test.
14	14	14	**Leaks.** Look within the engine compartment and underneath the unit for engine oil, water, and fuel leaks, and determine their source.
19	19	19	**Valve Mechanism.** If valve noises occur, examine valve tappet clearances while hot. Valve tappets, shafts, and springs should appear in good condition, correctly assembled, and secure. Oil should be delivered properly. Also make sure that the valve cover gaskets are in good condition.
19			Remove the valve mechanism cover, and observe valve clearances and the condition of valve mechanisms.
	19		ADJUST. Adjust the clearances to the values given in paragraph 57.
		20	**Spark Plugs.** Examine the installed spark plugs to see that their insulators are in good condition and clean, and that there is no leakage around the insulators or gaskets. When operating conditions require, the spark plugs may be removed for service.
20	20		Remove the spark plugs and examine for poor condition, paying particular attention to broken insulators, excessive carbon deposits, and to electrodes which are burned thin. Replace unserviceable plugs. Report excessive deposits or damaged insulators, as these conditions may indicate incorrect heat range.
	20		CLEAN. Clean deposits from the electrodes and insulators, and check again for cracks. If a plug cleaner is not available, install new or reconditioned plugs.

Tech. Insp.	Semi-annual	Monthly	
	20		ADJUST. Adjust gaps to 0.030-inch by bending to the grounded electrodes. After completing item 21, reinstall the plugs, using new gaskets and taking care not to overtighten them, as overtightening may cause distortion and damage.
21	21		**Compression Test.** With all spark plugs out, insert a compression gauge in a spark plug hole and, with the throttle wide open, rotate the engine at cranking speed until the maximum compression is indicated. Do not crank the engine more than is necessary to obtain the maximum reading of 185 pounds (par. 3). Be sure battery is fully charged. Record the reading in the space provided on the back of the form. Repeat this process for each cylinder. If pressure in a cylinder is appreciably below normal, squirt sufficient engine oil on the piston head to prevent loss of compression temporarily, and recheck. Low compression, brought up to normal by oil sealing, indicates piston, ring, or cylinder wear or damage. Low compression, not brought up to normal by this method, indicates valve or gasket leakage.
22	22	22	**Battery (Cable, Hold-Downs, Carrier, Record Gravity, and Voltage).** Inspect battery case for cracks and leaks. Clean top of battery. Inspect cables, terminals, bolts, posts, straps, and hold-downs for good condition. Test specific gravity and voltage and make a record on Form No. 461. Specific gravity readings below 1.225 indicate battery should be recharged or replaced except when using electrolyte for tropical climates. Electrolyte level should be one-half inch above plates.
	22	22	Bring electrolyte to proper level by adding distilled or clean water. Clean entire battery and carrier. Repaint carrier if corroded. Clean battery cable terminals, terminal bolts and nuts, and battery posts, and grease them lightly. Inspect bolts for serviceability. Tighten terminals and hold-downs carefully to avoid damage to battery.
23	23	23	**Crankcase.** With engine idling, examine crankcase, valve covers, and timing-gear cover for oil leaks. Stop the engine and, after oil has drained into the crankcase, see whether the oil is at the proper level.
	23	23	**NOTE:** If an oil change is due, drain the crankcase and refill to proper level with specified oil. Do not start the engine again until item 24 is completed.
24	24	24	**Oil Filters, Coolers, and Lines.** Inspect the oil filter, and all external engine oil lines to see whether they are in good condition, secure, and do not leak.
	24	24	**NOTE:** When due, or when oil-filter cartridge condition indicates a filter cartridge change is necessary, remove the filter cartridge, clean the case, and install a new filter cartridge of the correct type, installing new gaskets and tightening the cover securely.

Tech. Insp.	Semi-annual	Monthly	
25	25	25	**Radiator (Core, Shell, Mountings, Hose, Cap and Gasket, and Steam Relief Valve).** See that these items are in good condition, correctly assembled, securely mounted and connected, and do not leak; note whether the core air passage are obstructed with dirt, insects or trash, and whether the core fins are badly bent; note whether the steam-relief valve operates freely and is in correct position for the prevailing atmospheric temperature. Also examine the coolant to see whether it is so contaminated with rust, oil, or other foreign matter that the cooling system should be cleaned. If cleaning is necessary, proceed as follows: Drain the radiator, taking care to save the drainings to put back into radiator if ethylene-glycol antifreeze is in use. Clean the cooling system according to current directive, using only specified cleaner. Flush cleaner from the entire cooling system with clean water. Refill radiator with coolant, adding specified inhibitor, unless new antifreeze, which contains inhibitor, is used. Do not fill to top; allow room for expansion.
			ANTIFREEZE. If antifreeze is in use, determine its protective value and make a record in the space provided on the reverse side of the work sheet.
	25	25	CLEAN. Clean the dirt, insects, and trash from the exterior of the core by blowing out with compressed air or with a stream of water applied carefully from the rear side of the core. (Do not use steam).
			CAUTION: Use only a suitably shaped piece of wood or blunt instrument in straightening fins; otherwise tubes may be punctured.
	25		TIGHTEN. Tighten all loose radiator mountings and hose clamps.
26	26	26	**Water Pump, Fan, and Shroud.** Observe water pump to see that it is in good condition, not leaking, and securely installed. Loosen drive belts and leave them loose until adjustment is made (item 29). Examine shaft for end play and loose bearings. Inspect fan blades to see whether they are in good condition, properly secured to the hub, and whether the shroud is in good condition, properly aligned with the fan, and securely mounted.
	26	26	TIGHTEN. Tighten water pump packing gland nut cautiously. Do not overtighten as this may cause scoring of the shaft and leakage.
27	27	27	**Battery-Charging Generator, Starter, and Switch.** Note whether these items are in good condition, securely mounted, and whether the wiring connections are clean and secure; see that the starter linkage and retracting spring are in good condition and secure.

Tech. Insp.	Semi-annual	Monthly	
27	27		Remove the battery-charging generator and starter inspection covers and see that the commutators and brushes are in good condition and not excessively worn; that the brushes are free in the holders and have sufficient spring tension to hold them in contact with commutator; and that the brush-connecting wires are secure and not chafing.
	27		CLEAN. Clean the commutator end of the generator and starter by blowing out with compressed air. If the commutator is dirty, clean with fine sandpaper (No. 00) and blow out the dust with compressed air. See that air passages in generator are clean and unobstructed. Check seating of brushes.
	27		TIGHTEN. Tighten the starter mounting bolts securely.
29	29	29	**Drive Belts and Pulleys.** Observe all drive belts for evidence of fraying condition, excessive wear, and deterioration from oil. See that all drive pulleys and hubs are in good condition and securely mounted. Check coupling between engine and generator.
31	31	31	**Distributor.** Observe whether the distributor body and external attachments are in good condition and secure. Examine other parts of the distributor as follows:
			CAP, ROTOR, AND POINTS. Blow or wipe the dirt or dust from the distributor cap, remove the cap, and see that the cap, rotor, and the breaker-plate assembly parts are in good condition, correctly assembled, secure, and serviceably clean. Pay particular attention to cracks in the cap and rotor, corrosion of terminals, and connections in these parts, and to burning of the outer ends of the conductor strap of the rotor. Also see whether the breaker points are in good condition, well aligned, and adjusted to specifications. If the breaker-plate assembly is unserviceably dirty, remove the distributor, clean in dry-cleaning solvent, dry with compressed air, lubricate parts as specified below, and reinstall in its correct position for timing. When cleaning the distributor, remove the wick and lubrication cup, clean and dry them while removed, and reinstall only after the distributor assembly is cleaned and blown dry with compressed air. If the breaker points are pitted, burned, or worn to an unserviceable condition, install a new set of points. If the points are badly pitted, replace the capacitor also, as it is probably the cause of the pitting. Install the new points so that they are well aligned and engage squarely. If the points are slightly pitted or burned, dress them with an American-Swiss No. 6 file (or equivalent) or #00 sandpaper (do not use emery cloth), and remove the filings with compressed air.
			SHAFT. Test by hand-feel for looseness, to determine whether or not the distributor camshaft is excessively worn in its bushings.

Tech. Insp.	Semi-annual	Monthly	
			CENTRIFUGAL ADVANCE. Install the rotor on the upper end of the distributor camshaft and note whether the camshaft can be rotated by finger force through the normal range of movement which is permitted by the centrifugal-advance mechanism. Note also whether it returns to its original position when the fingers are removed from the rotor and that there is no binding or hanging up in the mechanism during this check.
			SPECIAL LUBRICATION. Lubricate the cam surfaces, the movable breaker-arm pin, the wick, and the camshaft according to the lubrication instructions. Take care to keep lubricant away from the distributor points, not to apply more lubricant than is specified, and to wipe the cam clean before lubricating its surfaces.
	31		ADJUST. Adjust the breaker point gap to 0.020 inch.
32	32	32	**Coil and Wiring.** Examine the coil to see that it is in good condition, clean, and securely mounted. All high-voltage ignition wiring, including shielding or conduits, should be in good condition and securely fastened to all support mountings and terminals. See that all insulation and connections are clean. Inspect all low-voltage wiring in the engine compartment in the same manner. Inspect resistors and capacitors for condition and connections. Inspect power outlet receptacles and connections and convenience outlets for cleanliness and security of mounting.
			NOTE: Do not tighten wiring connections unless actually loose as overtightening of terminals will cause damage.
33	33	33	**Manifolds.** Observe the intake and exhaust manifolds to see that they are in good condition, secure, and that manifold gaskets appear to be in good condition and not leaking.
	33		TIGHTEN. Tighten all manifold assembly, mounting, exhaust pipe, and carburetor connecting flange nuts evenly and securely.
34	34	34	**Air Cleaners.** Remove the carburetor air cleaner element. See that the gaskets and seals are in good condition. Observe the condition of the cleaning element, baffles, and body. Note the oil in the reservoir, paying particular attention to the amount of dirt present. Also see that the oil level is satisfactory.
	34	34	CLEAN AND SERVE. Wash the cleaner element in dry-cleaning solvent, then dry it and apply engine oil. Allow any excess oil to drain. Refill the reservoir to the correct level with clean engine oil. Reassemble, making certain all gaskets are in good condition and in place. Install the air cleaner, being careful that it is pressed firmly into place and that the mounting is secure.
35	35	35	**Breather Cap and Ventilators.** See that they are in good condition, correctly assembled, secure, and that the ventilator tubes are open.

Tech. Insp.	Semi-annual	Monthly	
	35	35	CLEAN AND SERVE. Remove the crankcase breather and wash it thoroughly in Diesel oil. Knead the filter element to remove all lumps, wash it in Diesel oil, permit it to dry, and saturate it with engine oil. Replace the filter element in the breather and reassemble it. Replace the breather on the engine.
36	36	36	**Carburetor (Choke, Throttle, Linkage, Governor).** See that these items are in good condition, correctly assembled, and securely installed; that the carburetor does not leak; that the control linkage, including the choke and throttle shaft, is not excessively worn; that the choke valve opens fully when the control is in its released position; that the throttle valve opens fully when the governor operates at its farthest range; and that the governor is secure and properly sealed.
37	37	37	**Fuel Filters, Screen, and Lines.** Examine the fuel sediment bowl, fuel lines, and connections, to see that they are in good condition, secure, and not leaking.
	37	37	CLEAN. Close the fuel shut-off valve, and remove the filter bowl, gaskets, and two filter elements. Without disassembling the disk-type filters, clean the filter elements, sediment bowls, and screens in dry-cleaning solvent. Dry the elements thoroughly. Be sure to clean any screen or filter element at carburetor fuel line connection or at the fuel pump. Reinstall the removed parts, using new gaskets. Turn on the fuel shut-off valve after assembling, and recheck for leaks. NOTE: If filter element or screen is damaged or clogged beyond cleaning replace it.
38	38	38	**Fuel Pump.** Disconnect the fuel line at the carburetor and observe whether or not there is continuous spurting of gasoline. Replace any pump that does not produce proper pressure, being sure to make a similar check of the new pump to see that it is satisfactory.
39	39	39	**Starter (Action, Noise, and Speed).** Start the engine, observing whether the general action of the starter is satisfactory, particularly whether it engages and operates properly without excessive noise and has adequate cranking speed; and whether the engine starts readily. Also, as soon as the engine starts, note whether the oil pressure gauge and ammeter indications are satisfactory.
40	40	40	**Leaks.** Look in the engine compartment and under the unit. for engine oil, fuel, and water leaks. Trace all leaks to their source, and report or correct them.
41	41	41	**Ignition Timing (Advance).** With the engine running, observe the ignition timing. Also note whether automatic controls advance the timing as the engine is accelerated gradually.
	41	41	ADJUST. Adjust the ignition timing in accordance with timing instructions, paragraph 52 **p** (5).

Tech. Insp.	Semi-annual	Monthly	
42			**Engine Performance.** Observe whether the engine runs smoothly at normal speed
42	42	42	VACUUM TEST. Connect a vacuum gauge to the intake manifold. With the engine running at normal speed, the vacuum gauge should read about 17 to 20 inches and the pointer should be steady. A badly fluctuating needle between 10 and 15 inches may indicate a defective cyclinder head gasket or valve. An extremely low reading may indicate a leak in the intake manifold or gasket. Throw the electric load on and off quickly. If the gauge indicator fails to drop to approximately 2 inches as the load is applied, and fails to recoil to at least 24 inches as the load is removed, it may be an indication of diluted oil, poor piston ring sealing, or abnormal restriction in the carburetor, air cleaner, or exhaust.
			NOTE: The above readings apply to sea level. There will be approximately a 1-inch drop for each 1,000 feet of altitude.
43	43	43	**Battery Charge Relay (Connection, Voltage, Current, and Cut-out).** See whether it is in good condition and whether all connections and mountings are secure. Connect a low-voltage circuit tester and observe the cut-out to see if it controls the generator output properly. Follow the instructions in the manual, or those which accompany the test instrument. Replace if test shows faulty operation.
43	43		**CAUTION: This test should be made only after the regulator unit has reached normal operating temperature.**
63	63	63	**Engine Mountings and Braces, Ground Strap, and Side Pans.** These items should be in good condition and securely mounted and connected. Be sure to examine both front and rear engine mountings. If the mounting bolts are loose, tighten them properly.
74	74	74	**Bearings (Seals and Mountings).** Examine the bearings for any excessive end play. See that they are adequately lubricated, that seals are not leaking, and that the mountings are secure.
	74	74	TIGHTEN. Tighten the bearing mountings securely.
80	80	80	***Frame (Side and Cross Members).** Inspect frame, brackets, and cross members to see that they are in good condition, secure, and correctly aligned. If the frame appears to be out of line, report the condition to proper authority.
81	81	81	***Wiring, Conduits, and Grommets.** Observe these items to see that they are in good condition, properly supported, connected, and secure.
82	82	82	**Fuel Tank, Fittings, and Lines.** Inspect the fuel tank to see that it is in good condition and securely mounted. Examine the cap for defective gaskets or plugged vents. See that the filler neck is in good condition and the cap fits securely. Check fuel lines and fittings to see that they are in good condition, securely supported, and not leaking. Remove the fuel tank drain plug and drain off the accumulated water and sediment. Drain only until the fuel starts to run clear.
	82		

Tech. Insp.	Semi-annual	Monthly	
84	84	84	**Exhaust Pipes and Muffler.** Examine the exhaust pipe to see that it is securely attached to the exhaust manifold, that the gasket or packing does not show visible evidence of leakage, and that the other end is clamped securely to the muffler. Inspect the muffler to see that it is in good condition and securely mounted. Check the flexible exhaust pipe to see that it is securely screwed to the muffler, properly supported, and unobstructed at its outer end. See that the drain hole in the exhaust pipe neck is not clogged.
85			**Lubrication.** Inspect the lubrication of the entire power unit. Where disassembly was necessary for inspection purposes, lubrication must be performed, unless it is to be scheduled for repair.
	85	85	LUBRICATE. Lubricate all points of the power unit in accordance with instructions in lubrication chart and the following instructions: Use only clean lubricant. Keep all lubricant containers and dispensers covered except when withdrawing lubricant. Lubrication of items on the Preventive Maintenance Service and Technical Inspection Work Sheet that are marked with an L (special lubrication symbol) should be omitted on this lubrication service *with the exception of the external lubrication cup of the distributor*. This will avoid duplication and, in some cases, overlubrication. Before applying lubricant, clean the lubrication fitting or plug, so that dirt will not enter with the lubricant. If lubrication fittings, flexible lines, vents, or plugs are found missing or damaged, they should be replaced immediately. Clean the hole in which the new fitting is to be installed, install the fitting and lubricate the unit. On all unsealed bushings or joints, the lubricant should be applied until it appears at the openings. Open any clogged lubrication passages until lubricant is properly delivered. When draining oil from the engine, always drain the oil immediately after it has been warmed and agitated to a good draining condition by operation of the engine. Refill to the correct level with specified oil as soon as the draining is completed. **CAUTION: Do not fill to overflowing. Reinstall all drain and filler plugs securely. Take care that any required gaskets are in good condition and in place on the reinstalled plugs.** Do not apply more than the specified amount of lubricant to generators, starter, distributor, or water pump. Excessive lubrication of grease bearings will cause overheating. Wipe off excessive lubricant that may drip onto rubber parts or on the body of the power unit.
94	94	94	**Hood (Hinges and Fasteners).** Observe whether the power unit hood, hinges, fasteners, and props are in good condition, secure, and properly lubricated.

Tech. Insp.	Semi-annual	Monthly
98	98	98
103	103	103
104	104	104
131	131	131
135	135	135
141	141	141
142	142	142

Circuit Breaker and Rheostat Controls. Observe whether these items are clean, dry, in good condition, secure, and whether any electrical connections are loose.

***Paint and Markings.** Examine the paint of entire unit to see that it is in good condition, paying particular attention to any bright spots in finish that might cause glare or reflection. Inspect markings and identfication for legibility. Include indentification plates and their mountings if furnished.

Radio Bonding (Suppressors, Capacitors, and Shielding). See that their bonding connections are in good condition, clean, and secure. Note whether all items are securely mounted.

NOTE: Any irregularities, except cleaning and tightening, should be reported to the proper authority.

Tools (Standard). Check all the standard tools against the packing list to see that they are all present. Inspect to see that tools are in good condition, clean, and properly stowed or securely mounted. Also examine the tools which have cutting edges to see that they are sharp.

Publications and Forms. See that the following are present in a legible condition:

Technical Manual 11-980

W.D., A.G.O. Form No. 48 (Trip Ticket)

W.D., A.G.O. Form No. 468 (Unsatisfactory Equipment Report)

Modifications (MWO's). Inspect the equipment to determine whether all modification work orders have been completed.

Final Test. Make a final test, rechecking items 3, 9, 10, 13, and 14. Confiine this test to the minimum time necessary for satisfactory observation.

NOTE: Correct or report all deficiencies found during final test.

PART FOUR
AUXILIARY EQUIPMENT
NOT USED

PART FIVE
REPAIR INSTRUCTIONS

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). For particulars see paragraph 62. 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).

SECTION X
THEORY OF EQUIPMENT

42. FUNCTIONING OF ENGINE.

a. **Four-Stroke Cycle.** The engine (figs. 4, 5, 9 and 22) used in Power unit PU-58/G is a conventional automotive, internal-combustion, gasoline type. Such engines develop their power by burning a mixture of gasoline and air under compression in the cylinders and applying the expanding force thus produced on the heads of the pistons. The downward motion of pistons is transmitted through connecting rods to the crankshaft, producing a rotary motion of the crankshaft. This engine operates on the usual four-stroke-cycle principle, the action of which may be considered as being a repetition of a cycle of four different strokes. The action of each cylinder is the same, but is 180° of crankshaft travel later than that of the preceding cylinder. Firing order is 1-3-4-2.

(1) INTAKE STROKE. The piston travels downward while the intake valve is open and the exhaust valve is closed. The resulting reduction in pressure within the cylinder causes air to be drawn in through the air cleaner, carburetor, intake manifold and intake valve port. As the air passes through the carburetor the proper proportion of gasoline is mixed with it.

(2) COMPRESSION STROKE. The piston travels upward with both valves closed and compresses the fuel mixture in the combustion chamber at the upper part of the cylinder. As the piston reaches the top of the stroke a spark occurs at the spark plug and burning of the fuel mixture begins.

(3) POWER STROKE. Burning of the fuel mixture continues, developing great heat and pressure. Both valves remain closed and the piston is forced downward, transmitting its power to the crankshaft.

(4) EXHAUST STROKE. The piston travels upward with exhaust valve open, intake valve closed, and forces the exhaust gases from the cylinder. These gases pass out through the exhaust port, exhaust manifold, exhaust pipe, and muffler.

b. **Power.** The amount of power developed by the engine and hence its speed, under a given load, is determined by the position of the throttle valve in the carburetor which regulates the amount of fuel mixture that enters the cylinders. The throttle valve is automatically controlled by the engine governor.

c. **Valves and Camshaft.** The valves are operated in proper sequence and timing by tappets which ride on a series of cams on the comshaft. The camshaft is driven by a chain from a sprocket on the crankshaft and turns at just half the speed of the crankshaft. The valves are closed by spring action. A gear on the camshaft drives the oil pump and ignition unit.

d. **Cooling.** Water is circulated around the cylinders, valve ports, and combustion chambers to conduct heat away from the engine. The

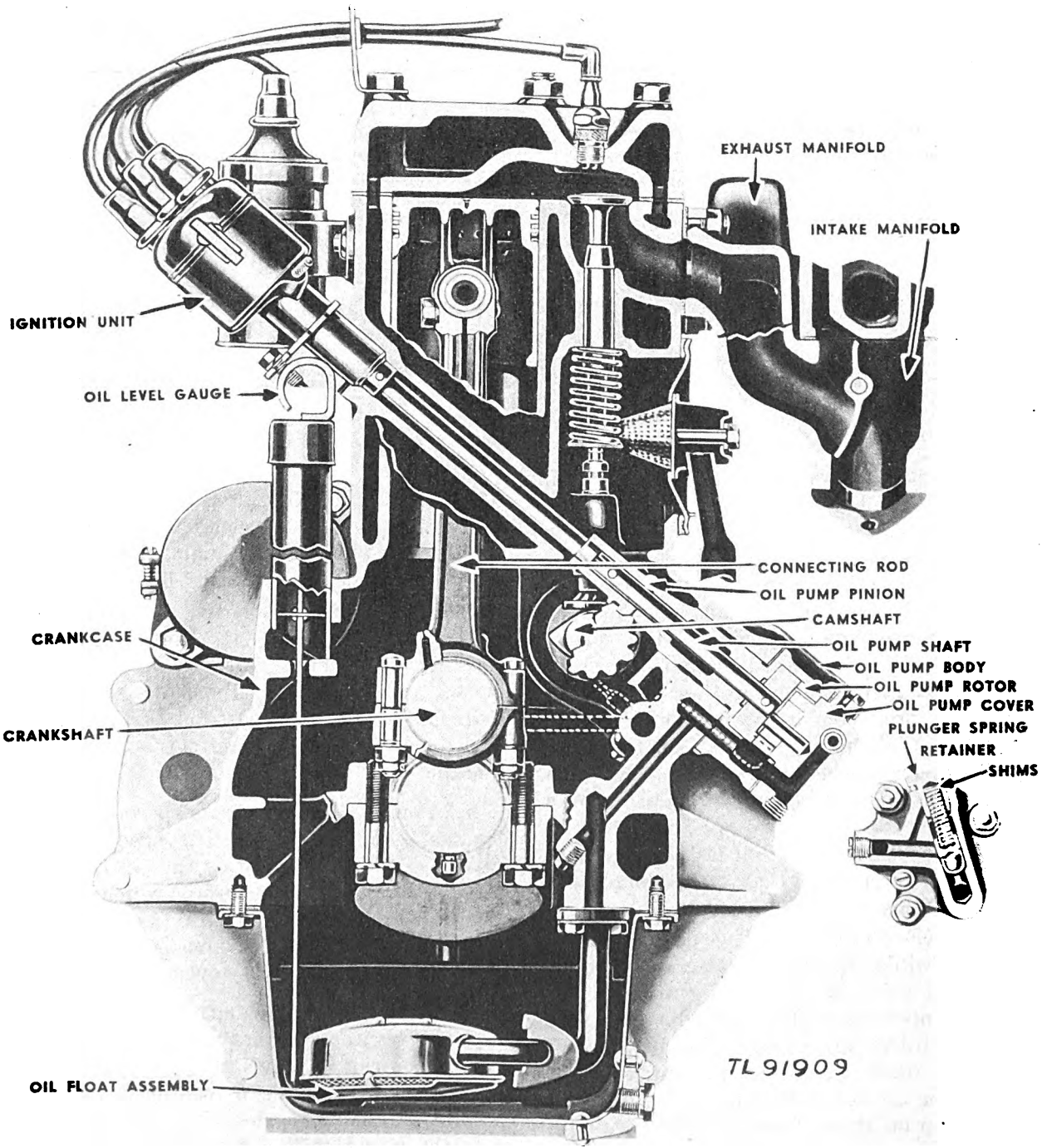


Figure 22. Front-sectional view of engine.

water flows from the outlet at the top of the cylinder head, to the radiator where it is cooled, the returned to the water jacket. Circulation is maintained by a centrifugal type water pump. Air circulation is maintained by a pusher type fan. A thermostat in the water outlet at the top of the cylinder head tends to maintain a uniform water jacket temperature under varying operating conditions by regulating the water circulation. The radiator cap is designed to maintain a pressure of 4 pounds per square inch before releasing vapor through the overflow pipe, thus saving water.

e. Lubrication. Lubrication is provided within the engine by pumping oil from the oil pan to the main, connecting rod, and camshaft bearings from which it sprays to other interior parts. The oil pressure registers on the ENGINE OIL PRESSURE gauge on the control panel and is regulated by a pressure relief valve in the pump body.

f. Oil Filter. The oil filter (fig. 5) on the left side of the engine, filters particles of dust, carbon and other foreign material from the crankcase oil. Oil from the pressure lubricating system of the engine passes into the filter near the top, then through the filter and out at the bottom connection, from which it is conducted to the timing chain cover and returns to the crankcase. In service the filter element becomes filled with foreign material collected from the oil and no longer can perform its function. It must then be replaced with a new element. Only a portion of the oil leaving the pump passes through the oil filter, but all the oil in the crankcase passes through frequently enough to be kept in a clean condition if the filter element is changed often enough. As soon as the oil becomes dark, the element should be changed.

g. Engine Governor. The engine governor (figs. 4 and 47) is of the conventional flyweight type, driven by a V-belt from a pulley on the crankshaft. It controls the engine speed and, thus, the frequency of the a-c generator. The governor arm is connected with the throttle arm of the carburetor and the action is such that an increase in engine speed tends to close the throttle, and vice versa. The engine speed may be adjusted by adjusting the spring tension. The governor is lubricated by oil from the pressure lubricating system of the engine.

h. Carburetor. This power unit is equipped with a downdraft, metering jet type carburetor (figs. 4 and 23), the prime function of which is to deliver a proper mixture of fuel and air to the engine under all load conditions.

(1) Gasoline enters the carburetor bowl through the float-operated needle valve assembly, the level to which it rises in the bowl being controlled by the float.

(2) When operating at very light load, the throttle valve is nearly closed and most of the gasoline enters the fuel mixture by way of the idle well jet, low speed jet, economizer (near which point it combines with streams of air from the by-pass and lower bleed), and then through passage to the port and the idle adjustment screw seat. This mixture is richer than required, but upon further mixing with air from the venturi provides a suitable mixture, the combined richness being adjustable by means of the idle adjustment screw.

(3) At about 30 percent of full load, the throttle valve opens so far that little fuel passes through the path just described. However, at this throttle position the reduction of air pressure at the tip of the main nozzle allows fuel to pass from the carburetor bowl through the metering jet, through the passage and the main nozzle, and into the main air stream. The amount of fuel through this path depends on the degree of reduction of pressure at the tip of the main nozzle below atmospheric pressure and upon the effective opening through the metering jet.

(4) As the throttle valve opens further under increasing load, the pressure at the tip of the main nozzle is further reduced and the metering rod is raised by mechanical linkage with the throttle so as to increase the effective opening through the metering jet. The various parts are so proportioned as to provide a suitable mixture at all operating loads.

(5) The pump with which the carburetor is equipped is not required and should be disconnected.

i. Fuel Pump. The diaphragm type fuel pump (figs. 4 and 24) operates continuously while the unit is operation and supplies fuel from the fuel tank to the carburetor. It is mounted on the right side of the engine and driven by an eccentric on the camshaft.

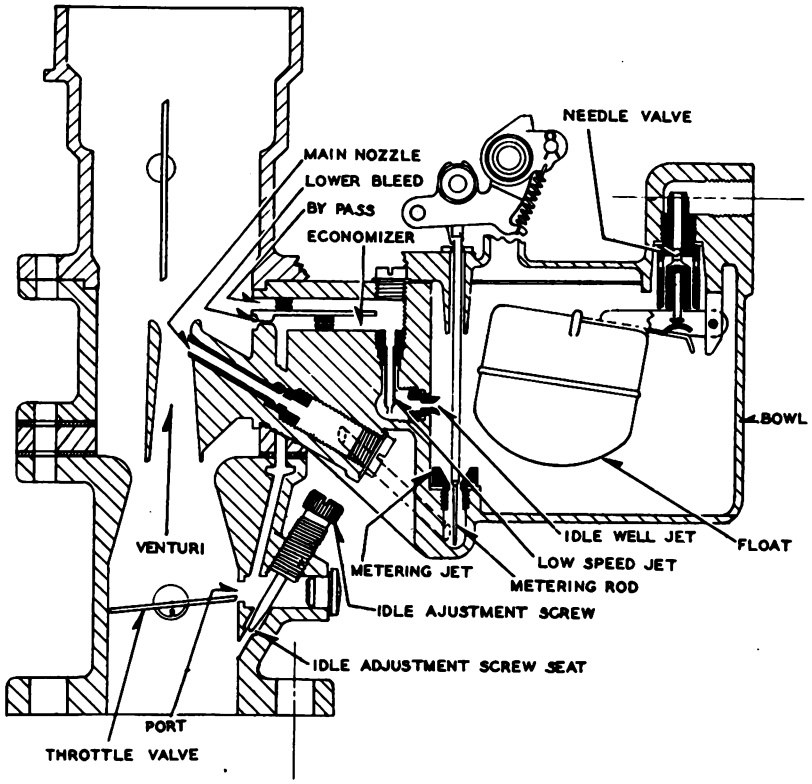


Figure 23. Carburetor functioning diagram.

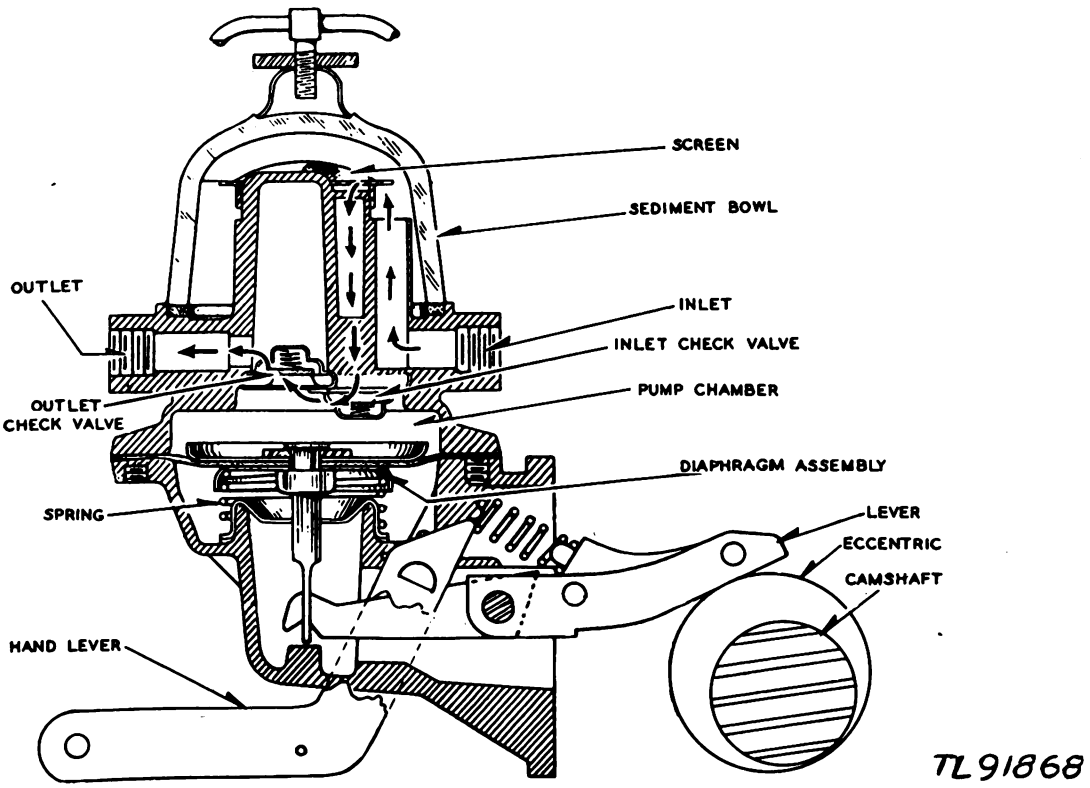


Figure 24. Fuel pump functioning diagram.

(1) A special lever arrangement transmits motion to the diaphragm assembly. When the diaphragm assembly is drawn downward, the pressure within the pump chamber is reduced and fuel flows from the fuel tank, through the fuel line, and into the pump inlet. It passes upward through the inverted sediment bowl, through the screen, and inlet check valve into the pump chamber. Upward movement of the diaphragm forces fuel from the pump chamber through the outlet check valve and the pump outlet. From the pump outlet the fuel passes through a fuel line to the carburetor.

(2) The diaphragm is pulled downward by the lever arrangement, but is returned upward by the action of the spring. After the carburetor bowl becomes filled with fuel, the diaphragm returns upward only as permitted by the flow of fuel through the needle valve of the carburetor.

(3) A hand lever permits operating the pump manually for the initial filling of the carburetor bowl after it has been drained or has run dry because of an empty fuel tank.

j. Air Cleaner. The air cleaner (fig. 3) cleans the air which enters the carburetor intake. Air enters near the top of the cleaner, passes down and over or through a pool of oil in the cup at the bottom. Some oil is carried up and deposited in the metallic filter element. Surplus oil which does not adhere to the filter element runs back into the cup. Dust and foreign particles in the air adhere to the oily surface of the element and are constantly washed back into the cup where they settle to the bottom. Cleaning the cup and filter and filling to the proper level with clean oil will keep the cleaner in good operating condition.

k. Ignition System.

(1) PURPOSE. The compressed gases of the fuel mixture in a cylinder are ignited by a spark which jumps the gap between the spark plug electrodes. The high voltage required to produce this spark is furnished by the ignition coil (fig. 5) which obtains its electrical energy from the storage battery. The spark must occur at the proper time with respect to the upward travel of the piston near the top of its compression stroke and it must occur in each cylinder in its proper sequence of firing order, which is 1-3-4-2. The ignition unit (fig. 5) which regulates the timing of the spark and its distribution to the spark plugs in proper sequence, is mounted on the left side of the engine and driven by a gear on the camshaft.

(2) RADIO SHIELD (figs. 5 and 13). The ignition unit is shielded to reduce radio interference. If for any reason the shield cover must be removed for inspecting the breaker points, etc., care should be exercised in replacing it so that the cover makes good contact with the base of the ignition unit housing, and all shield wires are firmly held by the cover.

(3) BREAKER MECHANISM (fig. 10). The breaker contacts are connected in series with the primary winding of the spark coil. The cam revolves at one-half the engine speed and opens the breaker contacts four times each revolution. Each time the breaker contacts open, a spark is produced at a spark plug gap. The mechanism is properly timed so that the spark occurs when the piston has almost reached the top of its compression stroke. As the engine speed increases, the governor assembly in the lower part of the case automatically advances the timing with respect to piston position.

(4) CAPACITOR. The capacitor (fig. 10) is connected in parallel with the breaker contacts. Its action is to greatly increase the intensity of the spark and to increase the life of the breaker contacts.

(5) DISTRIBUTOR (fig. 10). The high tension current travels from the spark coil to the spark plug by way of the distributor. It enters the distributor at the center tower, passes through the metal strip of the revolving rotor and out at the tower under which the metal strip is passing. Thus the sparks are distributed to the spark plugs, in proper sequence.

(6) SPARK PLUGS (fig. 9). The spark plugs are important parts of the ignition system. Each consists of a center electrode highly insulated from the base which carries another electrode. The ignition spark jumps across the gap between the electrodes and it is quite important that this gap be kept adjusted at approximately 0.030-inch. The original spark plugs are Champion No. C-10-S, and replacements should be of the same type.

1. Starting Motor (figs. 5 and 25).

(1) The starting motor is similar in construction to the charging generator. Both have

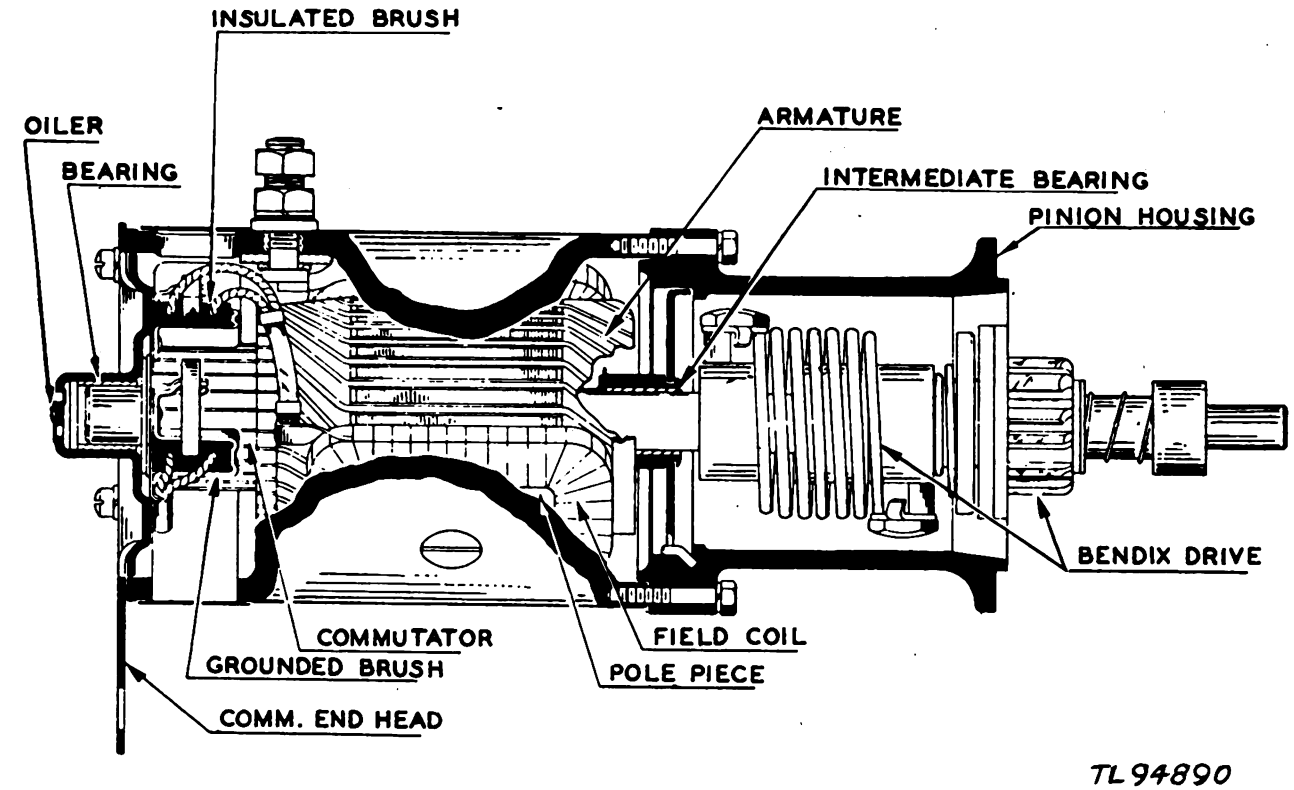


Figure 25. Starting motor.

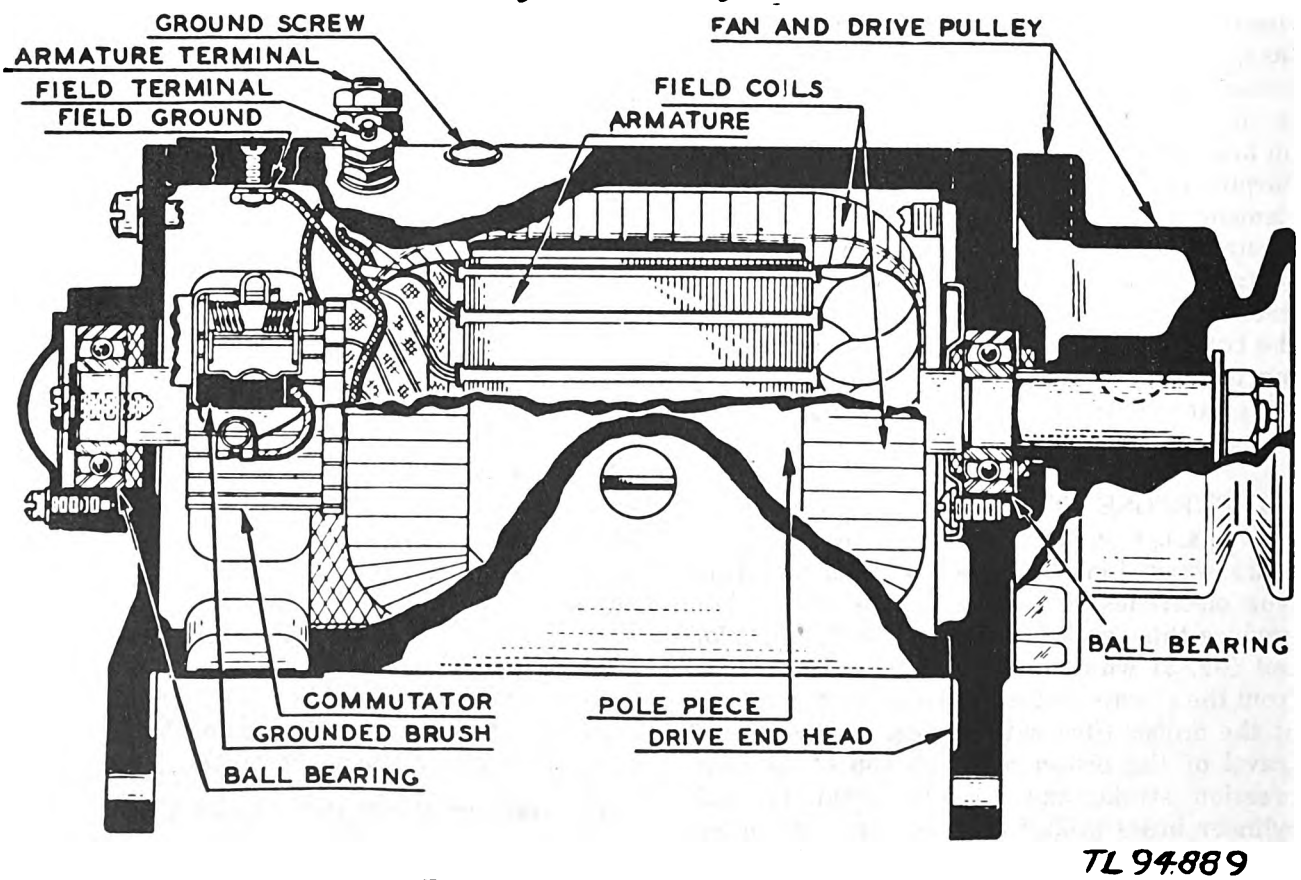


Figure 26. Battery-charging generator.

a frame, field coils, armature, and brushes. However, the operating principle is reversed. When the storage battery is properly connected to the motor circuit, magnetic fields are set up in armature and field and cause the armature to revolve with sufficient power to crank the engine.

(2) The battery is connected to the starter by means of the solenoid switch which is controlled by the START button on the control board.

(3) Driving connection with the flywheel of the engine is made by means of a Bendix drive. This drive is so designed that, as the starting motor quickly accelerates, a counterweighted drive pinion engages the teeth of the flywheel ring gear. When the engine starts and the speed of the engine exceeds the speed of the starting motor, the drive pinion is forced out of engagement with the flywheel.

m. Battery Charging System. The storage battery is recharged by current supplied by the battery charging generator while the power unit is in operation. Included in the battery charging system are the relay, the battery charging generator, the battery charging voltage regulators, and the charge rate ammeter.

(1) BATTERY CHARGING GENERATOR. The 40-ampere, two-brush type charging generator (figs. 5 and 26) supplies the electrical energy for charging the storage battery. It is a simple d-c generator working on the same generating principle as the exciter described in paragraph 43. During normal engine operation, when its voltage is higher than that of the battery, it supplies energy direct to the ignition system and to certain control circuits. It is mounted on the left side of the engine and driven by the same V-belt that drives the engine fan and water pump. The mounting bracket provides for movement toward or away from the engine to adjust the belt tension. The fan, which is integral with the drive pulley, provides forced air circulation.

