TM 11-948

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POWER UNIT

PE-210-(FR)

WORKING INSTRUCTIONS

Servalan

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POWER UNIT

PE-210 (FR)

CONTENTS

DESTRUCTION NOTICE

WHY - To prevent the enemy from using or salvaging this equipment.

WHEN - When ordered by your commander.

HOW - 1. Smash - Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.
2. Cut - Use axes, handaxes, machetes.
3. Burn - Use gasoline, kerosene, oil, flame throwers, incendiary grenades.
4. Explosives - Use firearms, grenades, TNT.
5. Disposal - Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT - 1. Smash - Cylinder head, cylinder, spark plug shield, spark plug, magneto, carburetor, generator, control box, gas tank, meter box.
2. Cut - All connecting wires and cables.
3. Burn - Packing cases, instruction books, canvas cover, fuel, oil.
4. Bury or scatter - Any or all of the above pieces after damaging.

DESTROY EVERYTHING

SAFETY NOTICE

1. 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 sickness or death.

2. Do not service the unit with gasoline while the unit is running or if a radio transmitter is operating near the power unit. Avoid spilling fuel on a hot engine.

3. The operator should observe every standard safety regution while operating this power unit.

PART ONE

INTRODUCTION

Section I. DESCRIPTION

1. General

a. Power Unit PE-210 (figs. 1 and 2) is a compact, light-weight, electric generator set, consisting of a gasoline Engine GE-12-G and a d-c (direct-current) Generator GN-52-B. It has a nominal rating of 450 watts and is designed to deliver 30 amperes dc, with voltage variable from 6 to 22 volts. The unit may be started by hand or by connecting it to a 12-, or 18-volt storage battery. The unit is used principally for charging storage batteries. It may also be incorporated as an aid in starting larger power units at very low temperatures.

b. Engine GE-12-G is a single-cylinder, air-cooled, two-cycle gasoline engine which develops 1 hp (horsepower) at 3,000 rpm (revolutions per minute).

c. The GN-52-B is a d-c generator. It is coupled directly to the engine crankshaft by means of a female spline coupling which matches the splined extension on the crankshaft. Mounted on the tubular frame is a control box, which is used in controlling the generator output and is provided with a switch for starting the engine with a battery.

NOTE. The generator used in Power Unit PE-210-(FR) is coupled to the engine by a flexible coupling-fan assembly. The driving member of the coupling is provided with a female spline which matches the splined extension of the engine crankshaft.

d. The complete power unit is contained in an open frame of tubular construction. It is mounted on four rubber shock mounts which hold the unit securely in place during transportation and also serve to absorb vibration when the equipment is in operation. A metal box for spare parts is attached to the tubular frame assembly. Tools are contained in a canvas bag and are appropriately identified.

2. PERFORMANCE CHARACTERISTICS

Power Unit PE-210 (FR), when used to charge storage batteries, performs as follows :

a. When Charging 6-Volt Batteries

Ampères	Volts	Engine rpm
15	6,5	1,750
20	7.0	1,850
25	7.3	1,950
30	7,6	2,050

b. When Charging 12-Volt Batteries

Ampères	Volts	Engine rpm
8	13.0	2,160
10	13.5	2,230
15	13.8	2,300
20	13.85	2,400
25	14.0	2,500
30	14.2	2,630

3. Table of Condensed Specifications

Engine

Make	René BRIBAN & Co
Model	Sig.C.GE-12-G
Type	two-cycle
Number of cylinders	one
Bore	2-in. (inch)
Stroke	1 1/2-in.
Piston displacement	4.72 cu in.
Compression ratio	5.5 to 1
Engine speed (nominal)	3,000 rpm
Cooling	air-cooled
Horsepower	1 at 3,000 rpm
Piston	Vanasil
Piston rings	three (compression-type)
Piston pin	stationary in piston
Lubrication system	oil mixed with fuel
Air cleaner	dry type
Oil filter	none
Spark plug	HOT-Type 13/16"
Fuel tank capacity	1 gallon
Governor	electric solenoid type
Main bearings	ball bearing

Generator

Make	Moteurs LEROY
Type	d-c
Rating	450 watts, 30 amps at 15 volts
Brushes	four carbon brushes
Bearings	Two double-seal ball

4. Table of Major Components

Item	Height (in.)	Width (in.)	Length (in.)	Weight (lb.)
1 Bare unit consisting of:	13 3/4	16 1/4	17 3/4	65
1 Engine GE-12-G (complete)	13 1/4	13 1/2	17 3/4	37
1 Generator GN-52-B	5 5/8	5 5/8	9 3/8	20
1 Generator Control C-890-U	4 1/4	4 1/2	9 1/8	
2 Cords CD-1334, 6 ft lg			72	
1 Set tools				
1 Set running spare parts				

Power Unit PE-210, packed for export; weight 122 lb, volume 5 cu ft.

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisitioning of spare parts.

5. Description of Major Components

a. Engine. Engine GE-12-G is a single-cylinder, two-cycle, air-cooled unit, with a 2-inch bore, a 1 1/2-inch stroke, and a piston displacement of 4.72 cubic inches. It is designed to operate satisfactorily on 80-octane field gasoline, 100-octane aviation gasoline, or commercial gasoline with an octane rating as low as 62, and will run approximately 7 1/2 hours at full load on a single filling of the 1-gallon fuel tank.

Engine GE-12-G is a modification of Engine GE-12-B. Differences in models are explained in paragraph 6.

b. Generator. Generator GN-52-B is a 450-watt, 30-ampere, 15-volt, d-c shunt-wound, compensated, open, four-pole generator. The generator voltage can be regulated in the range of 6 to 22 volts full load by dual control of engine speed and shunt field through the rheostat adjusting knob on the control box. Rotation of the armature is counter-clockwise, viewed from the commutator end. Differences between the Generator used in power unit PE-210 and Generator used in power unit PE-210-(FR) are explained in paragraph 6.

c. Generator Control C-890-U-(FR). This control Box is attached to tubular frame of unit (fig.2). It contains a rheostat, starting switch, reverse-current relay, a 0 to 50 amp. scale ammeter, a 0 to 30 volt scale voltmeter, and three capacitors. A terminal Block is mounted on the inside of the bottom of the box.

(1) The rheostat, in conjunction with the electric governor, controls the engine speed and generator voltage to permit charging batteries 6 to 18 volts.

(2) When the unit is connected to a battery of 12 volts or higher, the starting switch, when held in the ON position, permits the battery current to flow through the generator and thus causes it to act as a motor for cranking the engine.

c. Place all tools in the tool kit and attach the kit to the tubular frame of the power unit.

d. Check the running spares with the spare parts list and replace any missing parts.

e. Bolt the unit to a wooden sub-base and place a block under the generator. Clamp the generator to the sub-base with wire or a steel strap to prevent any movement of the unit inside the frame during shipment.

f. If complete protection is necessary, wrap the unit in waterproof paper and seal all edges. Place the unit in the original box if available or build a new crate to inclose the unit.

Section IV. BEFORE-OPERATION PROCEDURES

15. Preparation for Use

Place 1 gallon of gasoline in a clean container and add 1/2 pint of engine oil (OE). An oilmeasuring cup is an integral part of the fuel tank cap. Use four measuring cupfuls of engine oil to each gallon of gasoline. Shake the container or stir the fuel and oil until thoroughly mixed. Then pour the mixture into the fuel tank. To avoid loss of oil from the measuring cup, hold a finger over the vent hole in the side of the tube. *Never plug this hole.*

Caution: Never run Power Unit PE-210 (FR) on gasoline to which oil has not been added. Never attempt to fill the fuel tank while the unit is operating.

a. Before pouring the fuel mixture into the tank, ground the fuel container momentarily to an unpainted surface on the unit that is away from the tank. Always keep the fuel container in contact with the tank during filling operations. This reduces the danger of fire from a static discharge (spark).

b. Replace the fuel tank cap securely.

c. Open the fuel shut-off valve and the air vent in the top of the fuel tank. Wipe off any fuel which may have been spilled while the tank was being filled.