(2) BATTERY CHARGING REGULATORS. The charging generator is controlled by a battery charging relay (fig. 27) which includes a voltage regulator and circuit breaker. The contacts of each of the three units are opened and closed by the electromagnetically controlled movement of an iron armature. An adjustable spring resists the magnetic attraction set up by current flowing through the coil and thus the value of current required to move the armature, may be adjusted.

(*a*) The voltage regulator controls the generator and does not allow it to rise above a value determined by the voltage regulator setting. This prevents overcharging the battery.

(*b*) The current limiting regulator prevents overload damage to the charging generator by limiting the maximum generator output to the value for which this regulator is adjusted.

(*c*) The circuit breaker closes the charging circuit when the generator voltage rises above the battery voltage and opens that circuit when the generator voltage falls below the battery voltage. This prevents discharge of the battery through the generator when the generator voltage is lower than the battery voltage.

(3) STORAGE BATTERY (fig. 3). The 6-volt storage battery is of the automotive type. It supplies power for electric cranking, electric choking, ignition during the starting period, and for operating certain controls. It is recharged automatically by the battery generator while the power unit is in operation.

n. Electric Choke Control. The electric choke control (fig. 4) is of the electromagnetic type with thermostatic compensator. The magnet coil is connected in parallel with the starting motor circuit and thus the carburetor is choked automatically while being cranked electrically. Motion of the magnet armature is transmitted through a U-shaped bimetal thermostatic spring within the lower part of the case. The arrangement is such that when the engine is cold the choking is more forceful than when the engine is warm.

43. FUNCTIONING OF A-C GENERATOR. (figs. 6, 28 and 29).

The generator receives mechanical power from the engine and converts it to electrical power. It consists of a d-c exciting generator and a revolving field type of alternator.

a. Exciter (fig. 29).

(1) Residual magnetism remains in the magnetic circuit of the exciter when 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

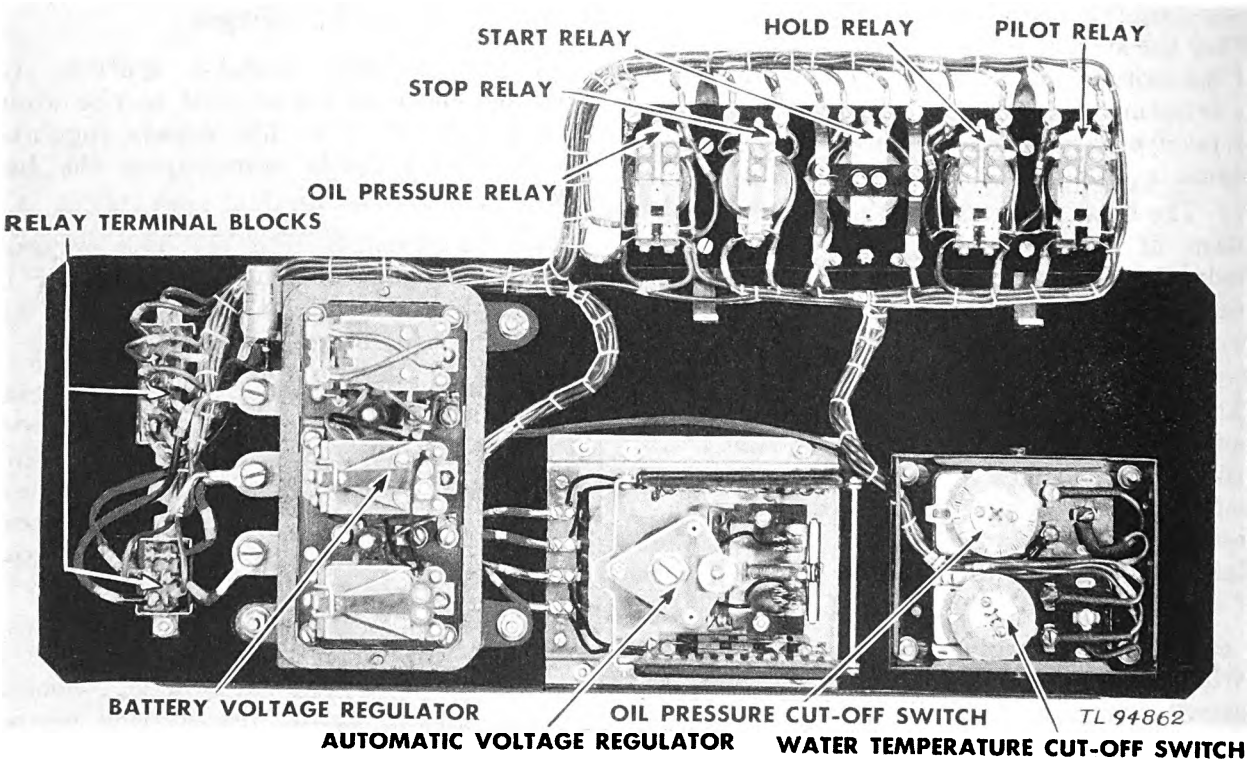


Figure 27. Auxiliary control assembly.

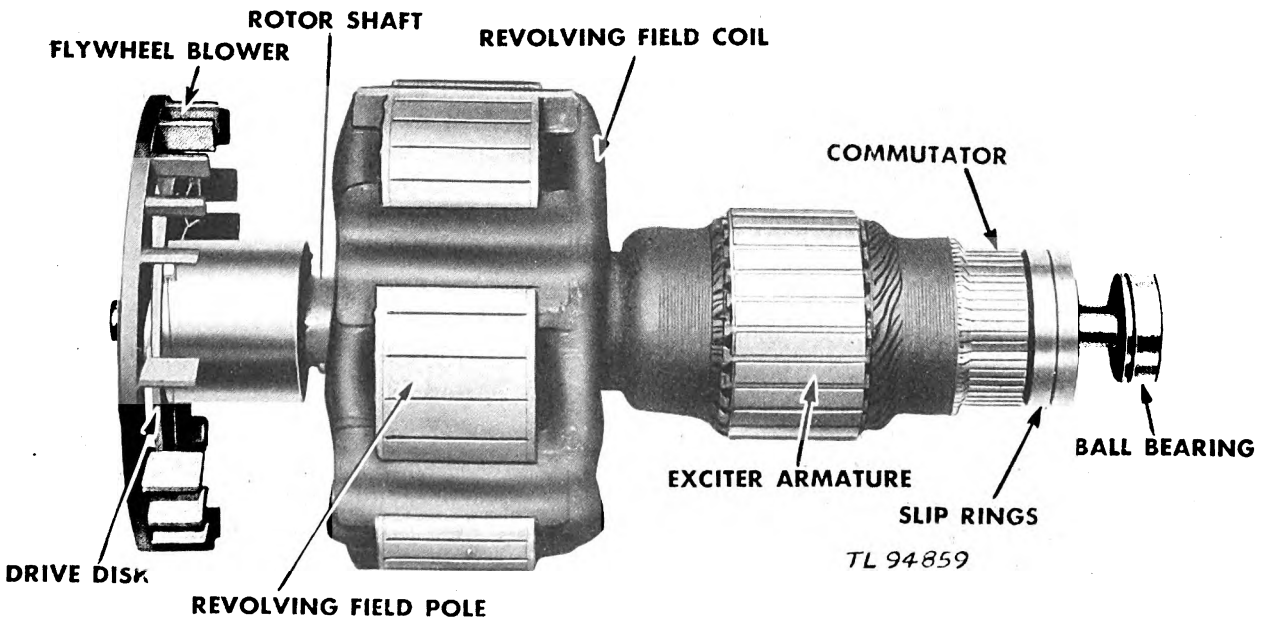


Figure 28. Rotor assembly.

these conductors as they pass poles of alternate polarity induces alternating voltages in the conductors. The conductors are connected with commutator bars which revolve under, and in contact with, the exciter brushes. The various parts are so placed that the commutator bars, in contact with any given brush, always have the same polarity and dc flows in the exciter circuits outside the armature.

(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 that can thus build up is regulated by an external resistance in this field circuit. This resistance usually consists of the resistors of the automatic voltage regulator, but may be the hand-operated field rheostat instead. One end of the exciter field winding is connected to one side of the exciter output circuit. The other side of the field winding is connected with the regulator-rheostat switch on the control panel. By means of this switch the field circuit may be switched to the automatic voltage regulator or to the hand rheostat. The automatic voltage regulator is normally used; the hand rheostat is an emergency alternate.

(3) The greater portion of the exciter output is used to excite the alternator revolving field. The exciter is connected with the alternator field windings by means of the brushes and slip rings.

b. Alternator (fig. 29). The revolving field of the alternator is magnetized by dc from the exciter. The field poles, of alternate polarity, revolve by the conductors of the stator and induce alternating voltages in them. Those conductors are connected in two groups and the groups are connected to the control panel. If the exterior circuit is complete, ac will flow in it. No commutator and brushes are required in the a-c circuit. The a-c output voltage is raised or lowered by raising or lowering the exciter voltage, and normally is regulated indirectly by the automatic voltage regulator.

c. Alternator Connections. The two separate a-c windings of the alternator may be connected in parallel to produce 120-volts, or in series to produce 240-volts. These connections are made by means of jumpers at the a-c terminal block (fig. 33). The four leads from the two a-c windings of the alternator are connected directly to the a-c terminal block. Each pole of the two-pole circuit breaker is connected in one side of the two a-c windings, between the a-c terminal block and the a-c output terminals. An a-c ammeter is connected in each leg of the circuit breaker; the ammeter on the left indicates the current in the load connected to the left-hand output terminal, and the ammeter on the right indicates the current in the load connected to the right-hand output terminal. The a-c voltmeter is connected across only one 120-volt winding, and indicates the voltage between the right-hand output terminal and neutral at all times; however, the voltage of the other winding will be very close to that of the metered one. The RUNNING TIME METER, the TROUBLE LAMP receptacle and the a-c circuit of the voltage regulator are also connected across the same 120-volt a-c winding.

44. FUNCTIONING OF CONTROL PANEL.

a. Starting Cycle.

(1) The storage battery supplies the power for electric starting. With the ignition switch at NORMAL OPERATING POSITION the power unit is started by pressing the START button. This energizes the coil of the start relay and closes the two pairs of contacts on the relay (figs. 12 and 26).

(2) The closing of the left-hand start relay contact supplies battery voltage to the start solenoid. The return circuit of the start solenoid is through the armature of the battery-charging generator, and thus the start solenoid will hold in during the cranking period; however as soon as the battery-charging generator builds up to approximately 3 or 4 volts, the start solenoid will drop out and the starter cease cranking even though the start relay button is held down. (The start relay button has to be held down until oil pressure builds up above 8 pounds pressure in order that the hold-in circuits will operate.)

(3) The closing of the start solenoid connects the battery directly to the starter and cranks the engine. This relay also supplies current to the electric choke, thus choking the carburetor.

(4) The closing of the right-hand contacts of the start relay supplies current to the ignition coil directly from the battery circuit during the cranking period.

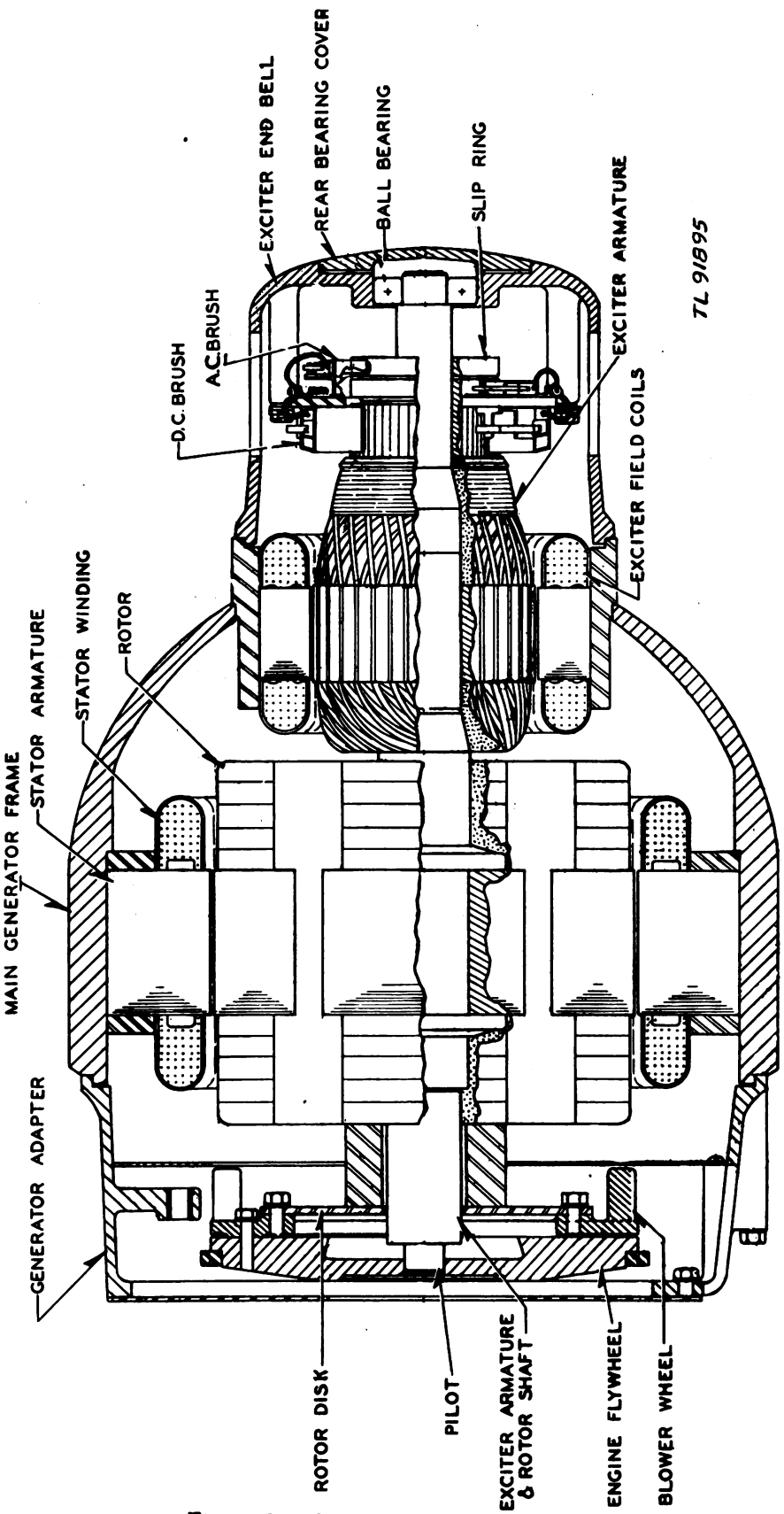


Figure 29. Cross-section of main generator.

(5) At this state of the starting cycle, the ignition is energized, the carburetor is being choked, and the engine is being cranked. The engine starts, the battery charging generator builds up voltage, thus opening the start solenoid which cuts off the starter and the electric choke. The speed increases and the oil pump builds up pressure in the lubricating system. When this rises above 8 pounds pressure the contacts of the low oil pressure safety switch transfer and ground return of the oil pressure relay coil. The hot side of this coil is directly connected to the battery-charging generator armature and there is already enough voltage built up at this point to close the oil pressure relay. The right-hand contacts of the oil pressure relay automatically seal it in while the power unit is in operation. The left-hand contacts of this relay ground the return of the holding relay coil.

(6) The hot side of the hold-relay coil is energized from the battery through the right-hand contacts of the start-relay. The ignition circuit is also connected in at this point and is energized simultaneously with the hold-relay coil. The left-hand contacts of the hold-relay automatically seal it in if the automatic water-safety switch is in the low position. The current used to energize the hold-relay during operation comes from the battery through the stop-relay, normally-closed contact, the water-safety-switch, and through the pilot-relay, normally-closed contacts. Therefore, the stop relay, pilot relay, and water safety-switch must be in their normal positions in order that the hold relay will seal in and energize the ignition circuit, thus keeping the unit in operation.

(7) If the water temperature rises above the setting on the water safety switch (206°), the contacts transfer and, in so doing, the hold-relay circuit is broken, opening the contacts of the hold-relay and shutting he unit down. Battery current is routed through the water safety-switch to the high-water-temperature warning light (amber color) showing that the unit was shut down due to high water temperature.

(8) If the oil pressure drops below the setting on the oil-pressure safety switch (8 pounds) the contacts transfer, grounding the return circuit of the pilot-relay coil. The hot side of the pilot-relay is already connected to the battery by way of the hold-in circuit. The opening of the right-hand contacts of the pilot relay opens the hold-relay and shuts the unit down. The left-hand contacts of the pilot-relay seal it in by grounding the coil return circuits. An oil-failure-warning light (red color) is connected in parallel with the pilot-relay coil and indicates that the unit is shut down due to oil pressure failure.

(9) To stop the power unit, press the stop button which grounds the return of the stop relay coil. The contacts of the stop relay open and drop out the hold-circuit causing the unit to stop.

(10) The fuel gauge and tank element are connected to the same circuit as the ignition coil and the gauge registers while the hold relay is energized. A switch immediately under the fuel gauge may be closed momentarily to cause the gauge to register while the engine is not operating.

(11) The fuel gauge (fig. 35) and the fuel gauge tank element are connected to the ignition switch in such manner that the gauge registers while the ignition system is supplied with current. If it is desired to have the gauge register while the engine is operating, this may be done by operating the fuel gauge at the left. The switch should be returned to the NORMAL OPERATING POSITION as soon as the fuel gauge reading has been observed.

(12) When the ignition switch is in the HAND-CRANKING POSITION, ignition is supplied directly from the battery to the ignition coil, thus by-passing all the relays and protective circuits. With the switch in this position, the engine may be started by hand cranking. This makes it possible to use the power unit in an emergency when there may be trouble in a relay circuit. *It will be necessary to throw this switch to the NORMAL OPERATING POSITION before the engine can be stopped by means of the STOP button.*

(13) Remote control circuits, if used, are merely extended circuits connected in parallel with the START and STOP button circuits on the control panel. REMOTE START and REMOTE STOP buttons are used in the same manner as the START and STOP buttons on the control panel.

b. Voltage Regulator.

(1) The voltage regulator (figs. 27 and 30) is a device for automatically obtaining constant

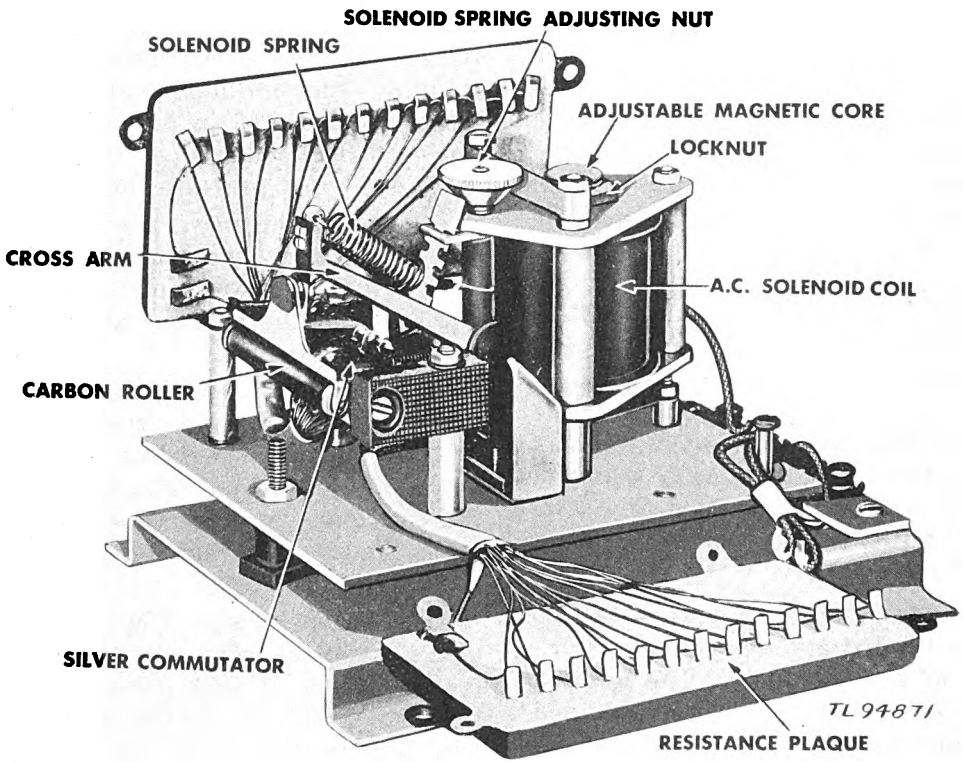


Figure 30. A-c voltage regulator.

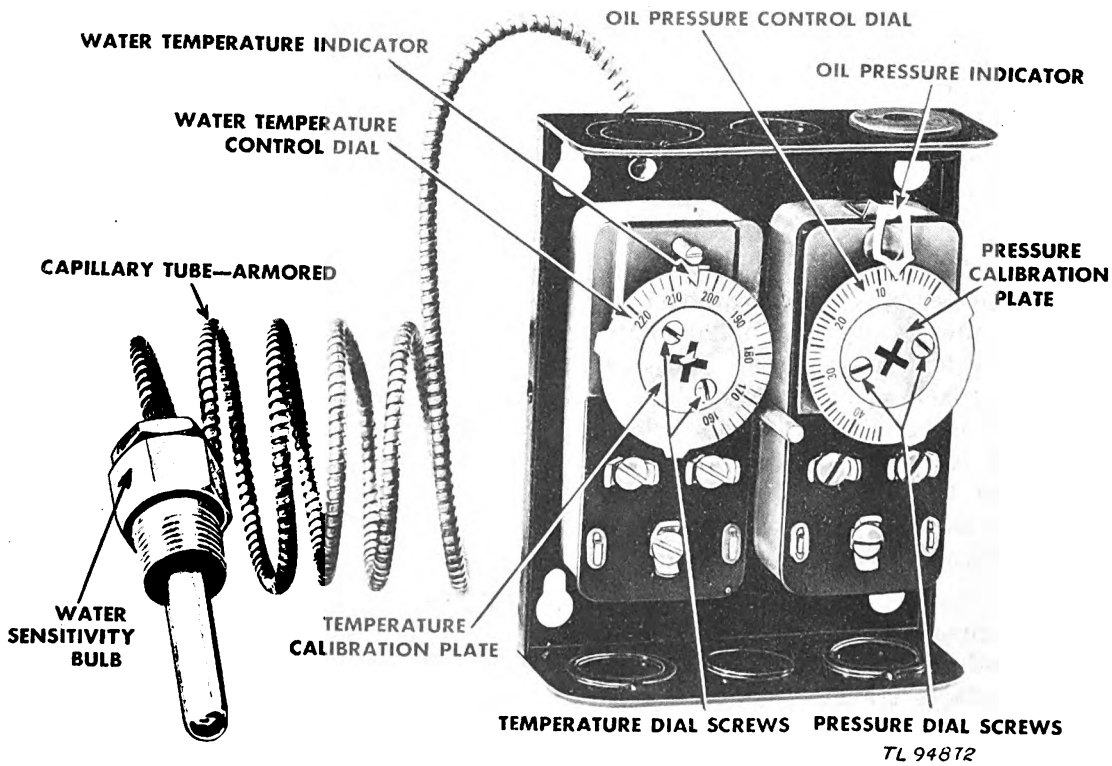


Figure 31. Water temperature, oil pressure safety switch.

voltage for all normal load conditions. The regulator performs the functions of an automatic field-control rheostat.

(2) The regulator consists mainly of an a-c solenoid, a commutator, and two resistor plaques. The solenoid coil is connected to the output of the stator winding, and is affected by voltage changes which actuate the solenoid plunger and also the cross-arm which moves the carbon contact. This roller moves across the silver commutator, thereby adjusting the resistance of the plaques to a value which maintains the generator voltage.

(3) The regulator has two separate electrical circuits, ac and dc. The a-c circuit consists of the solenoid coil; two 100-ohm dropping resistors which are located in the resistance plaques; and the 160-ohm voltage regulator rheostat located on the panel. The dc circuit consists of two 50-ohm tapped resistors and the commutator. The resistors take the place of the field rheostat and are adjusted by the movement of the carbon roller on the silver commutator. The commutator consists of a stack of insulated silver segments, each segment connected to a tap on the regulator resistance. The commutator is ground to a "V" shape, and the carbon contact roller rests on the commutator at two points, thereby short-circuiting all the resistance included between these two points. By moving the contact roller transversely across the commutator, the distance between these two points of contact is changed, and thus the effective resistance of the voltage regulating resistor is adjusted. The solenoid is quick-acting and allows the regulator to momentarily over-correct and then find a new steady-state position. The carbon contact roller is not in constant motion, moving only when the load is changed.

(4) To use the regulator, switch the voltage regulator switch on the control panel to the ON position and adjust the voltage to 120-volts by means of the voltage regulator rheostat. When the regulator is ON, the manual, field-control rheostat is shorted out and the a-c solenoid is connected to the stator circuit. In the OFF position, the regulator resistance is shorted out and the a-c solenoid circuit is opened. This circuit arrangement permits adjustments to be made on the regulator when the generator is running, merely by switching the regulator to the OFF position.

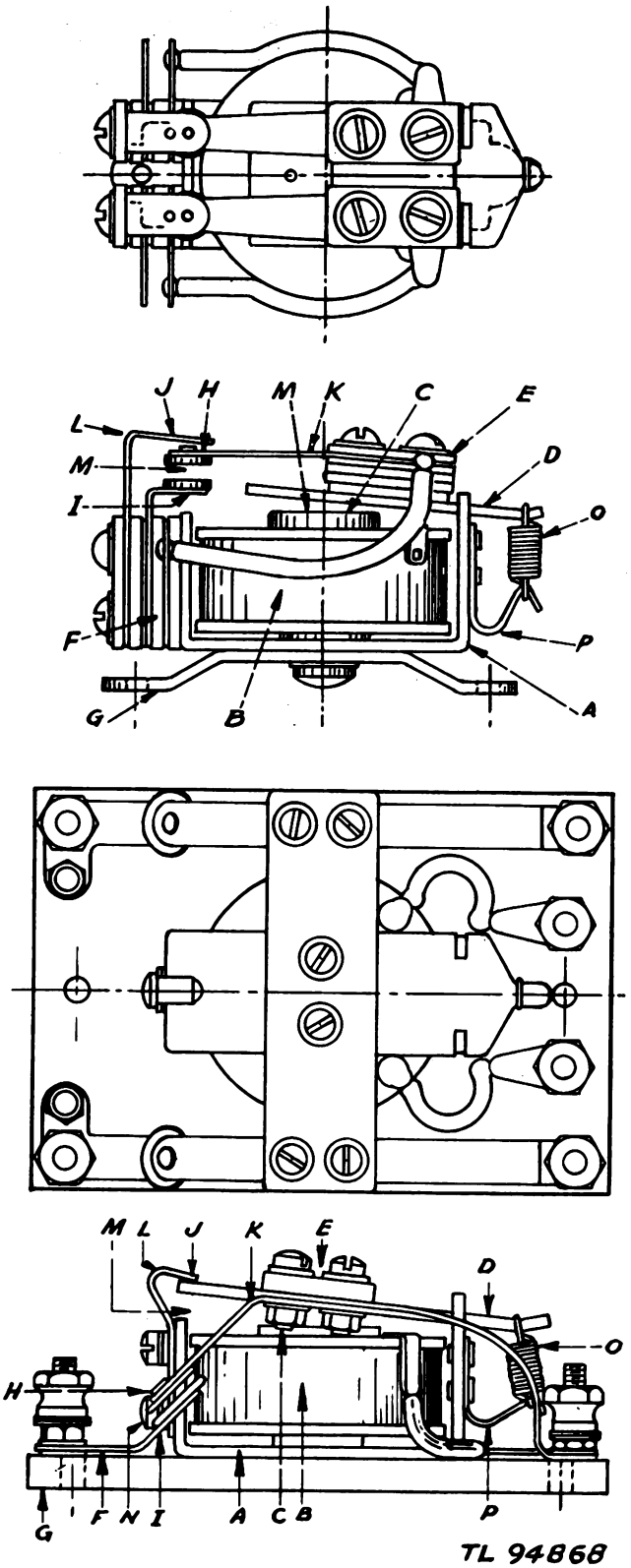
c. High Water Temperature Safety Switch.

(1) DESCRIPTION. The high water temperature safety switch (figs. 27 and 31) is electrically connected to the STOP button circuit. It automatically stops the engine if the temperature of the water in the engine water jacket rises higher than the temperature for which the dial is set. A temperature element extends down into the cooling liquid and contains a volatile liquid. The element is connected through a small tube to the diaphragm or bellows which operates the switch contacts. As the temperature within the water jacket rises, the liquid within the temperature element expands the bellows which closes the switch contacts, thus stopping the engine. The engine may be started again in the usual manner after the temperature drops about 10°. The cause of the high temperature should be determined and corrected before again starting the engine.

(2) ,ADJUSTMENT. The temperature at which the engine will be stopped may be adjusted by turning the dial so that the desired stopping temperature is exactly under the pointed indicator at the top of the dial. The dial should be set to stop the engine at a temperature at least several degrees below the boiling point of the cooling liquid. For water at sea level, the setting should be 205°. This should decreased 3° for each 1,000 feet above sea level. Other cooling liquids may require different settings.

d. Low Oil Pressure Safety Switch. The low oil pressure safety switch (figs. 27 and 31) is a small switch operated by oil pressure. When the oil pressure builds up to approximately 8 pounds per square inch the switch contacts open. It is so connected with the control system that if the pressure drops below 8 pounds, the ignition is cut off and the engine stops. The cause of the low oil pressure should be determined and corrected before again attempting to start the engine. After making this correction, push the stop button to return all relay circuits to normal, removing the voltage from the red low oil pressure warning light. The engine may then be started in the usual manner.

e. Relays. On the back of the auxiliary control assembly are mounted the start, stop, hold, pilot, and oil pressure relays (figs. 27 and 32). Each relay includes a coil of insulated copper



A Frame

B Coil

C Core

D Armature

E Armature contact assem.

F Stationary contact assem.

G Mounting bracket

H Movable contact

I Stationary contact

J Armature stop

K Adjustment point for air gap and contact pressure

L Adjustment point for contact spacing

M Air gap

N Contact spacing

O Voltage pull-in Control spring.

P Adjustment point for control spring

1 AIR GAP SETTING TO CONTROL CONTACT PRESSURE

Insert gauge 0.025" ± 0.005" at point M and hold in place by closing armature. Bend contact H at point K until it barely touches Contact I. Remove thickness gauge.

2 CONTACT SPACING

Bend stop J at point L until thickness gauge 0.060" ± 0.010" can be inserted freely into spacing at point N.

3 PULL-IN ADJUSTMENT

Adjust spring O at point P until armature D will close satisfactorily at 5 volts dc.

Figure 32. Details of 6-volt relays.

wire wound on a soft iron core. An iron armature is hinge-mounted near one end of the iron core and held away from the core by means of a spring. When electric current flows through the coil, the core becomes magnetized and the iron armature is attracted so strongly that it moves toward the core, thus opening or closing the relay contacts. When the circuit to the coil is opened and current no longer flows through it, the core loses most of its magnetism and the spring pulls the armature away from the coil, reversing the action of the contacts. All relays are connected in the d-c control circuits.

SECTION XI
TEST EQUIPMENT USED IN TROUBLE SHOOTING

45. STANDARD TEST EQUIPMENT.

a. When testing the generator windings, have the following equipment at hand:

1 pair of test leads with prods
1 3-or 4-candle power, 6-volt lamp and socket
1 6-volt battery
1 d-c voltmeter, 0-10 volts
1 #10 stranded insulated copper wire, length

b. When testing rotor alignment, cyclinder walls, piston clearance, and screw tension, have the following equipment:

1 dial gauge
1 feeler gauge
1 torque wrench

c. When testing condition of battery:

1 hydrometer
1 d-c voltmeter, 0-10 volts

46. IMPROVISED TEST EQUIPMENT.

Test leads listed in above paragraph may be used without disassembling the generator. When an exiter armature winding or an alternator field winding tests open-circuited, short-circuited, or grounded, the practical repair is to install a new rotor assembly. If a stator winding tests open-circuited, short-circuited, or grounded, the practical repair is to install a new stator winding assembly unless the trouble is in the leads outside of the winding proper. The rotor windings and the stator windings can be successfully repaired only by trained personnel.

SECTION XII
TROUBLE-SHOOTING PROCEDURES

47. GENERAL TROUBLE-SHOOTING INFORMATION.

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

a. Engine and generator trouble charts. Paragraphs 49, 50, and 51.

b. Control box wiring diagram. Figures 35 and 36.

c. Ignition circuit wiring diagram. Figure 33, 34, 35, 36, 59, 60, 61 and 62.

d. Illustrations of components. Front, top, and bottom views aid in locating and identifying parts. Cross-section views of components are also valuable.

48. SEQUENCE OF TROUBLE-SHOOTING PROCEDURE.

The trouble chart which follows indicates various symptoms of trouble which are readily detected. When the nature of the trouble has been determined, check the various points under the heading "Possible cause" in the sequence given. Follow the sequence given, since seemingly major troubles may be reduced to minor troubles by checking the items in the prescribed order.

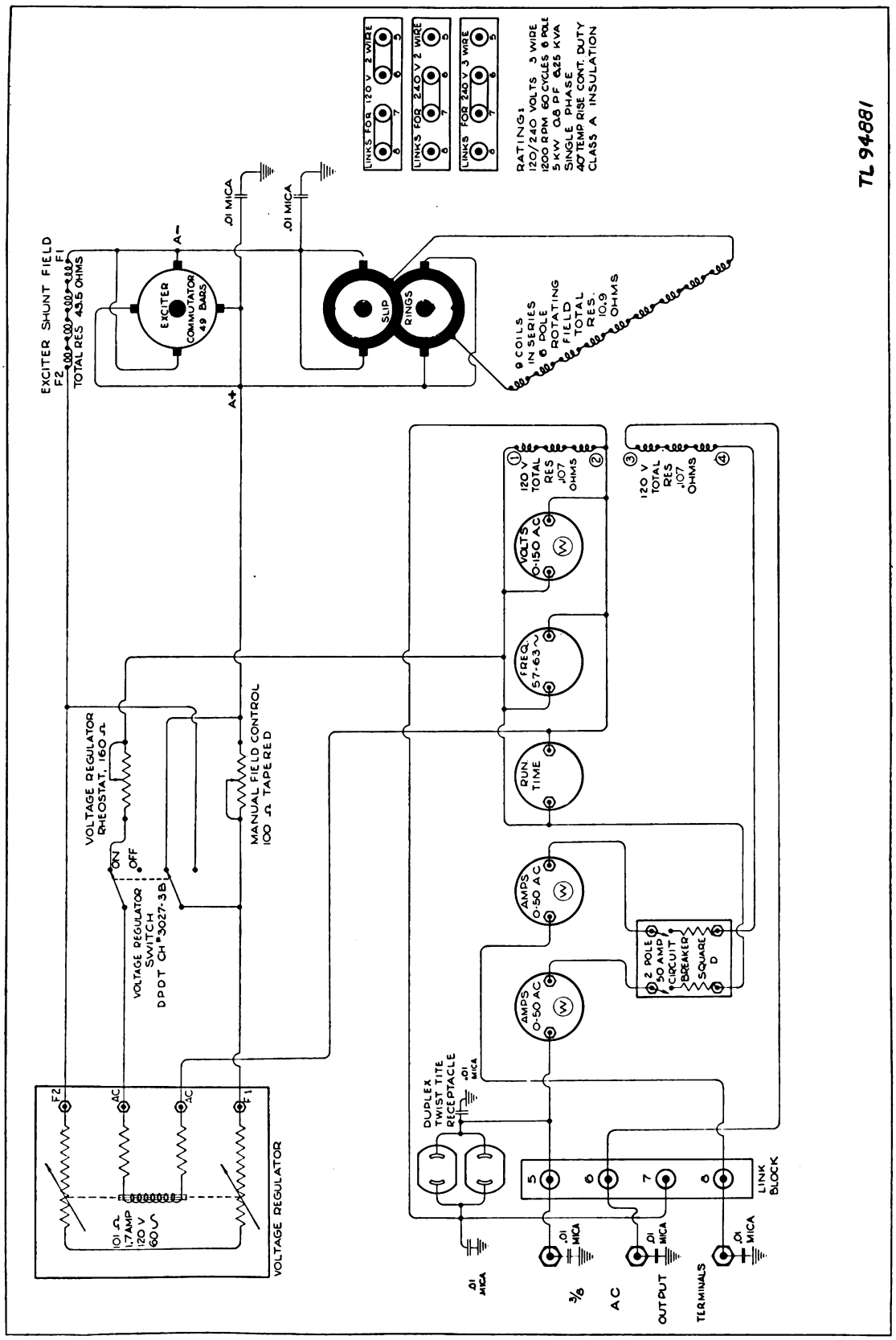


Figure 33. Schematic wiring diagram for alternator and control panel (Serial Nos. 1 through 1500).

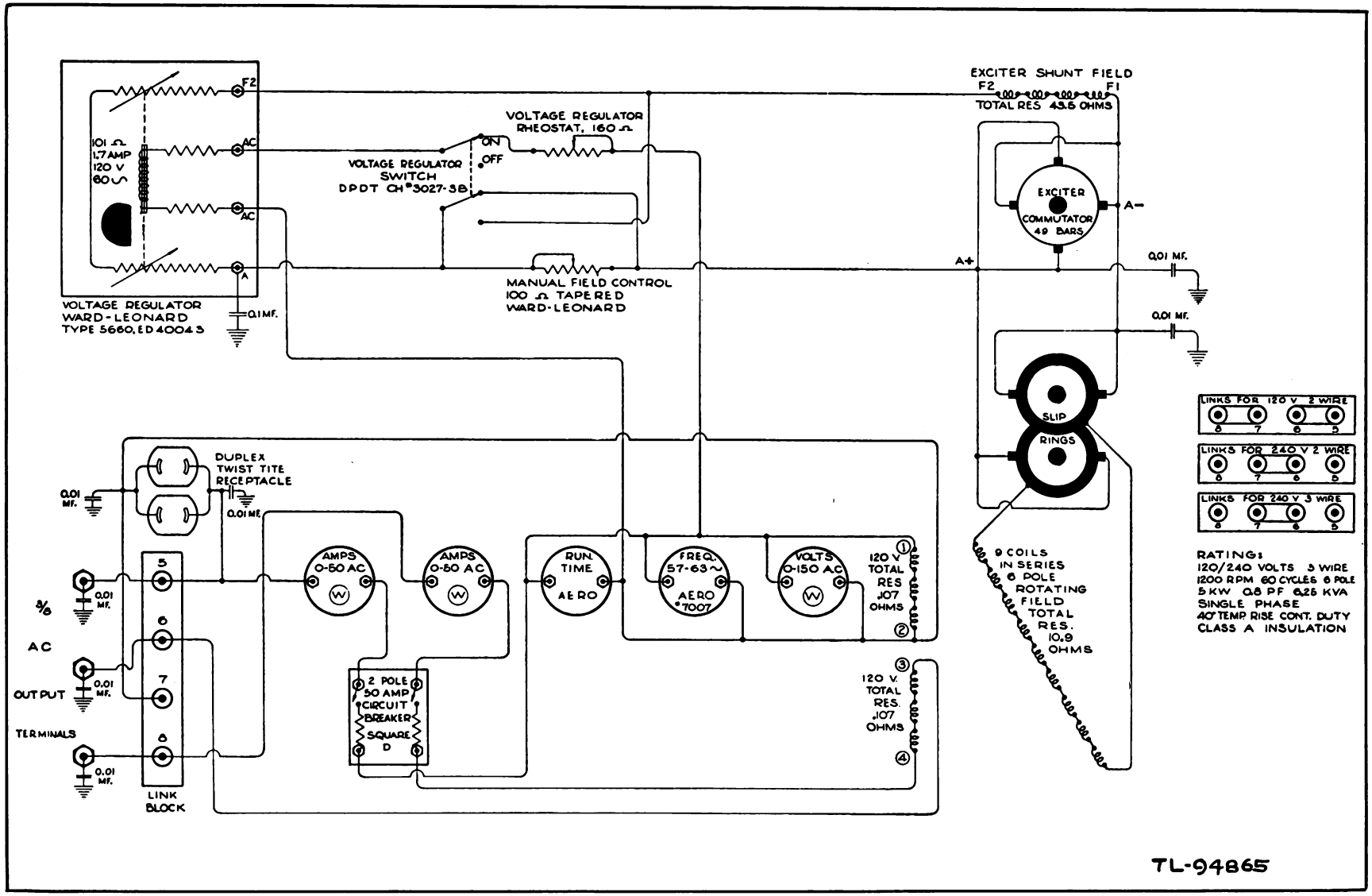


Figure 34. Schematic wiring diagram for alternator and control panel (Serial Nos. 1501 and above).

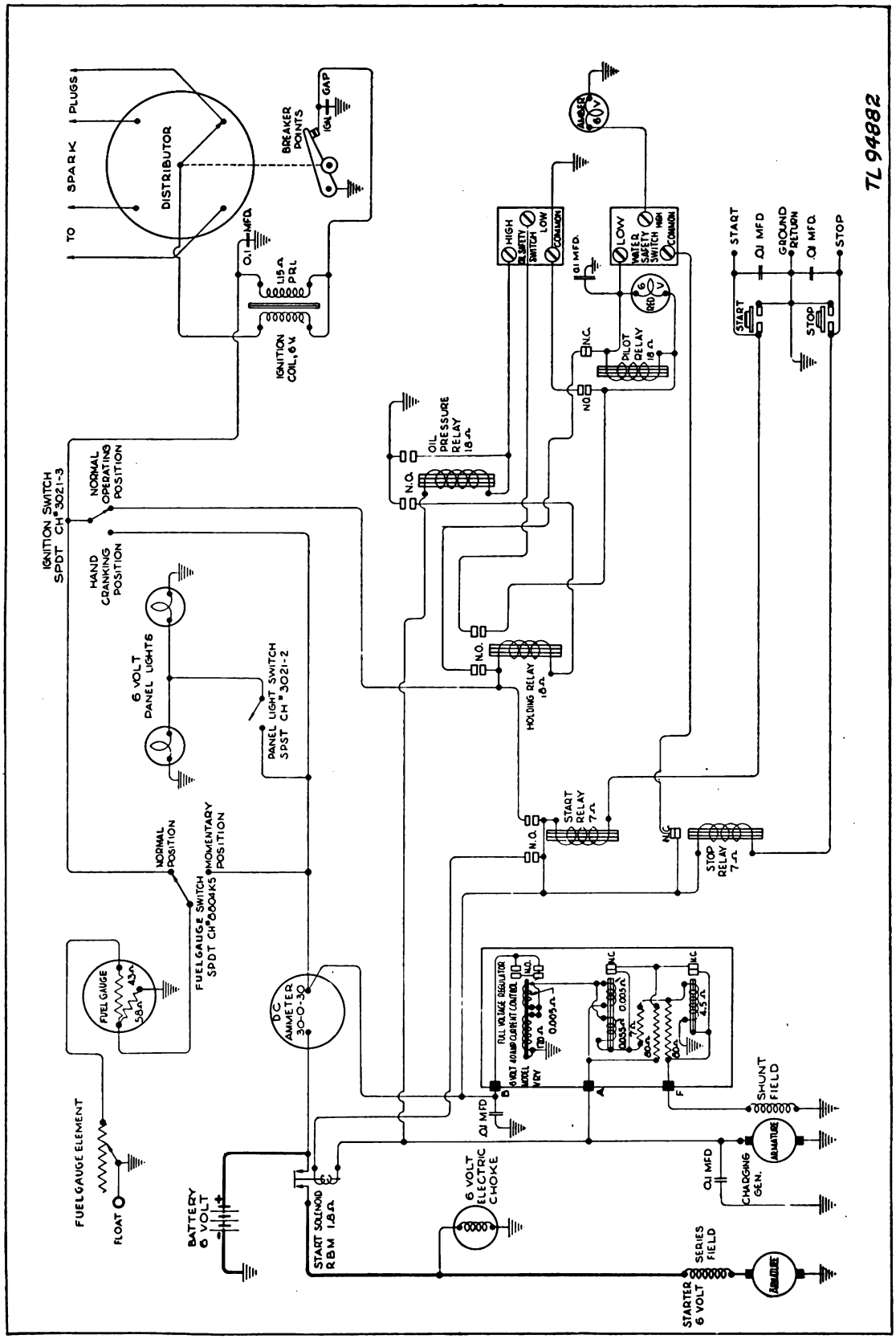


Figure 35. Schematic wiring diagram of d-c engine controls (Serial Nos. 1 through 1500).