16. Visual Inspection

a. Check the fuel shut-off valve, fuel tank drain valve, fuel line and connections, and carburetor float bowl for leaks (fig. 20).

b. Check the installation of the unit, including exhaust connections, foundation, and shelter. Make sure cooling-air intake is not obstructed.

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PART TWO

OPERATING INSTRUCTIONS

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

Section V. OPERATION

17. Starting

a. Rope Starting Power Unit PE-210 (FR). (1) The carburetor adjustments have been factory set and, unless changed, do not need readjustment each time the engine is started. See paragraph 67.1 for instructions for carburetor adjustments.

(2) Move the choke lever to the closed position (fig. 7-8). To close the choke, pull the choke lever toward the air cleaner.

(3) Slip the knotted end of the starter rope into the notch of the starter pulley and wind it clockwise around the pulley. Hold the unit frame with one hand and pull the starting rope up sharply with the other hand. If the engine does not start after four or five crankings, refer to paragraph 59 for the possible cause.

(4) When the engine starts, move the choke lever away from the air cleaner to its fully open position. If the engine will not run unless the choke is partially closed, readjust the carburetor in accordance with instructions in paragraph 67.1

Caution: Except in an extreme emergency, always operate the unit for at least 5 minutes before applying load. This is specially important when operating in low temperatures.

(5) Overchoking the engine when starting will flood it. This is particularly true when the engine is warm. If this occurs, proceed as follows:

(a) Close the main adjusting screw (fig. 8) by turning it clockwise as far as it will go. Note the number of turns so that the screw can be reset to its original position.

Caution: When closing the main adjustment screw, do not force it as this will damage the needle valve and seat.

(b) Open the crankcase drain cock and crank the engine a few times with this cock open. Be sure to close the cock securely after cranking.

(c) Remove the spark plug and clean and dry the spark plug adapter. Dry the spark plug and reinstall it in the engine.

(d) Make sure the choke is fully open and crank the engine.

(e) As soon as the engine starts, reset the main adjusting screw to its original position.

b. Precautions After Starting **(1) Insufficient fuel.** Failure to run more than a few seconds after starting or when load is applied usually indicates a lean carburetor adjustment. If this occurs immediately after starting and while the engine is still cold, partially close the choke. If it is necessary to keep the choke partially closed after the engine has reached operating temperature, readjust the carburetor in accordance with instructions in paragraph 67.

(2) Too much fuel. When the engine appears to misfire every alternate revolution and lacks power, it is usually an indication that the carburetor setting is too rich or that the choke is not fully open. Make sure that the choke is in a fully open position. If the choke is fully open and the difficulty persists, see paragraph 67. A slight amount of erratic missing may occur when the unit is operating without load. This is a characteristic of the engine and should disappear when load is applied. If erratic missing continues after load is applied, the difficulty may be due to a fouled spark plug or clogged spark plug adapter. Remove the spark plug. Clean the spark plug adapter, and clean or replace the spark plug to remedy this condition.

c. *Battery Starting*. Prepare the unit for battery starting as follows:

(1) Connect one Cord CD-1334 from the positive (+) terminal on the storage battery to the terminal on the control box marked +.

(2) Connect the other Cord CD-1334 from the negative (-) terminal on the storage battery to the terminal on the control box marked -

(3) Note the voltmeter reading. If the leads are connected properly, the voltmeter will indicate the battery voltage. If the leads are reversed, the voltmeter pointer will swing off scale to the left.

Note. Set the rheostat control knob at approximately one-third to onehalf travel from the extreme counterclockwise position. This, when using a 12 or 18-volt starting battery, prevents the carburetor throttle from closing when the starting switch is pushed up.

(4) The unit is now ready to start. Following the instructions given in subparagraph *a* above, push the starting switch on the control box and hold it up until the engine starts. Release the switch and make necessary running adjustments.

Caution: If the engine does not start within 20 to 30 seconds, release the starting switch and consult the trouble chart for the possible cause (part. 59). Always start the engine manually for charging operations.

(5) If the red and yellow leads connected to the terminals above

the starting switch are reversed when using 12- or 18-volt batteries, the generator will charge normally but no current will be supplied to the generator field when the starting switch is placed in starting position. Check the wiring diagram in the control box cover or figure 11 and correct this condition if it exists.

18. Operational Precautions

a. Overloading the generator causes overheating and may destroy the generator windings. However, an overload of 10 amperes beyond the rated output (30 amperes) for a period not exceeding 5 or 10 minutes is permissible but only on a 6- or 12-volt battery. A short-circuited generator will cause the throttle to open wide and the engine to overspeed.

b. When charging 18-volt batteries, limit the charging rate to 20 amperes to avoid overloading the unit.

c. Never accelerate the engine beyond its governed speed as this will raise the voltage output which may damage the insulation of the generator.

d. Do not charge batteries at more than a 10-ampere rate in temperatures close to -40° F, since the battery electrolyte will bubble excessively and the gas may damage nearby equipment. Keep open flames or sparks away from the immediate battery area during charging operations. The hydrogen gas generated is highly combustible.

19. Stopping Power Unit PE-210 (FR)

To stop Power Unit PE-210-(FR), turn the stop switch lever which extends from the magneto back plate and hold it in the OFF position until the engine comes to a complete stop. Close the fuel shut-off valve and fuel tank air vent when the unit is not in operation.

Section VI. EQUIPMENT PERFORMANCE CHECK LIST

20. Use of Check List

The equipment performance check list is a tabulation of information dealing with preparatory, starting, and stopping operations. The operator checks each item in the column headed *Item* in the order in which it appears. The column headed *Action or condition* lists operations to be performed. The column headed *Normal indication* lists the action that should result or the condition that should exist as a result of the action performed. The column headed *Corrective measure* lists action necessary to correct abnormal conditions.

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21. Equipment Performance Check List for Power Unit PE-210-(FR)

	Item No.	Item	Action or condition	Normal indication	Corrective measure
PREPARATORY	1	Connections	Connect positive (+) and negative (-) battery terminals to (+) and (-) control box terminals	Battery voltmeter will indicate battery voltage.	Reverse battery connection (par 17b).
	2	Fuel tank	Check fuel supply.	Tank full.	Add fuel (par 15).
	3	Fuel tank air vent	Open vent.	None apparent.	If clogged, engine may start and then stop. Make sure vent is open
	4	Fuel shut-off valve	Open valve.	None apparent. Valve should turn freely	If clogged, engine may start and then stop. Make sure valve is open.
	5	Carburetor needle valve	Set at position 7 or 8.	Indicator vane or needle valve pointing to 7 or 8.	Set valve in correct position (par 17a).
STARTING	6	Choke.	Close	Lever pulled toward air cleaner	Set lever in closed position.
	7	Starting rope.	Wind rope clockwise around pulley, and pull.	Engine should start.	If engine fails to start, see paragraph 59.
	8	Start switch	Push Button	Engine should start.	If engine fails to start, see paragraph 59.
OPERATING	9	Charging terminals	Should be connected to battery by cables	Voltmeter should indicate rate of charge	Adjust engine speed (par 54).
STOPPING	10	Stop lever	Press down.	Engine should stop.	If engine fails to stop, shut off fuel supply.