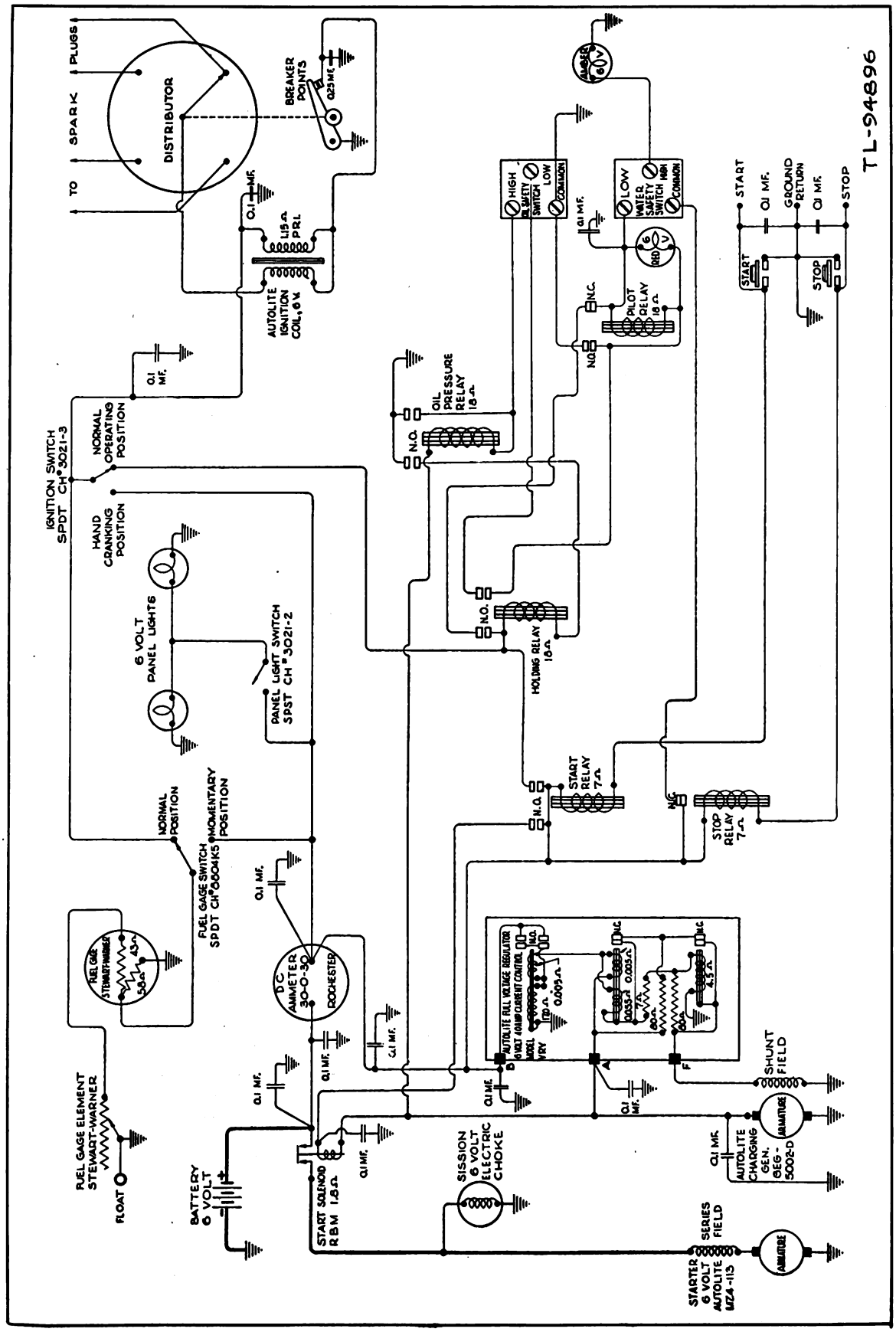


Figure 36. Schematic wiring diagram of d-c engine controls (Serial Nos. 1501 and above).

49. ENGINE TROUBLE CHART.

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
Starter will not operate	Discharged battery	Hydrometer test	Recharge or replace battery
	Corroded terminals	Battery terminals	Clean and tighten terminals
	Loose connections	Cables	Tighten connections
	Defective solenoid switch	Short across heavy terminals	Replace switch
	Starter pinion jammed	Remove starter	Turn pinion back
	Defective start relay	Start relay operations	Clean contacts. Return unit to depot for replacement if necessary
	Starter brushes or commutator in poor condition	Starting motor	Clean commutator, free brushes in holders, if in poor condition, return starter to depot for repairs
	Defective starting motor winding	Starting motor	Return starter to depot for repairs
Starter turns but engine does not	Weak battery	Hydrometer test	Recharge or replace battery. Clean and tighten terminals
	Corroded terminal	Battery terminals	
	Defective cable	Battery cable	Install new cable
	Gum on starter thread	Remove starter, inspect thread	Clean with kerosene
	Broken starter spring	Remove starter, inspect spring	Install new spring
	Teeth stripped from flywheel	Inspect teeth opening	Return unit to depot for repairing
Starter turns engine too slowly	Oil too heavy in crankcase	Inspect oil	Drain, refill with lighter oil
	Weak battery	Hydrometer test	Recharge or replace battery
	Corroded terminal	Battery terminals	Clean and tighten terminals
	Defective cable	Battery cables	Install new cable
	Worn starter bearings	Remove starter, inspect bearings	Return starter or unit to depot for repairing
	Starter brushes or commutator in poor condition	Starting motor	Clean commutator, free brushes in holders. If in poor condition, return starter to depot for repairs
Starter cranks engine but engine will not start	Battery too weak to supply ignition while cranking	Hydrometer test	Recharge or replace battery. Start by hand crank meanwhile
	Faulty ignition	Spark plugs	Clean, adjust or replace plugs. Resurface or replace contacts and adjust gap
		Breaker contacts	
		Coils, cables, capacitor	Replace defective parts
	Lack of fuel or faulty carburetion	Fuel tank empty	Refill
		Shut-off cock positions	Open correct shut-off cock

49. ENGINE TROUBLE CHART (Contd).

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
Starter cranks engine but engine will not start		Ignition relay	Clean all relay contacts. Return unit to depot for replacement if necessary
		Fuel screens	Clean
		Fuel pump	Clean, repair or replace
		Electric choke	Replace, if defective
		Engine flooded	Crank few times with spark plugs removed
		Poor fuel	Drain, refill with good fuel
		Dirt in fuel screen, lines, or carburetors	Clean
	Poor compression, usually because of leaking valves or worn or defective piston rings	Hand crank with ignition off, noting whether compression uniformly good on all cylinders	Tighten or replace head gasket. Tighten spark plugs. Adjust tappets If still not corrected, return unit to depot for repairing
	Wrong timing	Spark timing	Retime
Engine backfires at carburetor	Lean fuel mixture	Carburetor	Clean carburetor
		Fuel screens	Clean screens
		Air leaks at intake of manifold	Replace gaskets, tighten manifold nuts
	Poor fuel	Fuel	Drain, refill with good fresh fuel
	Spark too late	Flywheel marks	Retime ignition
	Distributor wires crossed	Distributor wires	Install wires correctly
	Intake valves leaking	Hiss through carburetor when hand cranked with ignition off	Adjust tappets. If this does not correct, return unit to depot for servicing
Engine misses at all speeds	Fouled spark plug	Spark plugs	Clean and adjust
	Defective or wrong spark plug	Spark plug	Replace
	Sticking valves	Valves	Return unit to depot for repairing
	Loose or damaged head gasket	Remove cylinder head and inspect gasket	Replace gasket
		Cylinder head and block for warped seating surface	If warped, return to depot for repairs
	Broken valve spring	Valve springs	Replace
	Defective ignition wires	Ignition wiring	Replace
	Pitted or improperly adjusted breaker contacts	Breaker contacts	Adjust or replace
	Defective ignition capacitor	See if breaker contacts sooty and spark weak and yellow	If so, replace capacitor
	Tappets need adjusting	Tappets	Adjust

49. ENGINE TROUBLE CHART (Contd).

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
Engine misses at heavy load	Spark plugs defective	Spark plugs	Replace
	Faulty ignition	Breaker and coil	Adjust or replace
	Clogged carburetor jets	Carburetor	Clean
	Clogged fuel screens	All fuel screens	Clean
	Tappets adjusted too close	Tappets	Adjust
	Defective high tension cables	High tension cables	Replace
Engine misses at light load	Carburetor idle adjustment set wrong or clogged	Carburetor	Adjust, clean if needed
	Spark plug gaps too narrow	Spark plugs	Set at .030"
	Intake air leak	Intake manifold	Tighten or replace gaskets
	Faulty ignition	Breaker and coil	Adjust or replace
	Uneven compression	Crank with ignition off, noting whether compression uniformly good on all cylinders	Tighten head gasket and spark plugs Adjust tappets If still not corrected return unit to depot
Engine stops unexpectedly	Fuel tank empty	Fuel gauge	Refill, or set fuel shut-off cock for other tank
	Clogged fuel line	Fuel supply at carburetor	Clean fuel line
	Defective fuel pump	Check pump	Replace pump
	Faulty ignition	Check for loose connections or defective wires	Tighten connections or replace wires
	Water temperature high, indicated by lighting of high water temperature pilot (red)	Water in radiator	Add water
		Cardboard over radiator	Remove cardboard
		Unit overloaded	Reduce load
		Ventilation	Increase ventilation
		Fan belt	Tighten, or install new one
		Water not circulating freely due to sludge or defective hose	Drain, flush, and refill, radiator, replace defective hose
	Oil pressure too low, indicated by lighting of low oil pressure pilot (green)	Start manually and note oil pressure	Refer to symptom of low oil pressure for remedies
Low oil pressure	Oil too light	Inspect oil	Drain, refill with proper oil
	Oil badly diluted	Inspect oil	Drain, refill with proper oil
	Oil too low	Oil level	Add oil
	Oil relief valve not seating	Oil relief valve	Remove and clean

49. ENGINE TROUBLE CHART (Contd).

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
Low oil pressure	Badly worn engine bearings	Smoky exhaust excessive oil consumption which cannot otherwise be accounted for	Return unit to depot for repairing
	Sludge on oil screen	Must remove pan to check	Return unit to depot for checking
	Badly worn oil pump	No simple check	Return unit to depot for checking
	Defective oil gauge	No simple check	Return unit to depot for checking
	Clogged or plugged oil line	Oil line	Blow out lines or replace. If not satisfactory, return to depot for repairs
High oil pressure	Oil too heavy	Inspect oil	Drain, refill with proper oil
	Clogged oil passage	No simple test	Return unit to depot for checking
	Oil relief valve stuck	Oil relief valve	Remove and clean
	Defective oil pressure gauge	Should read zero when unit not operating	If not, install new oil pressure gauge

50. GENERATOR TROUBLE CHART.

Engine runs but a-c voltage does not build up.	Poor commutation	Exciter commutator and brushes	See below for remedy
	Faulty voltage regulator	Try using field rheostat	Return unit to depot for repairs
	Open circuit, short circuit or ground in generator	No simple test	Return unit to depot for repairs
	Loss of residual magnetism	No simple test	Connect 6-volt battery momentarily across exciter field terminals while unit is not running
Voltage unsteady but engine not missing	Poor commutation or poor brush contact at slip rings	Exciter commutator and brushes	See that brushes seat well on commutator, are free in holders, are not worn shorter than ¾" and have good brush tension. If commutator is rough or badly grooved return unit to depot for repairing
	Loose connections, especially in exciter or regulator circuits	Check for loose connections	Tighten connections
	Fluctuating load	Check load for unusual conditions	Correct any abnormal load condition causing trouble

50. GENERATOR TROUBLE CHART (Contd).

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
Voltage drops under heavy load	Engine lacks power	See symptom of engine missing under heavy load Crank with ignition off, noting whether compression uniformly good on all cylinders	See remedies for engine missing under heavy load Tighten or replace head gasket. Tighten spark plugs. Adjust tappets. If still not corrected, return to depot for repairing
		Carburetor Carburetor air cleaner Choke Carbon in cylinders Restricted exhaust line	Clean carburetor Clean air cleaner See that it opens wide Remove carbon Clean or increase the size
Circuit breaker trips and disconnects load	Load too great Load line short circuited	Ammeter Ammeter	Reduce load Remove short circuit
Generator overheating	Overloaded	Ammeter	Reduce load
Lights dim at far end of line but bright near unit	Too small line wire for load and distance	Wire size, against load and distance	Install larger or extra wires or reduce load
Motors run slowly and overheat at far end of line but OK near unit	Too small line wire for load and distance	Wire size, against load and distance	Install larger or extra wires or reduce load

51. SPECIAL TROUBLES.

Pinging sound when engine is rapidly accelerated or heavily loaded	Carbon in cylinders Spark too early Wrong spark plugs Spark plugs burned or carboned Valves hot Fuel stale or octane Lean fuel mixture	Inspect through spark plug hole Flywheel marks Spark plugs Spark plugs Tappet clearence Fuel Carburetor	Remove carbon Retime ignition Install C-10-S plugs Install new plugs Adjust tappets Use good fresh fuel Clean
Clicking sound	Tappet clearance too great Broken valve spring	Tappet clearance Valve springs	Adjust tappets Install new spring

51. SPECIAL TROUBLES (Contd).

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
Hollow clicking sound with cool engine under load	Loose pistons	Put tablespoonful heavy oil in cylinder suspected. Crank engine with ignition off to lubricate piston. Then start engine, if noise not present, indicates loose piston or piston rings	If noise only slight and disappears when engine warms up, no immediate attention needed. Otherwise return to depot for repairing
Excessive oil consumption, light blue smoky exhaust	Poor compression usually leaking valves	Hand crank with ignition off, noting whether compression uniformly good on all cylinders	Tighten or replace head gasket. Tighten spark plugs. Adjust tappets. If still not corrected, return unit to depot for servicing
	Oil leaks from oil pan or connections. This does not cause smoky exhaust	Inspect visually for leaks	Replace gaskets and leaking tubing Tighten screws and connections
	Oil too light or diluted	Inspect oil	Drain, refill with correct oil
	Bearing clearance too great	Oil pressure gauge registers low and this cannot otherwise be accounted for	Return unit to depot for repairing
	Oil pressure too high	Oil pressure gauge	Refer to symptom of high oil pressure for remedies
	Engine misses firing	Voltmeter reading unsteady and exhaust irregular	Refer to symptoms of engine misses
	Faulty ignition	Spark plugs Breaker contacts	Clean, adjust or replace Resurface or replace contacts and adjust gap
		Coils, cables, capacitor	Replace defective parts
	Unit operated a great deal at light or no load	Operating conditions	No remedy needed
	Too much oil	Bayonet gauge	Drain excessive oil
Black, smoky exhaust, excessive fuel consumption fouling of spark plugs with black soot, possible lack of power under heavy load	Fuel mixture too rich	Carburetor float for leak and high level needle valve for leak jets, and metering rod for wear or damage, gasket washers for leaks	Install needed carburetor parts, adjust float level. Be sure all jet gaskets are tight and in place and needle valve gasket is tight and in place
	Choke not open	Choke	See that choke opens properly
	Dirty carburetor air cleaner	Air Cleaner	Clean, refill to proper oil level

SECTION XIII

DISASSEMBLY AND REPAIR

52. ENGINE DISASSEMBLY AND REPAIR.

a. Engine Removal. To remove the engine from Power Unit PU-58/G for major overhaul purposes, proceed as follows:

(1) Remove front housing support and radiator as instructed in paragraphs 52 **n** (3) (*b*) and 52 **k.**

(2) Remove the rear housing superstructure and the entire generator, following instructions contained in paragraph 54 **b.**

(3) Remove the electric choke control rod. Disconnect the exhaust pipe from the exhaust manifold.

(4) Remove the two front engine support bolts.

(5) Attach a hoist to the engine and lift it from the skids.

b. Converting engine from Truck, model MB, 1/4 ton, 4x4, for use in Power Unit PU-58/G. The engine used in truck model MB, 1/4 ton, 4x4, may be used in Power Unit PU-58/G when the following changes are made:

(1) Remove the truck engine flywheel and place the rear engine plate No. 89 in position at the rear of the cylinder block. Remove the pilot bushing from the flywheel and install the flywheel as instructed in paragraph 52 **j.**

(2) Place the generator adapter (fig. 55) in position and install two dowel bolts No. 90 with two 3/8 by 1/8 by 3/32 inch lockwashers and two 3/8-24 hexagon nuts. Install two 3/8 by 1-1/2 USS bolts in the top holes and four 3/8 by 1 inch USS bolts in the four remaining holes, using six 3/8 by 1/8 by 3/32 inch lockwashers and six 3/8 inch USS hexagon nuts.

(3) Install a flywheel blower using six 5/16 by 1-1/4 inch USS hexagon-head cap screws and six 5/16 by 1/8 by 1/16 inch lockwashers.

(4) Install the air baffle ring using five 10/32 by 3/8 inch round-head machine screws with five 10 by 1/16 by 3/64 inch lockwashers.

(5) Remove the battery charging generator from Power Unit PU-58/G and install it in the truck engine.

(6) Remove the two cap screws from holes Nos. 6 and 11 on the cylinder head of the truck engine (fig. 21) and install in their places two studs No. 14. Remove the front exhaust manifold stud and install in its place a stud No. 16. Install the governor bracket No. 436 on these studs using the original nuts.

(7) Remove the starting cranknut assembly and the fan drive pulley. Install a fan and governor drive pulley No. 82. Replace the starting cranknut assembly.

(8) Install the engine governor from Power Unit PU-58/G, using the two spacers needed to align the governor pulley with the governor drive pulley on the crankshaft. Use three 3/8 by 1-3/4-inch SAE hexagon-head capscrews, with lockwashers and plain washers.

(9) Install and adjust the governor belt and the fan belt.

(10) Remove the fuel pump inlet fuel line and fitting from the truck engine and install in their places a fitting and a fuel line from the power unit. Use two clips and attach the fuel line to the engine. Place one clip under the nut and washer of the bolt at the inner end of the idler pulley adjustment brace and one clip under the head, lockwasher, and plain washer of the ignition unit hold-down screw. By means of a clip, attach the fuel line to the engine by placing the clip under the nut and lockwasher of the upper left bolt which holds the generator adapter ring to the engine block.

(11) Remove the intake manifold and install an intake manifold No. 40. If the manifold No. 40 is not available, the original truck engine manifold may be used but engine operation will not be as smooth (fig. 64).

(12) Remove the two 1-11/16-inch manifold-to-carburetor studs and install two studs, No. 42 in their places. Install a manifold baffle assembly No. 396, manifold shield No. 402, insulator gasket No. 401, overspeed governor No. 422, carburetor flange gasket No. 400 and carburetor No. 330 with control lever. If necessary to use the diffuser from the larger truck manifold, clip it off so it may be installed in the smaller No. 40 manifold. Connect the fuel line from pump to carburetor. Install a choke arm on

the choke arm of the carburetor. Connect the throttle control rod to the governor and to the carburetor throttle arm.

(13) Remove the valve spring cover and install a valve spring cover No. 28, with the screened opening near the rear. If cover No. 28 is not available, the original truck engine valve spring cover may be used after drilling it and soldering-in a fitting as in the old cover. Connect the governor oil return tube to this fitting.

(14) Remove the 1/4-inch pipe plug from the center of the intake manifold and install the crankcase ventilating valve group, connecting it to the ventilator assembly near the rear end of the valve spring cover. If the ventilating valve group is not available, leave the pipe plug in the manifold and plug the opening in the ventilator assembly in the valve spring cover.

(15) Install the oil filter. Remove the fitting from the bottom of the oil filter and install a tee. Install an elbow in the bottom of the tee and another elbow in the top of the engine governor housing. Install the governor oil supply tube, connecting it to the two elbows. Install the oil filter inlet and outlet tubes.

(16) Remove the oil drain plug and gasket and install the oil drain assembly which consists of gasket No. 228, adapter No. 226, 1/2-inch close pipe nipple, drain valve No. 232, another 1/2-inch close pipe nipple, 1/2-inch pipe tee and 1/2-inch pipe plug. If these fittings are not available, the original truck engine drain plug and gasket may be left in place (fig. 69).

(17) Remove the elbow from the rear oil passage opening and install a tee and a low oil pressure cut-off switch. If this switch is not available, a pipe plug may be installed in the opening in the tee.

(18) Remove the pipe plug from the left side of the cylinder head and install a 1/2-inch pipe bushing. This is in preparation for installing the thermal element of the ENGINE WATER TEMPERATURE gauge. If the gauge is not available, leave the pipe plug in the cylinder head.

(19) Remove the ignition coil and install the air cleaner bracket. Replace the ignition coil, installing a capacitor under the rear nut and one end of a bond strap under the front nut, with an internal-external toothed lockwasher between the lug of the bond strap and the coil bracket.

(20) Install an air cleaner. Install an air cleaner horn on the carburetor using a clamp. Install air cleaner hose with two clamps.

c. Valve Servicing. Lack of power in an engine may be caused by poor seating of the valves in the valve seats, which allows the gases in the compression chamber to escape into the intake or exhaust manifold.

(1) WHEN TO GRIND VALVES.

(*a*) By the use of a cylinder compression gauge it can be readily determined which valves are not properly seating. Compression gauge readings should all be within 10 pounds of each other and not less than 70 pounds.

(*b*) If no gauge is available, turn the engine by the hand crank and note whether the compression is uniformly good on all cylinders. Compression should rock the crank backward forcibly if allowed to do so when well up on the compression stroke. Compressed gases leaking past an exhaust valve cause a hissing noise at the exhaust outlet. If leaking past an intake valve, a hissing noise may be heard through the carburetor. Disconnect the air cleaner horn at the carburetor and the exhaust line at the power unit and have someone crank the engine while you listen for these sounds, if you have reason to suspect that valves are leaking. Any valve leak present after the tappets are properly adjusted should be corrected by grinding all valves.

(*c*) The above instructions are based on the use of fuels having a low lead content. Observe the following instructions when using army 80 octane, aviation 100 octane, or other fuel that contains more than 2 cubic centimeters of lead per gallon.

1. Every 64 operating hours, change the oil in the crankcase and clean and adjust the spark plugs.

2. Every 128 operating hours, remove lead, and carbon deposits from the combustion chambers. Inspect the valves, then grind them if necessary.

3. Every 256 operating hours, replace all spark plugs. Grind the valves, except where conditions warranted this being done at the end of 128 operating hours.

(2) GRINDING VALVES. Use extreme care whenever valves are ground in order to main-

tain accurate limits and clearances. Good engine performance will thus be insured. Proceed as follows:

(*a*) Drain radiator by opening drain cock at the bottom of the radiator.

(*b*) Disconnect governor oil supply line at governor.

(*c*) Remove oil filter and bracket by removing the nuts on the cylinder studs, and lay filter on idle pulley bracket.

(*d*) Remove fuel line from fuel pump to carburetor.

(*e*) Remove carburetor air cleaner horn and tube.

(*f*) Remove electric choke control rod. Disconnect throttle control rod at governor end and the manual choke wire at carburetor end.

(*g*) Remove nuts holding carburetor to manifold and remove carburetor.

(*h*) Disconnect the governor oil return tube and the crankcase air vent tube.

(*i*) Remove the cylinder head nuts which hold the governor bracket and remove the governor assembly.

(*j*) Remove nuts and bolt holding exhaust pipe to manifold.

(*k*) Remove manifold stud nuts and manifold.

(*l*) Disconnect wires from the ignition resistor, remove holding bolt and ignition resistor.

(*m*) Remove the upper radiator hose. Remove all spark plugs. Remove the cylinder head cap screws, stud nuts, and the temperature gauge bulb, then lift head from engine block. Removal is made easy by using lifting hooks screwed in No. 1 and 4 spark plugs holes. **Do not drive screw driver or any other sharp instrument in between the cylinder head and the block to break the head loose from the gasket.**

(*n*) Remove the valve spring cover screws and the cover. Care should be taken not to lose the copper gasket on each screw as well as the screen and gasket. Wad a piece of cloth or cotton waste over the three holes in the valve chambers to prevent the valve keys dropping into crankcase upon removal.

(*o*) With valve spring compressor inserted between valve tappet and spring retainer, raise springs on those valves which are in closed position and remove valve locks. Turn crankshaft with crank or by fan belt until those valves which are open become closed and repeat the operation.

(*p*) Remove valves and place them in a valve carrying board, so that they can be identified as to cylinders from which they were removed. Remove valve springs. The valve springs should be tested for pressure which should show 116 pounds when valves are open (spring compressed, length 1-3/4-inches or 50 pounds pressure when closed (springs extended, length 2-7/64-inches). The free length of the valve spring is 2-1/2-inches. Any springs which are distorted or do not fall within these specifications should be replaced with new springs.

(*q*) Clean carbon from cylinder head, top of pistons, valve seats, and cylinder block. Clean valve guides with guide brush. Clean valves on a wire wheel brush, making sure that all carbon is removed from the top and bottom of the heads. Remove any gum which may have accumulated on the stems.

(*r*) The clearance between the intake valve stem and the valve guide is 0.0015 to 0.00325 inch, the exhaust valve stem clearance to guide is 0.002 to 0.00375-inch. Excessive clearance between the valve stem and the valve guide will cause improper seating and burned valves. If there is too much clearance between the inlet valve stem and the valve guide, on the suction stroke there will be a tendency to draw oil vapors up the guide into the combustion chamber causing excessive oil consumption, fouled spark plugs and poor low speed performance. Check the wear of each valve guide by inserting a new valve in it and feeling the clearance by moving the valve stem back and forth. If the clearance is excessive, install a new valve guide as instructed in subparagraph (3) below.

(*s*) Check the clearance of each valve in its guide and discard any having excessive clearance. Reface the usable ones to a 45° angle. Replace discarded valves with new ones. If seats in the block show excessive pitting, reface the seats.

(*t*) Then, by hand, touch up the valves to the seats with fine, valve grinding compound.

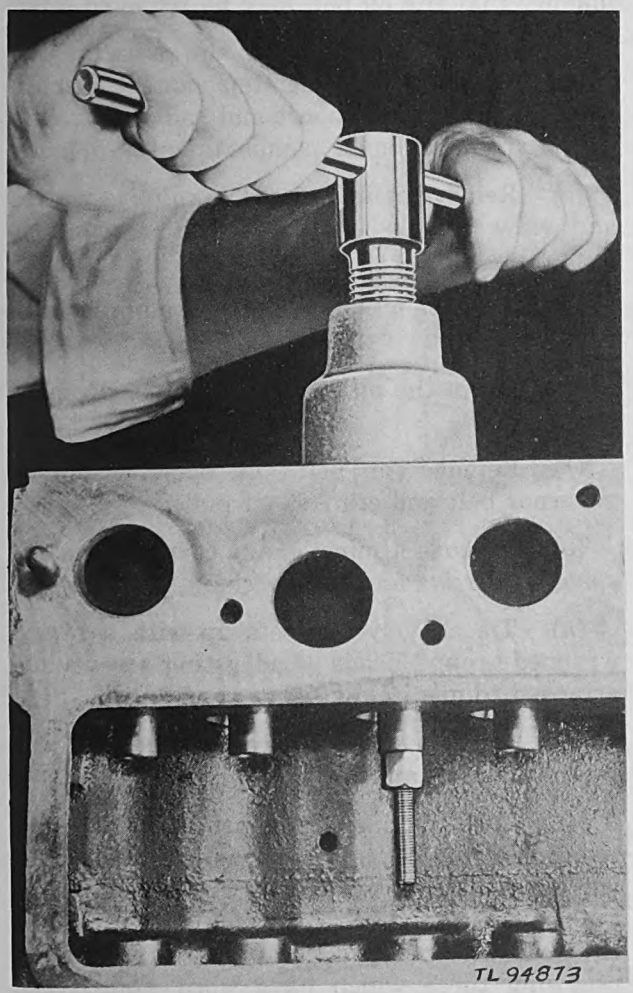


Figure 37. Removing valve guides.

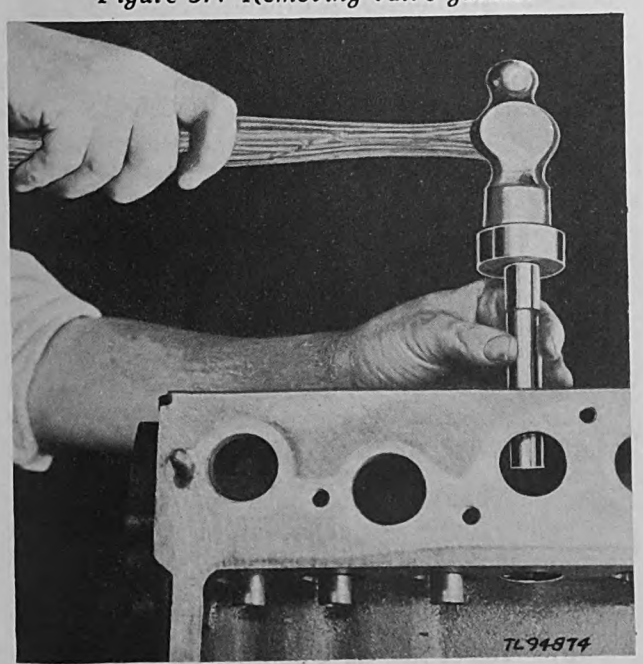


Figure 38. Installing valve guides.

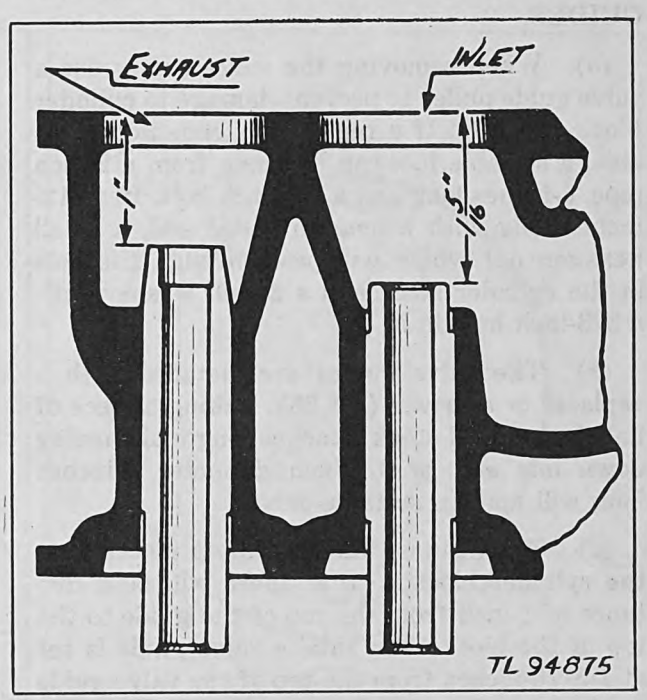


Figure 39. Position of valve guides.

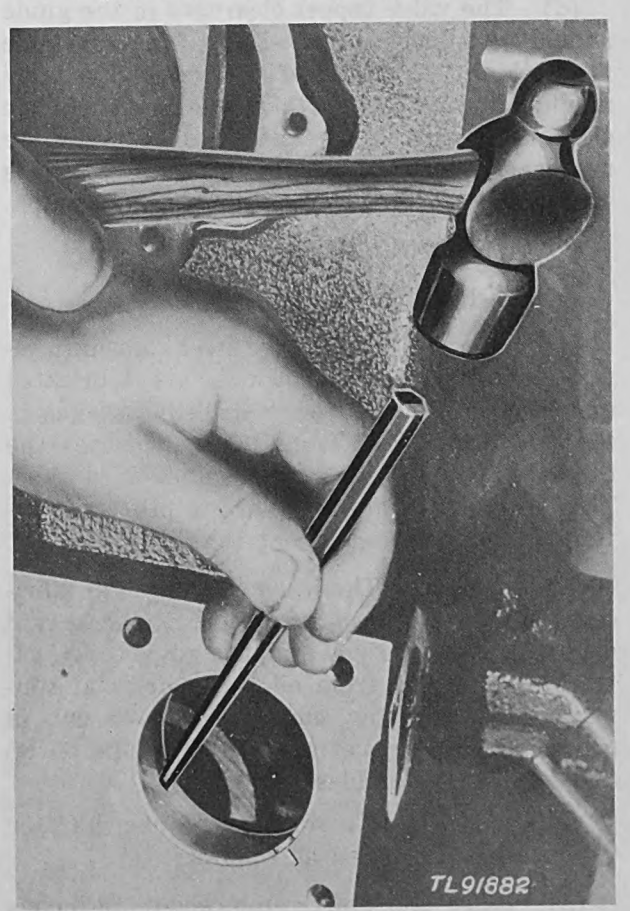


Figure 40. Staking camshaft bearings.

(3) REMOVING AND REPLACING VALVE GUIDES.

(*a*) When removing the valve guides use a valve guide puller to prevent damage to cylinder block (fig. 37). If a regular puller is not available, a suitable tool can be made from a 2-inch pipe, 6-inches long and a 3/8-inch bolt, 10 to 12-inches long with a long threaded end, a small hexagon nut which will pass through the hole in the cylinder block and a 2-inch washer with a 3/8-inch hole in it.

(*b*) The valve guides are installed with a replacer or a driver (fig. 38). Taking a piece of half-inch round stock 6-inches long and turning down one end to 3/8-inch diameter 2-inches long will make a suitable driver.

(*c*) The exhaust valve guide is installed in the cylinder block so that there will be a distance of 1-inch from the top of the guide to the top of the block. The intake valve guide is set at 1-5/16-inches from the top of the valve guide to the top of the block (fig. 39).

(*d*) The valve tappet clearance in the guide should be 0.0005 to 0.002-inch. It is advisable to check the clearance of the valve tappet by moving it back and forth in the guide. If the clearance seems to be excessive, it might be necessary to install a new valve tappet. This operation is covered in the following paragraph.

d. Camshaft and Valve Tappets.

(1) DESCRIPTION.

(*a*) *Bearings.* The alloy steel camshaft rotates on four bearings which are lubricated under oil pressure through drilled passages in the crankcase. The front bearing carries the thrust and is a steel-backed babbit-lined shell. This bearing is staked in place to prevent rotation and endwise movement (fig. 40).

(*b*) *Tappets.* The valve tappets are lubricated through oil troughs cast in crankcase and drilled passages to valve tappet guides. The oil troughs are filled from oil spray holes at connecting rod bearing ends. A groove cut in center of valve tappet shank carries the oil up and down in the guides.

(2) REMOVAL. To remove the camshaft or valve tappets, proceed as follows:

(*a*) Raise the power unit about 18-inches from the floor and support it securely in such manner that the oil pan may be removed later.

(*b*) Drain the water from the radiator. Remove the front housing top plate. Remove housing front and support and radiator assembly. Remove exhaust compartment top plate.

(*c*) Remove cylinder head, manifolds, valves and valve springs, following the instructions in paragraph 52 **c**.

(*d*) Remove oil pump and fuel pump assemblies.

(*e*) Drain the oil from the engine. Remove the oil pan.

(*f*) Remove fan belt, fan blade assembly, governor belt and crankshaft pulley.

(*g*) Remove timing chain cover, camshaft sprocket screws and timing chain.

(*h*) Tie all valve tappets up with a string wrapped around heads of adjusting screws and attached to manifold studs.

(*i*) Remove sprocket from camshaft. Remove camshaft and valve tappets.

(*j*) Carefully inspect camshaft for scores, roughness of cams and bearings. Examine valve tappet faces where they contact cams and replace if found to be scored, rough, or cracked. Check clearance of tappets to guides, renewing those which have worn excessively. Oversize available, 0.004-inch.

e. Valve Timing.

(1) TIMING CHAIN AND SPROCKETS.

(*a*) The timing chain is non-adjustable. The lubrication is positive through drilled passages in the crankshaft and sprocket from the front main bearing. These should be checked whenever the chain or sprockets are replaced.

(*b*) To replace timing chain, it is necessary to remove radiator, fan blades, fan belt, crankshaft pulley, and timing case cover (par. 52 **n** (3) **b** and 52 **f**). Remove screws holding camshaft sprocket to camshaft and remove chain.

(*c*) When chain has been removed it will be necessary to give due attention to the valve timing when chain is replaced.

(2) PROCEDURE.

(*a*) To set the valve timing, turn the crankshaft so that No. 1 and No. 4 pistons are at top

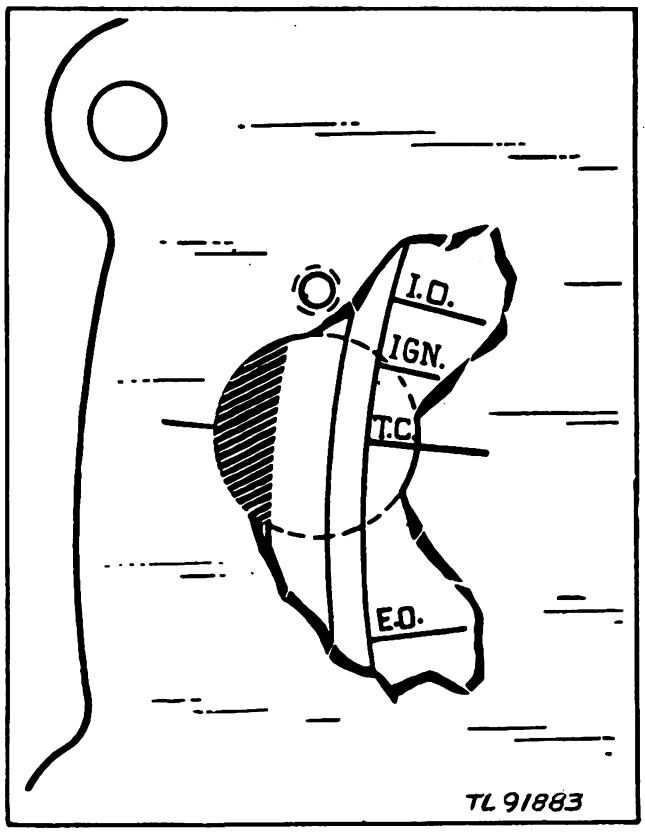


Figure 41. Timing marks, flywheel.

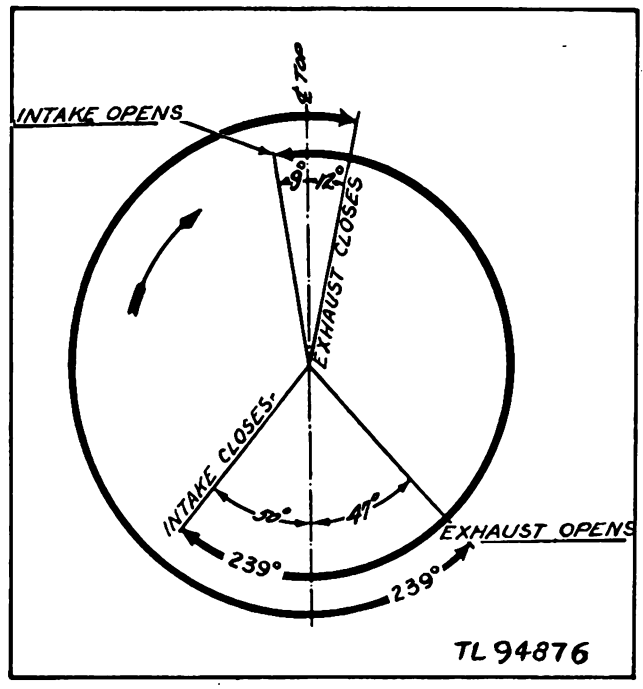


Figure 43. Valve timing.

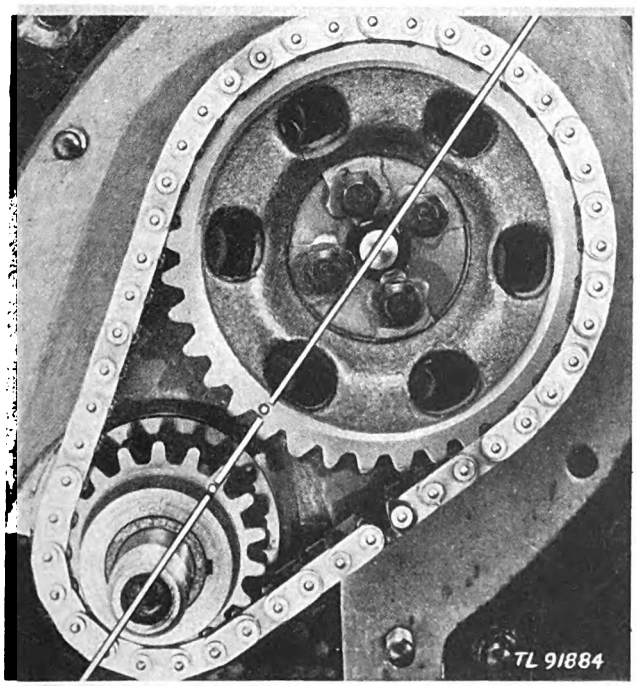


Figure 42. Timing sprockets.

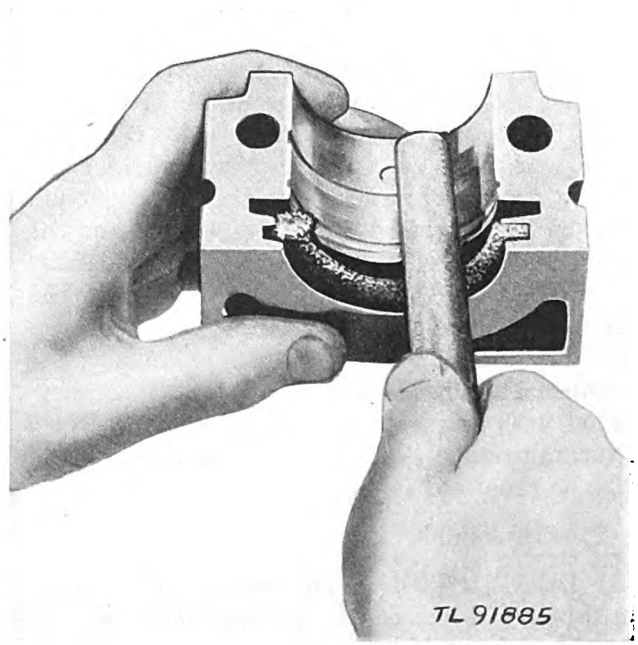


Figure 44. Rear main bearing packing.

dead center. Top dead center is indicated by a mark TC on the flywheel which is visible through a hole in the flywheel housing (fig. 41).

(*b*) Place the camshaft sprocket on the camshaft and line up the holes for the capscrews. Screw all four capscrews in by hand. Rotate the camshaft so that the punch mark on the face of the sprocket is in line with the punch mark on the crankshaft sprocket (fig. 42).

(*c*) Remove the camshaft sprocket and install the timing chain. Change the position of the camshaft sprocket, within the chain, until all four capscrew holes are matched. Unless the position of the camshaft has been changed, the punch marks on the camshaft and crankshaft sprockets will now be in line (fig. 42). Make sure the camshaft thrust washer is in place, replace the capscrews and again check the line-up of the punch marks. Timing is correct when a straight line between sprocket centers cuts through the punch marks on both sprockets (fig. 42). In this position No. 4 cylinder is at top of compression stroke and the distributor arm should be under the segment for that cylinder.

(*d*) Tighten capscrews and lock with the special washers.

(*e*) Inlet valve opens 9° before top center measured on flywheel or 0.039-inch piston travel from top center. To check valve timing, (fig. 43), adjust inlet valve tappet of No. 1 cylinder to 0.020-inch. Rotate crankshaft clockwise until piston in No. 1 cylinder is ready for the intake stroke, at which time the tappet should just be tight against end of valve stem and the mark on flywheel "I.O." should be in the center of timing hole in the flywheel housing on the right side of engine (fig. 41).

(3) TIMING CHAIN COVER SEAL. The crankshaft oil seal is woven asbestos impregnated with graphite and oil. When necessary to install new oil seal, the steel retainer should also be renewed.

f. Crankshaft.

(1) DESCRIPTION. The crankshaft rotates in three steel-backed babbitt-lined bearings, the front bearing taking the thrust. Packing at the rear bearing (fig. 44) prevents the escape of oil. The main bearing journal diameter and length dimensions are: front, 2.3340-1.920-inch; center, 2.3340-1.8125-inch; rear, 2.3340-1.75-inch.

(2) SERVICING.

(*a*) The steel-backed babbitt-lined bearings are made to size and are interchangeable without line reaming. The running tolerance of the bearing is established at 0.001 to 0.0025-inch. No adjustment is provided on the main bearing. Should they require attention they should be replaced to maintain proper control of oil. Main bearing cap screw torque wrench should read 65-70 foot-pounds. If new crankshaft bearings are installed, care should be taken to see that the drilled passages line up with drilled passages in the crankcase, and that the bearings set snugly over the dowel pins. Undersize main bearings are available in 0.010-inch, 0.020-inch, and 0.030-inch. Power Unit PU-58/G has 0.010-inch undersize main bearings as standard equipment.

(*b*) The end play of the crankshaft is 0.004 to 0.006-inch and adjusted by shims between the crankshaft sprocket thrust washer and end of main bearing. To adjust end play, the crankshaft sprocket must be removed with gear puller.

(*c*) Whenever it is necessary to remove the crankshaft or install new crankshaft bearings, the engine has to be removed from the housing (par. 52 j).

(3) REAR BEARING SEAL.

(*a*) The rear main bearing is sealed by a wick type packing, installed in grooves machined in the crankcase, and rear main bearing cap (fig. 44).

(*b*) To install a new seal at the rear main bearing cap, insert the packing in the groove with the fingers. Then, using a round piece of wood or steel, roll the packing into the groove. When rolling the packing, start at one end and roll the packing to the center of the groove. Then, starting from the other end, again roll toward the center. By following the above procedure you are sure that the wick is firmly pressed into the bottom of the groove. The small portion of the packing which protrudes from the groove at each end should be cut flush with the surface of the bearing cap. To prevent the possibility of pulling the packing out of the grove while cutting off the ends it is recommended that a round block of wood, the same

diameter as the crankshaft be used to hold the packing firmly in position while the ends are being cut off.

(*c*) Should it be necessary to install a new seal in the crankcase, it will require the removal of the engine from the housing and the removal of the crankshaft. The same procedure should be followed when installing a crankcase seal as when installing a seal in the bearing cap.