PART THREE

MAINTENANCE INSTRUCTIONS

Section VII. PREVENTIVE MAINTENANCE TECHNIQUES

22. Meaning

PM (preventive maintenance) is a systematic series of operations performed periodically in order to keep equipment operating at top efficiency. The primary purpose of PM is to *prevent* major break-downs and the consequent need for repair. The primary function of trouble shooting and repair is to locate and *correct existing* defects.

23. Importance

PM is of utmost importance since the failure or inefficient operation of one piece of equipment may cause the failure of an entire system. It is necessary to inspect the power unit systematically each day it is operated and at weekly intervals, so that defects may be discovered and corrected before they result in serious damage or failure (sec. IX).

24. Services

a. General. These services are the responsibility of the commanders of operating organizations. They comprise the scheduled maintenance services performed by power unit operators and maintenance personnel respectively.

b. Operator. Ordinarily, the power unit operator will replenish fuel, lubricant, and battery liquid. He will perform necessary cleaning operations; tighten loose nuts, bolts, screws, and other fastenings; care for tools and accessories; and make such emergency repairs as are within the scope of his ability, tool equipment, and parts available. He will perform all daily lubrication operations, before operation, at halt (during shut-down periods), and after operation (par. 39). He will assist the unit mechanic in performing the weekly maintenance on the unit.

c. Maintenance Personnel. Maintenance personnel will perform the weekly and monthly maintenance operations (sec. IX) assisted by the operator. The unit mechanic will also see that daily lubrication operations have been properly performed by the operator. Any maintenance or repair operations beyond the scope of maintenance personnel will be reported to the officer in charge.

bolts are secure. See that the rubber mountings are in good condition and free from oil or grease.

g. Lubrication as Needed. Refer to section VIII and perform the lubrication operations scheduled for daily lubrication. Perform any other lubrication operations scheduled for this particular period.

Section VIII. LUBRICATION

35. Lubrication Orders

a. Lubrication orders are illustrated, numbered, and dated cards or decalcomania labels which prescribe approved lubrication instructions for mechanical equipment which requires lubrication by using organizations. Current lubrication orders should be requisitioned in conformance with instructions and lists in SR 310-20-3.

36. LO 11-947

a. If not already installed, LO 11-947 (fig.58) will be obtained and mounted on Power Unit PE-210. Instructions therein will be fully complied with.

b. LO 11-947 is mounted on the fuel tank.

37. Approved Lubricants and Cleaner

Symbols	Standard nomenclature
OE-10	To be used at all temperatures.
OE-A	Oil Engine, Arctic, for use in Sub zero Temperatures, When available.
GL	Grease, Lubricating, Special or Navy Spec. OS1350.
SD	Solvent, Dry Cleaning, Federal P-3-661a.
DA	Oil, Fuel, Diesel, U.S.Army Spec. 2-102C.

38. Lubrication Instructions

a. Organization Personnel. Lubrication to be performed by organization personnel will be in accordance with LO 11-947 (fig. 58).

b. Lubrication by Field or Base Personnel (after Disassembly).

(1) The magneto cam lubricating wick (cam wiper) is saturated with grease at the factory and should not require any lubrication for long periods. However, if it becomes necessary to remove the flywheel, clean off all the old lubricant and dirt from the cam surface and apply 1 or 2 drops

of engine oil (OE-10) to the felt wick. Avoid excessive lubrication of the wick.

(2) The magneto breaker-arm pivot bearing is lubricated at the time of assembly and should not require additional lubrication. When replacing breaker points (par 71c), clean off all the old lubricant with solvent (SD) and allow to dry thoroughly. Apply a thin coat of grease (GL) to the magneto breaker-arm pivot-bearing surface.

Caution: Avoid placing lubricant on the breaker points. Wipe off excess lubricant.

c. Parts Not To Be Lubricated.

The generator used on Power Unit PE-210 (FR) has two, prelubricated, sealed ball bearings. These bearings cannot be relubricated.