(*d*) When installing rear main bearing cap to case, a little sealer should be put on the cases of the cap where it fits against the case. The rubber seal packing that goes between the main bearing cap and the case is cut to a given length and will protrude down from the case approximately 1/4-inch. When the oil pan is installed it will force this seal tightly into the holes and prevent any oil from leaking from the engine into the generator adapter (fig. 45).

g. Connecting Rod and Piston—Description.

(1) CONNECTING ROD. The connecting rods are drop-forged. The babbitt bearings are of the replaceable type, steel-backed, babbitt-lined, precision cut to size and no fitting is required. Clearance on the crankshaft is 0.0005 to 0.0025-inch. Total side clearance is 0.005 to 0.009-inch. Undersize rod bearings are available in 0.010, 0.020, and 0.030-inch sizes. Power Unit PU-58/G has 0.010-inch undersize bearings as standard equipment (fig. 46).

(2) PISTON. The piston is aluminum alloy, T-slotted cam ground, tin plated, and with a heat insulation groove above top ring. Pistons are available in the following over-sizes: 0.010-inch; 0.020-inch and 0.030-inch, and semi-finished 0.030-inch.

h. Cylinder Bores.

(1) CHECKING. The best method for determining the condition of the cylinder bores preparatory to reconditioning is the use of a dial gauge. The dial gauge will instantly and automatically indicate the slightest variation of the cylinder bores. To use the dial gauge simply insert in the cylinder bores and move up and down its full length. It is then turned spirally or completely rotated at different points, taking readings at each point. In this manner all variations in the cylinder bores from top to bottom may be determined.

(2) REFINISHING.

(*a*) When cylinders are more than 0.005-inch out of true it is best to rebore the cylinders.

(*b*) After the cylinder has been rebored within 0.002-inch of the size desired, it should be finished or polished with a cylinder hone. Do not use a piston as a hone. In operating, the hone is placed in the cylinder bore and run up and down the full length of the cylinder wall. This procedure should be followed until the piston can be pushed through the bores with a 0.003-inch feeler gauge 3/4-inch wide on the thrust side and show a pull on the feeler gauge of 5 to 10 pounds.

i. Oil Circulating System.

(1) OIL PUMP.

(*a*) *Description.* The oil pump (fig. 22) is planetary gear type. It consists of two spur gears enclosed in a one piece housing. It is provided with a relief valve to control maximum oil pressure. In operation the oil is drawn from the crankcase through the floating oil intake. The oil then passes through a drilled passage in the crankcase to the oil pump from which it passes through drilled passages in crankcase to crankshaft and camshaft bearings. The oil pump is driven from a spiral gear on the camshaft.

(*b*) *Removing Oil Pump from Engine.* To remove oil pump fro mengine for dismantling, remove the three nuts on studs holding oil pump to crankcase. Slide oil pump from studs. Remove screw from oil pump cover plate which will allow cover to be removed from housing.

(*c*) *Removing Oil Pump Driven Gear.* To remove oil pump driven-gear, file off one end of straight pin and with a small drift, drive pin through oil pump shaft. The oil pump shaft with rotor can be removed from the body in an assembly.

(*d*) *Removing Oil Relief Plunger Spring Retainer.* When removing oil relief plunger spring retainer, care must be taken not to lose the small shims which govern the spring tension on the relief plunger. Adding shims increases the oil pressure, removing shims decreases the pressure. The pressure at which the relief valve opens will register about 22 pounds on ENGINE OIL PRESSURE gauge under normal operating temperature.

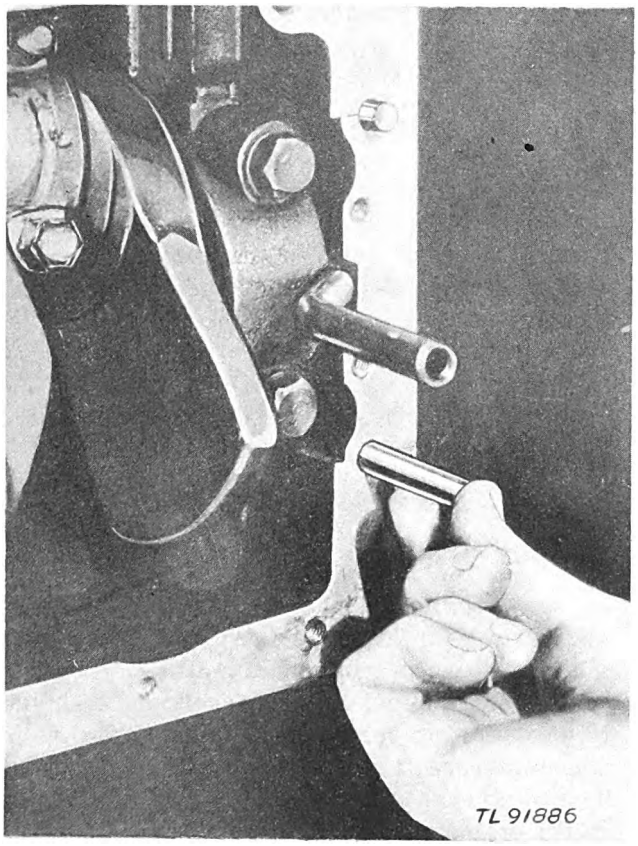


Figure 45. Rear main bearing cap seal.

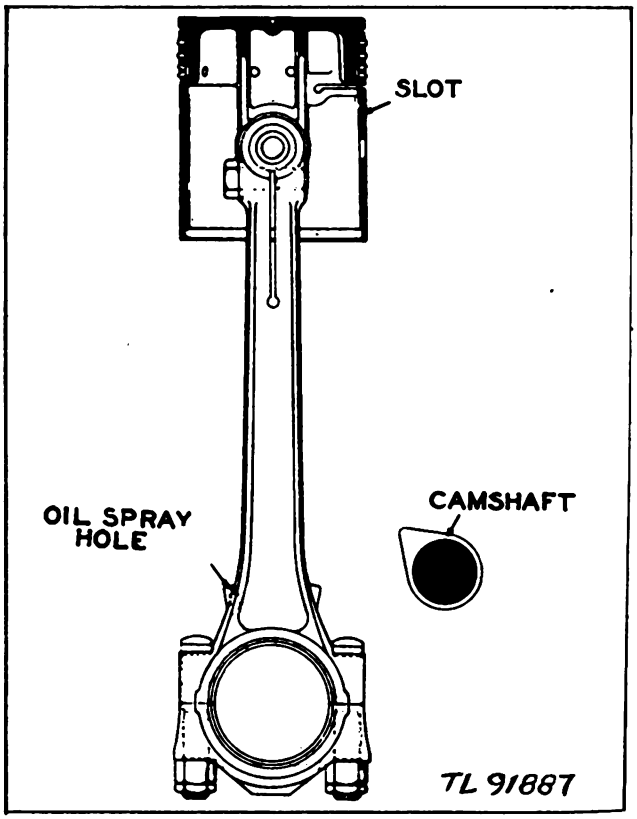


Figure 46. Connecting rod and piston.

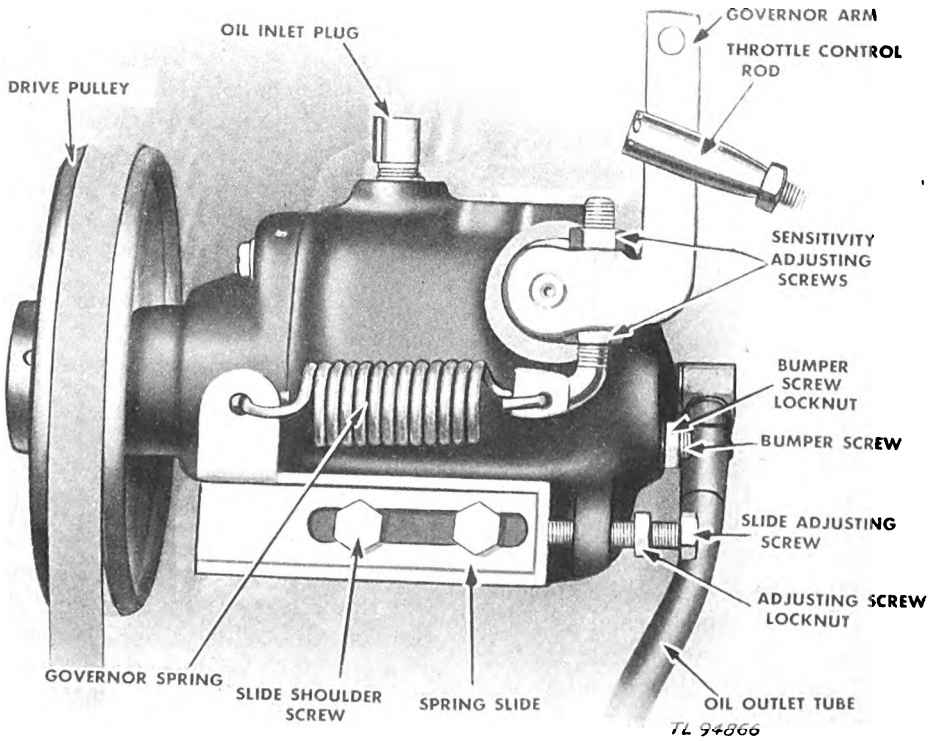


Figure 47. Engine governor.

(2) FLOATING OIL INTAKE.

(*a*) *Description.* The floating oil intake, (figs. 9 and 22) is attached to the crankcase with two cap screws. The construction of the float and screen cause it to float on top of the oil, raising and lowering in relation to the amount of oil in the crankcase. This construction is to prevent the circulation of water or dirt, which may have accumulated in the bottom of the oil pan, by drawing the oil horizontally from the top surface.

(*b*) *Removal.* Whenever removed, the float, screen, and tube should be cleaned thoroughly in a suitable cleaning fluid to remove any accumulation of dirt. Oil pan screw torque wrench reading is 10-14 foot-pounds.

(3) OIL FILTER.

(*a*) *Description.* The oil filter (fig. 3) is designed to control contamination of engine oil. The filter element removes particles of dust, carbon, and other foreign material from the oil which cause discoloration and sludge. The inlet line to the filter is connected to the oil distribution line at the front plug on right-hand side of the engine. The outlet or oil return line to the engine connects to the timing chain cover.

(*b*) *Removal.* When the oil on the level indicator in the engine filler-tube becomes dark, remove the oil filter cover; remove the drain plug and drain out the sludge after which, replace the drain plug. Next, remove the element and install a new element. Install new cover gasket; reinstall cover; start engine and check for leaks; then check oil level; add to oil supply if necessary.

j. Flywheel.

(1) DESCRIPTION. The flywheel is made of cast steel, machined throughout and balanced to insure smooth engine performance. The flywheel is attached to the crankshaft flange by two dowel bolts and four special head cap screws.

(2) REMOVING PILOT BUSHING. No pilot bushing is used at the center of the flywheel on Power Unit PU-58/G. If a new flywheel has such a bushing, remove the bushing with a press or with a hammer and blunt-nosed punch before installing the flywheel. **Be very careful to avoid marring the flywheel surface, particularly the inner surface of the hole and other surfaces where the flywheel fits against machined surfaces.**

k. Engine Support Plates and Mounting.

(1) FRONT SUPPORT PLATES. The front engine support plate is bolted to the front face of the cylinder block and forms the back panel for the attachment of the timing chain cover.

(2) REAR SUPPORT PLATE. The rear engine plate is attached to the rear of the cylinder block and provides a means for attaching the generator and adapter ring which supports the rear end of the engine.

1. Engine Governor (fig. 47).

(1) BELT TENSION. Check and adjust the belt tension periodically to assure correct speed control. Correct belt tension permits one side of the belt to be pushed inward 1-1/4 to 1-1/2-inches by applying thumb pressure midway between the pulleys. It is adjusted by shifting the position of the governor assembly as permitted by slotted holes. A sealed, vacuum operated governor on the intake manifold limits the top speed of the engine in case of belt breakage, but the belt should be replaced before breakage occurs.

(2) REGULATION LIMITS. It is advisable to refer to the FREQUENCY METER and the a-c voltmeter while adjusting the governor. At no-load, the frequency should not exceed 63 cycles per second and the voltage should not exceed 126 or 252 volts, depending on whether the a-c terminal jumpers are connected for 120 or 240 volts. At full load, unity power factor, the frequency should not be lower than 59 cycles per second and the voltage should not be lower than 118 or 236 volts.

(3) ADJUSTMENT. If it becomes necessary to reset the governor, proceed as follows:

(*a*) With spring tension on the main governor spring (fig. 47), adjust the length of the carburetor control rod so that the carburetor throttle lever clears the wide open stop by at least 1/64-inch.

(*b*) Turn the bumper screw out far enough so that it does not function. Start the engine. Then turn the main adjusting screw until the correct speed is obtained.

(*c*) Should the governor surge under full or part load, turn the auxiliary adjusting screw

out a few turns at a time until the surging stops. For close regulation, keep the auxiliary adjusting screw in as far as possible without causing the governor to surge. Each time its adjustment is changed, it will be necessary to readjust the main adjusting screw for correct speed.

(*d*) Should the governor surge at no load, turn the bumper in until the surging stops, then tighten the locknut. Do not turn bumper screw in far enough to increase the engine speed. Tighten all locknuts.

m. Fuel System. The fuel system includes the fuel tank, fuel pump, carburetor, connecting fuel lines, shut-off valves, strainers, and sediment bowls. It may also include an auxiliary fuel tank. The most important servicing required of the fuel system is to keep it free of dirt, water and leaks. This requires care in handling of the fuel, and periodic cleaning of sediment bowls and strainers to keep dirt and water which enter from reaching the passages and jets of the carburetor. Fuel leaks should be corrected as soon as discovered.

(1) FUEL TANK. The 10-1/2-gallon fuel tank is mounted above the generator. It may be removed after first removing the hold-down clamps.

(2) FUEL PUMP.

(*a*) The diaphragm type fuel pump (fig. 24) operates continuously while the engine is operating and pumps fuel from the fuel tank to the carburetor (par. 42 i and fig. 24).

(*b*) Remove and clean the sediment bowl and strainer monthly. When replacing, tighten the clamp screw sufficiently to hold the bowl tightly on the gasket. Check for leaks and if one is found, install a new gasket.

(*c*) If the fuel does not reach the carburetor bowl, check the fuel supply, the position of the shut-off valve, the fuel lines, and strainer before disassembling the main body of the pump. Remove the pump from the engine when moving parts are to be inspected or replaced.

(*d*) Failure of the pump to function may be due to a leaking valve, gasket or diaphragm, or to a weak or broken spring. After removing the six screws from the pump body, the two main castings may be separated to permit inspection of the interior mechanism. Replace worn or damaged parts with new ones. Inlet and outlet check valves are interchangeable. The inlet check valve is installed with the spring down and the outlet check valve is installed with the spring up. They are held in place by a straddle plate and two screws. Check-valve gaskets must be in place before the check valves are installed.

(*e*) The vertical driving member of the diaphragm assembly hooks under the end of the lever mechanism (fig. 24) and must be disengaged at that point before it can be removed. When installing a diaphragm assembly, hold the body casting in an upside-down position to facilitate engagement of the diaphragm assembly with the hook on the lever.

(*f*) When reassembling, make sure that all gaskets are in place and all screws tight.

(3) CARBURETOR (fig. 23). The carburetor mixes the fuel and air in proper proportion for burning in the engine.

(*a*) *General.* If the engine is not performing correctly, do not hastily assume that the carburetor is at fault. First carefully check the ignition system, valve action, timing, compression, fuel system other than carburetor, fuel, oil, operating temperature, and the load. Only when these items are in normally good condition may the carburetor be properly adjusted. *Do not attemp to compensate for a faulty condition elsewhere by changing the carburetor adjustment. Correct the fault where it exists.*

(*b*) *Servicing.* The carburetor requires little attention other than cleaning and this can be kept at a minimum by using clean fuel and keeping the screens and sediment bowls clean throughout the fuel system. A drain plug and screen at the bottom of the carburetor bowl should be cleaned periodically.

(*c*) *Dismantling.* Remove the carburetor from the engine and dismantle it for a thorough cleaning. Remove the screw plugs, jets, and the idle adjusting screw. Be careful not to lose any of the fibre washers. Clean the jets and passages with compressed air, if available.

(*d*) *Main Nozzle.* Do not remove the main nozzle unless necessary to replace it. It can be cleaned without removing. If a new one is installed, make sure that ony one gasket is used with it and that the diagonally-cut inner end stands in a vertical position when tight (fig.

23). If necessary, a soft copper wire may be used to clean jets and bleed. *Never use an iron or steel wire.* A slight enlargement or distortion of these holes may make it necessary to replace the part. Replace any parts that are damaged or badly worn.

(*e*) *Needle Valve.* Remove the float and inspect the needle valve. If worn, or known to be leaking, install a complete new needle and seat assembly. Shake the float. If it contains gasoline, it leaks. Install a new one.

(*f*) *Float Level.* Check the float level. Hold the cover and float assembly in an upside-down position and allow the float to set at the position determined by its own weight. The vertical distance from the gasket surface of the cover to the float should be 3/8-inch. If measured with the gasket in place, make allowance for the gasket thickness. Take the measurement at the top surface of the float, near the end opposite the float arm. A simple way to take this measurement is to use a sheet-metal gauge 2 or 3 inches long and 11/32-inch wide with parallel edges. When set on edge across the inverted cover with the gasket in place, the float should barely touch the gauge by its own weight. Any change in level adjustment should be made by bending that portion of the float arm which rests against the needle valve. Bend very slightly. Do not roughen or destroy its curvature. Do not stretch the needle valve spring.

(*g*) *Metering Rod.* Do not disturb the position of the metering rod, unless necessary to replace it. In that case, set the new rod at same position. If this rod is set too high, the full load fuel mixture will be too rich. If the rod is set too low, the full load fuel mixture will be too lean.

(*h*) *Pump.* The pump on this carburetor is not required in constant speed service and should be made inoperative by removing the connecting link between the pump arm and the pump plunger rod.

(*i*) *Air Cleaner.* Since a dirty air cleaner may place too great a restriction on the flow of air to the carburetor, always clean it as described in paragraph 42 j when servicing the carburetor. Also, make sure that the choke opens properly.

(4) FUEL LINE. The fuel lines (figs. 3 and 8) require little attention except routine inspection for leaks. Replace leaking fuel lines with new ones.

(5) SEDIMENT BOWL AND STRAINER (fig. 8). The sediment bowl and strainer beneath the fuel tank require periodic cleaning.

n. Cooling System. The performance of an engine is dependent to a great extent upon the proper operation of the cooling system. This system includes the engine water jacket, radiator, connecting hose, circulating pump, thermostat, and the ENGINE WATER TEMPERATURE gauge.

(1) DRAINING SYSTEM. To drain the cooling system, open the drain cock located at the lower right-hand corner of the radiator, directly under the water outlet, also the drain cock at the lower left front corner of the cylinder block.

(2) FILLING THE COOLING SYSTEM. Close the drain cocks on the cylinder block and radiator. Fill the radiator with clean water or, during cold weather, with an anti-freeze solution. Do not overfill the radiator while anti-freeze solution is being used, because the solution expands when heated and an appreciable amount of liquid would be lost through the overflow. The solution should be 1-inch from the bottom of the filler neck. The capacity of the cooling system is 15-1/2-quarts.

CAUTION: Should water be lost from the cooling system and the engine overheat, do not add water immediately but allow the engine to cool, then add water slowly while the engine is running. If cold water is poured into the radiator while the engine is overheated, there is danger of cracking the cylinder block and head.

(3) RADIATOR.

(*a*) *Servicing.* The radiator is designed to cool the water under all operating conditions. However, the radiator core must be kept free from corrosion and scale, in addition to the maintenance of other cooling units, to obtain satisfactory service. At least every 1,000 operating hours, remove the radiator and clean it inside and out in a cleaning solution. At the same time, examine the core for leaks or damaged cells and make any needed repairs. After

the radiator and cooling system have been cleaned and flushed out, use a corrosion preventative. Rust and scale may eventually clog up water passages in both the radiator and water jacket of the engine unless a rust inhibitor is used. This condition is aggravated in some localities by the water available.

(*b*) *Removing Radiator.* To remove the radiator, proceed as follows:

1. Remove the front side panels from the housing and slide the front top plate back.
2. Open the radiator drain cock and drain the radiator.
3. Loosen the top front hose clamp and either of the clamps on the hose connected to the water pump. Disconnect the water outlet elbow after loosening the clamp.
4. Remove the two bolts from the front ends of the front housing top-plate guide rods.
5. Remove the three nuts which hold the fan guard. Bend the top radiator support brackets outward slightly and remove the fan guard.
6. Remove the four bolts which hold the bottom corners of the housing front support to the skids.
7. Remove four bolts from the sides of the housing front support.
8. Tip the front support, with radiator, slightly forward and remove it carefully.
9. Remove the two nuts which hold the bottom of the radiator to the cross-member of the front support.
10. Remove the four nuts from the two top radiator suports and lift the radiator from the support.
11 While the radiator is removed, install any new radiator hose needed, but do not tighten the clamps until all other connections are made after installing the radiator.

(*c*) *Emergency Repairs.* Emergency repairs may be made in the event the radiator is punctured by a bullet or shrapnel. If a tube is not completely severed, cut it or break it off with a pair of pliers, strip the fins from the tubes above and below the break for 1/2-inch or the necessary distance to enable bending of the punctured tube around itself. Flatten the tube both above and below the break, to stop the flow of water.

(*d*) *Use of a Truck Radiator.*

CAUTION: In an emergency, the radiator furnished on truck, model MB, 1/4 ton, 4 x 4, may be used on Power Unit PU-58/G. However the engine will not be as well cooled when using this smaller radiator.

Instructions for installing the truck radiator follow:

1. Remove the radiator No. 254 as instructed in subparagraph (*b*) above.
2. Install the truck radiator on the front housing support, using two wood spacer Blocks No. 244 beneath the radiator to support it at the right height. These spacer blocks are included in the set of mobile spare parts. The radiator studs should pass through the holes in the blocks. Install a brace rod at the top of the radiator to connect it to the front housing support at that point. This brace rod is a 5/16-inch diameter stud, 5-inches long, with a 5/16-18 N.C. thread, 1-1/4-inches long at each end. Use four 5/16-18 hexagon nuts with lockwashers. One end of the brace rod extends through the front housing support, with a nut and lockwasher on each side of the sheet metal of the housing support. The other end extends through the metal lug on the top of the radiator, with a nut and lockwasher on each side of the lug. Tighten all nuts securely.
3. Install the radiator and front housing support on the power unit by reversing the order of procedure used in disassemblying. Tighten the hose clamps last, and inspect the connections for leaks after the radiator is filled. Stop all leaks.

(4) THERMOSTAT. The cooling system is designed to provide adequate cooling under the most adverse conditions; however, it is necessary to employ some device to prevent overcooling during normal operations and to quickly warm up the engine from a cold condition. This is accomplished by use of a thermostat (fig. 9) which is located in the water outlet on top of the cylinder head. The thermostat opening is set by the manufacturer and cannot be altered. The thermostat opens at a temperature of 145° to 155° F. To test the thermostat, heat sufficient water to 170° F and submerge the thermostat. The valve should open to the limit at this temperature. If the valve fails to open, a new thermostat will be required.

(5) ENGINE WATER TEMPERATURE GAUGE (fig. 11). The ENGINE WATER TEMPERATURE gauge is connected to a thermal element in the cylinder head by means of capillary tube. If the gauge becomes inaccurate or inoperative, it should be replaced with a new one including a thermal element and capillary tube.

(6) FAN AND WATER PUMP.

(a) *Description.* The fan and water pump (fig. 48) are mounted on the same shaft. The pump is of the centrifual type and circulates the water in the cooling system.

(b) *Bearing.* The double row ball bearing is integral with the shaft and is packed with a special high melting point grease at the time of manufacture, so it requires no lubrication. The ends of the bearings are sealed to retain the lubricant and prevent dust and dirt from entering.

(c) *Construction.* The bearing is retained in the housing by a retaining wire, which snaps between the bearing and the water pump body. The seal washer has four lugs which fit into the slots in the end of the impeller. One side of the seal washer bears against the ground surface of the pump body and the other against the seal. The rubber bears against the machined surface on the inside of the impeller. The seal maintains a constant pressure against the seal washer and impeller, assuring positive seal. The drain hole in the bottom of the housing prevents any water seepage past the seal washer entering the bearing. The impeller and pulley are pressed onto the straight shaft under 2,500 pounds pressure.

(d) *Dismantling.* Remove the fan belt and fan blade assembly and then the water pump from the engine. Remove the bearing retainer wire. Place the water pump body on an arbor-press face-plate and press the water pump shaft through the impeller and pump body. Remove the seal washer and seal. Place the pump shaft and fan pulley on the press so that the bearing will clear in the opening, and press the shaft from the pulley.

(7) FAN BELT. The fan is driven by a 42° angle V-belt. The outside length is 44-1/8-inches, while the maximum width is 11/16-inch. To install the fan belt, loosen the clamp bolt on the slotted bracket at the idle pulley and move the pulley toward the engine. Slide the belt over the crankshaft pulley, up through the fan blade assembly and over the fan pulley, then over the idle pulley. Adjust the fan belt by moving the idle pulley away from the engine to a point where the fan belt can be depressed 1-1/4 to 1-1/2-inches midway between the fan pulley and the idle pulley (fig. 20).

(8) ANTIFREEZE SOLUTION.

(a) *When Required.* In low operating temperatures, it is necessary to protect the cooling system with some type of antifreeze solution to prevent damage from freezing.

(b) *Alcohol.* When alcohol is used in an antifreeze solution, care must be taken not to spill any of the solution on the finished portions of the housing. If so spilled, it should be washed off immediately with a good supply of cold water, without wiping or rubbing. The evaporating point of a water and alcohol cooling solution is approximately 170° F. If the surrounding temperature starts to rise, check the solution frequently with a hydrometer as there may be considerable loss of alcohol through evaporation, thus raising the freezing point of the solution. This in turn may cause damage to the cooling system due to freezing.

(c) *Ethylene Glycol Solution.* Ethylene glycol antifreeze solutions have a higher point of distillation than alcohol and consequently may be operated at higher temperatures without loss of the solution through evaporation. Ethylene glycol has the further advantage that, in a tight system, only water is required to replace evaporation losses. However, any solution lost mechanically through leakage or foaming must be replaced by additional new solution.

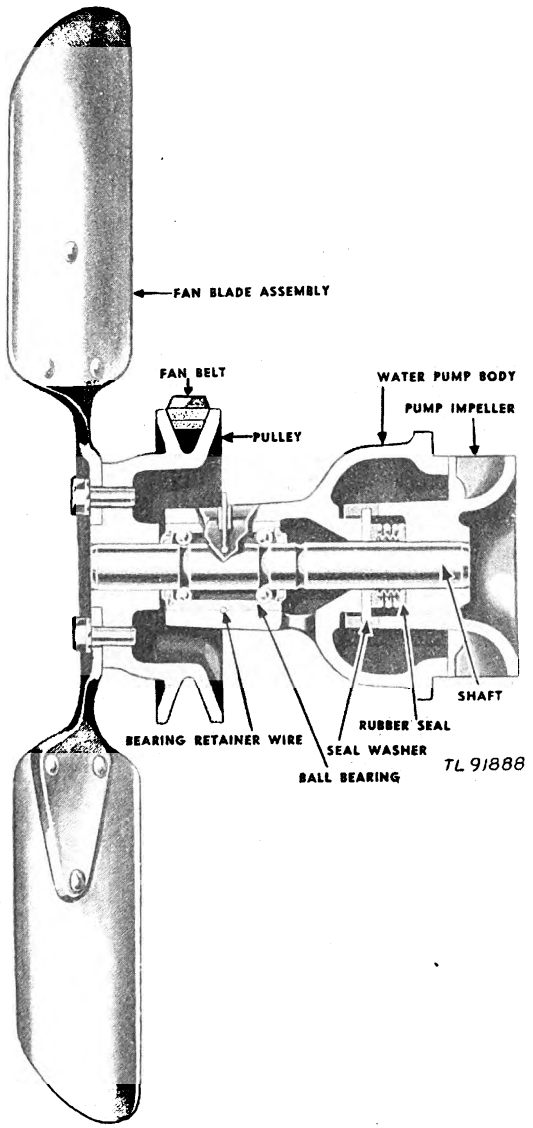


Figure 48. Cross-section of fan and water pump.

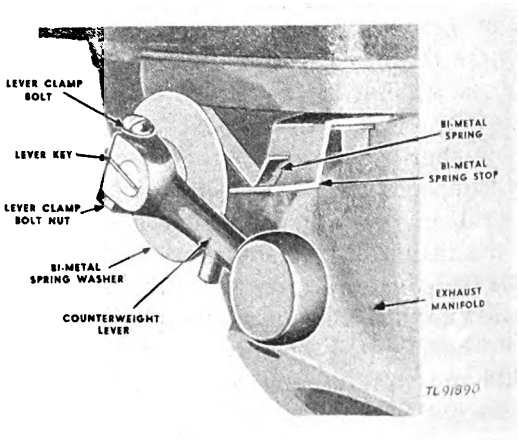


Figure 49. Heat control valve.

o. Exhaust System.

(1) EXHAUST AND INTAKE MANIFOLDS.

(*a*) *Description.* The exhaust and intake manifolds make a unit in which the hot exhaust gases are thermostatically controlled and directed around the intake manifold to assist in vaporizing the fuel when the engine is cold, thereby aiding in warming up the engine and reducing oil dilution. It also minimizes the use of the carburetor choke control and results in proper temperature of the incoming gases under all operating conditions.

(*b*) *Function.* When the engine is cold, the counterweight lever closes the heat control valve and directs the hot exhaust gases against the intake manifold (figs. 4 and 49). As the engine warms up, the bimetal spring expands and opens the valve directing the exhaust gases into the exhaust pipe.

(*c*) *Servicing.* All parts are replaceable but little servicing is required. When assembling the manifolds to the cylinder block, new gaskets should be installed and the nuts drawn up evenly until they are all tight to avoid gas leakage. The torque wrench reading should be 31-35 foot-pounds.

(*d*) *Use of Truck Manifold.* In an emergency when the correct intake manifold, No. 40, is not available, an intake manifold assembly, used on truck, model MB, 1/4 ton, 4 x 4, may be used on Power Unit PU-58/G. The latter manifold is larger and the operation will not be as smooth while using it.

(2) MUFFLER. The exhaust manifold is connected by steel tubing to the muffler outlet at the upper center part of the housing. Additional exhaust tubing may be connected at the outlet to carry the exhaust gases away from the power unit.

CAUTION: Do not operate the power unit inside a closed room without first connecting an exhaust line to carry all exhaust gases out-of-doors. Exhaust gases are poisonous and may cause death.

(3) SERVICING EXHAUST SYSTEM. If the exhaust system becomes clogged with carbon, it will create a back pressure on the engine that will prevent its developing full power, and will cause combustion chambers and valves to become covered with carbon to the extent that a carbon removal and valve grinding job will become necessary. Keep the exhaust system free of excessive carbon. Keep all joints tight. If the flexible pipe leaks, replace it.

(4) USE OF TRUCK MUFFLER. In an emergency the muffler, as used on truck, model MB, 1/4 ton, 4 x 4, may be adapted for use on Power Unit PU-58/G.

(*a*) Saw off the inlet and outlet tubes of the truck muffler even with the ends of the muffler proper. Because of the recesses in the muffler ends, this will leave about 1/2-inch of tube protruding from the muffler at each end.

(*b*) Center a standard 1-1/2-inch pipe nipple, at least 3-inches long, in a lathe chuck. Cut off the protruding end of the nipple so the piece remaining in the chuck is 1-7/8-inches long. Then, with the pipe nipple in the chuck, bore it to a diameter of 1.750-inches and to a depth of 0.500-inch. Remove the pipe nipple from the chuck and place it on the protruding 1/2-inch of tubing on the muffler inlet. See that it fits snugly over the tubing and sets against the end of the muffler. Make a strong, tight joint by welding entirely around the fitting where it meets the end of the muffler.

(*c*) Install a threaded connection at the outlet end of the muffler in the same manner, using for this purpose a standard 1-1/4-inch pipe nipple at least 3-1/2-inches long, cut to a length of 2-1/16-inches. Bore it to a diameter of 1.531-inches and to a depth of 0.500-inch.

(*d*) Remove the original muffler and install the modified truck muffler in its place.

(*e*) Connect the muffler outlet to whatever exhaust line is used, making use of standard pipe fittings to assure gas-tight connections.

p. Ignition Unit.

(1) BREAKER CONTACTS. The breaker contacts in the ignition unit (fig. 10) eventually become pitted and must be replaced. When not too badly pitted, they may be resurfaced by means of a carborundum hone. They must be removed to do this. Surfaces should be finished to a slightly convex form, almost flat. When properly adjusted they must open 0.020-inch and when closed they should contact at the central areas of their surfaces. Spring tension is adjustable and should be between 17 and 20 ounces, measured at the con-

tact of the breaker arm just as the contacts separate.

(2) CAPACITOR. If the spark is weak and the breaker contacts are badly burned and have a sooty appearance, a new capacitor is probably required. The capacitor may fail without such symptoms. The capacitance should be between 0.18 and 0.26 microfarads. If the capacitance is outside of these limits, the capacitor should be replaced.

(3) CAP AND ROTOR. Keep the distributor cap and rotor clean. If the cap is cracked, shows evidence of arcing, or has corroded contacts, replace it with a new one. Replace the rotor when burning has shortened it. This may be evidenced by a burned condition on top of the strip.

(4) GOVERNOR. Check the governor for free operation. Hold the distributor shaft and turn the cam to the left as far as it will go. Then release it. The cam should return immediately to its original position with no drag or restriction. Inspect the distributor shaft bearing in the housing. Also inspect the shaft friction spring on the end of the shaft which is inserted into the coupling on the oil pump shaft. If the friction spring is damaged, replace it.

(5) TIMING. Ordinarily, the timing of the ignition unit should not be disturbed. If, however, it should become necessary to re-time the unit after having removed it, the following procedure may be followed.

(*a*) Remove the cover from the timing hole on the flywheel housing (fig. 41). Crank the engine slowly with the hand crank until No. 1 piston is coming up on compression. Stop when the ignition timing mark IGN on the flywheel appears in the center of the timing hole in the flywheel housing.

(*b*) Place the distributor arm of the rotor in line with No. 1 tower of the distributor cap so that the breaker contacts are just opening. Set the unit in place on the engine and turn the rotor shaft slightly, as necessary, so that the driving lug on the end of the shaft engages the slot in the drive coupling. Then push the unit down and install the holddown screw. Rotate the case until the contacts are just breaking, then lock it in place by tightening the clamp screw. Complete the assembly. Start the engine and recheck the timing with a neon timing light, if available. The correct timing depends somewhat on the fuel used and should be set at the point at which the constant full load voltage is highest. A further test is to switch from no load to full load at once. If there is a pinging knock during acceleration, retard the spark just enough to eliminate it. Final adjustment is made by loosening the clamp screw and turning the unit slightly, as necessary. Tighten the screw. Install the timing hole cover.

q. Spark Plugs. Keep the spark plugs clean and properly adjusted. When porcelain cracks or becomes badly eroded, or when electrodes are badly burned, install new spark plugs of the same type. Set the gap between electrodes at 0.030 inch. When installing, make sure the gaskets are in place and tighten the plugs securely.

r. Battery. The battery requires certain routine attention. Follow the battery manufacturer's instructions when available, otherwise check as follows:

(1) Keep the water level about 3/8-inch above the plate separators. Use distilled water, clean rain water that has not been handled in metallic containers, or water known to be harmless to batteries. Avoid overfilling. Never allow the water level to recede below the tops of the separators.

(2) Keep the top of the battery and the terminals clean. A coating of petroleum jelly on the terminals helps prevent harmful corrosion.

(3) Keep the battery in a fully charged condition. If allowed to remain in a low state of charge, sulphation of plates will reduce the capacity and greatly shorten the life of the battery. A discharged battery will freeze at 20° F.

53. REASSEMBLY OF ENGINE PARTS AND ACCESSORIES.

a. Installing the Engine. Disassembly information may be found in paragraph 52.

(1) Lower the engine carefully into the skids by means of a hoist. Place substantial blocking under the rear of the oilpan to support the engine about 1/2-inch above its normal position. While still attached to the hoist, install the front engine support bolts loosely. Remove the hoist.

(2) Install the generator by reversing the procedure of disassembly and giving particular attention to the instructions contained in paragraph 54 **b.**

(3) Install the front housing support and radiator by reversing the procedure of disassembly.

(4) Connect the exhaust pipe to the manifold, using a new gasket and tightening the nuts securely.

(5) Install the electric choke control rod.

b. Valve Guides. After removing and servicing the valve guides (par. 52 **c**), reassembly should be performed as follows:

(1) When reassembling valve springs and retainers in the engine, make sure that the closed coils are up against the cylinder block (fig. 50). Then install the valves, each in its proper seat. Using a valve spring compressor, raise the valve springs on those valves which are in closed position and insert the valve spring locks with a valve-key inserting tool. If no key-inserting tool is available, hold the keys in place by sticking them to the valve stem with grease. Crank the engine until other valves are closed and install the remaining keys.

(2) Adjust the valve-tappet-to-valve-stem clearance to 0.014-inch (fig. 50). Remove cloth or waste from the valve chamber.

(3) Clean the top of the block and pistons of any foreign matter and install the cylinder head gasket. Clean the carbon from cylinder head and wipe off all foreign matter, then install it over the studs on the cylinder block. Install the oil filter bracket. Install the cylinder head cap screws and nuts bringing them down finger-tight, then with a tension wrench tighten the cylinder head screws and nuts in sequence (fig. 21), tightening screws to 65 to 75 foot-pounds or 780 to 900 inch-pounds, and the nuts to 60 to 65 foot-pounds or 720 to 780 inch-pounds.

(4) Clean and adjust the spark plugs, setting the electrode gaps at 0.030-inch. Install spark plugs in cylinder head to prevent any foreign matter from entering the combustion chamber during the remaining operations. Be sure to install spark plug gaskets.

(5) Install manifold with new gaskets. Install manifold clamp washers with convex surface toward manifold. Install manifold nuts, drawing them up tight. Install exhaust pipe to manifold with new gasket.

(6) Install governor, adjust governor belt tension, and connect governor oil supply line.

(7) Overhaul and recondition carburetor. (See instructions par. 52 **m** (3).) Install carburetor to manifold and attach controls. Install air cleaner horn and tube.

(8) Recondition the ignition unit and set the ignition timing in accordance with instructions in paragraph 52 **p.** Make sure when installing the distributor assembly in the crankcase that it fits into the crankcase properly. Install and connect the ignition resistor.

(9) Install the upper radiator hose and all line connections. Close radiator drain cock and fill the radiator with water or anti-freeze solution as required. Arrange the end of the governor oil return tube so that returning oil will enter the crankcase through one of the three holes in the valve spring chamber. Start the engine and allow to run without load for 5 or 10 minutes. Then stop it and recheck the tappet clearances.

(10) If necessary, install new valve spring cover gasket (shellac to cover). Install cover to engine block. Clean crankcase ventilator tube and screen and reinstall with gaskets.

(11) Install the governor oil return tube.

(12) Start the engine. After it reaches normal operating temperature, make any speed adjustment needed to provide correct frequency as shown by FREQUENCY METER.

c. Camshaft and Valve Tappets. To reinstall the camshaft and valve tappets, after referring to paragraph 52 **d,** proceed as follows:

(1) Install valve tappets and tie up in place with string. Install camshaft. Install camshaft thrust washer.

(2) Set the valve timing. (See instructions given in paragraph 52 **e**).

(3) Install oil pump. (See instructions in paragraph 53 **e**).

(4) Install the plunger and spring in the front end of camshaft with round end out. Inspect pin in timing chain cover to see that it stands perpendicular to the cover face. Put a light

smear of cup grease on the end of the pin and on the end of the plunger, then assemble the cover to the engine.

(5) Complete the reassembly by reversing the operations used for removal of the camshaft.

d. Reassembling Connecting Rod to Piston. (1) PISTON CLEARANCE. The clearance of the piston in the cylinder bore is 0.003-inch. Check clearance with 0.003-inch feeler gauge 3/4-inch wide. Feeler gauge should have from 5 to 10 pounds pull when being removed. The gauge should extend the entire length of the piston on the thrust side which is the opposite side from the T-slot in the skirt. If it is ever found necessary to install an over-size piston, the cylinder bore must be honed with a regular cylinder-honing tool and the manufacturer's instructions should be carefully followed to get a true straight cylinder. *Do not try to lap in a new piston by using compound because it will ruin the tin plating on the piston and cause a scoring or wiping condition on both the piston and cylinder walls. Refer to paragraph* 52 **h**, *cylinder bores and cylinder boring.*

(2) PISTON RINGS.

(*a*) The width of the compression rings is 3/32-inch. The width of the oil control ring is 3/16-inch. The upper compression ring is installed with the inside beveled edge up. The face of the lower compression ring is tapered 0.005-inch. The letters TOP on the upper edge of the ring indicate how the ring is installed (fig. 51).

(*b*) When fitting the rings to the cylinder bores, the end gap is 0.008-0.013-inch (fig. 52). When fitting piston rings to grooves (figs. 53 and 54) give them the following clearances: compression rings, 0.0005-0.001-inch; oil rings, 0.001-0.0015-inch. Oversize rings are available in the following sizes: 0.010-inch, 0.020-inch, 0.030-inch. Use standard rings up to 0.010-inch oversize cylinder bores.

(3) REASSEMBLY. (For a description of connecting rods and pistons, see paragraph 52 **g**).

(*a*) Clamp the connecting rod in a vise, using vise-jaw protector shields of a soft metal, or two pieces of hardwood, on each side of connecting rod and 3 inches from the piston-pin end.

(*b*) Start the piston pin into the piston with the groove facing down. Assemble the piston to the connecting rod with the slot in the piston (fig. 46) opposite the oil spray hole in the bearing end of the connecting rod. Install the piston pin clamp screw.

(*c*) Center the piston on the pin and place assembly on connecting rod aligning fixture. Tilt piston to left, with piston resting against surface plate. With a feeler gauge, measure the clearance between the piston skirt and surface plate. Tilt piston to right and check clearance. If clearance is within 0.003-inch on both left and right positions, the connecting rod is in alignment. A difference greater than 0.003-inch indicates connecting rod is twisted.

e. Oil Pump Reassembly.

When replacing the oil pump on the engine, the following procedure should be followed in order to have correct timing for the ignition. Set No. 1 piston coming up on the compression stroke, then turn the flywheel so that the timing mark IGN appears on the flywheel in the center of the hole in the flywheel housing on the left-hand side (fig. 41). Set the distributor rotor at the No. 1 terminal tower in the distributor cap, with breaker contacts just breaking. Hold the oil pump in one hand with the oil relief valve spring retainer in the same position as it would be when installed in the engine; turn the shaft so that the wide side of the slot in the driven-gear end is toward you, then line up the pin which holds the driven-gear to the shaft so that it will fall in line with the right side of the slot in the pump body. Slide the assembly onto the studs in the crankcase and feed the gear slowly into the camshaft gear. Note when fully set, if the rotor on the distributor has moved from its original setting. If it has, remove the oil pump and turn one tooth to obtain the correct setting.

f. Flywheel Reassembly. If a new flywheel has a pilot bushing, refer to paragraph 52 **j** (2). (1) REASSEMBLING. When reassemblying the flywheel to the crankshaft, be sure it is properly installed in relation to the No. 1 crank throw, as indicated by the timing marks, and that it fits properly to the crankshaft flange to avoid runout or looseness. To check runout, use a dial indicator attached to the rear engine plate. The runout should not exceed 0.008-inch

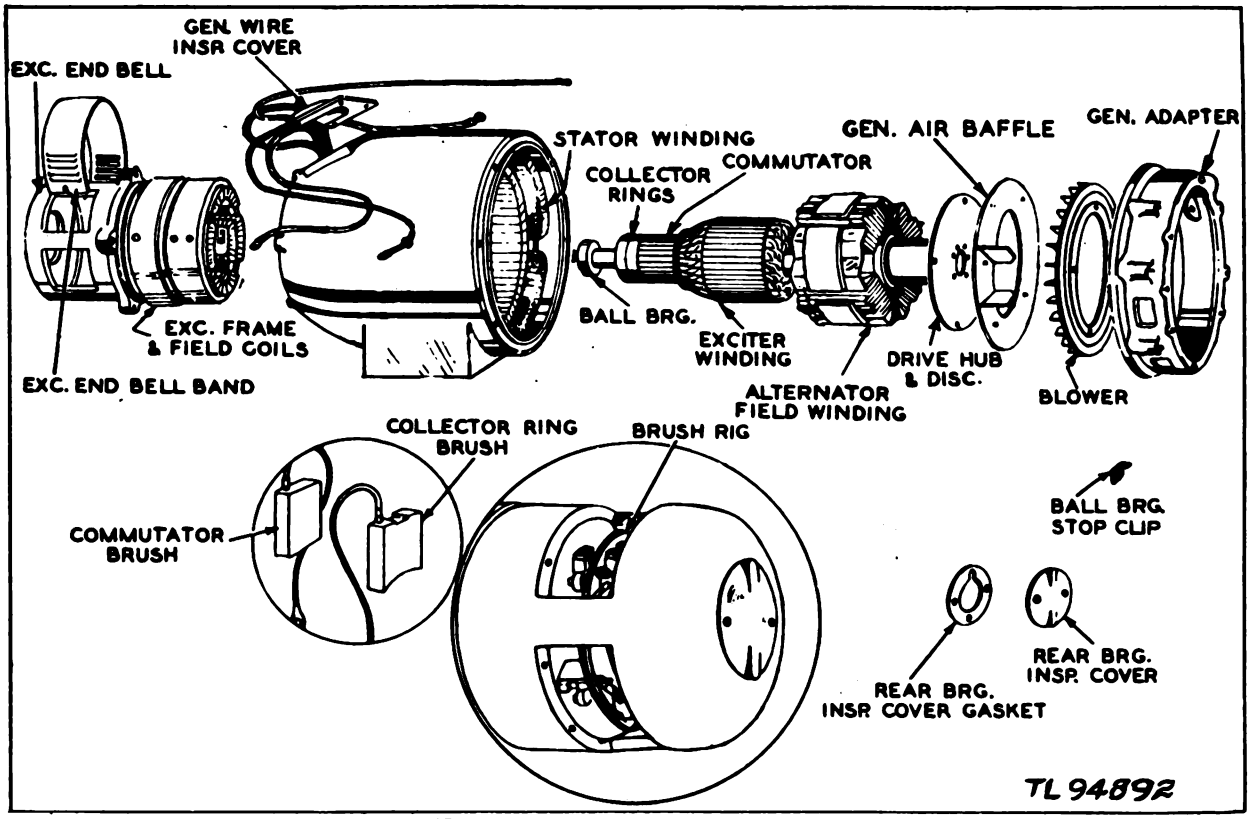


Figure 55. Generator assembly.

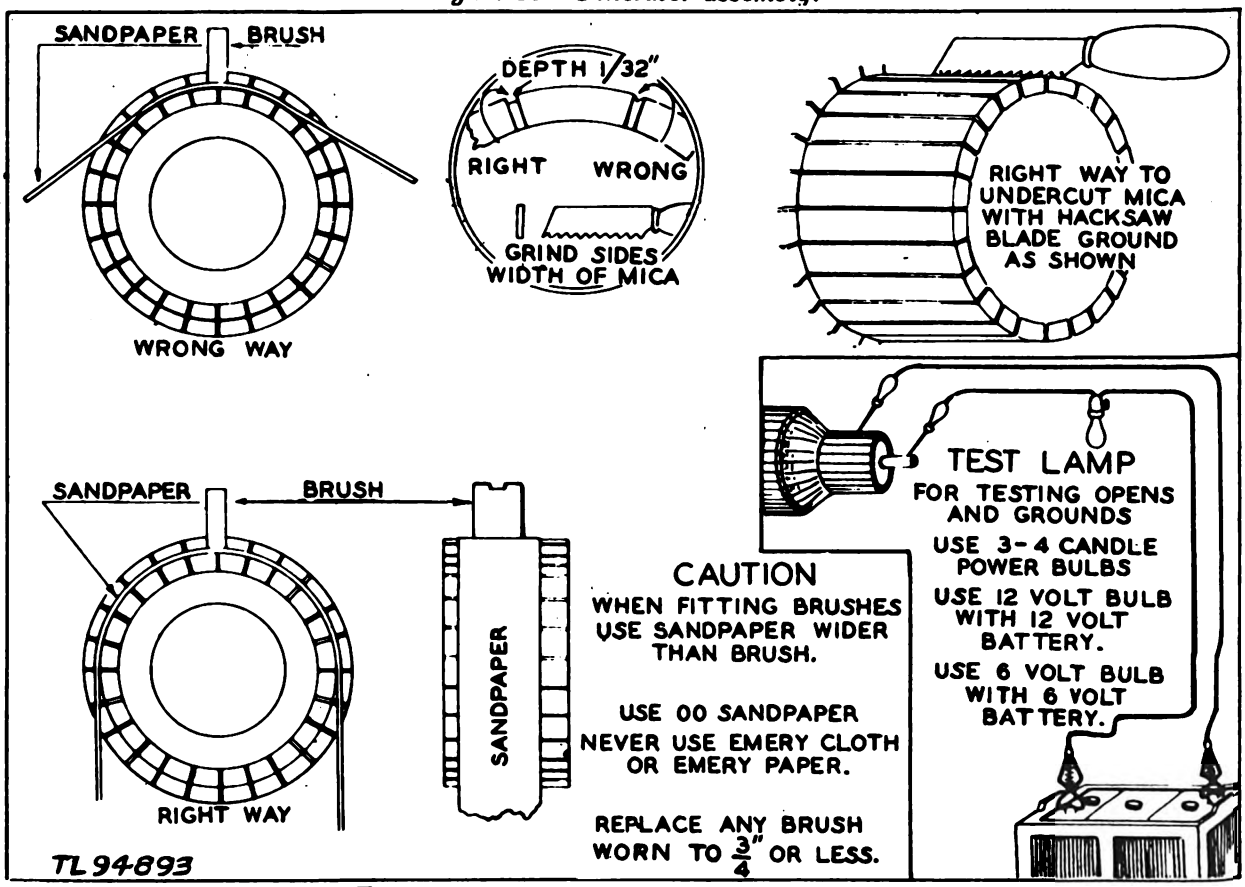


Figure 56. Care of commutator and brushes.

on the rear face near the rim. The torque wrench reading should be 35-40 foot-pounds.

(2) INSTALLATION IN THE FIELD. When installing a new crankshaft or flywheel in service, it is the general practice to replace the tapered dowel bolts with straight, snug-fitting bolts. Assemble the crankshaft and flywheel in proper relation, then install the straight bolts previously used and tighten securely. Next, use a 35/64-inch drill to enlarge the tapered bolt holes. Then ream the holes with a 9/16-inch straight reamer and install two flywheel-to-crankshaft bolts No. 80B with two 1/2-20 hexagon nuts and two 1/2-inch lockwashers, instead of the two dowel bolts formerly used. This procedure overcomes the difficulty in correctly tapering the holes in the field.

g. Fan and Water Pump.

To reassemble the water pump, install the long end of the shaft in the pump body from the front end until the outer end of the bearing is flush with the front end of the pump body. Dip the seal and the seal washer in brake fluid and install in the impeller. Place the impeller on an arbor press and press the long end of the shaft into the impeller until the end of the shaft is flush with the impeller. Support the assembly on the impeller end of the shaft and press the fan pulley onto the shaft so that the end of the shaft is flush with the face of the fan pulley. Move the shaft in the pump body so the grooves in the bearing and pump body line up, and install the bearing retaining wire. Install the fan blade assembly with the spacer.

54. EXCITER AND ALTERNATOR REPAIRS.

The term "generator" is used to designate the complete assembly comprising the alternator and exciter, with its accessory equipment such as brushes, brushholders, and bearings.

a. Routine Servicing.

(1) BRUSH INSPECTION. Remove the cover from the exciter every 200 operating hours and inspect the commutator collector rings, and brushes. Make sure that brushes move freely in holders and have uniformly good spring tension. Correct spring tension is 14.5 to 19.5 ounces for the slip ring brushes; 30 to 40 ounces for the exciter brushes, when the end of the spring is even with the top of the brush holder. Replace any brushes worn to less than 3/4-inch length (fig. 55).

(2) SANDING BRUSHES. Sand new brushes to a good seating contact. This may be done by drawing a strip of No. 00 sandpaper around the commutator, sanded side out, while the brush rests on the sanded surface of the paper with normal spring tension (fig. 56). Make sure that the sandpaper contacts a large area of the commutator in both directions from the brush. Draw the sandpaper in the normal direction of armature rotation. Raise the brush for the return stroke. Repeat until a proper seating surface is obtained. Slip ring brushes are sanded in the same manner.

(3) COMMUTATOR. The commutator acquires a mahogany-colored surface after being in service a short time. If smooth, this surface requires no attention. Slight roughness may be improved by holding a piece of No. 00 sandpaper against the surface while the engine operates slowly. Brushes should be lifted in holders while doing this operation. A badly worn, burned, or pitted commutator will require refinishing in a lathe. After refinishing the commutator, or whenever the copper has worn down flush with the mica insulation which is between the bars, the mica must be undercut 1/32-inch These operations should not be attempted by unauthorized personnel.

(4) NEUTRAL POSITION OF EXCITER BRUSHES. The edge of the exciter brush ring has a small indentation that coincides with the edge of the upper right supporting boss when the ring is in proper neutral position. This spot is marked with white paint on both the ring and the support boss. This setting of the brush ring in neutral position should be maintained (fig. 57).

(5) SLIP RINGS. The slip rings require the same attention as the commutator except that there is no mica to be undercut.

(6) CLEANLINESS. After servicing the commutator, slip rings and brushes, blow the sand, copper, and carbon dust from the generator.

(7) GENERATOR BALL BEARING. Every 3 months, or 500 operating hours, whichever occurs first, remove the cover from the generator end bell. Clean the old grease from the bearing recess and repack with an approved ball bearing lubricant. Do not use common hard

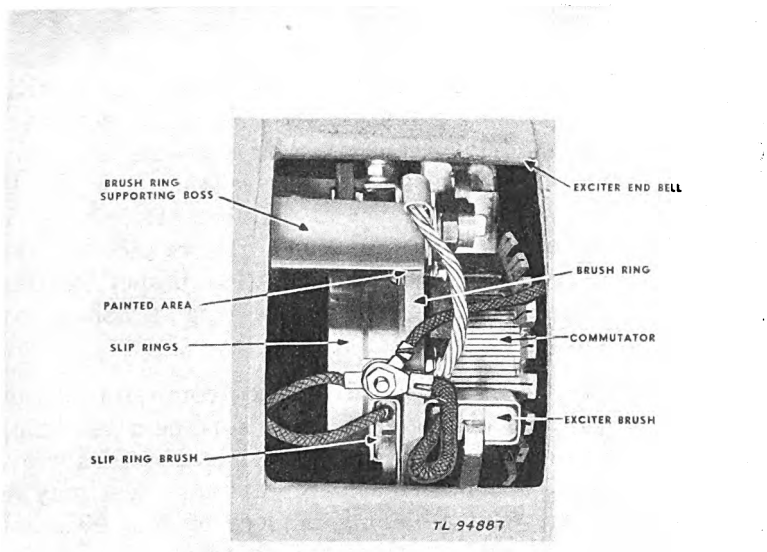


Figure 57. Neutral position of exciter brushes.

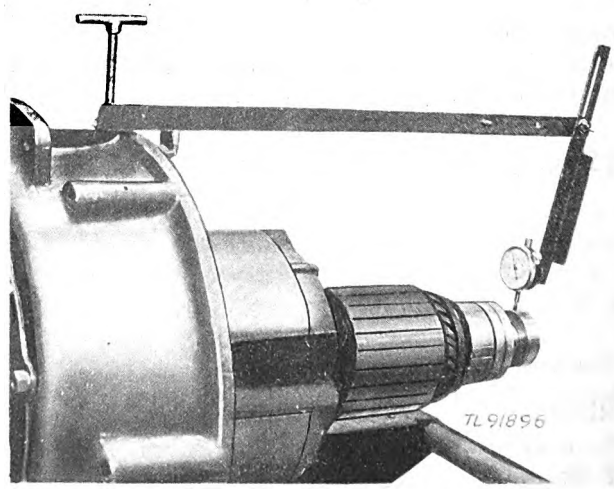


Figure 58. Checking rotor alignment with dial gauge.

oil. Replace the cover, using a new gasket, if needed. Be sure the retaining clips which hold the outer race of the ball bearing from turning in the end bell are in place.

b. Major Servicing. Replacement of exciter field coils, rotor or stator (fig. 28) require removing major parts of the generator. The housing superstructure must be removed before such major servicing of the generator can be done.

(1) REMOVING HOUSING SUPER-STRUCTURE. When it becomes necessary to remove a major part of the generator, the housing superstructure must be removed. It is best to remove it as a complete assembly, using the following schedule of operations:

(*a*) Disconnect all wires leading from the power unit.

(*b*) Remove the side and top panels from the housing. To remove the front top panel it will be necessary to remove the bolts by which the retaining chains are attached to the panel.

(*c*) Disconnect the positive battery cable at the battery.

(*d*) Remove two hexagonal nuts from the top edge of the control panel and tip the panel out and down to a horizontal position.

(*e*) Disconnect from the panel the bond strap extending from the exciter end bell. Disconnect the four main generator leads at the a-c terminal block.

(*f*) Disconnect from the panel the voltage regulator leads marked A1 and F2 at the bottom center terminal block.

(*g*) Disconnect wire No. 32 from the fibre terminal post mounted under the solenoid starting-switch bracket on left side of the center housing support.

(*h*) Disconnect wire No. 33 from the left-hand terminal of the solenoid starting switch.

(*i*) Disconnect wire No. 36 from the top rear terminal of the ignition coil.

(*j*) Remove six-prong plug from socket on the auxiliary control assembly.

(*k*) Disconnect the wire from the electric choke.

(*l*) Disconnect the oil pressure gauge line at the fitting on right-hand base of engine block.

(*m*) Remove wire clip around oil pressure gauge line from top side of generator housing.

(*n*) Open the radiator drain cock and drain the radiator. If the cooling system contains an antifreeze or a rust inhibitor, the liquid should be drained into a clean container and saved for re-use.

(*o*) Remove the thermal element from the left side of the cylinder head. To do this, remove only the smaller of the two brass hexagonal nuts. Disconnect the bond strap from the capillary tube. Lay the thermal element back in the right side of the housing, being careful to avoid making a sharp bend or kink in the capillary tube.

(*p*) Close the two-way shut-off valve beneath the main fuel tank by turning the valve handle to the rear. Disconnect the fuel line at the sediment bulb. If an auxiliary fuel line is used, disconnect it at the end near the two-way valve.

(*q*) Remove the two wire clamps from right side of the lifting yoke.

(*r*) Remove tool box.

(*s*) Remove the short, right, top-plate guide rod. Remove the bolt from the rear end of the left, top-plate guide rod.

(*t*) Remove the eight bolts which hold the rear super-structure to the skids and center housing supports.

(*u*) Check to see that all necessary disconnections have been made.

(*v*) Lift the rear super-structure completely away.

(2) REMOVING EXCITER FRAME. After the housing super-structure has been removed, the exciter may be removed. Proceed as follows:

(*a*) Remove the cover band from the exciter. Lift all brushes high in their holders and set the ends of the springs against them to hold them high.

(*b*) Remove the end bearing cover from the exciter end bell. Remove the screw and lock which hold the outer race of the ball bearing from turning.

(*c*) If the entire generator frame is to be removed, omit the next three operations and proceed to subparagraph (3) below.

(*d*) Disconnect the shunt field lead near the upper left exciter brush holder, and the series field lead near the lower brush holder.

(*e*) Remove the cap screws which hold the exciter to the generator frame. Remove the end bell.

(*f*) If the exciter field assembly is to be removed, first remove the outlet cover from the top of the generator frame, untape the group of lead wires and separate the exciter series field lead from the four a-c leads. Then the exciter frame may be removed. It may be tapped on either side with a lead hammer to break the joint. Then insert small prying bars in the joint at opposite sides of the frame and complete the removal.

(3) SUPPORTING THE ROTOR. After the end bell or the complete generator frame is removed, the rotor has no rear support and care must be used to avoid placing any weight on this exposed end. At whatever stage the disassembly is stopped, place wood blocking under the bearing end of the rotor shaft to carry the weight of the rotor (fig. 28). To leave it unsupported for a considerable time may result in distorting the shaft. Do not put blocking under the commutator or slip rings.

(4) REMOVING THE GENERATOR. After the housing super-structure has been removed, the alternator frame may be removed (fig. 6). This may be done without removing the exciter from the generator frame, if desired. Proceed as follows:

(*a*) Remove the cover band from the exciter. Lift all brushes high in their holders and set the ends of the springs against them to hold them high.

(*b*) Remove the end bearing cover from the exciter end bell. Remove the screw and lock which hold the outer race of the ball bearing from turning.

(*c*) Loosen, but do not remove, the two front engine support bolts. Loosen the upper radiator hose connections.

(*d*) Remove the four bolts which attach the generator mounting base to the skids.

(*e*) Remove the screw from the top of the generator frame and screw in an eye bolt with which to lift the generator. The thread is 1/2-13.

(*f*) Remove the two nuts from the U-bolt at top of lifting yoke. Remove the two bolts from bottom of lifting yoke. Remove yoke.

(*g*) Attach a hoist to the eye bolt and raise the generator about 1/2-inch. Then place substantial blocking under the generator adapter ring so as to support the rear end of the engine after the generator frame is removed. Lower the weight onto the blocking and make sure there is sufficient blocking to hold the generator supports about 1/4-inch off the skids. Be careful not to so raise the generator that damage may be caused to the connections at the front of the engine or to jam the fan against the radiator core.

(*h*) Again support the weight of the generator by means of the hoist, but do not raise the adapter ring from the blocking.

(*i*) Remove the nuts from the studs which hold the generator frame to the adapter housing. Slide the generator frame assembly to the rear until it clears the rotor assembly. Be careful that the frame assembly does not ride on the rotor assembly as it is being removed.

(*j*) If the rotor assembly is not to be removed, support the bearing end of the rotor on blocks just sufficiently high to carry its weight without distorting the shaft.

(*k*) If the rotor is to be removed, attach a rope around the shaft near each end of the assembly and support its weight with a hoist. Then remove the cap screws which attach the drive flange to the flywheel. Remove the rotor assembly from the flywheel, care being taken not to damage the pilot which sits in a recess in the engine flywheel.

(*l*) If the adapter ring is to be removed, place blocking under the rear end of the engine, ahead of the adapter ring so as to support the weight of the engine. Then remove the blocks from under the adapter ring. Remove the bolts which attach the adapter ring to the engine. Slide the adapter ring back until free of the engine.

(5) ASSEMBLING GENERATOR TO POWER UNIT.

(*a*) Reassembly is accomplished by a reversal of the operation used in disassembly. Use care. Be certain that all contact surfaces between parts are clean before fitting together. Tighten all nuts, screws, and connections securely. Use lockwashers in all places where they were used originally, preferably new lockwashers.

(*b*) After tightening the cap screws which attach the rotor drive flange to the flywheel, use a dial gauge (fig. 58), and check the alignment of the rotor. The run-out should not exceed a total of 0.010-inch. To correct excessive run-out, turn by means of hand crank until high side is up. Grasp the end of the rotor in both hands and push downward, but not too forcibly. Then test again. Repeat until total run-out as shown by dial gauge is within 0.010-inch. Loosening and re-tightening the cap screws may help to correct excessive run-out.

(*c*) Be sure to install the rear bearing lock, fitting it into the slot in the bearing race. Pack the bearing housing 1/3 full of approved ball-bearing lubricant before installing cover. Tighten the front engine mounting bolts and the hose clamps. Before starting the engine, check the assembly carefully to make sure no operation has been omitted.

(6) TESTING WINDINGS.

(*a*) *General.* Most of the following testing instructions may be used without disassembling the generator. In each instance where an exciter armature winding or an alternator field winding tests open-circuited, short-circuited, or grounded, the practical repair is to install a new rotor assembly. If a stator winding tests open-circuited, short-circuited or grounded, the practical repair is to install a new stator winding assembly unless the trouble is in the leads outside the winding proper. The rotor windings and the stator windings can be successfully repaired only by a competent rewinding shop. The tests require the use of a 6-volt battery, a 3 or 4 candlepower, 6-volt lamp and socket, two test prods and the necessary connecting wire (fig. 56). Certain tests require a d-c voltmeter. Before starting the tests, remove the cover from the exciter, lift all brushes high in their holders and set the ends of the springs against them to hold them high. Then disconnect the four stator winding cables from post Nos. 1, 2, 3, and 4 of the a-c terminal block. (See wiring diagrams, figs. 33 and 34). Tag the cables so as to avoid error in replacing them. In using test prods, make sure that good electrical connection is made at points of contact.

(*b*) *Testing Stator Windings for Ground* Touch one test prod to the stator frame. Touch the other prod to cable terminal No. 1. If the lamp lights, the stator winding is grounded. Touch one prod to the stator frame and the other to terminal No. 3. If the lamp lights, that stator winding is grounded. Inspect the cables throughout their lengths, since it is possible that the ground may be in the cable instead of the winding. If so, tape the defective section of the cable with several layers of half-lapped rubber tape, then with two layers of friction tape. If the ground is in the winding proper, the winding assembly will have to be replaced.

(*c*) *Testing Stator Windings for Open-Circuit.* Touch one test prod to cable terminal No. 1 and the other to No. 2. If the lamp does not light, that winding is open circuited. Repeat the test, sticking the prods through the cable insulation and into the copper of the cables near the two terminals instead of touching the terminals. If the circuit does not open on this test but tests open when contact is made at the terminals, it indicates that a terminal is loose on its cable. Sweat it on securely with solder. Test the other stator windings similarly by touching the test prods to cable terminals Nos. 3 and 4.

(*d*) *Testing Stator Windings for Short-Circuit.* Touch one test prod to terminal No. 2 and the other to terminal No. 3. If the lamp lights, the two windings are shorted together. Connect terminal No. 2 to No. 3. Connect terminal No. 1 to one terminal of the 6-volt battery. If there is a large flash or spark, both windings are short-circuited, and the No. 4 terminal should not be held in contact with the battery terminal. If there is only a small spark, connect No. 4 terminal with the battery. Then, with a good d-c voltmeter, capable of registering with reasonable accuracy voltages from 0 to 8 volts, take voltage readings between terminals No. 1 and 2 and between terminals No. 3 and 4. Both readings should be almost exactly the same, one-half the battery voltage. If one reading is much higher than the other, the winding with the low reading is short-circuited. If tests indicate a short-circuit, inspect the cables throughout their lengths. If the short-circuit is due to damaged cable insulation, wrap the damaged sections with several layers of half-lapped rubber tape and then with two layers of friction tape. If the short-circuit is in the winding proper, install a new stator winding assembly.

(*e*) *Testing Alternator Field Winding for Open-Circuit.* Touch one test prod to each collector ring. If the lamp does not light, the field circuit is open-circuited.

(*f*) *Testing Alternator Field Winding for Short-Circuit.* If a considerable number of turns in one coil are short-circuited, that coil will run cooler than other coils which are in good condition. Grounds at two points in the winding would short-circuit the intervening portion and the winding would test grounded.

(*g*) *Testing Rotor Windings for Ground.* Touch one test prod to the rotor shaft and the other to a collector ring. If the lamp lights, the alternator field winding is grounded. Touch one test prod to the rotor shaft and the other to the exciter commutator. If the lamp lights, the exciter armature winding or the commutator is grounded.

(*h*) *Testing the Exciter Armature for Open or Short-Circuit.* This test requires the use of an armature growler after first removing the exciter frame. However, if there is a short-circuit or an open-circuit in either the winding or the commutator, the armature usually will test defective on the following simple test. Use a 1-foot piece of No. 10, or larger, stranded, insulated copper wire. There must be many small strands. Remove the insulation 1/2-inch at each end and spread the strands like the bristles of a flat brush. With the exciter brushes raised and the engine running at normal speed, hold one end of the test wire against the sharp edge, not the brush surface, of the commutator approximately midway between two adjacent brushes. Pass the wire over one brush and into the next space between the two adjacent brushes. Touch this end of the test wire similarly against the sharp edge of the commutator midway between brushes. If the armature is in good order, a heavy short-circuit current will build up quickly and result in a heavy flash at one or both points of contact. Do not maintain the contact after the flash. If no flash develops at once, move the ends of the test wire back and forth along the sharp edge of the commutator, hunting for the correct points of contact, which will be near the centers of the spaces between brushes. If no flash can be developed, the armature is defective and must be replaced or repaired.

(*i*) *Testing Exciter Field Windings for Grounds.* Disconnect the shunt field lead near the upper left exciter brush holder and the series field lead near the lower left brush holder. Touch one test prod to the exciter frame. Touch the other test prod to any of the field leads. If the lamp lights, the winding is grounded. Inspect the leads. If the ground is in a lead, tape the defective section with several layers of half-lapped rubber tape, then with two layers of friction tape. If the ground is in the winding proper, the exciter field must be removed. Then remove the hollow-head screws which hold the field pole shoe to the frame. Remove screws from one pole shoe at a time, push the pole shoe and coil away from the frame and test again for ground. The ground is in the coil which was the last one loosened before the test indicates that the ground has been removed. Remove the pole shoe from the coil and locate the grounded spot on the coil by visual inspection. Install a new winding. If a new winding is not available, it may be possible to repair the coil by taping the defective area with several layers of carefully half-lapped friction tape, then shellacing the area. Replace after the shellac has dried.

(*j*) *Testing Exciter Field Windings for Open or Short-Circuit.* The exciter field windings are connected in parallel-series and the field assembly must be removed to test for short or open circuits. Disconnect the four coil leads at the point where the shorter, heavy cable connects with the windings. This breaks the connection between the shunt and series windings and provides open ends for testing each winding as a straight series of four coils. Use the test prods to test for open circuit in either winding and for short-circuit between windings. Test for short circuit in the turns of a shunt coil by connecting the series of four shunt coils across a 6-volt battery and taking a voltage reading across each coil. If the voltage is lower on one coil than on the others, that coil has some turns short-circuited. To test for open circuit in either the shunt or series field winding, touch one test prod to each of the two ends of the series of four coils. If the lamp does not light, there is an open circuit. Unless the trouble is located, at connection between coils, and easily repaired, install new coils.

(*k*) *Other Tests.* The same test may be used for many tests for grounds, open circuits, or short circuits elsewhere on the power unit. When the lamp lights, obviously the circuit between prods is complete. If the lamp does not light, there is no circuit.

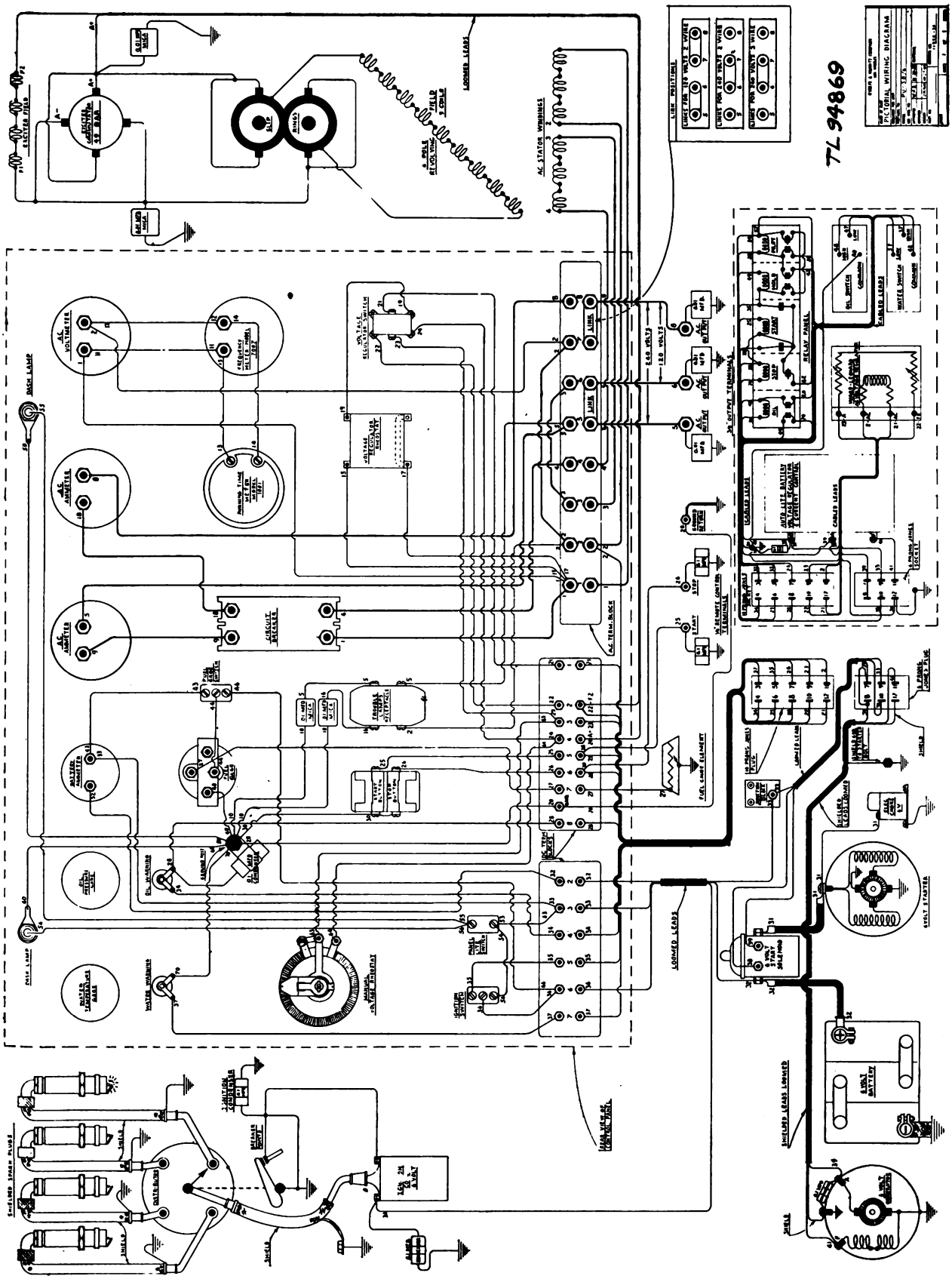


Figure 59. Pictorial wiring diagram for alternator. control panel, and auxiliary controls (Serial Nos. 1 through 1500).

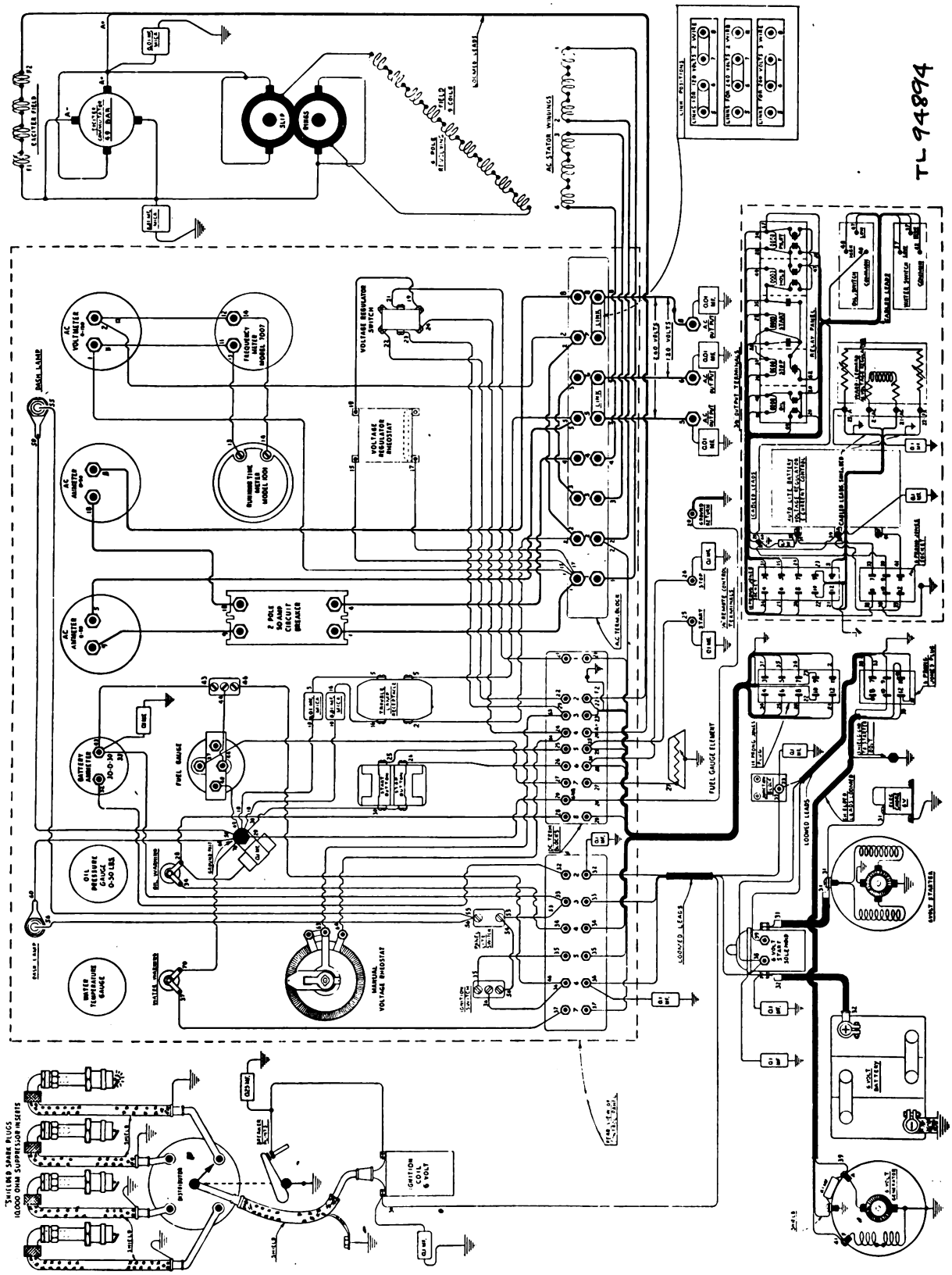


Figure 60. Pictorial wiring diagram for alternator, control panel, and auxiliary controls (Serial Nos. 1501 and up).

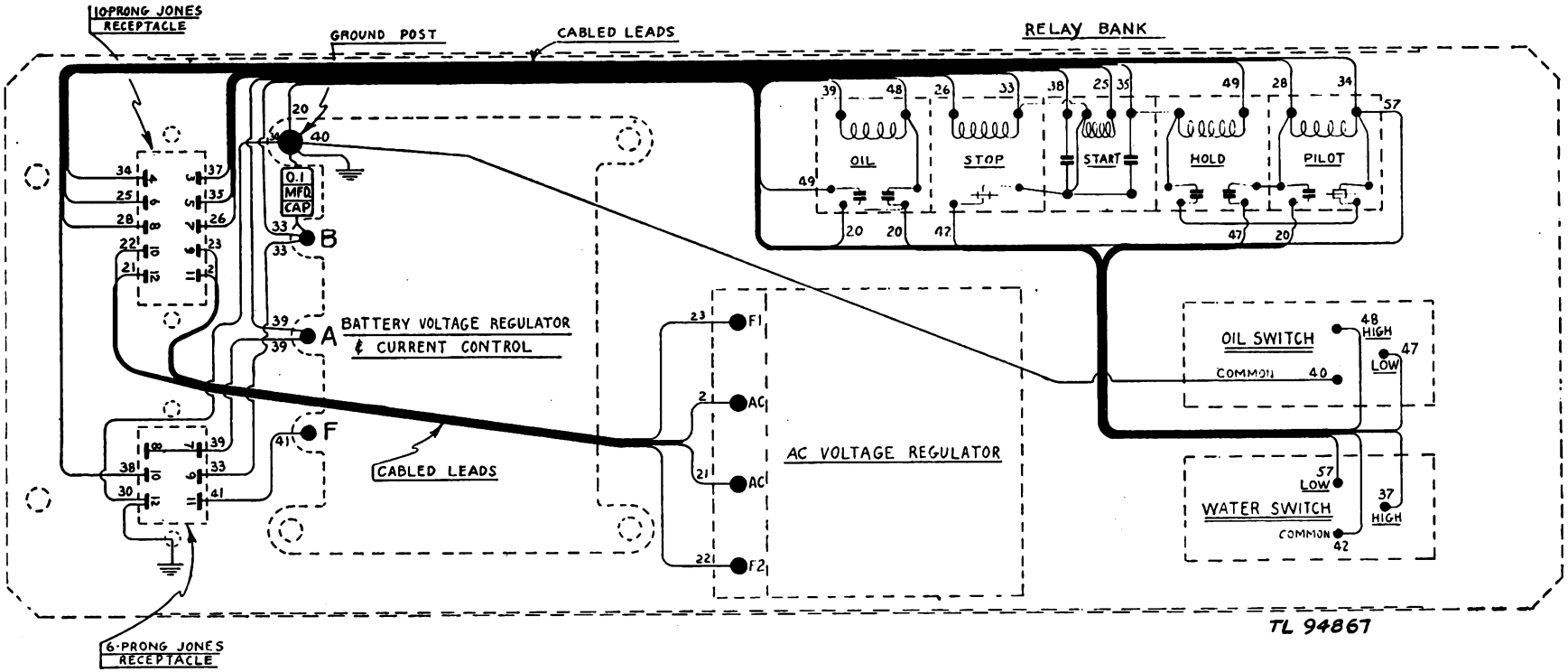
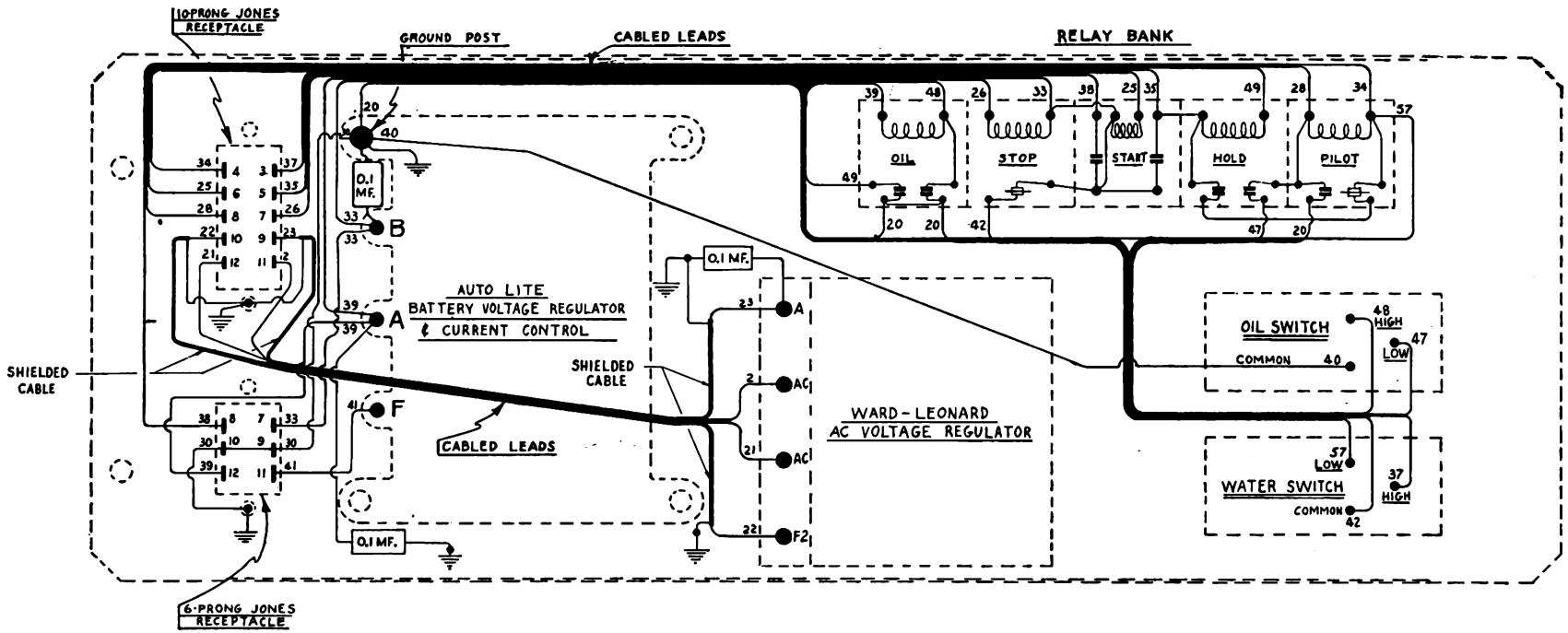


Figure 61. Pictorial wiring diagram, auxiliary control assembly (Serial Nos. 1 through 1500).



NOTE:
ALL WIRES ARE #18,7 STRAND SN
EXCEPT:
Nº 33, Nº 39, Nº 41 } #12,7 STRAND SN
Nº 30, Nº 40 } #14,7 STRAND SN

TL 94878

Figure 62. Pictorial wiring diagram, auxiliary control assembly (Serial Nos. 1501 and up).

55. CONTROL PANEL REPAIRS.

CAUTION: Before changing main control panels from one unit to another, consult wiring diagrams, figs. 33, 34, 35, 36, 59, 60, 61 and 62.

Make sure that the inter-changed panel has the proper wiring for the unit for which it is to be used. Units with serial numbers from 1 through 1500 are wired in accordance with figures 33, 35, 59 and 61. Units above 1500 are wired as indicated in figures 34, 36, 60 and 62. A panel of one series used on a unit of another without changing the wiring would result in severe damage to the instruments on the unit.

a. Solenoid Starting Switch. If it is suspected that the solenoid starting switch (fig. 5) is not closing properly, test by touching a heavy jumper wire across its two large terminals. If the engine is not cranked, as a result, there is trouble elsewhere. If the engine is cranked, as a result touch a jumper wire from its positive terminal to which the positive battery cable is connected, to the smaller front terminal. If the engine is not cranked as a result, the solenoid starting switch is at fault and a new one should be installed.

b. High Water Temperature Safety Switch.

(1) DESCRIPTION. The setting and functioning of the high water temperature safety switch (figs. 11, 27 and 31) are explained in paragraph 44 c. To assure proper functioning, its accuracy may be checked in the following manner.

(2) CHECKING ACCURACY. Remove the radiator cap and insert the bulb of a good Fahrenheit thermometer in the water in the radiator. Set the dial at 220. Cover the radiator and operate the engine until the water temperature exceeds 180° F. Then slowly turn the dial counterclockwise until the ignition is switched off. Then the dial reading should coincide with the thermometer reading. If the readings differ, the dial scale should be adjusted.

(3) ADJUSTING. The factory setting of the dial scale is sealed by applying sealing compound to a small area of both the scale and in the central disk of the dial. *Do not break this seal unless it is necessary to adjust the dial.* Then, after checking with a thermometer as just described, loosen the two screws in the central disk of the dial without disturbing the dial setting. With the screws loosened, break the seal and set the scale so its reading corresponds with the thermometer readings just taken. Tighten the screws. Set the safety switch for a higher temperature to permit starting the engine. Repeat the test to verify the correctness of the adjustment.

(4) ADJUSTING WHEN A THERMOMETER IS NOT AVAILABLE. Water in an open vessel, such as an uncapped radiator, boils at 212° F at sea level. The boiling point drops approximately 3° for each 1,000 feet above sea level. If the elevation with respect to sea level is known, the approximate boiling point of water for that location may be calculated and that value may be used to check the switch operation. It is important that the cooling liquid be water only when making this check. Operate the engine with the radiator covered, and with the cap off, until the water boils freely. Turn the dial counterclockwise until the ignition is switched off, then compare the dial reading with the calculated water temperature. If an adjustment is required, adjust the dial scale so that the reading at the instant the ignition is switched off, with water boiling, corresponds with the calculated temperature. The method of changing the dial scale adjustment is explained in the preceding paragraph. Use the thermometer method of adjusting when possible.

(5) ENGINE WATER TEMPERATURE GAUGE (fig. 11). The reading of the ENGINE WATER TEMPERATURE gauge should be checked against the thermometer reading, or the calculated boiling point temperature. If the gauge is more than a few degrees inaccurate, install a new gauge and thermal element.

c. Low Oil Pressure Safety Switch.

The low oil pressure safety switch (figs. 11, 27 and 31), closes when the oil pressure drops to approximately 8 pounds per square inch, operates the stop relay and switches off the ignition. If the engine stops unexpectedly, and the water temperature is normal, it may be due to the closing of the low oil pressure safety switch because of low oil pressure. If the oil pressure will not build up to about 8 pounds per square inch to open this switch, the engine will not continue to run after the START button is released. Throw the ignition switch to HAND

CRANKING POSITION and start the engine. If the ENGINE OIL PRESSURE gauge shows that the oil pressure does not build up normally, do not operate the engine until the trouble is located and corrected. If the oil pressure builds up normally and it is suspected that the low oil pressure safety switch is at fault, disconnect the wires from it, throw the ignition switch to NORMAL OPERATING POSITION and start the engine electrically. If the engine runs normally and with normal oil pressure, but stops as soon as the wires are connected to the low oil pressure safety switch, the safety switch is at fault and a new one should be installed. The engine may be operated temporarily without the protection afforded by this switch, if necessary. If this is done, tape the wire terminal. Give special attention to the lubrication during the emergency and install a new low oil pressure safety switch at the first opportunity.

d. Battery Charging Voltage Regulator.

(1) CHECKING.

(*a*) In case of apparent trouble in the battery charging circuit, thoroughly check the entire charging circuit for loose connections, corroded battery terminals and loose or corroded ground straps. If the entire charging circuit is in good condition the regulator (fig. 27) or generator (fig. 26) is at fault and the following suggestions will aid in determining the cause and remedy:

(*b*) A fully charged battery and low charging rate indicate a normal condition.

(*c*) A fully charged battery and high charging rate indicate that the field circuit is not being properly controlled by the voltage regulator. This may be due to a short from the field-lead to the armature-lead between the generator and regulator, requiring replacement of wires; to the voltage regulator not being properly adjusted, requiring adjustment; or to the field circuit being shorted within the regulator requiring replacement of the regulator. In this latter case, depressing the regulator armature manually will not decrease the charging rate.

(*d*) A low battery, and low or no charging rate, indicate trouble in generator, voltage regulator, or battery-charging circuit breaker. If connecting a jumper across the field and armature terminals at the generator increases the charging rate, the voltage regulator requires attention. If the jumper provides a charging rate where there was no charge before, and the charge continues at proper value after removing the jumper, the charging circuit-breaker probably is adjusted to require too high a closing voltage. If the charging rate remains low with the jumper connected, the generator requires attention.

(2) ADJUSTMENTS.

(*a*) *General.* Do not change a regulator adjustment without first definitely determining that the adjustment is at fault. In checking, the regulator armature may be operated manually to help determine whether the proposed change in adjustment will accomplish the purpose before making the change. Before changing the adjustment of the springs, check the various gaps to see that they are within the limits specified. In checking the armature air gaps, insert the gauges between the magnet core and the armature on the contact side of the brass pin in the core. Make sure all contacts are perfectly aligned.

(*b*) *Circuit Breaker.* The circuit breaker armature air gap with contacts open should be 0.0595 to 0.0625-inch. To adjust, bend the armature stop. Contact points should open 0.015-inch or more. To adjust the contact points, bend supporting arms of the stationary points. Closing voltage should be between 6.4 and 6.6. Adjust spring tension, if necessary. Opening current should be between 0.5 and 0.6 amperes. Adjust by raising or lowering stationary points. This is done by bending the supporting arms and should be done after the closing voltage is known to be correct.

(*c*) *Regulator Armature.* The voltage regulator armature air gap should be between 0.040 and 0.042-inch. To adjust, slightly loosen the screw holding the upper point bracket and raise or lower the bracket. Tighten the screws. Movable contact springs should be straight and approximately parallel with the armature. The upper contact spring and armature stop gap should be .010 to .016-inch with the armature depressed. The charging voltage should be adjusted only after the engine has attained normal operating temperatures. Use a fully charged battery and a charging rate of 20 amperes. A thermometer should be placed so its bulb is about 2-inches from the side of the regulator. The adjustment is made by changing

spring tension. Voltage should be adjusted to one of the following values, depending on the temperature in Fahrenheit degrees: 50°, 7.41; 60°, 7.35; 70°, 7.35; 80°, 7.32; 90°, 7.29; 100°, 7.26; 110°, 7.23; 120°, 7.20.

(*d*) *Current Limiting Regulator.* The current limiting regulator armature air gap should be 0.047 to 0.049-inch. The contact point gap is 0.010-inch minimum. The gap between the contact spring and the armature stops should be 0.010 to 0.016-inch with the armature depressed. The spring tension should be such as to limit the maximum charging rate to 40 amperes. To obtain so high a charging rate for testing, disconnect the primary ignition wire at the distributor and press the START button. Crank the engine electrically for 30 seconds. Immediately connect the ignition wire and start the engine. The charging rate will be high momentarily and will taper down within a few minutes.

e. Relays.

(1) GENERAL. The relays on the auxiliary control assembly require no attention under normal conditions. All relays are of direct-current type. In case of failure of any relay, the power unit may be operated temporarily by starting manually. The functioning of the relays is explained in paragraph 44 a. By referring to wiring diagrams (figs. 61 and 62) and using them in connection with paragraph 44 a the various relay circuits may be checked and any relay trouble may thus be traced to a certain relay.

Substitute a new relay for the one suspected of being at fault, and observe whether the condition is corrected. The battery charging relay may be repaired, if necessary. A defective start, stop, hold, pilot or oil pressure relay should be replaced with a new one.

(2) BATTERY CHARGING RELAY. The battery charging relay requires little attention. Do not disturb the factory adjustment unnecessarily. If the adjustment has been disturbed, or a new part has been installed, a definite procedure must be followed in making correct adjustments. Refer to figure 63 to complement these instructions.

(*a*) With the coil assembly installed in the frame and the nut securely tightened, place the armature and contact assembly in position. The contact spring rests against the armature at the point (A) with a pressure of about 1-pound. If this tension has been lost, install a new armature and contact assembly.

(*b*) Install the stationary contact panel with contact. The screw holes are elongated to permit adjusting.

(*c*) Adjust the gap (C) to approximately 0.040-inch by raising or lowering the stationary contact as permitted by slotted holes (D). Measure this gap with a thickness gauge when contacts are just touching.

(*d*) See that contacts set squarely together when the armature is entirely down and that they make contact at the centers of the contact surfaces. If necessary, bend the frame slightly at point (F) and the contact arm at points (E) to obtain alignment. After bending at either point it will be necessary to readjust gap (C).

(*e*) Adjust gap (B) to 3/64-inch by bending the stop as required.

(*f*) If a new spring is to be installed, it must be stretched very carefully before assembling. The coils of a new spring rest tightly together with some tension. Stretch the spring just enough so that a very small clearance remains between the coils when released. The clearance should be just enough to prevent the coils from touching. If the clearance is too great, discard the spring.

(*g*) Install the spring with the hooks attached exactly as directed in figure 63.

(*h*) Adjust the spring tension so that 10 volts dc applied to the coil will close the contacts forcibly but 8 volts will not be sufficient to close them. Use five cells of two batteries to obtain 10 volts, four cells to obtain 8 volts. To increase the spring tension, bend the lower loop up closer to the first coil. If more tension is needed than obtainable in this manner, bend the support downward at (G). To reduce the tension, bend the support upward.

56. SUPPRESSION EQUIPMENT.

a. General. To reduce interference with radio, the power unit is equipped with capacitors, suppressors, bonding straps, internal-external tooth (IET) lockwashers and a metal housing.

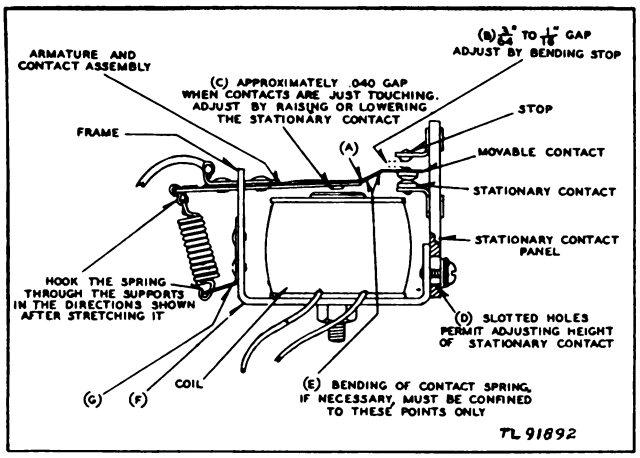


Figure 63. Battery charging relay.

b. Metal Housing. The metal housing serves as shielding and thus plays an important part in the suppression of radio interference. The power unit should be operated with side panels and top plates in place.

c. Loose Connections. Check the entire power unit for loose electrical connections, bolts, nuts, and screws. Keep all these tight at all times. At bonding strap connections and certain other points, special lockwashers with internal and external teeth are used, not only for locking the screws, bolts, or nuts securely, but also because the teeth make good electrical contact with adjacent surfaces. Make sure washers of this type are used when needed.

d. Capacitors. The location and capacitance of suppression capacitors are shown in the wiring diagram of figure 33. Make sure all are in place and that connections are tight. They may be removed and tested individually in the same manner used for radio capacitors. Replace any that test open, shorted, or of incorrect capacitance.

e. Bonding Straps. Be sure that all bonding straps are in place and in good order and that connections are electrically good and mechanically secure. Bonding straps are used at the following points:

(1) One from remote control ground return terminal block to control panel.

(2) One from control panel to generator end bell.

(3) One from control panel to housing at each of the four shock mountings of the control panel.

f. Commutators, Slip-Rings and Brushes. Check to see that there is no abnormal arcing at the exciter brushes. Commutators and slip-rings must be smooth and clean. Mica must be properly undercut on the commutator of the exciter. All brushes must seat properly, with proper spring tensions, and in proper positions.

g. Ignition System. Check, clean, and adjust the complete ignition system, including spark plugs. Particularly check for defects to high tension cables, the distributor cap and rotor, and the ignition capacitor. Replace any parts not in good condition. Make sure the suppressors are on the high tension cables and in good order.

h. Faulty Contacts. A switch or a-c circuit breaker contact may be tested for contact pressure by connecting a jumper across its terminals when it is in a normally closed position. If the switch or circuit-breaker tests defective, install a new one. A similar jumper test may be made across the terminals of suspected relay contacts or across the terminals of the voltage regulator contacts. Study the wiring diagram to see that the jumper is used across the correct terminals, and only while the contacts being tested are normally closed.

i. Interference from Outside Sources. Defective lamps, transformers or appliances, or poor connections anywhere on the load circuit may result in radio interference which must be corrected at its source. Any commutator-type motor may cause radio interference by brush sparking. This condition may be caused by: poor condition of commutator, wrong brush setting, brushes not properly seated or too light spring tension, excessive current caused by overloading motor, low line voltage, or cover band on exciter not in place.

SECTION XIV
OTHER REPAIR PROCEDURES

57. PAINTING AND REFINISHING.

a. Touching-up Power Unit PU-58/G.

When the painted surfaces of the power unit are scratched or the finish has been damaged, rust and corrosion may be prevented by thoroughly cleaning, and then touching up the damaged surface. The extent of the treatment required will depend upon various conditions. If only small portions of the unit have been scratched or scraped, proceed as follows:

(1) Remove all traces of oil or grease with cleaning solvent, and thoroughly sandpaper the spot or spots to be painted. Apply the paint in light, even coats with a small brush. Two light coats of paint are better than one heavy coat.

(2) If the painted surfaces of the unit are blistered from overheating, remove all of the old paint with remover, and thoroughly clean with sandpaper or steel wool, all surfaces to be repainted. Apply a smooth, even priming coat; sand the priming coat lightly with fine sandpaper; and complete the paint job with two light, even coats of finish paint.

(3) Refinish the entire unit whenever it has received a complete overhaul.

CAUTION: Avoid getting paint on moving parts in such a manner as to hinder their movement. Do not paint electrical contacts.

b. Paint Specifications. First a priming coat should be applied similar to U. S. Army Specification No. 3-173 which consists of a brown, synthetic primer containing zinc chromate. The surface coat should be a fungus-proof paint similar to the olive drab lusterless, synthetic enamel originally applied to the unit.

58. EMERGENCY REPAIRS.

When a bullet or shrapnel punctures a tube in the radiator, cut the tube or break it with a pair of pliers, if it is not already completely severed, strip the fins from the tube above and below the break for approximately 1/2-inch. Bend the broken ends of the tube so that the bent ends are parallel with the tube. Flatten both the bent ends and the tube to stop the flow of water.

SECTION XV
REPAIR AND ANALYSIS DATA

59. TABLE OF ENGINE SPECIFICATIONS, TOLERANCES, AND CLEARANCES.

Intake valve seat	no insert—45° chamfer x 1-17/32" diam
Exhaust valve seat	no insert—45° chamfer x 1.15/32" diam
Intake valve guide stem-to-guide clearance	0.0015 to 0.00325 in.
Exhaust valve guide, stem-to-guide clearance	0.002 to 0.00375 in.
Intake and exhaust valve tappet operating clearance	0.014 in. when cold
Intake and exhaust tappet clearance for valve timing	0.020 in.
Intake opens 9° before upper dead center piston—Closes 50° after lower dead center piston	
Exaust opens 47° before lower dead center piston—Closes 12° after upper dead center piston	
Main bearing diameters and length — No. 1	2.3340 x 1.920 in.
Main bearing diameters and length — No. 2	2.3340 x 1-13/16 in.
Main bearing diameters and length — No. 3	2.3340 x 1-3/4 in.
Main bearing diametral clearance	0.001 in.

Crankshaft end play	0.004 to 0.006 in.
Crankpin journal	1-15/16" diam. x 1-5/16" length
Connecting-rod bearing diametral clearance	0.008 to 0.0023 in.
Connecting-rod bearing side clearance	0.0085 in.
Cylinder bore	3-1/8 in.
Piston clearance—top land	0.0205 to 0.0225 in.
skirt	0.003 in.
Number and type of piston rings per piston	4 rings (3 plain, 1 oil)
Width of oil ring gap	0.008 to 0.013 in.
Width of compression ring gap	0.008 to 0.013 in.
Piston pin clearance in piston	0.0001 to 0.0009 in.
Ignition timing, maximium degrees advance	22° at 3000 engine rpm
Breaker gap	0.020 in.
Breaker arm tension	17-20 oz.

Timing—Breaker points open during 5° of crankshaft rotation, or 0.0103-inches of piston travel before top center.

60. TABLE OF POINT-TO-POINT RESISTANCES (fig. 33).

a. Generator.

Total revolving field:			
Cold	10.9	ohms @ 20° C	
Hot	12.5	ohms @ 65° C	
Total stator armature	0.107	ohms @ 20° C	
	0.122	ohms @ 65° C	
Total exciter shunt field	43.5	ohms @ 20° C	
	49.6	ohms @ 65° C	

b. Voltage Regulator.

Total resistance of unit	101	ohms
Rheostat	160	ohms
Manual field control	100	ohms

c. Ignition Coil	1.15	ohms	primary
d. Start Solenoid	1.8	ohms	
e. Start Relay	7	ohms	
f. Stoy Relay	7	ohms	
g. Holding Relay	18	ohms	
h. Oil Pressure Relay	18	ohms	
i. Pilot Relay	18	ohms	

61. ENGINE ADJUSTMENTS.

Before returning Power Unit PU-58/G to service after repairs have been made, preoperation adjustments given in paragraph 15 should be checked.

62. GENERATOR ADJUSTMENTS.

Preoperation adjustments of the control panel, also described in paragraph 17 should be carefully checked after repairs have been made and before the power unit is put into operation.

63. WAR DEPARTMENT UNSATISFACTORY EQUIPMENT REPORT.

When trouble occurs more often than repair personnel feel is normal, War Department Unsatisfactory Equipment Report, W.D., A.G.O. Form No. 468 should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D.C. Refer to TM 38-250 for complete instructions on the handling of this report.

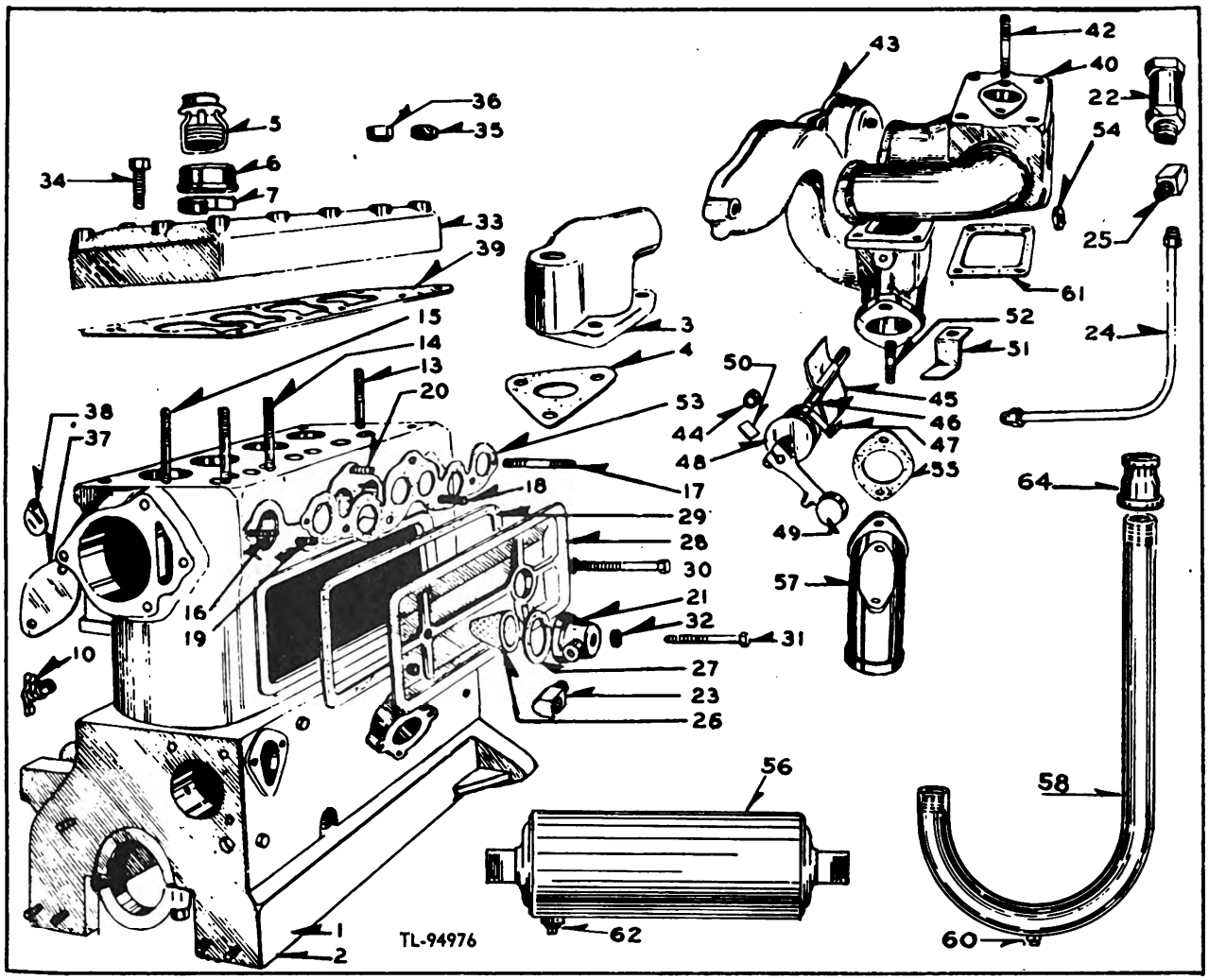


Figure 64. Cylinder, manifold, and exhaust group.

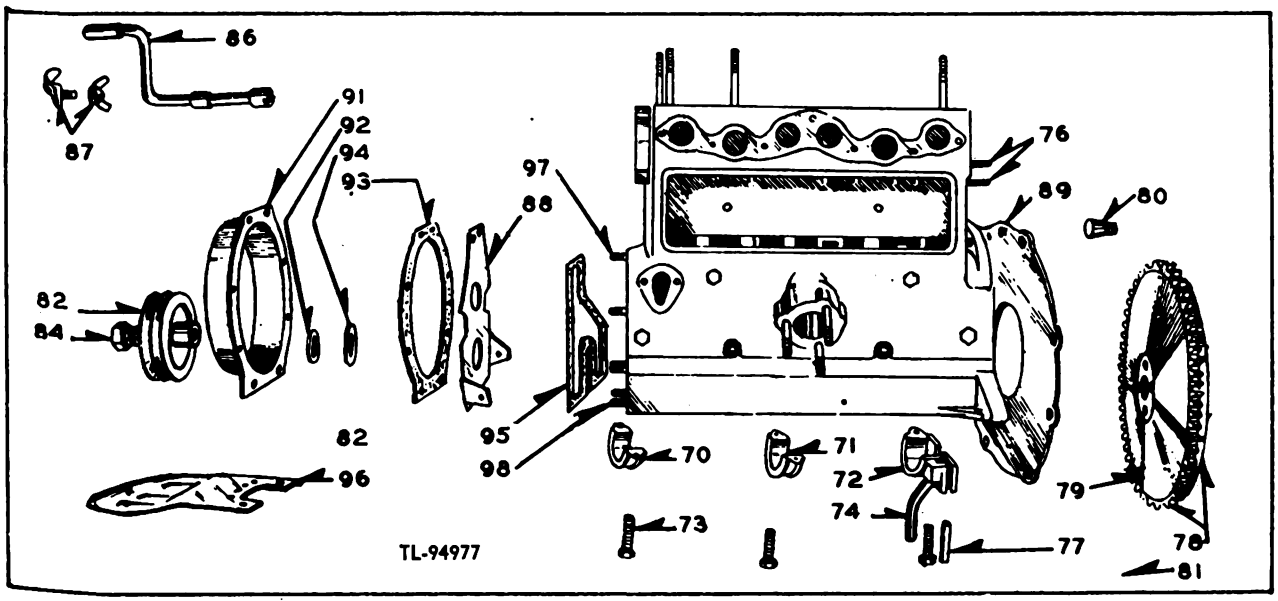


Figure 65. Timing chain cover, flywheel, bearings and crank group.

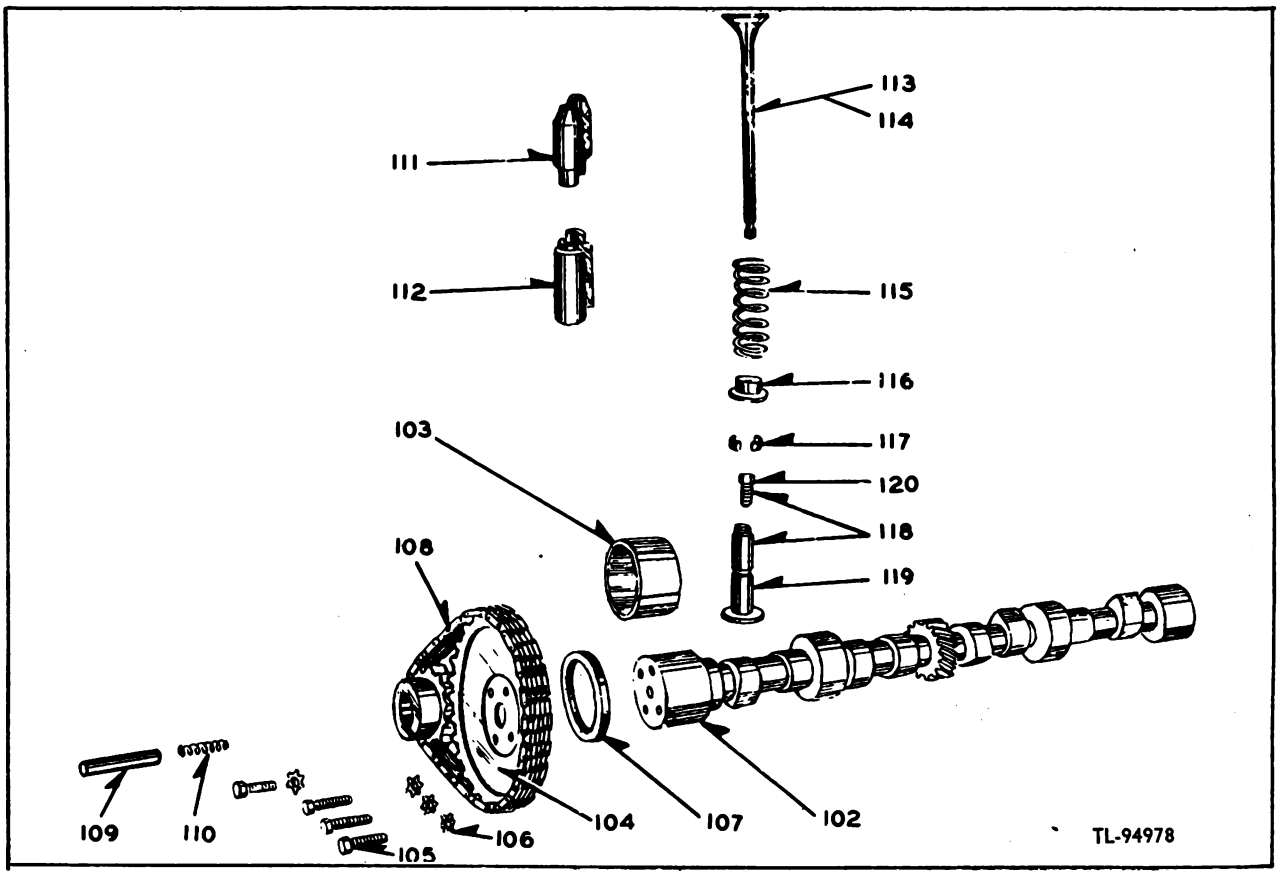


Figure 66. Camshaft and valve group.

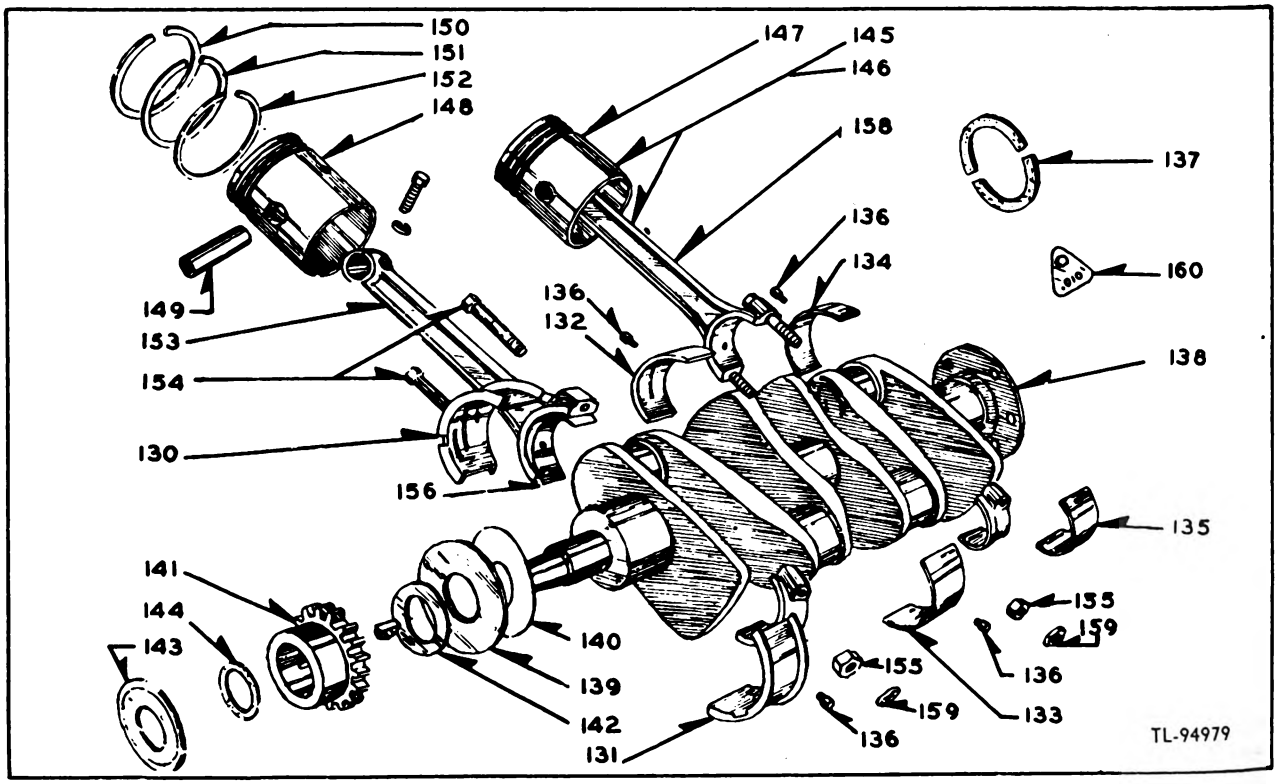


Figure 67. Crankshaft and connecting rod group.

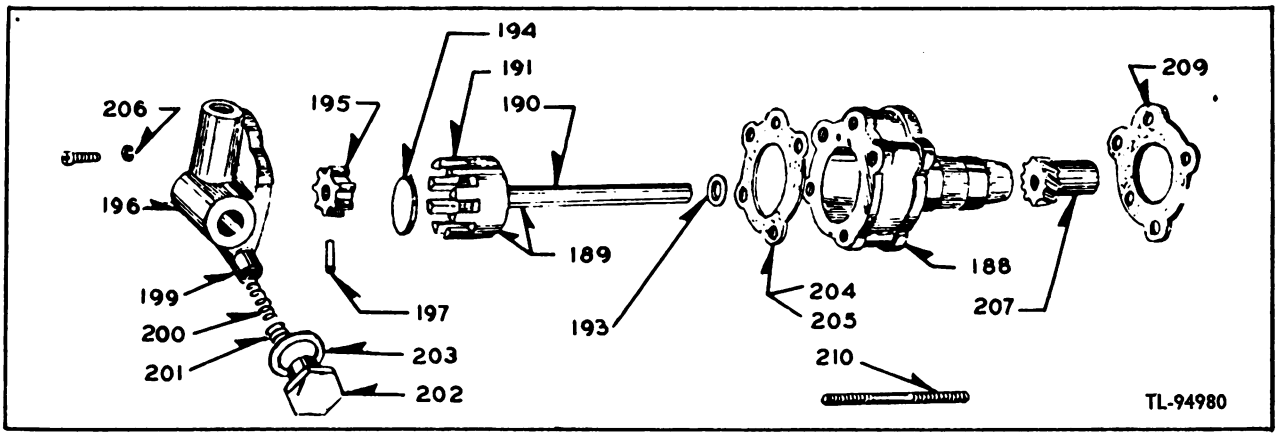


Figure 68. Oil pump group.

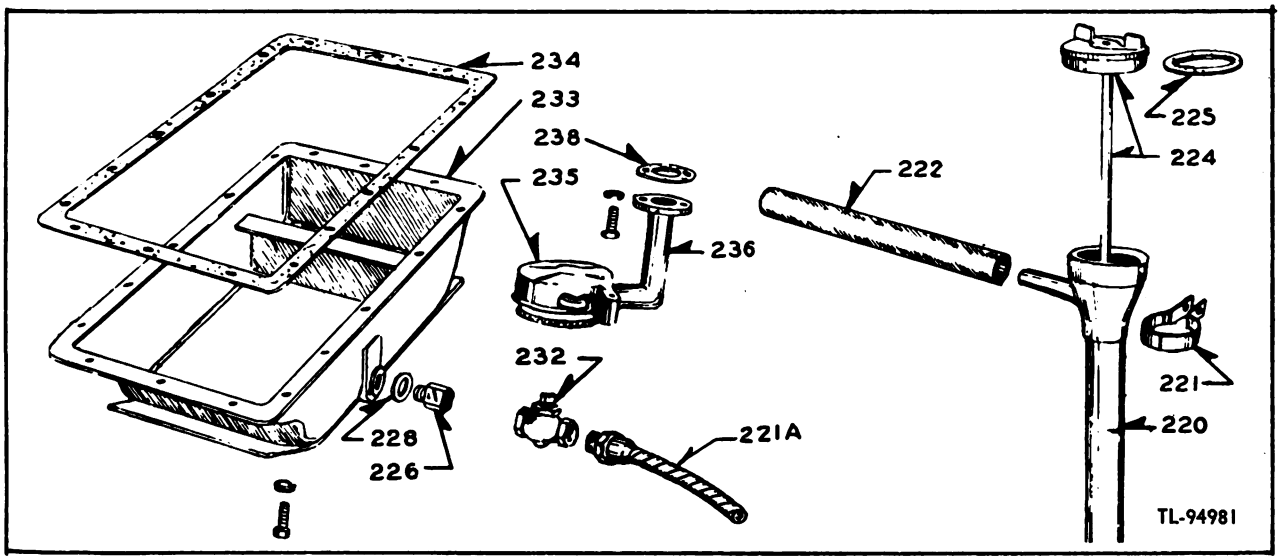


Figure 69. Oil pan and filler tube group.

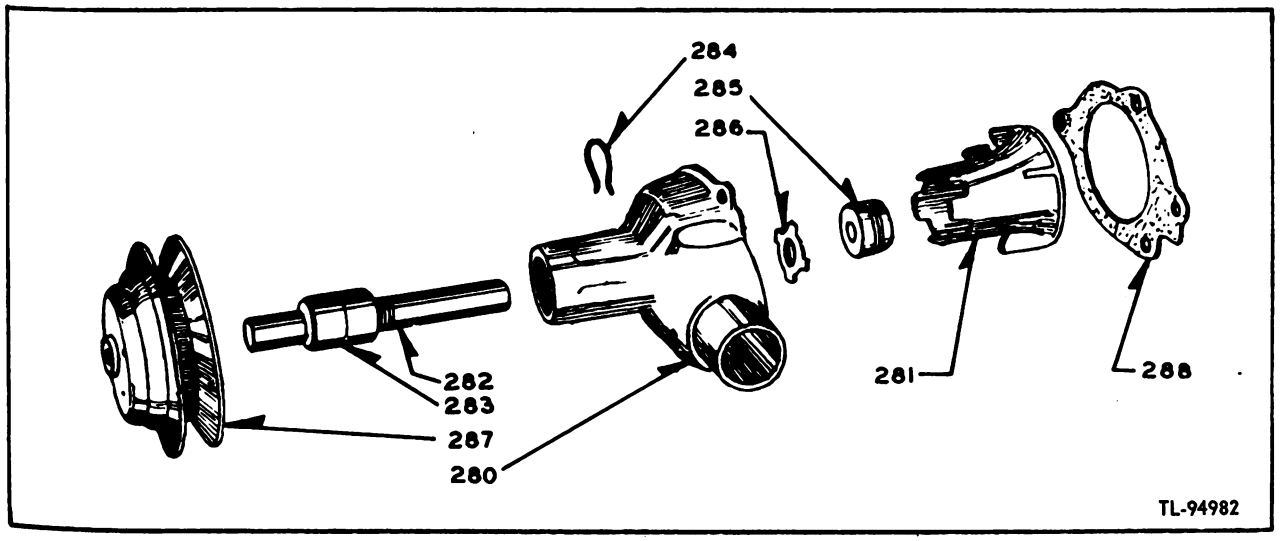


Figure 70. Water pump group.

APPENDIX

SECTION XVI

MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G.

a. Ordnance Parts.

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		ENGINE PARTS (TO BE FURNISHED BY THE ORDNANCE DEPARTMENT)	
		FOR OFFICIAL LISTING OF STOCK QUANTITIES OF ENGINE SEE ORD 8 SNL G-716	
Figs. 4		ENGINE ASSEMBLY GROUP	
and 5	9680-A8612	ENGINE: less accessories; assembly consist of; CYLINDER BLOCK OIL PAN & HEAD EXHAUST & INTAKE MANIFOLDS WATER PUMP ASSEMBLY FAN DRIVING & DRIVEN PULLEYS GOVERNOR MOUNTING BRACKET	WO A8612
	3320-GPW18390B	GASKET SET: engine overhaul; FM GPW-18390B; consists of: 1 gasket, WO 630365 FM GPW-6288. 1 gasket, WO 630359 FM GPW-6020. 1 gasket, WO A8558 FM GPW-6051B. 1 gasket, WO 634814 FM GPW-9450. 1 gasket, WO 638737 FM GPW-9417. 1 gasket, WO 638640 FM GPW-9448. 1 gasket, WO 634811 FM GPW-9435. 1 gasket, WO 630398 FM GPW-6627. 1 gasket, WO 639980 FM GPW-6710. 1 gasket, WO 639870 FM GPW-6659. 2 gaskets, WO 630392 FM GPW-6619. 1 gasket, WO 314338 FM B-12410. 1 gasket, WO 375927 FM GPW-6625. 1 gasket, WO 630394 FM GPW-6630.	WO A17401

		1 gasket, WO 634813 FM GPW-6642. 1 gasket, WO 334103 FM GPW-6353. 2 packings, WO 637790 FM GPW-6701. 4 gaskets, WO 637863 FM 01A-12410. 1 gasket, WO 630305 FM GPW-6521. 2 gaskets, WO 51875 FM GPW-6555. 1 gasket, WO 639650 FM GPW-8255. 1 gasket, WO 637053 FM GPW-8543. 1 packing, WO 637098 FM GPW-6700. 2 packings, WO 637237 FM GPW-6702. 1 gasket, WO 630299 FM GPW-6648.	
Fig. 65 88	3320-6031A3	PLATE: engine front; assembly; FM GPW-6031A3.	WO A1463
89	3320-GPW7007	PLATE: engine cylinder block to flywheel housing; FM GPW-7007.	WO A5121
		ENGINE CRANKCASE, CYLINDER HEAD AND BLOCK GROUP	
	FM-355597S	BOLT: dowel; rear engine plate to cylinder block; FM-355597S.	WO 630101
	H001-5420520	BOLT: hex hd; steel; 3/8-16 NC x 3/4 (front plate to block); Ordnance part #100133.	WO 6412
	H001-5420580	BOLT: hex hd; semi-finish; alloy-steel; 3/8-16 NC x 1-1/8 (elbow to cylinder head); Ordnance part #106331.	WO 52911
	3320-355452S	BOLT: cap; hex hd; engine valve spring cover; rear (hex hd; steel; 5/16-18 NC—2x3-1/16) FM 355452-S.	WO 632158
	3320-355451S	BOLT: cap; hex hd; engine valve spring cover (hex hd; steel; 5/16-18 NC-2 x 4-1/8) (front) FM 355451S.	WO 632158
	H001-5421220	BOLT: hex hd; semi-finish; alloy-steel; 3/8 24 NF-3 x 3/4 (cover to engine plate); Ordnance part #100025.	WO 50163
	H001-5421260	BOLT: hex hd; steel; 3/8-24 NF x 1 (cover to engine plate); Ordnance part #100026.	WO 5919
Fig. 64 10	H106-0103647	COCK, drain: 1/4"; engine cylinder block; FM 9N8115-WH 145A; Ordnance part #103647.	WO A1126
	3320-GPW6054	COVER: engine timing chain; assembly; FM GPW-6054.	WO A1190
3	ONA-7335	ELBOW: engine water outlet—optional; ONA-7335.	OK 1624-18
	3320-GPW6288	GASKET: engine timing chain cover; FM GPW-6288.	WO 630365
29	G503-0194022	GASKET: engine valve spring cover; FM GPW-6521.	WO 630305
Fig. 64 39	3320-GPW6051B	GASKET: engine cylinder head; FM GPW-6051B.	WO A8558

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
	3320-GPW18387B	GASKET SET: engine valve grind; FM GPW-18387B; consists of: 1 gasket, WO A8558 FM GPW-6051B. 1 gasket, WO 630305 FM GPW-6521. 2 gaskets, WO 51875 FM GPW-6555. 1 gasket, WO 630299 FM GPW-6648. 1 gasket, WO 639650 FM GPW-8255. 1 gasket, WO 634811 FM GPW-9435. 1 gasket, WO 638640 FM GPW-9448. 4 gaskets, WO 637863 FM 01A-12410. 1 gasket, WO 634814 FM GPW-9450.	WO A17402
4	G503-0194030	GASKET: engine water outlet elbow; FM GPW-8255.	WO 639650
33	3320-GPW6050	HEAD: engine cylinder; assembly; FM GPW-6050.	WO A1534
35	3320-351025S7	NUT: engine cylinder head stud; hex semi-finish alloy-steel; 7/16-20 NF-2; FM 351025S7.	WO 638539
	H001-4167601	NUT: reg hex semi-finish, alloy-steel; 3/8-24 NF-2 (timing cover) FM 33800-S7; Ordnance part #120369.	WO 52542
	H006-0283755	PLUG: pipe; steel; 3/8"; engine cylinder block; FM 358063S.	WO 376373
	117244	PLUG: pipe; sq hd; black; 1/4" (cylinder water jacket drain) FM 353055-S7; Ordnance part #117244.	WO 53410
	H006-0282480	PLUG: expansion; steel; 1-1/4 engine cylinder block; Ordnance part #103895.	WO 51091
	H006-0283566	PLUG: pipe; 1/8"; engine cylinder block FM 358064S.	WO 5085
	H006-0282510	PLUG: expansion; 1-3/4"; camshaft rear bearing; FM 74127S; Ordnance part #103897.	WO 51460
	H001-1312560	STUD: front plate & timing chain cover to cylinder block FM 88022S.	WO 384958
Fig. 64			
14	3320-GPW6067	STUD: long; engine cylinder head; FM GPW-6067.	WO A1548
15	3320-GPW6066	STUD: short; engine cylinder head; FM GPW-6066.	WO 349368
	H001-1518009	WASHER: lock; regular steel; 3/8"; front plate to block bolt; Ordnance part #103321.	WO 5010
	H001-1518009	WASHER: lock; steel; 3/8"; (21/32 OD x 13/32 ID x 3/32 thk) (timing cover) Ordnance part #103321.	WO 5010

CRANKSHAFT BEARINGS GROUP

	3320-GPW18347	BEARING SET: engine crankshaft; standard; FM GPW-18347; consists of: 1 bearing,WO 637007 FM GPW-6333A. 1 bearing, WO 637008 FM GPW-6338A. 1 bearing, WO 638730 FM GPW-6339A. 1 bearing, WO 638731 FM GPW-6341A. 1 bearing, WO 638732 FM GPW-6331A. 1 bearing, WO 638733 FM GPW-6337A.	WO A6798
	3320-GPW18348	BEARING SET: engine crankshaft; .010 undersize; FM GPW-18348; consists of: 1 bearing, WO 637724 FM GPW-6333B. 1 bearing, WO 637725 FM GPW-6338B. 1 bearing, WO 639237 FM GPW-6339B. 1 bearing, WO 639238 FM GPW-6341B. 1 bearing, WO 639239 FM GPW-6331B. 1 bearing, WO 639240 FM GPW-6337B.	WO A6746
	3320-GPW18349	BEARING SET: engine crankshaft; .020 undersize; FM GPW-18349; consists of: 1 bearing, WO 116522 FM GPW-6333C. 1 bearing, WO 116524 FM GPW-6338C. 1 bearing, WO 116526 FM GPW-6339C. 1 bearing, WO 116528 FM GPW-6341C. 1 bearing, WO 116530 FM GPW-6331C. 1 bearing, WO 116532 FM GPW-6337C.	WO A6747
	3320-GPW18350	BEARING SET: engine crankshaft; .030 undersize; FM GPW-18350; consists of: 1 bearing, FM GPW-6331D WO 116531. 1 bearing, FM GPW-6333D WO 116523. 1 bearing, FM GPW-6337D WO 116533. 1 bearing, FM GPW-6338D WO 116525. 1 bearings, FM GPW-6339D WO 116527. 1 bearing, FM GPW-6341D WO 116529.	WO A6748
	3320-GPW18288	CRANKSHAFT & DOWEL GROUP: engine assembly; FM GPW-18288; consists of: 2 bolts, dowel, WO 116295 FM GPW-6390. 2 nuts, dowel bolt, WO 52804 FM 33929S. 2 washers, dowel bolt, WO 62330 FM 34909S2. 1 crankshaft, WO 638121 FM GPW-6303A.	WO A7568
Fig. 67 144	3320-GPW-6352	GASKET: engine crankshaft oil slinger; FM GPW-6353.	WO 334103
	3320-GPW6319	NUT: engine crankshaft; w/pin; assembly; FM GPW-6319.	WO 387633
	3320-GPW-6701	PACKING: engine crankshaft bearing cap; FM GPW-6701.	WO 637790
	3320-GPW6700	PACKING: engine crankshaft, front end; FM GPW-6700.	WO 637098
137	3320-GPW6702	PACKING: engine crankshaft, rear end; FM GPW-6702.	WO 637237
	3320-GPW6369	PIN, dowel: engine crankshaft bearing; FM GPW-6369.	WO 635377

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
	H101-0112011	PIN: 1/8 x 7/8; drain tube to rear bearing cap; FM 358420S; Ordnance part #112011.	WO 337112
	3320-GPW6326	PIPE, drain: engine crankshaft rear bearing cap; FM GPW-6326.	WO 630294
	3320-GPW6287	RETAINER: engine crankshaft packing; FM GPW-6287.	WO 375920
	3320-GPW6345	SCREW, cap: engine crankshaft bearing; FM GPW-6345.	WO 381519
	3320-GPW6342B	SHIM: adjusting; engine crankshaft; FM GPW-6342B.	WO 630262
Fig. 67 143	3320-GPW6310	SLINGER, oil: engine crankshaft; FM GPW-6310.	WO 375877
	H001-1518011	WASHER, lock: reg; steel; 1/2"; (bearing cap to crankcase bolt); FM 34809-S; Ordnance part #103323.	WO 5009
	3320-GPW6308	WASHER, thrust: engine crankshaft; FM GPW-6308.	WO 634796
		FLYWHEEL AND RING GEAR GROUP	
	3320-GPW6390	BOLT: special; flywheel to engine crankshaft dowel; FM GPW-6390.	WO 116295
Fig. 65 79	3320-GPW18289	FLYWHEEL: with dowel bolts and nuts; FM GPW-18289; consists of: 1 flywheel, WO A1443 FM GPW-6375. 2 dowel bolts, WO 116295 FM GPW-6390. 2 nuts, WO 52804 FM 33929S. 2 washers, WO 52330 FM 34909S2.	WO A7503
78	3320-GPW6384	GEAR, ring: engine flywheel; starter; FM GPW-6384.	WO 635394
	H001-4185680	NUT: hex; steel; 1/2-20 NF-2 (flywheel dowel bolt); FM 33943S; Ordnance part #114496.	WO 52804
	H001-4167601	NUT: reg; hex; semi-finish; alloy-steel; 3/8-2 NF-2 (flywheel dowel & bolt); FM 33800-S7.	WO 632156
	3320-GPW6387	PIN, dowel: engine flywheel to crankshaft; FM GPW-6387.	WO 632156
	3320-355497S	SCREW: flywheel to engine crankshaft; FM 355497S.	WO 632157
	H001-7017680	WASHER, lock: steel; 3/8 ID (flywheel bolt); FM 34942S; Ordnance part #114606.	WO 52378
	H001-7017740	WASHER, lock: steel external teeth; 1/2" (flywheel bolt); FM 34944S; Ordnance part #114608.	WO 52330

		PISTONS, RINGS, PINS, CONNECTING RODS AND BEARINGS GROUP	
	3320-GPW18330A	BEARING SET: engine connecting rod; standard; FM GPW-18330A; consists of: 2 bearings, WO 639862 FM GPW-6211A.	WO A7233
	3320-GPW18330B	BEARING SET: engine connecting rod; .010 undersize; FM GPW-18330B; consists of: 2 bearings, WO 116534 FM GPW-6211B.	WO A7234
	3320-GPW18330C	BEARING SET: engine connecting rod; .020 undersize; FM GPW-18330C; consists of: 2 bearings, WO 116535 FM GPW-6211C.	WO A7235
Fig. 67	3320-GPW18330D	BEARING SET: engine connecting rod; .030 undersize; FM GPW-18330D; consists of: 2 bearings, WO 116536 FM GPW-6211D.	WO A7236
154	WO 640070	BOLT: engine connecting rod bearing cap; steel; 7/16-20 NF x 2-3/8.	WO 640070
159	H001-0726020	NUT, lock: stamped; engine connecting rod cap bolt nut; FM 356028 S; Ordnance part #107381.	WO 52825
155	FM 356021S	NUT: hex; 7/16-20 NF-2; engine connecting rod cap bolt; FM 356021S.	WO 636962
149	3320-GPW6135A	PIN: standard; engine piston; FM GPW-6135A.	WO 636961
	3320-GPW6135D	PIN: engine piston; .003 oversize; FM GPW-6135D.	WO 116003
148	3320-GPW6105A	PISTON: standard; w/pin; engine; assembly; FM GPW-6105A.	WO 637041
	3320-GPW6105C	PISTON: .020 oversize; w/pin; assembly; FM GPW-6105C.	WO 116019
	3320-GPW6105F	PISTON: .040 oversize; w/pin; assembly; FM GPW-6105F.	WO 116701
	3320-GPW6149E	RING SET: standard; engine piston; FM GPW-6149E.	WO A6794
	3320-GPW6149G	RING SET: .020 oversize; engine piston; FM GPW-6149G.	WO A6796
	3320-GPW6149J	RING SET: .040 oversize; engine piston; FM GPW-6149J.	WO A15283
153	3320-GPW6200	ROD, connecting: #1 & #3; engine assembly (w/o bearings); FM GPW-6200.	WO 640071
158	3320-GPW6201	ROD, connecting: #2 & #4; engine assembly; (w/o bearings); FM GPW-6201.	WO 640072
	FM 355497S	SCREW, lock: piston pin; FM 355497S.	WO 632157
	H001-1518009	WASHER, lock: reg; steel; 3/8" (piston pin lock screw); Ordnance part #103321.	WO 5010
Fig. 66		VALVES, SPRINGS, GUIDES AND SEATS GROUP	
112	3320-GPW6511B	GUIDE, valve stem: engine; intake; FM GPW-6511B.	WO 637045
111	3320-GPW6510B	GUIDE, valve stem: engine exhaust; FM GPW-6510B.	WO 375811
117	3320-GPW6546	LOCK: engine valve spring retainer; FM GPW-6546.	WO 375994
116	3320-GPW6514	RETAINER: engine valve spring, lower; FM GPW-6514.	WO 637044
115	3320-GPW6513	SPRING, engine valve: FM GPW-6513.	WO 638636

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		VALVES, SPRINGS, GUIDES AND SEATS (contd).	
113	G503-7036579	VALVE: intake, engine; FM GPW-6507.	WO 637182
114	G503-7036580	VALVE: exhaust; engine; FM GPW-6505.	WO 637183
		VALVE LIFTS, PUSH RODS, AND TAPPETS GROUP	
120	3320-GPW6549B	SCREW, adjusting: engine valve tappet; FM GPW-6549B.	WO 640020
119	3320-GPW6500A	TAPPET: engine valve; FM GPW-6500A.	WO 637047
		CAMSHAFT AND BEARINGS GROUP	
103	3320-GPW6262A	BUSHING: engine camshaft; front; FM GPW-6262A.	WO 639051
102	G503-0131476	CAMSHAFT: engine assembly; FM GPW-6250.	WO 637065
109	3320-GPW6243	PLUNGER, thrust: engine camshaft; FM GPW-6243.	WO 375907
	3320-GPW6245	SPACER, thrust: engine camshaft; FM GPW-6245.	WO 375900
110	3320-GPW6244	SPRING: engine camshaft thrust plunger; FM GPW-6244.	WO 375908
Fig. 66		TIMING CHAINS AND SPROCKETS GROUP	
105	3320-355499S	BOLT: special; hex hd; sprocket to engine camshaft; (3/8-24 NF x 1-1/4); FM 355499S.	WO 634850
108	G503-7036574	CHAIN, drive: engine camshaft; FM GPW-6260.	WO 638457
	H101-0124552	KEY, Woodruff: #13; sprocket to engine crankshaft; FM 74182S; Ordnance part. #124552.	WO 50917
Fig. 67	3320-GPW6342A	SPACER: engine camshaft sprocket; FM GPW-6342A.	WO 630727
141	G503-7036572	SPROCKET: engine crankshaft; 18 teeth; FM GPW-6306; (LK-S35116-1).	WO 638459
Fig. 66 104	G503-7036571	SPROCKET: engine camshaft; 36 teeth; FM GPW-6256; (LK-S35117-1).	WO 638458
106	3320-GPW6269	WASHER, lock: sprocket to engine camshaft; 3/8"; FM GPW-6269.	WO 315932
		ENGINE LUBRICATING OIL PUMPS GROUP	
	H001-5419140	BOLT, hexagon: 5/16-18 x 3/4; special engine oil float to engine crankcase; FM 355396S.	WO 636796
Fig. 68 194	3320-GPW6673	DISK: engine oil pump rotor; FM GPW-6673.	WO 636600

Fig. 69 235	G503-7036578	FLOAT: engine oil assembly; FM GPW-6615.	WO 630396
209	3320-GPW6630	GASKET: engine oil pump to cylinder block; FM GPW-6630.	WO 630394
	3320-GPW18380	GASKET SET: engine oil pump; FM GPW-18380; consists of: 4 gaskets, WO 630392 FM GPW-6619. 1 gasket, WO 375927 FM GPW-6625. 1 gasket,WO 630398 FM GPW-6627. 4 shims, WO 630389 FM GPW-6628. 1 gasket WO 630394 FM GPW-6630. 1 gasket, WO 634813 FM GPW-6642. 1 gasket, WO 630299 FM GPW-6648. 1 gasket, WO 639870 FM GPW-6659. 1 gasket, WO 380197 FM 355262S.	WO A6750
	3320-GPW18379	KIT, repair: engine oil pump; FM GPW-18379; consists of: 1 shaft, WO 636599 FM GPW-6608. 1 gear, WO 637425 FM GPW-6610. 1 pinion, WO 343306 FM GPW-6614. 1 pin, WO 330964 FM GPW-6684.	WO A6749
	H001-4167561	NUT: reg; hex; semi-finish; alloy-steel; 5/16-24 NF-2 (pump assembly to block); FM 33798-S7; Ordnance part #120368.	WO A1532
	H006-0283180	PLUG, pipe: slotted; 1/8; engine oil pump relief; Ordnance part #118831.	WO 52525
Fig. 68	3320-GPW6600	PUMP, engine oil: assembly; FM GPW-6600.	WO 637636
	H001-1026108	SCREW: engine oil pump cover to body; FM 31079S.	WO 51819
Fig. 68 210	H101-0103180	STUD: engine oil pump to cylinder block; FM 88141S.	WO 375981
Fig. 69 236	3320-GPW6617	SUPPORT: engine oil float; FM GPW-6617.	WO 630397
	H001-7025711	WASHER, lock: reg; steel; 5/16"; (oil float strainer support); Ordnance part #120214.	WO 52558
		ENGINE LUBRICATING OIL FILTER GROUP	
	H001-5419820	BOLT: hex hd; semi-finish; alloy-steel; 5/16-21 NF x 3/4 (oil filter to bracket); Ordnance part #100013.	WO 51396
	G148-0382003	BOLT: engine oil filter cover hex hd; steel; 7/16-20 NF-2; FM GPW-18691A (PU-25755).	WO A1232
	3320-GPW18663	BRACKET: engine oil filter; FM GPW-18663.	WO A1247
	G148-0140135	COVER: engine oil filter; assembly; FM GPW-18687A.	WO A1231
	H017-0540462	ELEMENT: engine oil filter; w/gasket; assembly; FM GPW-18662B (PU 26637).	WO A1236
	H017-0540501	FILTER, oil: engine assembly; FM GPW-18660A (PU 27078).	WO A1230

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		ENGINE LUBRICATING OIL FILTER GROUP (contd).	
	G503-0194033	GASKET: engine oil filter cover; FM GPW-18688A (PU 25802).	WO A1235
	G116-1593934	GASKET: engine oil filter cover bolt; FM GPW-18675A (PU 25756).	WO A1233
	FM 3580405 (PU 25795)	PLUG, drain: engine oil filter steel; hex; 9/16-1/4-18 thd; FM 358040S (PU 25795).	WO A1237
	G148-0389795	SPRING: engine oil filter cover bolt; FM GPW-18685A (PU 25757).	WO A1234
	H001-7043711	WASHER, plain: steel; SAE std; 5/16" (filter to bracket nut); FM 34846-S7; Ordnance part #120393.	WO A1533
	H001-7025711	WASHER, lock: reg S, 5/16" (filter to bracket); Ordnance part #120214.	WO 52558
		ENGINE LUBRICATING RELIEF VALVE GROUP	
	3320-GPW6663	PLUNGER: engine oil pressure relief; FM GPW-6663.	WO 630518
	3320-GPW6644	RETAINER: engine oil pressure relief spring; FM GPW-6644.	WO 630390
	3320-GPW6628	SHIM, adjusting: engine oil pressure relief; FM GPW-6628.	WO 630389
	3320-GPW6654	SPRING: engine oil pressure relief valve; FM GPW-6654.	WO 356155
		CRANKCASE VENTILATION AND BREATHERS GROUPS	
	3320-GPW6762	BAFFLE: engine crankcase ventilation; FM GPW-6762.	WO 630298
	3320-GPW6758B	BODY: engine crankcase ventilation; assembly; FM GPW-6758B.	WO A6919
Fig. 64 23	3320-GPW9268	ELBOW: engine crankcase ventilator to tube; FM GPW-9268.	WO 384549
25	FM GPW-6722	ELBOW, pipe: 1/4"; engine crankcase ventilation tube to valve; FM GPW-6722.	WO A6885
27	3320-GPW6648	GASKET: engine crankcase ventilation to valve spring cover; FM GPW-6648.	WO 630299
24	3320-GPW6756	TUBE: crankcase ventilator valve; assembly; FM GPW-6756.	WO A6922
22	3320-GPW6769	VALVE: engine crankcase ventilator assembly; FM GPW-6769.	WO A6895
Fig. 69		ENGINE LUBRICATING OIL PAN LINES, LEVEL GAUGES	
226	OK 1594-9	ADAPTER: engine crankcase oil drain.	OK 1594-9
	H001-5419100	BOLT: hex hd; 5/16-18 NC x 5/8; engine oil pan; Ordnance part #106324.	WO 51485

	H006-0214315	CONNECTOR: 1/4" flared tube; oil filter tubes; Ordnance part #137405.	WH 200X4
	3320-9N18686	ELBOW: flexible connector; engine oil filter to engine; FM 9N18686.	WO-384569
	H006-0260846	ELBOW: engine governor oil line; Ordnance part #137420.	WH 400X3
	3320-GPW6789	GASKET: engine oil filler cap; FM GPW-6789.	WO A7280
	3320-GPW6734	GASKET: engine oil pan drain adapter; FM GPW-6734.	WO 314338
	G503-0194020	GASKET SET: engine oil pan; FM GPW-18512; consists of: 1 gasket, WO 630398 FM GPW-6627. 1 gasket, WO 639980 FM GPW-6710. 1 gasket, WO 314338 FM GPW-6734, optional with WD 640030, FM-B-12410.	WO A1538
Fig. 69			
222	33-H-585	HOSE: 1/2" ID; 6-1/2" long; oil filler tube; to the air cleaner.	
224	3320-GPW6766C	INDICATOR: engine oil level & filler cap; assembly; FM 6766C.	WO A6525
	ONA 19468	LINE: flexible 9" long; governor oil return; ONA 19458.	OK 10188
	ONA 7402	LINE: 3/16" x 21"; engine governor oil inlet; ONA 7402.	OK 17669
	OK 10201	LINE: oil pressure; engine block to safety switch; assembly.	OK 10201
	OK 10200	LINE: engine oil pressure; safety switch to oil gauge; assembly.	OK 10200
	3320-GPW6675	PAN, oil: engine assembly; FM GPW-6675.	WO A7238
	H006-0385110	TEE, oil pressure: engine safety switch; Ordnance part #143482.	WH 600X4
	H006-0385190	TEE, engine oil filter: lower.	WH 550X4
	OK 10151-12	TUBE: engine oil drain; assembly.	OK 10151-12
	3320-GPW6763C	TUBE: engine oil filler; assembly; FM GPW-6763C.	WO A6915
	G503-0217815	TUBE: inlet; engine oil filter; assembly; FM GPW-18667.	WO A1197
	FM GPW-18666	TUBE: engine oil filter outlet; assembly; FM GPW-18666.	WO A1198
		VALVE: 1/2"; engine oil drain.	
	H001-7025711	WASHER, lock: reg; steel; 5/16"; (oil pan); Ordnance part #120214.	WO 52558
Fig. 64		INTAKE AND EXHAUST MANIFOLDS GROUP.	
44	3320-GPW9462	BEARING: engine heat control valve shaft; FM GPW-9462.	WO 636438
	H001-5419180	BOLT: hex hd; semi-finish, alloy-steel; 5/16-18 NC x 1 (intake to exhaust manifold); Ordnance part #100122.	WO 51486
	G503-0194027	GASKET SET: engine manifold; FM GPW-18323; consists of: 1 gasket, WO 638640 FM GPW-9448. 1 gasket, WO 634811 FM GPW-9435. 1 gasket, WO 634814 FM GPW-9450.	WO A7835

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
Fig. 64		INTAKE AND EXHAUST MANIFOLDS GROUP (contd).	
50	3320-GPW9465	KEY: engine manifold heat control valve lever; FM GPW-9465.	WO 637211
49	3320-GPW9458	LEVER, counterweight: engine manifold; heat control; FM GPW-9458.	WO 637210
40	9680-A8158	MANIFOLD, engine intake: assembly.	WO A-8158
43	3320-GPW9426	MANIFOLD, engine exhaust: assembly; FM GPW-9426.	WO A-912
	G183-5415015	NUT: reg; hex; semi-finish; alloy-steel; Seez Pruf; 3/8-24 (intake and exhaust manifold); FM 351023S; Ordnance part #A247965C.	WO 53287
	H001-4135661	NUT, machine screw: hex; steel; No. 10 24 NC (clamp lever to shaft); FM 355836-S7; Ordnance part #120361.	WO A1701
	117244	PLUG, pipe: sq hd; black; 1/4" (engine intake manifold); FM 353055-S7; Ordnance part #117244.	WO 53410
	H001-1030102	SCREW, machine: rd hd; steel; No. 10 (.190)-24 NC-2 x 3/4; FM 355160-S.	WO 5272
Fig. 64			
46	3320-GPW9456	SHAFT, engine manifold: heat control valve; FM GPW-9456.	WO 637206
	9680-A8169	SHIELD, intake manifold: engine assembly.	WO A8169
47	3320-GPW9467A	SPRING: engine manifold heat control valve; FM GPW-9467A.	WO-637208
51	3320-GPW9463	STOP: engine manifold heat control valve bi-metal spring; FM GPW-9463.	WO 639743
52	H101-0112209	STUD: engine exhaust to manifold; FM GPW-88032S.	WO 332515
	WO 349712	STUD: engine inlet and exhaust manifold.	WO 349712
	H101-0103190	STUD, short: engine inlet and exhaust manifold; FM GPW-88042S.	WO 300143
	FM 88057S7	STUD, long: engine inlet and exhaust manifold; FM 88057S7.	WO 632159
Fig. 64			
45	3320-GPW9460	VALVE: engine manifold heat control; FM GPW-9460.	WO 636439
48	3320-GPW9484	WASHER: engine manifold heat control valve bi-metal spring; FM GPW-9484.	WO 637209
	H001-1519010	WASHER, lock: 5/16"; (intake manifold); FM 34906-S; Ordnance part #115548.	WO 52428
54	3320-GPW9443	WASHER: engine manifold clamp; FM GPW-9443.	WO 344732

CARBURETOR GROUP

	ONA-7375	ARM: engine carburetor choke; assembly; ONA-7375.	OK 1764-9
	ONA-7435	ARM: engine carburetor throttle; assembly.	ONA 7435
	1500-53A168S	ARM: engine carburetor pump w/collar assem; FM GPW-9528 CAR 53A-168S.	WO 116181
Fig. 23	1500-114-21S	ARM: w/screw; engine carburetor throttle shaft assembly; FM GPW-9583 CAR 114-21S.	WO 116197
Fig. 23	1500-572S	CARBURETOR: engine assembly; CAR 572S.	WO A7690
	3320-GPW9628	CLAMP: engine carburetor air horn; FM GPW-9628.	WO A-281
Fig. 23	1500-146-95S	COVER: engine carburetor bowl and pin assembly; FM GPW-9513 CAR 146-95S.	WO 116208
Fig. 23	1500-21-74S	FLOAT: engine carburetor; w/lever; assembly; FM GPW-9550 CAR 21-74S.	WO 116172
	G716-7033750	GASKET: engine governor and carburetor to intake manifold; lead; ONA 143A1.	OK 10213
	1500-184	GASKET SET, engine carburetor: consists of: 2 flange gaskets, CAR IA-56. 1 flange insulator gasket, CAR IA-57. 3 needle seat and plug gaskets, CAR 20-22. 3 metering rod jet & plug gaskets, CAR 20-26. 1 strainer plug gasket, CAR 20-61. 1 nozzle gasket, CAR 20-72. 2 body flange gaskets, CAR 121-56. 1 bowl cover gasket, CAR 121-73.	CAR 184
Fig. 23	1500-6-496S	HORN, air: engine carburetor; assembly; CAR 6-496S.	WO 116664
	1500-1344	KIT, repair: engine carburetor; consists of: 2 flange gaskets, CAR 1A-56. 1 flange insulator gasket, CAR 1A-57. 1 low speed jet assembly, CAR 11-180S. 1 rivet plug, CAR 11B-35. 5 rivet plugs, CAR 11B-79. 1 idle part rivet plug, CAR 11B-108. 1 strainer plug and gasket assembly, CAR 11B-125S. 2 nozzle and pump passage plug and gasket assemblies, CAR 11B-127S. 2 low speed jet and idle passage plug and gasket assemblies, CAR 11B-129S. 1 nozzle retainer plug, CAR 11B-171. 1 nozzle, CAR 12-255. 1 nozzle gasket, CAR 20-72. 1 needle spring and seat assembly, CAR 25-93S. 1 pump check strainer, CAR 30-20. 1 set choke valve attaching screws, CAR 39-10. 1 set throttle valve attaching screws, CAR 39-11. 1 idle well jet, CAR 43-67. 1 pump jet, CAR 48-84. 1 choker pull back spring, CAR 61-119.	CAR 1344

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		CARBURETOR GROUP (contd).	
		1 connector rod spring, CAR 61-128. 1 pump arm spring, CAR 61-169. 1 metering rod spring, CAR 61-201. 1 spring retainer, CAR 63-35. 1 plunger and rod assembly, CAR 64-62S. 1 metering rod standard, CAR 75-570. 4 bowl cover lockwashers, CAR 86-10. 2 body flange lockwashers, CAR 86-11. 4 bowl cover attaching screws, CAR 101-82. 2 body flange attaching screws, CAR 101-122. 2 air horn screw and washer assemblies, CAR 101-150S. 1 metering rod pin hex nut, CAR 105A19. 1 throttle shaft arm and screw assembly, CAR 114-21S. 1 throttle connector rod, CAR 115-59. 1 connector link, CAR 117-58. 1 metering rod jet and gasket assembly, CAR 120-135S. 2 body flange gaskets, CAR 121-56. 1 bowl cover gasket, CAR 121-73. 1 discharge disk check plug assembly, CAR 122-47S. 1 intake ball check plug assembly, CAR 122-64S. 1 metering rod disk, CAR 129-15. 1 metering rod pin washer, CAR 136-39. 1 metering rod pin, CAR 150-97. 3 pin springs, CAR 150A-10.	
	ONA 7430	LEVER: engine carburetor idle set; ONA 7430.	OK 1673-9
	1500-53A170S	LEVER: engine carburetor pump; operating; CAR 53A170S.	WO 116182
	1500-25-93S	NEEDLE, pin: engine carburetor spring and seat assembly; FM GPW-9567 CAR 25-93S.	WO 116174
	CAR 105A34	NUT: hex; engine carburetor throttle lever adjusment screw; CAR 105A34.	WO 116653
	H001-4167601	NUT: hex; steel; 3/8-24 NF-2 (carburetor to manifold stud) SM-33800-S7; Ordnance part #120369.	WO 52542
	G179-0579810	PIN: engine carburetor float lever; FM GPW-9558, CAR 24-23.	WO 116173
Fig. 23	G104-0102538	SCREW, idle adjusting: engine carburetor; FM GPW-9541, CAR 30A39.	WO 116176
	CAR 101-192	SCREW: engine carburetor throttle lever adjustment; CAR 101-192.	WO 116652

	G103-1781857	SCREW, idle adjusting; engine carburetor; CAR 101-120.	WO 116651
	1500-101150S	SCREW AND WASHER: engine carburetor air horn attaching assembly; FM-355200S7 CAR 101-150-S.	WO 116385
	CAR 13-85	SHAFT: engine carburetor choke valve; CAR 13-85.	WO 116665
	1500-3-497S	SHAFT: engine carburetor throttle and lever; assembly; CAR 3-497S.	WO 116646
	G103-1789631	SPRING: engine carburetor idle adjustment screw; FM GPW-9578 CAR 61-57.	WO 116183
	1500-7-116S	VALVE: engine carburetor choke; assembly; FM GPW-9549 CAR 7-116S.	WO 116157
	1500-2-116	VALVE: engine carburetor throttle; CAR 2-116.	WO 116545
		FUEL PUMPS AND CONTROLS GROUP	
	0040-1521960	ARM, rocker; engine fuel pump; assembly; FM GPW-9399 AC 1521960.	WO 115641
	G085-3000180	BAIL, gas strainer: engine fuel pump; FM GPW-9387 AC 1523231.	WO 115657
	H001-5419160	BOLT: hex-hd; steel; 5/16-18 NC x 7/8 (fuel pump to cylinder block) Ordnance part #106325.	WO 6428
Fig. 24	G085-3000880	BOWL, metal: engine fuel pump; FM GPW-9355 AC 1537065.	WO A-1494
	G085-3004580	CLAMP: engine fuel pump valve; FM 11A9361 AC 1521956.	WO 115653
Fig. 24	G085-3002220	GASKET: engine fuel pump bowl; FM GPW-9364 AC 1523096.	WO 115656
	G085-3002240	GASKET: engine fuel pump to cylinder block; FM IGA9417 AC 838263.	WO 638737
	0040-1538360	KIT, repair: fuel pump; FM GPW-183730 AC 158360; consists of: 1 gasket, WO 638737 FM IGA9417. 1 link, WO 115880 FM INC9381. 1 pin, WO A-1046 FM GPW 9378. 1 washer, WO A-1047 FM GPW9377. 3 washers, WO 113440 FM 34803S7. 1 seal, WO 115870 FM GPW 9469. 1 spring, WO 115643 FM GPW 9380. 1 screen, WO 115654 FM GPW 9365. 1 diaphragm, WO 116695 FM GPW 93988. 1 spring, WO 116694 FM GPW 9396. 1 gasket, WO 115656 FM GPW 9364. 2 valves, WO 115651 FM 11A9352. 2 gaskets, WO 115652 FM GPW 9363. 1 screw, WO 51546 FM 26466S7. 3 screws, WO 113439 FM 31628S7.	WO A-9293
Fig. 24	G085-1414736	NUT, thumb: gas strainer; engine fuel pump; FM GPW-9373 AC 855763.	WO 113461
Fig. 24	3320-GPW9350B	PUMP: fuel mechanical; engine assembly; FM GPW 9350B AC 1538312.	WO A-8323

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		FUEL PUMPS AND CONTROLS GROUP (contd).	
Fig. 24	G085-3004880	SCREEN, filtering: engine fuel pump; FM GPW-9365 AC 1523099.	WO 115654
	0040-1521880	SEAL: engine fuel pump pull rod; FM GPW 9469 AC 1521880.	WO 115870
	G067-1501511	SEAT, gas strainer bowl: engine fuel pump; FM GPW-9388 AC 854005.	WO 113460
Fig. 24	0040-1521985	WASHER: engine fuel pump diaphragm spring seat; FM GPW-9468 AC 1521985.	WO 115869
	H001-7025711	WASHER, lock: steel; 5/16"; (fuel pump to cylinder block bolt); Ordnance part #120214.	WO 52558
		AIR CLEANER PARTS TUBES, HOSES, AND CLAMPS GROUP	
	G503-7036575	CLAMP, hose: engine carburetor to air cleaner; FM GPW 9653.	WO 635097
	H106-0111604	CLAMP, hose: 3/4"; engine carburetor air cleaner tube; FM-GPW6772; Ordnance part #111604.	WO 53108
	OK 10211-0	CLEANER: engine carburetor air; assembly.	OK 10211-0
	6855-613306	CUP, oil: engine carburetor air cleaner; FM GPW-9658 OKS 613306.	WO A-5631
	G503-0169093	ELEMENT: engine carburetor air cleaner; w/wing bolt; FM GPW-9617 OK 613387.	WO A-5630
	G179-7010485	GASKET: engine carburetor air cleaner body; FM GPW-9621 OKS 613313.	WO A-5632
	6855-613314	GASKET: engine carburetor air cleaner oil cup; FM GPW-9623 OKS 613314.	WO A-5633
	3320-GPW-9632	HORN: engine carburetor air; FM-GPW-9632.	WO A463
	ONA 7448	HOSE: 2-1/8 x 13", flexible; carburetor to air cleaner; ONA 7448.	GV 8830
	6855-613380	SPRING, toggle: engine carburetor air cleaner assem; FM GPW-9612 OKS 613380.	WO A7191
		ENGINE SPEED GOVERNOR GROUP	
	OK 11733-0	CAP, fuel tank: assembly; EAT-GA 565.	OK 11733-0
	WH 200X4	CONNECTOR: 1/4"; inverted male; fuel line pump to fuel filter.	WH 200X4
	3320-GPW 9268	CONNECTOR: fuel line; pump to carburetor; FM GPW 9268.	WO 384549
	WH 3400X2	ELBOW, Street: fuel line.	WH 3400X2
	WH 400X4	ELBOW: inverted male; engine fuel pump connection.	WH 400X4
	SW 439032	GAUGE, fuel: tank unit; assem.	SW 439032

	9680-A6616	LINE: engine fuel pump to carburetor.	WO A6616
	OK 10199	LINE: flexible; fuel tank to fuel pump; 51" long.	OK 10199
	OK 1781/9-1	LINE, auxiliary fuel: assembly; 20'long.	OK 1781/9-1
	WH 3326X2	NIPPLE, close: fuel line.	WH 3326X2
		ENGINE SPEED GOVERNORS GROUP	
Fig. 47	GV 3R44	BELT: engine governor drive.	GV 3R44
Fig. 47	KS 26628	BOLT, eye: engine governor springs; KS 26628.	WRS-B1210
	9680-A-6419	BRACKET: engine governor support.	WO A-6419
	5300-26773	GASKET: engine governor bumper spring screw; KS 26773.	WRS X8
	5300-26646	GASKET: engine governor housing cover; KS 26646.	WRS B1217
	5300-25230	GASKET: housing cover screw; engine governor; KS 25230.	WRS B1218
Fig. 47	5300-26710-326	GOVERNOR: w/pulley; engine assembly; KS-26710-326.	WRS B1200
	KS 235-739D	GOVERNOR: engine overspeed assembly.	KS 235-739D
Fig. 47	H001-4185560	NUT, lock: engine governor spring eye bolt; KS H7434; Ordnance part #114493.	WRS X210
Fig. 47	G716-7037325	NUT, lock: engine governor adjusting screw.	WRS X209
Fig. 47	G716-7037325	NUT, lock: engine governor bumper spring screw; KS HA6202.	WRS X209
	H013-0500755	OIL SEAL: engine governor shaft; GPC 49; ordnance part #500755.	WRS X204
	H013-0545296	OIL SEAL: engine governor operating shaft; GPC 37; Ordnance part #545296.	WRS X-205
Fig. 47	H001-0824032	PIN, taper: engine governor drive pulley; Ordnance part #103576.	WRS X-212
Fig. 47	G716-7036856	PLUG: engine governor oil level; KS A25368.	WRS X215
Fig. 47	G716-7036851	PULLEY: engine governor driven; Ordnance part #213891.	WRS B1216
Fig. 47	H101-0213891	SCREW, adjusting: engine governor; KS 21535.	WRS X208
Fig. 47	G716-7036854	SCREW: engine governor bumper spring; KS 26649.	WRS G1018
	G716-7037326	SCREW: engine governor housing cover; KS 26648.	WRS X214
	G716-7036853	SCREW: shoulder type; engine governor spring slide.	WRS B1220A
Fig. 47	5300-26618	SLIDE: engine governor spring; KS 26618.	WRS B1207
	WO A6824	SPACER: engine governor mounting.	WO A6824
Fig. 47	G716-7036855	SPRING: control, engine governor.	WRS B600A
	5300-H9367	SPRING: engine governor bumper; KS-H9367.	WRS S500
	KS 22450	STUD: engine governor and carburetor manifold.	KS 22450

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		FUEL FILTERS GROUP	
	G104-0500265	BOWL: engine fuel filter.	TL OW 363
	TL OW 447	CLAMP: wire and thumb nut; engine fuel filter assembly.	TL OW 447
	8480-0W418	FILTER: engine fuel; assembly.	TL OW 418
	G104-0501276	GASKET: bowl; engine fuel filter.	TL OW 222
	G104-0503246	SCREEN: engine fuel filter.	TL OW 352
		THROTTLE AND CHOKE CONTROLS AND FUEL SHUT-OFF VALVE GROUP	
	OK 10212-0	CHOKE, engine carburetor: automatic; assem; PG-AC758B; 6 volt.	OK 10212-0
	OK 1643-12	CONTROL: engine carburetor choke assembly.	OK 1643-12
Fig. 4	OK 10207-9	LINK: engine governor to carburetor assembly.	OK 10207-9
Fig. 4	OK 1638-9	ROD: engine carburetor automatic choke.	OK 1638-9
Fig. 8	G716-7039036	VALVE: fuel tank shut-off.	WH 6737
		MUFFLER AND MUFFLER PIPES GROUP	
57	ONA 7399	ADAPTER: exhaust pipe.	OK 10166-0
	H001-5421300	BOLT: hex hd; semi-finish; alloy-steel; 3/8-24 NF x 1-1/4; adapter to manifold; Ordnance part #10027.	WO 50878
	H006-0221630	COUPLING: reducing; M I, 1-1/2 P T x 1-1/4 P T; Ordnance part #Q51G.	
55	3320-GPW9450	GASKET: engine exhaust adapter to manifold; FM GPW-9450.	WO 634814
56	OK 10161-24	MUFFLER: engine exhaust; assem.	OK 10161-24
	G183-5415015	NUT: hex; steel; 3/8-24 NF-2; exhaust flange to manifold; FM 351023S; Ordnance part #A247965C.	WO 53287
	OK 10159-12	PIPE: engine exhaust extension.	OK 10159-12
58	OK 10158-18	PIPE: engine exhaust.	OK 10158-18
62	H006-0283570	PLUG: C I sq hd; 1/2 P T cd-plated; engine exhaust muffler; Ordnance part #143935.	OK 10181-9
Fig. 64 60	OK 10184-9	PLUG: engine exhaust pipe drain; brass; sq hd; 3/8 P T w/1/16 diam hole.	OK 10184-9

	OK 10160-12	TUBING, flexible: engine exhaust; assembly.	OK 10160-12
	H001-7025711	WASHER, lock: reg; steel; 3/8"; exhaust flange to manifold; Ordnance part #120214.	WO 52558
		RADIATOR GROUP	
	119928	BUSHING: radiator drain valve; Ordnance part #119928.	WH 3226X4
	OK 11739-0	CAP: radiator.	OK 11739-0
Fig. 4	G716-7036598	RADIATOR: engine cooling assembly; PRX-R23788.	OK 11203-0
	H106-0103647	VALVE: radiator drain; Ordnance part #103647.	WH 145
		FITTINGS, LINES, HOSES, TUBES, CLAMPS, AND THERMOSTAT GROUP	
Fig. 4	3320-608287	CLAMP, hose; radiator; FM 60-8287.	WO 52226
Fig. 4	3320-GPW8284	HOSE: radiator outlet and inlet; FM-GPW8284.	WO A592
	ONA 7011	INSERT: engine water temperature thermostat changer.	OK 1598-9
	3320-GPW8578	RETAINER: engine water temperature thermostat; FM GPW-8578.	WO 639651
	G503-0400093	THERMOSTAT: engine water control assembly; FM GPW-8575 (HR 3108628).	WO 637646
	3320-GPW8290	TUBE, connecting: radiator inlet; FM-GPW8290.	WO A6374
	OK 1587-12	TUBE, connecting: radiator outlet.	OK 1587-12
		WATER PUMP GROUP	
	H001-5419160	BOLT: hex hd; steel; 5/16 NC x 7/8 (pump to block); Ordnance part #106325.	WO 6428
Fig. 70	H101-0100127	BOLT: hex hd; semi-finish; 5/16-18 NC x 2-1/2 (pump to block); FM-355442S; Ordnance part #100127.	WO 51858
288	G503-0194016	GASKET: engine water pump to cylinder block; FM GPW-8543.	WO 637053
281	3320-GPW8512	IMPELLER: engine water pump; FM GPW-8512.	WO 639993
	3320-GPW18515B	KIT, repair: water pump; engine; FM GPW-18515B; consists of: 1 shaft and bearing, WO 636297 FM GPW-8530-A. 1 wire, WO 636298 FM GPW-8576. 1 seal, WO 640031 FM GPW 8524A. 1 gasket, WO 637053 FM GPW 8543. 1 washer, WO 640034 FM GPW 8557A.	WO A-6839
	G503-034896	PUMP: engine water; assembly; FM GPW-8501.	WO 639992
	H001-7025711	WASHER, lock: reg; steel; 5/16"; (pump to block bolt).	WO 52558

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		FAN, FAN DRIVE, FAN PULLEYS, AND FAN BELTS GROUP	
Fig. 48	H017-0507226	BELT: drive; engine fan; FM GPW-8620A.	WO A-9490
Fig. 48	H001-5417600	BOLT: hex hd; semi-finish; alloy-steel; 1/4-20 NC x 5/8 (fan to pulley); Ordnance part #106319.	WO 51514.
Fig. 48	G716-7036597	FAN: engine cooling; assembly; ONA 7345; (SZ-AF07589).	OK 1645-18
	H001-0518022	KEY, Woodruff #9; pulley to engine crankshaft; FM 74178S; Ordnance part #124549.	WO 5036
Fig. 48	9680-A6414	PULLEY: engine fan and governor drive.	WO A-6414
Fig. 48	3320-GPW8509A	PULLEY: engine fan and water pump; FM GPW-8509A.	WO 636299
Fig. 48	H001-1518007	WASHER, lock: steel; 1/4"; (fan to pulley bolt); Ordnance part #103319.	WO 52706
		GENERATOR GROUP	
Fig. 26	FM-GPW 10005B	ARMATURE: battery charging generator; assembly FM-GPW-10005B (AL-GEG-2134F).	WO A10295
	G121-0115950	BAND, head: battery charging generator; assembly; FM-GPW-10142 (AL-GCE24).	WO A1649
	H012-1900060	BEARING: absorbent bronze; battery charging generator; commutator end; FM-GPW10128 (AL-GBF79).	WO A1793
Fig. 26	H012-1323017	BEARING, ball: battery charging generator drive end; FM-GPW10094; ND-77503 (AL-X1655).	WO A6299
	FM 355496S	BOLT: hex hd; steel; 3/8-16 NC x 7/8; battery charging generator support.	WO 633949
	3320-GPW10176	BOLT, pivot: battery charging generator brace; FM-GPW 10176.	WO A1468
	FM 355496S	BOLT: battery charging generator; bracket support to cylinder block.	WO 633949
	FM 355455S	BOLT: special; hex hd; steel; 5/16-24 NF 3 x 1-29/32 battery charging generator support.	WO A1397
	H101-0100123	BOLT: hex hd; steel; 5/16-18 NC x 1-1/4 (generator brace to generator); Ordnance part #100123.	WO 6157
	H001-5421280	BOLT: hex hd; steel; 3/8-24 NF x 1-1/8 (generator guide to brace); Ordnance part #106286.	WO 6606
	3320-GPW10143	BRACE: battery charging generator support FM-GPW 10143.	WO A1399

	FM-GPW 10153A	BRACE: battery charging generator w/handle; GPW 10153A.	WO A1491
Fig. 26	G121-0126320	BRUSH set: battery charging generator; FM-GPW 18274 (AL-GCE 2012S); consists of: 2 brushes, WO-A1630-FM-GPW10069 AL-GCE1012S.	WO A1651
	3320-GPW10177	BUSHING: battery charging generator brace; FM-GPW 10177.	WO A1470
Fig. 26	FM-GPW10119B	COVER: battery charging generator drive end; FM-GPW 10119B (AL-GEG1030).	WO A10292
Fig. 26	FM-GPW-10000A3	GENERATOR AND PULLEY: battery charging; assembly; FM-GPW 10000A3 (AL-GEG5101-D).	WO A10048
	3320-GPW10162	GUIDE, adjusting: battery charging generator brace; FM-GPW 10162.	WO A1400
	FM-GPW 10129	HEAD: battery charging generator; commutator end; partial assembly; FM-GPW 10129 (AL-GCE 1133A).	WO A10291
	FM-GPW10138	HEAD: battery charging generator drive end; assembly; FM-GPW 10138 (AL-GCE1125A).	WO A6300
	FM-GPW-10178A	INSULATOR: battery charging generator support; FM-GPW 10178A.	WO A1395
	FM-GPW 18363B	KIT, repair: battery charging generator; FM-GPW 18363B (AL-KIT119); consists of: 1 brush set, WO A1651, FM GPW 18274, AL-GCE-2012 S. 1 cover band screw, WO A1589, FM 34141 S7, AL 8 x 794 nut. 1 cover band screw, WO A1650, FM 27161 S7, AL-8 x 715. 2 screws, brush lead, WO A1632, FM 26457 S7, AL-8 x 305. 3 screws, D E bearing retainer, WO A1647, FM 36800 S7, AL-8 x 311. 2 springs, WO A1628, FM GPW 10057, AL-GCE53. 1 washer, felt, D E inner, WO A1644, FM 7810212 A, AL-GAU-31. 1 washer, felt D E outer, WO A1646, FM GPW 10212, AL GT78. 2 washers, lock, thru bolt, WO A5288, FM 34806 S7, AL 12x1014. 1 cover, oil wick, WO A1786, FM GPW 10087, AL GAR98 A. 1 wick, oil, WO A1785, FM GPW 10147, AL GAR73. 1 gasket, WO A1787, FM GPW 10122, AL GBW69. 4 screws, comm. end cover, WO A7803, FM 31061 S7, AL 8x888. 4 washers, lock, WO A10294, FM 34802 S7, AL 12x195. 1 gasket, oil retainer, WO A1789, FM GPW 10086, AL GBW73. 1 guard, oil, WO A1788, FM GPW 10082, AL GBW72. 1 plug, felt C E cover WO A10293, FM GPW 10112, AL GEG 33. 2 washers, lock, brush lead screw, WO 51532, FM 34802 S, AL X195. 3 washers, lock, WO 5168, FM 34803 S, AL X196.	WO A10369
	FM-GPW 18342B	KIT, repair: battery charging generator field coil; FM-GPW 18342B (AL KIT10); consists of: 1 bushing, insulating, WO A1599, FM GPW 10206 AL GCY-25. 1 bushing, insulating, WO A1598, FM GPW 10206 B, AL GCT-25. 1 coil, field assembly, WO A1604, FM GPW 10175, AL GEB-1005A.	WO A7840

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		GENERATOR GROUP (contd).	
		1 insulation, field connect., WO A1592, FM 01A 10193, AL-GAL-44. 1 insulator, terminal post, bottom, WO A1595, FM GPW 10208B, AL-GBW-67. 1 insulator, terminal post, bottom, WO A1594, FM GPW 10202C, AL-GBW-66. 1 insulator, terminal post, top, WO A1591, FM GPW 10202 B, AL-GAA32. 1 lead, assembly, WO A1601, FM GPW 10100, AL-GEB-44. 1 nut, No. 6 32 hex ground screw, WO A1610, FM 34051 S 7-8, AL-8X140. 2 nuts, No. 10 32 hex terminal, WO A1617, FM 350853 S7, AL-8X1377. 2 nuts, No. 14-24, WO A1611, FM 355883 S7, AL-8X177. 1 screw, No. 6 32 x 9/16 flat head, ground, WO A1618, FM 36009 S7, AL-8X1420. 2 screws, pole piece, WO A1596, FM 355486 S7, A1 GBY38A. 1 washer No. 10 plain, WO A1615, FM 34703 S7, AL-8X349. 1 washer, insulating WO A1597, FM GPW 10208A, AL-GC26. 1 washer, insulating, WO A1593, FM GPW 10202A, AL-GBW-34. 1 washer, lock, No. 10 WO A1614, FM 34843 S7, AL-12X196. 1 washer, plain, 1/4, WO A1616, FM 356264 S7, AL 8X361. 1 washer, lock, No. 14 WO A1612, FM 356263 S7, AL-12X193. 1 washer, lock No. 6, WO A1613, FM 34801 S7-8 AL 12X194.	
	H001-4167561	NUT: hex steel; 5/16-24 NF; FM 33798S7, Ordnance part #120368 (generator support insulator bolt).	WO A1532
	H001-4167540	NUT: regular; hex; steel; 5/16-18 NC (generator brace to generator bolt) Ordnance part #120376.	WO 52850
	H001-4167601	NUT: hex; steel; 3/8-24 NF 2; FM 33800S7 (generator pivot bolt) Ordnance type #120369.	WO 52542
	FM-GPW 10141	OILER: battery charging generator; FM-GPW 10141 (AL-X489).	WO 302347
	FM-GPW 10061	PULLEY: battery charging generator drive; w/spacer; assem; FM-GPW 10061 (AL-SP484A).	WO A1639
	FM-36800S7	SCREW: battery charging generator ground; FM-36800S7 (AL-8X1368).	WO A6297
	FM-GPW 10120	SCREW: battery charging generator frame; FM-GPW 10120 (AL-DK23).	WO A1590
	FM-GPW 10176	SCREW: battery charging generator; brace pivot; FM-GPW 10176.	WO A1468
	FM 27161S7	SCREW: 10-32 x 1-1/4; battery charging generator cover band; FM 27161S7 (AL-8X715).	WO A1650
	FM-GPW 10035	SPACER: battery charging generator drive pulley; FM-GPW 10035 (AL-GEG31).	WO A8842

	FM-GPW 10051	SPRING: battery charging generctor brush; FM-GPW 10057 (AL-GCE53).	WO A1628
	3320-GPW10155	SPRING: battery charging generator support brace; FM-GPW 10155.	WO A1469
	FM-GPW 10166	SUPPORT: battery charging generator; FM-GPW 10166.	WO A1392
	3320-GPW10166	SUPPORT: battery charging generator; FM-GPW 10166.	WO A1392
	3320-356436S	WASHER: battery charging generator support; FM-356436S.	WO A1396
	FM-GPW 10134	WASHER: battery charging generator drive end; FM-GPW 10134 (AL-GEW31).	WO A1638
	3320-356371S	WASHER: battery charging generator support; FM-356371S.	WO A1401
	178532	WASHER, lock: steel; cd pltd internal; external tooth; 5/16 I D; Ordnance stock No. 178532.	WO 53025
	H001-7045541	WASHER: plain; flat; cd pltd; 7/16 I D; FM 34707S7 (generator guide to brace) Ordnance stock No. 120388.	WO 5455
	H001-1518009	WASHER, lock: steel; 3/8"; (generator pivot bolt nut); Ordnance stock No. 103321.	WO 5010
		GENERATOR REGULATOR	
	FM-GPW10623	GASKET: generator regulator cover; FM-GPW 10623 (AL-VRA50).	WO A9046
	FM-GPW-10564	GASKET: generator regulator terminal; FM-GPW-10564 (AL-VRA51).	WO A9047
	FM-GPW-18299	KIT: repair; generator regulator; current regulator; FM-GPW-18299; (AL-KIT 16); consists of: 1 nut, adjusting, WO A7796, AL VRA15. 1 screw, adjusting, WO A7797, AL VRA16. 1 spring, armature, WO A7806, AL VRA 84. 1 spring, armature, WO A7806, AL VRA 84. 1 armature, WO 7808, AL VRY1061 B. 3 washers, lock, No. 8, WO 51532, AL X195. 3 washers, plain, No. 8, WO A1666, AL-8X350. 2 screws, fil hd, WO A7802, AL 8X878.	WO A7805
	FM-GPW 18311	KIT, repair: generator regulator; voltage regulator; FM-GPW 18311; consists of: 1 nut, adjusting, WO A7796, AL VRA15. 1 screw, adjusting, WO A7797, AL VRA16. 1 spring, armature, WO A7896, AL VRA 84. 1 armature, WO A7809, AL VRY 1080 B. 3 lockwashers, No. 8, WO 51532, AL X195. 3 washers, plain, No. 8, WO A1666, AL 8X350. 2 screws, fil hd, short, WO A7802, AL 8X878.	WO A7810
	FM-GPW 18298	KIT, REPAIR: generator regulator cutout relay; FM-GPW 18298 (AL-KIT 13); consists of: 2 washers, insulating, WO A7795, AL GAA35.	WO A7794

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		GENERATOR REGULATOR (contd).	
		1 nut, adjusting, WO A7796, AL-VRA15.	
		1 screw, adjusting, WO A7797, AL-VRA16.	
		1 spring, armature, WO A7798, AL-VRA17.	
		1 insulation, WO A7799, AL-VRA76.	
		1 armature and contact assembly, WO A7800, AL VRY 1043.	
		1 contact stationary bracket assembly, WO A7801, AL VRH 1073.	
		3 lockwashers, No. 8, WO 51532, AL X195.	
		3 washers, plain, No. 8, WO A1666, AL 8X350.	
		2 screws, fil hd, long, WO A7802, AL 8X878.	
		2 screws, fil hd, short, WO A7803, AL 8X888.	
		2 washers, insulator, WO A7804, AL X1465.	
	FM-GPW 10505	REGULATOR: generator; assembly; FM-GPW 10505 (AL-VRY4203G).	WO A1409
	FM-GPW 10594	RESISTOR: generator regulator; FM-GPW 10594 (AL-TC51N).	WO A9054
	FM GPW 10570	RESISTOR: generator regulator; FM GPW 10570 (AL-TC51U).	WO A5256
	FM 355427S	SCREW: fil hd; steel; 5/16-24/NF x 1/2; generator regulator; FM 355427S (AL 8X137).	WO A9050
		STARTER, SOLENOIDS, AND SWITCHES GROUP	
Fig. 25	2980-MZ2089	ARMATURE: engine starter assembly; FM GPW-11005 (AL MZ-2089).	WO A1568
	F227-0105011	BAND: engine starter; FM GPW-11077 (AL MZ-1024).	WO 109452
Fig. 25	G067-0900250	BEARING: engine starter; intermediate assembly; FM GPW-11130 (AL MAB-2040A).	WO A1582
Fig. 25	FM 355164S	BOLT: hex hd; engine starter, bendix housing; FM 355164S (AL MZ-52).	WO A1584
Fig. 25	G505-0152523	BRUSH: insulated; engine starter; FM GPW-11055 (AL-MZ12).	WO 109431
Fig. 25	G067-0900810	BUSHING: engine starter; commutator end; FM GPW-11135 (AL MG-77A).	WO A1583
Fig. 25	2980-EBA-46	DRIVE: bendix engine starter assembly; FM GPW-11350 (AL EBA-46).	WO A1573
Fig. 25	2980-PS1079A	HOUSING: engine starter bendix drive pinion; FM GPW-11131 (AL PS1079A).	WO A1585
	H001-0518016	KEY, Woodruff: #6; engine starter armature; FM 74175S (AL X-261); Ordnance stock No. 124546.	WO 53448

	2980 KIT 25	KIT, repair: engine starter bendix drive; FM GPW-18329 (AL KIT 25); consists of: 1 head driving, WO 21576, FM B11381, AL EB 8503. 1 key, Woodruff, No. 6, WO 5017, FM 74175S AL X261. 1 screw, head spring, WO A1578, FM GPW 11377, AL RB8506. 1 screw, shaft spring, WO A1579, FM GPW 11382, AL EB 8507. 1 sleeve, compression, WO A1575, FM B11357 A, AL EB7819S.	WO A7842
	2980 KIT 26	KIT, repair; engine starter field coil; FM GPW-18319 (AL KIT 26); consists of: 1 coil, field, upper right, WO A1563, FM GPW 11085, AL MZ1010. 2 connector, field coil, WO A1558, FM GPW 11090, AL MZ32. 1 insulator, field connection, WO A1557, FM GPW 11089, AL MZ30A. 2 nuts, 5/16 24, hex, WO A1565, FM 355944 S5, AL 5X1376. 1 post, terminal, WO 109433, FM GPW 11103, AL MU28. 4 screw, pole piece, WO A1559, FM 355485 S7, AL MZ38A. 1 terminal, WO A1554, FM GPW 11102, AL MU14. 2 washer, lock, 5/16, WO 5051, FM 34806 S7, AL X1014. 1 washer, plain, 5/16, WO A1555, FM 34706 S2, AL MU37. 1 washer, insulating, WO A1553, FM GPW 11094, AL MAB 31. 1 washer. insulating, WO 109437, FM GPW 11095, AL MU39. 1 bushing, insulating, WO 109436, FM GPW 11107, AL MU31. 1 coil and brush field assembly, lower left, WO 109427, FM GPW 11082, AL MZ1009. 1 coil and brush field assembly, lower right, WO 109428, FM GPW 11084, AL 1 coil, field, upper left, WO A1560, FM GPW 11083, AL MZ1007.	WO A7841
	FM 355944S5	NUT: hex; 5/16-24NF; engine starter terminal post; FM 355944S5 (AL 5X1376).	WO A1565
	2980-MZ2156	PLATE: engine starter; commutator end; assembly; FM GPW 11049; includes 2 WO-109446 brushes (AL MZ2156).	WO A1566
	G067-0905580	RING: take-up; bendix engine starter; FM B11371 (AL EB-8734).	WO A1580
	FM 36954 S7	SCREW: engine starter head band; FM 36954 S7 (AL X714).	WO A1588
	2980-EB8507	SCREW: engine starter bendix shaft spring; FM GPW-11382 (AL EB-8507).	WO A1579
	H001-1026463	SCREW: engine starter commutator end plate; FM 31596 S (AL X902).	WO A1572
	2980-EB8506	SCREW: engine starter bendix head spring; FM GPW-11377 (AL EB-8506).	WO A1578
	2980-EB8505	SPRING, drive: engine starter motor; FM GPW-11373 (AL EB-8505).	WO A1577
	G067-0905570	SPRING: engine starter brush; FM B11059 (AL MZ-19).	WO 109445
	G503-0295835	STARTER: engine assembly; FM GPW-11001A (AL MZ-4113).	WO A1245
	AL SS4025	SWITCH: magnetic; engine starter; 6 volt.	AL SS4025
	PLE 2782	SWITCH: engine starter (on dash) (AH-B1).	PLE 2782
	G067-0906840	WASHER, lock: engine starter housing screw; FM B11379 (AL EB-108).	WO A1574
	G104-1842710	WASHER, thrust: engine starter; armature commutator end; FM GPW-11036B (AL MU-54).	WO 109455

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		DISTRIBUTOR GROUP	
Fig. 10	FM GPW-12106B	CAP: engine ignition distributor; assembly; FM GPW-12106B (AL IG1324D).	WO A9307
	FM GPW-12217	CLIP: engine ignition distributor breaker arm spring; FM GPW-12217 (AL-1G676).	WO A1663
Fig. 10	GPW-12195	COLLAR: engine ignition distributor shaft; FM GPW-12195 (AL-IGB199).	
		CAPACITOR: engine ignition distributor; FM GPW-12300 (AL-IGW3139).	WO A1631
Fig. 10	FM GPW-13100B	DISTRIBUTOR: engine ignition; assembly; FM GPW-12100B (AL-1AD4008).	WO A9075
	FM GPW-18354	KIT: contacts; engine ignition distributor; FM GPW-18354 (AL IGP3028FS); consists of: 1 arm, WO A1570 FM-GPW 12162. 1 point, WO A1564 FM-GPW 12218.	WO A1687
	FM GPW-18343B	KIT, repair: engine ignition distributor; FM GPW-18343B (AL KIT 121); consists of: 2 bearing, distributor shaft, WO A1681 FM GPW-12082, AL IG579A. 1 clip, breaker arm spring, WO A1663 FM GPW-12217, AL IG676. 1 ring, lock spring, WO A1653 FM GPW-12177, AL IG680. 1 rivet, distributor drive, WO A1685 FM 72867S, AL GJ236. 1 screw, capacitor, WO A1670 FM 31026S7, AL 8X1546. 1 screw, WO A1668 FM 31027S8, AL 8X884. 1 screw, capacitor, WO A1633 FM 36787S7, AL IGC175. 2 washers, lock, No. 6, capacitor screw, WO A1669 FM 34801S7, AL X1012. 2 washers, lock, WO 5168 FM 34803S7 AL X196. 1 washer, cam spring, WO A1672 FM GPW-12120, AL IGS99. 1 washer, breaker arm, spring screw, WO A1667 FM 34701S7, AL 8X353. 1 washer, contact adjusting lock screw, WO A1666 FM 34702S2, AL 8X350. 1 washer, shaft thrust, upper, WO A1673 FM GPW-12182, AL IGS104. 1 washer, shaft thrust, lower, WO 106740 FM GPW-12199, AL IG90. 1 wick, cam sleeve felt, WO A1671 FM GPW-12133, AL IGH 28. 1 connector, terminal post, WO A10276 FM GPW-12165, AL LAD7. 1 insulation, terminal post, inner, WO A10277 FM GPW-12166, AL IAD8. 1 bushing, terminal post, WO A10278 FM GPW 12167 AL IAD-10. 1 post, terminal, WO A-10279 FM GPW-12163, AL IGL-8. 1 washer, insulator, terminal post, WO A-10280 FM GPW-12157, AL IGL-9. 1 nut, terminal post, WO A-5260 FM 34079S7 AL 8X-173. 1 washer, terminal post, WO A-5262 FM 34703S7, AL 8X-183A. 2 screws, breaker, plate holding, WO A-9318 FM 350110-S7, AL X-2878.	WO A15098
Fig. 10	FM B10141	OILER: engine ignition distributor; FM B10141 (AL-X490).	WO 107128

Fig. 10	FM GPW-12010B	PLATE: breaker; engine ignition distributor assembly; FM GPW-12010B (AL-IAD2004).	WO A9309
Fig. 10	FM GPW-12200	ROTOR: engine ignition distributor; FM GPW-12200 (AL-IG1657).	WO A1658
Fig. 10	FM-GPW-12083	SPRING: engine ignition distributor shaft friction; FM GPW-12083.	WO 637615
	FM GPW-12084B	SPRING: set; engine ignition distributor governor weight; FM GPW-12084B (AL-IGB350S).	
	FM GPW-12006	TERMINAL: engine ignition distributor; FM GPW-12006 (AL-IG94).	WO-A1652
	FM-GPW-12267	WASHER, thrust: engine; ignition distributor shaft; FM GPW-12267 (AL-IG816C).	WO-A1654
		IGNITION COIL, WIRING, SPARK PLUG, AND SWITCHES GROUP	
	FM GPW-12300B	COIL: engine ignition; assembly; FM GPW-12300B (AL IG-4070L).	WO-A7792
Fig. 4	CP C-10-S	PLUG, spark.	CP C10S
	H001-4167521	NUT: regular; hex; steel; cd-pltd; 1/4-28NF-2; engine ignition coil stud; FM 33796S7; Ordnance part No. 120367.	WO 52847
	FM 357689S7	STUD: engine ignition coil mounting; FM 357689S7.	WO 635886
	H001-7124701	WASHER, lock: steel; cd-pltd; internal tooth; 1/4"; ignition coil stud nut; Ordnance part No. 174916.	WO 53024
	15-C-2150	WIRE: 7MM; spark plug; 100 ft roll.	
Fig. 13	OK 10202-12	WIRE: spark plug; w/shielding and terminals; assembly.	OK 10202-12
		IGNITION COIL, WIRING, SPARK PLUG, AND SWITCHES GROUP (contd)	
Fig. 13	OK 10203-12	WIRE: secondary; ignition coil to distributor; w/shielding and terminals; assembly.	OK 10203-12
		INSTRUMENTS, GAUGES, AND LAMPS GROUP	
Fig. 11	RM 4000C14	METER: instrument panel; assembly (battery charging generator).	RM 4000C14
Fig. 11	SW-441002	GAUGE: instrument panel fuel; assembly; SW-441002.	PLE 1114
Fig. 11	G716-7039053	GAUGE: instrument panel engine water temperature; assembly; RM-2100C20.	PLE 1113
Fig. 11	G716-7039052	GAUGE: instrument panel engine oil pressure.	RM 2550C19
	M001-0213042	LAMP: incandescent; 1 cp; 6-8V; engine failure indicating; Ordnance part No. 115273.	MZ 51
		SWITCHES GROUP	
	CH-8810K6	SWITCH: engine; ignition; assembly; CH-8810K6.	PLE 1158
	WHR 11A07-1	SWITCH: engine safety; assembly.	WHR 11A07-1

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		BATTERY, BOXES, AND CABLES GROUP	
	H015-0500902	BATTERY: 6 volt; storage; assembly; Ordnance part No. 500902.	
	OK 10186	CABLE: battery to solenoid; assembly.	OK 10186
	OK 10187	CABLE: solenoid to engine starter; assembly.	OK 10187
	51-A-1562-150	ELECTROLYTE: storage battery.	
	OK 10153-12	STRAP: battery ground.	OK 10153-12
		COMMON TOOLS GROUP	
Fig. 71	41-H-523	HAMMER: machinist's ball peen; 16 oz; FM GPW-17042.	WO A373
Fig. 71	41-P-1652	PLIERS: combination; slip joint; wire-cutting type; length, 8".	
Fig. 71	41-S-1116	SCREWDRIVER: common; normal duty; single grip; length of blade, 18".	
Fig. 71	41-S-1076	SCREWDRIVER: common; heavy duty; integral handle (type III, class B); 6" blade; FM GPW-17020.	WO A-375
Fig. 71	41-W-446	WRENCH: adjustable automobile 1-1/2"; jaw opening, 8" long; Westcott #76 or equal.	
Fig. 71	41-W-1012-5	WRENCH: engineers'; double head; 15°; open end; sizes, 3/4" and 7/8".	
Fig. 71	41-W-1008	WRENCH, engineers'; angle 15°; double head; open end; normal duty; sizes, 5/8" and 3/4".	
Fig. 71	41-W-1002-40	WRENCH: engineers'; 15° angle; doublehead; open-end; normal duty; sizes, 1/2" by 9/16".	
Fig. 71	41-W-991	WRENCH: engineers'; angle, 15°; doublehead; open-end; normal-duty; size, 3/8" x 7/16".	
Fig. 71	41-W-988	WRENCH: engineers'; 15° angle; doublehead; open-end; sizes, 1/4" and 5/16".	
Fig. 71	41-W-3335-50	WRENCH: spark plug; w/handle, FM GPW-17017.	WO 637635
		SPECIAL TOOLS GROUP	
Fig. 71	41-B-155	BAR: cross; for 1/2" sq drive hinged handle.	
Fig. 71	41-B-307	BAR: socket wrench extension; 1/2" sq drive; length, 5".	
Fig. 71	41-B-309	BAR: socket wrench extension; 1/2" sq drive; length, 10".	

Fig. 71	41-G-405	GAUGE: thickness, range .002 to .015"; 8 leaves; Brown & Sharp #648 or equal.
	41-G-915	GRINDER, valve: hand-operated; universal type; w/short and long steam adapters, including vacuum cup type.
Fig. 71	41-H-1502	HANDLE, socket wrench; hinged; 1/2" sq drive.
Fig. 71	41-H-1505	HANDLE, socket wrench: reversible ratchet; 1/2" sq drive; complete with plug.
Fig. 71	41-H-1508	HANDLE, socket wrench: speeder swing type; 1/2" sq drive; length 18".
Fig. 71	41-H-1509-55	HANDLE, socket wrench: sliding T type; 1/2" sq drive; length, 11".
Fig. 71	41-J-380	JOINT, socket wrench: universal; 1/2" sq drive male and female.
	41-L-1410	LIFTER, valve spring: hand Mfgrs #T-19471; Sumner Product Co. #L-100.
	41-S-1552	SCREWDRIVER: Pyralin handle; sq shank; length of blade 4"; bit size 5/16"; Stanley Tool #1007.
	41-W-620	WRENCH, box: double-head; double hexagon; short; off-set; sizes, 3/8" and 7/16".
	41-W-600	WRENCH, box: double; offset; long double hexagon; sizes 1/2" x 9/16"; Bonney Co. #2805L.
	41-W-603	WRENCH, box: double-head; double offset; long; double hexagon; 15° angle; sizes, 11/16" and 3/4".
	41-W-608	WRENCH, box; double-head; double offset; long; double hexagon; 15° angle; sizes, 15/16" and 1".
	41-W-610-25	WRENCH, box: double offset; long; double hexagon; 1-1/16" x 1-1/4".
Fig. 71	41-W-3575	WRENCH, tappet: double end; 11/32" and 17/32".
	41-W-3005	WRENCH, socket: double hexagon; without handle 1/2" sq drive; straight thin wall, 7/16" opens.
	41-W-3007	WRENCH, socket; double hexagon without handle; 1/2" sq drive straight thin wall; 1/2" opening.
	41-W-3009	WRENCH, socket; double hexagon without handle; 1/2" sq drive straight thin wall; 9/16" opening.
	41-W-3026	WRENCH, socket; double hexagon without handle; 1/2" sq drive straight thin wall; 31/32" opening.
	41-W-3027	WRENCH, socket; double hexagon without handle; 1/2" sq drive straight thin wall; 1" opening.
	41-W-3029	WRENCH, socket: detachable; 1/2" sq drive 12-point opening; double hexagon; single 1-1/16" opening.
	41-W-3031	WRENCH, socket: detachable; 1/2" sq drive 12-point opening; double hexagon; single 1-1/8" opening.
	41-W-3029-10	WRENCH, socket: without handle; 1/2" sq drive; double hexagon opening; size 1-1/4".
	41-W-3029-5	WRENCH, socket: without handle; 1/2" sq drive; double hexagon opening; size 1-3/16".

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		EQUIPMENT GROUP	
	51-C-1640	COMPOUND, valve grinding: line, 2 oz container.	
		CRANK, engine starting.	WAK 50210
	13-0-1530	OILER, steel: hand, push-bottom; 4" straight spout; 1/2 point; FM-GPW-17038.	WO A3792
	41-W-3011	WRENCH, socket: double hexagon; without handle; 1/2" sq drive; straight thin wall; 19/32" opening.	
	41-W-3013	WRENCH, socket: double hexagon without handle; 1/2" sq drive; straight thin wall; 5/8" opening.	
	41-W-3014	WRENCH, socket: double hexagon without handle; 1/2" sq drive; straight thin wall; 21/32" opening.	
	41-W-3015	WRENCH, socket: double hexagon without handle; 1/2" sq drive; straight thin wall; 11/16" opening.	
	41-W-3017	WRENCH, socket: double hexagon without handle; 1/2" sq drive; straight thin wall; 3/4" opening.	
	41-W-3019	WRENCH, socket: double hexagon without handle; 1/2" sq drive; straight thin wall; 25/32" opening.	
	41-W-3021	WRENCH, socket: double hexagon without handle; 1/2" sq drive; straight thin wall; 13/16" opening.	
	41-W-3023	WRENCH, socket: double hexagon without handle; 1/2" sq drive; straight thin wall; 7/8" opening.	
	41-W-3025	WRENCH, socket: double hexagon without handle; 1/2" sq drive; straight thin wall; 15/16" opening.	
	42-P-1210	PAPER FLINT: sand paper; grade #2/0.	
	42-P-5347	PIN, cotter: split; steel type B; (assorted in small box); FM GPW-18318.	WO A7683
	41-T-805	TAPE, friction: general use; black (grade A) 3/4" wide; FM GPW-17058.	WO A7681
	52-V-2298	VARNISH: shellac; orange; 1 oz bottle.	
	22-W-1067	WIRE: iron; black; annealed; 22 gauge; 1/4 lb spool; FM GPW-17060.	WO A-7685
		STANDARD HARDWARE GROUP	
	H001-5417600	BOLT: hex hd; steel; 1/4-20 NC x 5/8; Ordnance part NO. 106319.	WO 5154

	H001-5419100	BOLT: hex hd; 5/16-18 NC x 5/8; Ordnance part No. 106324.	WO 51485
	H001-5419820	BOLT: hex hd; steel; 5/16-24 NF x 3/4; Ordnance part No. 100013.	WO 51396
	H001-5419160	BOLT: hex hd; steel; 5/16-18 NC x 7/8; Ordnance part No. 106325.	WO 6428
	H001-5419180	BOLT: hex hd; steel; 5/16-18 NC x 1; Ordnance part No. 100122.	WO 51486
	H101-0100123	BOLT: hex hd; steel; 5/16-18 NC x 1-1/4; Ordnance part No. 100123.	WO 6157
	H101-0100127	BOLT: hex hd; steel; 5/16-18 NC x 2-1/2; FM 355442S; Ordnance part No. 100127.	WO 51858
	H001-5420520	BOLT: hex hd; steel; 2/8-16 NC x 3/4; Ordnance part No. 100133.	WO 6412
	H001-5421220	BOLT: hex hd; steel; 3/8-24 NF 3 x 3/4; Ordnance part No. 100025.	WO 50163
	H001-5421260	BOLT: hex hd; steel; 3/8-24 NF x 1; Ordnance part No. 100026.	WO 5919
	H001-542580	BOLT: hex hd steel; 3/8-16 NC x 1-1/8; Ordnance part No. 106331.	WO 52911
	H001-5421286	BOLT: hex hd steel; 3/8-24 NF x 1-1/8; Ordnance part No. 106286.	WO 6606
	H001-5421300	BOLT: hex hd steel; 3/8-24 NF x 1-1/4; Ordnance part No. 100027.	WO 50878
	H001-4135661	NUT, machine screw: hex No. 10-24; FM 355836S7; Ordnance part No. 120361.	WO A1701
	H001-4167521	NUT, regular: hex steel; cd pltd 1/4-28 NF; FM 33796S7; Ordnance part No. 120367.	WO 52847
	H001-4167540	NUT: regular hex steel; 5/16-18 NC; Ordnance part No. 120376.	WO 52850
	H001-4167561	NUT: regular; hex steel, cd-pltd 5/16-24 NF; FM 33798S7; Ordnance part No. 120368.	WO A1532
	H001-4167601	NUT: regular; hex steel; 3/8-24 NF; FM-33800S7; Ordnance part No. 120369.	WO 52542
	G183-5415015	NUT: regular; hex steel; Seez-Pruf; 3/8-24 NF; FM 351023S; Ordnance part No. A247965C.	WO 53287
	H001-4185680	NUT: hex steel; 1/2-20 NF; FM 33943S; Ordnance part No. 114496.	WO 52804
	H001-1030102	SCREW, machine: rd hd; steel; 10-24 x 3/4; FM 355160S; Ordnance part No. 110502.	WO 5272
	H001-7043711	WASHER: plain; steel; cd-pltd; 5/16"; FM 34746S7; Ordnance part No. 120393.	WO A1533
	H001-1518007	WASHER, lock: steel; 1/4"; Ordnance part No. 103319.	WO 52706
	H001-7124701	WASHER, lock: steel; cd-pltd; internal-external tooth; 1/4"; Ordnance part No. 174916.	WO 53024
	H001-7027511	WASHER, lock: reg; 5/16; Ordnance part No. 120214.	WO 52558
	H001-1519010	WASHER, lock: internal tooth; 5/16" FM 34906S; Ordnance part No. 115548.	WO 52428
	178532	WASHER, lock: steel; cd-pltd; internal-external tooth; 5/16"; Ordnance part No. 178532.	WO 53025
	H001-1518009	WASHER, lock: regular; steel; 3/8"; Ordnance part No. 103321.	WO 5010
	H001-7017680	WASHER, lock: regular; steel; 3/8" ID; external tooth; FM 34942S; Ordnance part No. 114606.	WO 52378

64. MAINTENANCE PARTS LIST FOR POWER UNIT PU-58/G (contd).

a. Ordnance Parts (contd).

Ref symbol	Ordnance stock No.	Name of part and description	Mfr's part and code No.
		STANDARD HARDWARE GROUP (contd).	
	H001-7045541	WASHER: plain; flat; cd-pltd; 7/16 ID; Ordnance part No. 120388.	WO 5455
	H001-1518011	WASHER, lock: regular; steel; 1/2"; FM 34809S; Ordnance part No. 103323.	WO 5009
	H001-7017740	WASHER, lock: steel; external tooth 1/2"; FM 34944S; Ordnance part No. 114608.	WO 52330
		BULK MATERIAL GROUP	
	33-H-585	HOSE: 1/2" ID; 25 ft roll.	
	15-C-2150	WIRE: 7 mm; spark plug; 100 ft roll.	

b. Signal Corps Parts.

Ref symbol	Signal Corps stock No.	Name of part and description	Mfr's part and code No.
		GENERATOR PARTS GROUP	
		The following parts are ordered through Signal Corps supply.	
Fig. 29	3H4512.5/B25	BEARING, ball: AC end; spcl; Hoover #7306.	7306
Fig. 55	3H4595/B16	BRUSH, electrical contact: AC; generator; Onan No. 75361.	10910-0
Fig. 55	3H4595/B15	BRUSH, electrical contact: DC 1/2 x 1-1/4 x 1-1/4.	10911-12
Fig. 55	3H2408/R20	BRUSH RIG ASSEMBLY: includes inculation disk, brushes, springs, and guides.	10900-24
	3K4510321	CAPACITOR, fixed: .01 mf, 1000 v; Cornell Dublier #4LS.	4LS
	3H4595/G17	GASKET, cover: bearing.	11108-0
	3H2408/S2	SPRING, brush: AC; Onan No. 19653.	10908-0
	3H2408/S1	SPRING, brush: DC; Onan #5190.	10909-0
		SWITCHBOARD PARTS GROUP	
Fig. 11	3H900-50-17	BREAKER, circuit; 50 amp; 2 pole; Westinghouse Square D Co. style #1107699.	1178462
Fig. 12	3DA10-18	CAPACITOR, fixed: .01 mf, 600 v; Cornell Dublier type 4 C. D.	Type 4 C. D.
Fig. 12	3DA100-84.4	CAPACITOR, fixed: paper; .1 mf, 600 v; Cornell Dublier; wax impregnated.	
	6Z6806.16	LAMP, incandescent: panel; 3 cp, 6 v; single contact.	Type 63DL
	2Z5934-1	LAMP, incandescent: safety sw; 1 cp, 6 v; single cont std.	TS 51

Fig. 11	3F1050-15	METER, ammeter: 0-50 amp; 3-1/2" Westinghouse style #1159118.	NA 35
Fig. 11	3F2789-2	METER, frequency: 7 reed; 57 to 63 cyc; Aero No. 7007.	7007
Fig. 11	3F3363-3	METER, time: pioneer Electric No. 1527.	1527
Fig. 27	2Z7598-48	RELAY ASSEMBLY: Advance Electric No. 455-950.	455-950
Fig. 30	3H4962-1	REGULATOR, voltage: 120 v, 60 cyc; Ward Leonard type #5660, ED 40043.	5660
	3H4962-1/1	CONTACT ROLLER ASSEMBLY GROUP	52000.25-1
Fig. 30	3H4962-1/2	SPRING, pressure: contact.	2.54-10
Fig. 12	2Z7277.86	RHEOSTAT, voltage control: manual 100 ohm; 1108 vitrohn ring type 4" diam; Pioneer No. 1535.	1535
Fig. 12	2Z7278-87	RHEOSTAT, voltage regulator: 160 ohm; Ward Leonard No. 16718.9A.	Dwg. #16718.9A
Fig. 11	3Z9849.154	SWITCH, crank: hand; SPDT; C & H Aircraft No. 8810-K5.	8810-K5
Fig. 11	3Z9849.155	SWITCH, gauge: fuel; SPDT; C & H Aircraft No. 8804-K6.	8804-K6
Fig. 11	3Z9849.42	SWITCH, light: panel; SPST; C & H Aircraft No. 8801-K6.	8801-K6
Fig. 11	3Z9849.59	SWITCH, regular voltage; DPDT; C & H Aircraft No. 8824-K4.	8824-K4
Fig. 11	3Z9824-78	SWITCH, start-stop: composed of 2 B-1 Arrow-Hart & Hegeman units; Pioneer Electric No. 2782.	2782
Fig. 11	3F8150-31	METER, voltmeter: 0-150 v; 3-1/2"; Westinghouse style #1159010.	NA 35

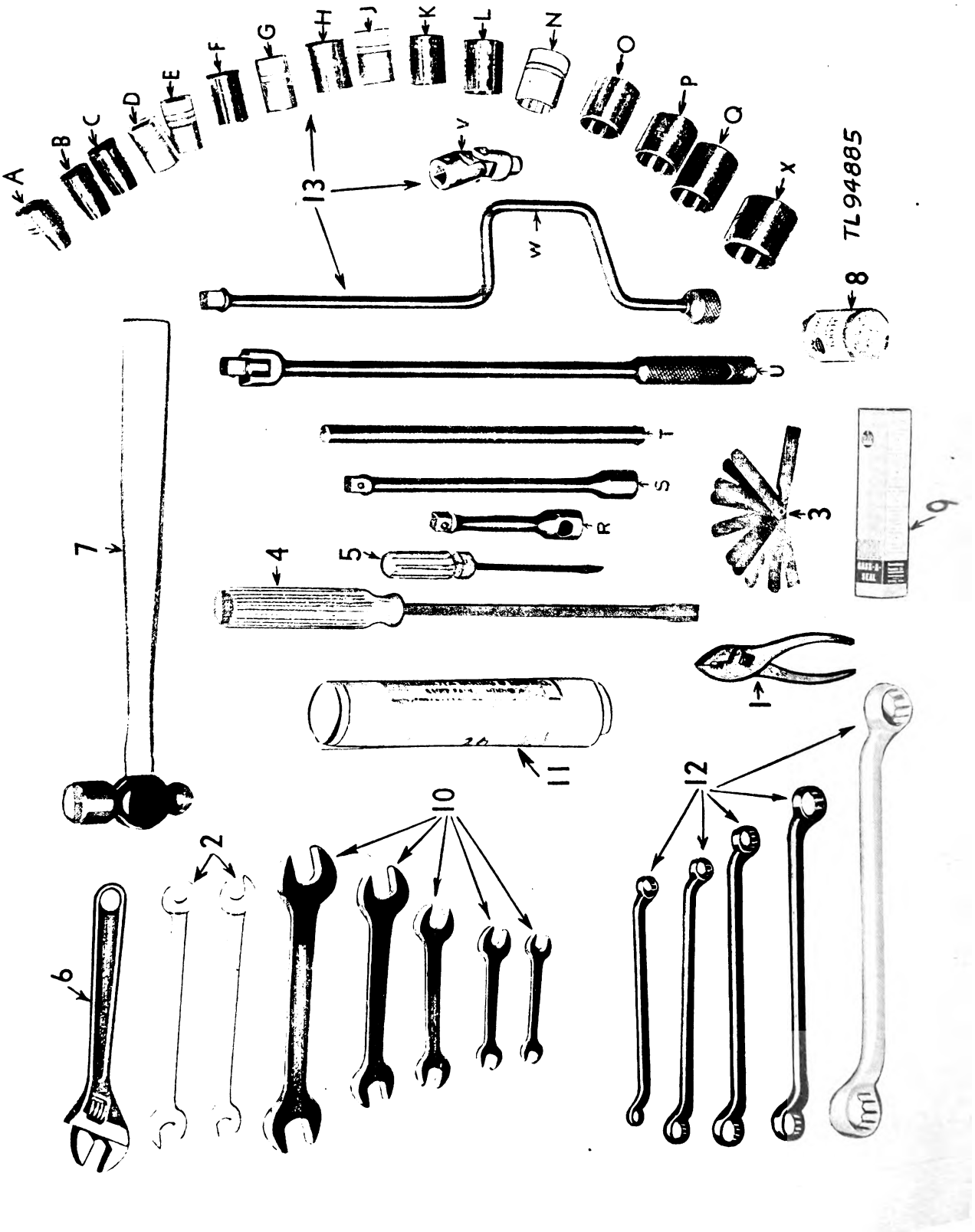


Figure 71. Tool group.

65. LIST OF TOOLS, INSTALLATION MATERIAL, AND EXHAUST PIPING MATERIAL.

a. Tools (fig. 71).

Item No.	Quan and Unit	Item
1	1 ea	Pliers, 8" gas
2	1 set	Wrenches, tappet
3	1 set	Feeler gauges in holder, 9 set, 0.003, 0.004, 0.005, 0.006, 0.008, 0.010, 0.012, 0.015, and 0.018
4	1 ea	Screw driver, 18"
5	1 ea	Screw driver, 6"
6	1 ea	Wrench, adjustable, 8"
7	1 ea	Hammer, 16 oz. ball pein
8	1 ea	Small box assorted cotter keys
9	1 tube	Gasket seal
10	1 set	Wrenches, open end, five in set:
		(a) 1/4 x 5/16"
		(b) 3/8 x 7/16"
		(c) 1/2 x 9/16"
		(d) 5/8 x 3/4"
		(e) 3/4 x 7/8"
11	2 sheets	Sandpaper, #00
12	1 set	Wrenches, box, 15°, 12 point, 5 in set:
		(a) 5/16 x 3/8"
		(b) 1/2 x 9/16"
		(c) 11/16 x 3/4"
		(d) 15/16 x 1"
		(e) 1-1/6 x 1-1/4"
13	1 set	Sockets and attachments in box, 1/2" square drive, consisting of:
	1 ea	(a) Socket, 7/16"
	1 ea	(b) Socket, 1/2"
	1 ea	(c) Socket, 9/16"
	1 ea	(d) Socket, 5/8"
	1 ea	(e) Socket, 11/16"
	1 ea	(f) Socket, 3/4"
	1 ea	(g) Socket, 13/16"
	1 ea	(h) Socket, 7/8"
	1 ea	(i) Socket, 15/16"
	1 ea	(j) Socket, 1"
	1 ea	(k Socket, 1-1/6"
	1 ea	(l) Socket, 1-1/8"
	1 ea	(m) Socket, 1-1/4"
	1 ea	(n) Socket, 1-5/16"
	1 ea	(o) Socket, 1-3/8"
	1 ea	(p) Socket, 1-7/16"
	1 ea	(q) Extension, 5"
	1 ea	(r) Extension, 10"
	1 ea	(s) Pin handle
	1 ea	(t) Hinge handle, 18"
	1 ea	(u) Universal joint
	1 ea	(v) Speed handle, 18"

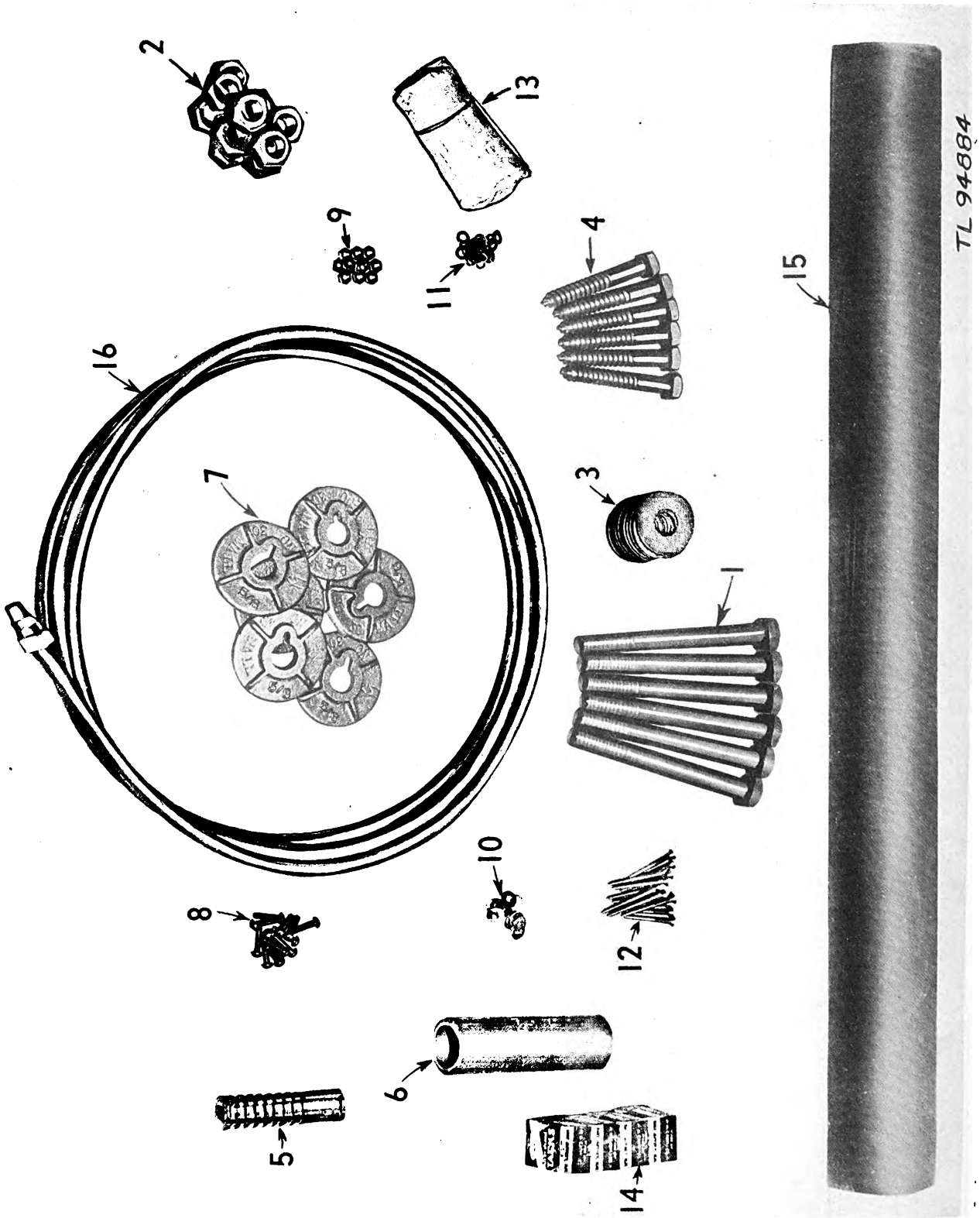


Figure 72. Installation material.

65. LIST OF TOOLS, INSTALLATION MATERIAL, AND EXHAUST PIPING MATERIAL (Contd).

b. Installation Material (fig. 72).

Item No.	Quan and Unit	Item
1	6 ea	Bolts, machine, 5/8 x 6", square head, steel—threaded 3"
2	12 ea	Nuts, hexagon head, 5/8", 11 threads, steel
3	12 ea	Washers, standard, 5/8", steel
4	6 ea	Screws, Lag, 5/8 x 4", steel
5	6 ea	Lag screw expansion (long standard) for 5/8" lag screws
6	6 ea	Pipe sleeves, 1-1/4" internal pipe size x 3", steel
7	6 ea	Washers, standard, 3", OD, cast iron
8	18 ea	Screws, right-hand machine screw, #10-24, 7/8" long
9	18 ea	Nuts, #10-24, hex head, steel
10	18 ea	Washers, standard, 3/16", steel
11	18 ea	Lockwashers, standard, 3/16", steel
12	24 ea	Screws, flat head wood screw, #8, 1-1/2" long, steel
13	1 lb	Nails, 10d, 3" long, steel
14	1/4 lb	Tacks, #8, 9/16" long, steel
15	1 pc	Duck, 12 oz. water-proof.
16	20 ft	Tubing, 3/8" OD, copper, soft drawn with fittings on one end suitable for connecting to the gasoline fuel system of the engine.

c. Exhaust Piping Material (fig. 73).

Item No.	Quan and Unit	Item
1	3 lengths	Pipe, 1-1/4" internal pipe size, 4' long, threaded at both ends, steel
2	1 ea	Ell, long sweep, 1-1/4" internal pipe size
3	1 ea	Tee, 1-1/4" internal pipe size, malleable iron
4	1 ea	Plug, pipe, 1-1/4" internal pipe size, malleable iron
5	1 ea	Union, ground joint, 1-1/4" internal pipe size, malleable iron
6	3 ea	Coupling, pipe, 1-1/4" internal pipe size, malleable iron
7	2 ea	Sheet metal, #18 gauge, 12" x 12" with 2" diam hole in center, galvanized iron
8	1 ea	Paper, roofiing, three-ply, 24" x 24"
9	20 ft	Perforated hanger iron, 7/8" x 1/16"
10	18 ea	Bolts, stove 1/4" x 1-1/2" with nuts, steel
11	18 ea	Screws, lag, 1/4" x 1-1/4", steel
12	1/2 lb	Wire, #14 gauge, soft iron
13	1 lb	Nails, roofing, 1", steel
14	1 pt	Roofing cement
15	2 ea	Nipples, 1-1/4" internal pipe size, close, steel
16	2 ea	Nipples, 1-1/4" internal pipe size by 4", steel
17	1 length	Pipe, flexible exhaust, 1-1/4" ID by 20" long, including attached 1-1/4"
18	10 lbs	internal pipe size, steel
		#66 Eagle Pitcher asbestos cement in waterproof bags

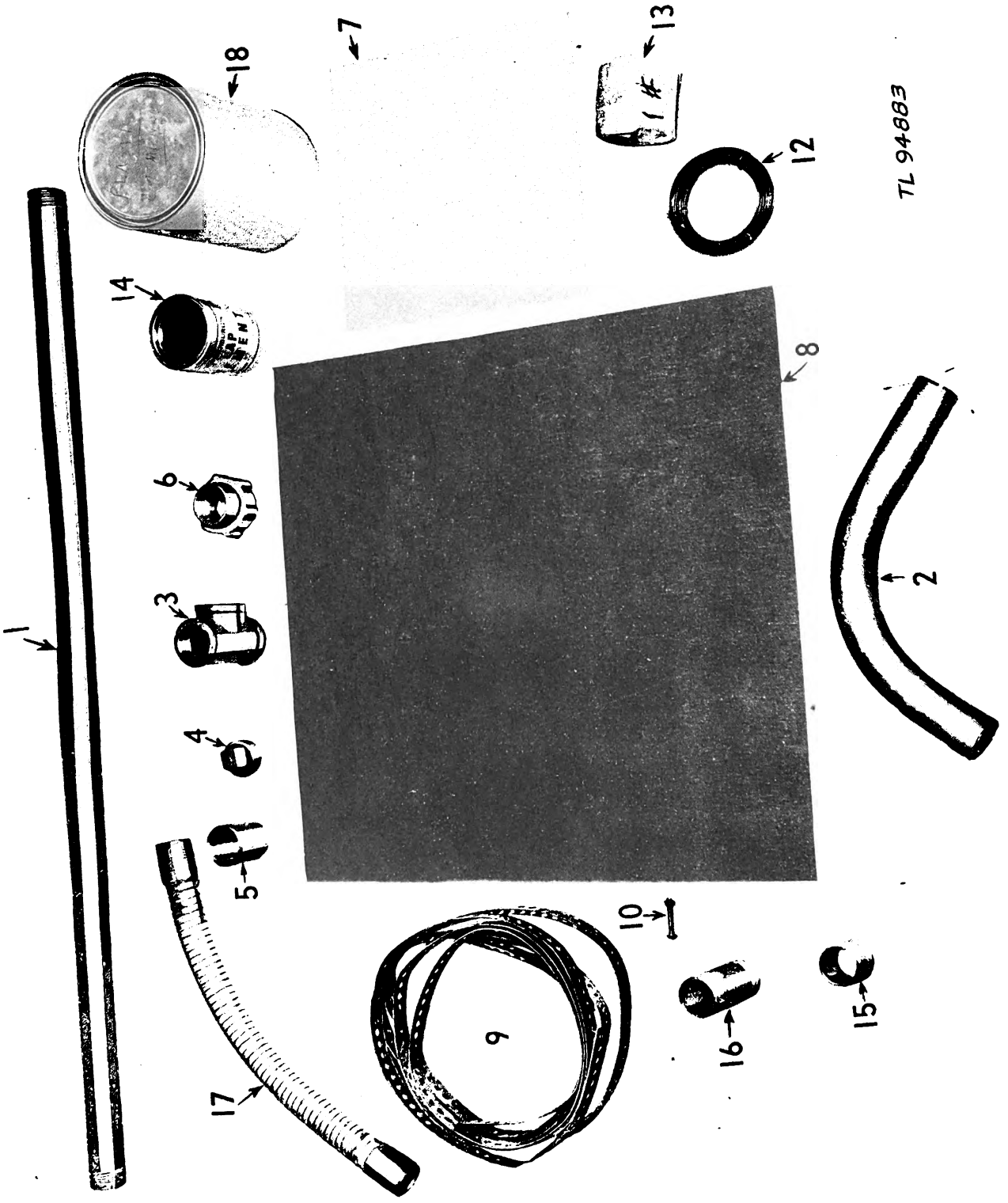


Figure 73. Exhaust piping material.

Order No. 2586-P.-45-32; 31,128 copies—9 April 1945.