39. Forms and Records *

a. The following standard forms will be used for reporting unsatisfactory conditions of equipment, or improper preservation, packaging, packing, marking, loading, stowage, or handling thereof :

(1) DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army), NAV DEPT SERIAL 85P00 (Navy), and AFR 71-4 (Air Force).

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

(3) AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700-45-5 and AFR 65-26.

(4) Use other forms and records as authorized.

b. The following forms are necessary in connection with the operation and maintenance of Signal Corps internal-combustion-engine-driven equipment:

(1) NME Form 110 (Vehicle and Equipment Operational Record) is explained in TM 37-2810, Changes No. 1.

(2) WD AGO Form 460 (Preventive Maintenance Roster) is explained in TM 37-2810, paragraph 4c.

(3) DA AGO Form 464 (Work Sheet for Preventive Maintenance and Technical Inspection of Engineer Equipment) is explained in TM 37-2810, paragraph 18.

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* *See Note page 88*

Section IX. PREVENTIVE MAINTENANCE

40. Meaning of Scheduled Preventive Maintenance

PM consists of many simple operations which are performed regularly to keep equipment in condition. When PM is intelligently planned and conscientiously performed, equipment rarely fails.

41. Preventive Maintenance Service *

a. Routine PM of Power Unit PE-210 (FR) is performed as part of normal operation, and is reported on NME Form 110 (pars. 25 and 26).

b. In addition, however, Power Unit PE-210 normally operated 8 hours daily must have special scheduled services performed weekly and monthly by trained personnel. For *longer* operating hours, the intervals *must be shortened*. For example, a power unit operating 16 hours daily requires a *weekly* service twice a week and *monthly* service twice a month.

c. Under extreme conditions of heat, cold, dust, or moisture, certain items may require special attention. (sec. X).

42. Scheduling Services *

Schedule services for a month in advance, using WD AGO Form 460 (Preventive Maintenance Roster).

a. On the left-hand page write the names of the responsible mechanics, the power units in their care, and the normal operating hours of each unit. Under UNIT SERIAL NO. give the number assigned to each power unit by your organization. If no such number is assigned, put the manufacturer's serial number in the EQUIPMENT REG. NO. column.

b. On the right-hand page, show in pencil the service which will come due during the month. Weekly services are numbered to show when the monthly service is due. When services are actually performed, write over the entries in ink. If a unit is deadlined by accident or for repair by field or base maintenance, show this fact on the roster but do not reschedule.

43. Technical Inspections

These inspections, which are similar to PM services, are made by technically qualified personnel. They are made for any of the following purposes:

a. To determine whether a power unit should be continued in service, overhauled, or salvaged.

b. To determine extent of damage and estimated cost of repair in Reports of Survey and the like.

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* *See Note page 88*

c. To discover the cause of difficulties encountered in service.

d. To insure that all defects have been corrected in a field or base shop before the unit is returned to the using organization.

e. To determine the condition of a unit at the time accountability for it is transferred.

44. General Procedures *

PM services and technical inspections are recorded in detail on DA AGO Form 464 (Work Sheet for Preventive Maintenance and Technical Inspection of Engineer Equipment). The use of this form is explained in TM 37-2810, Motor Vehicle Inspections and Preventive Maintenance Services.

a. Fill in the appropriate spaces at the top of work sheet.

b. The three double columns of blocks, or groups, are used for recording the completion of items.

(1) For a technical inspection (TI) use the left-hand blocks in each column. Rule out 256 HR. MAINT. and the right-hand blocks.

(2) For the weekly inspection, use the right-hand blocks. Rule out 64 HR. MAINTENANCE and the left-hand blocks. Write WEEKLY above the right-hand columns.

(3) For a monthly inspection, use the left-hand blocks. Rule out 256 HR. MAINT. OR TECHNICAL INSPECTION and the right-hand blocks. Write MONTHLY over the left-hand columns.

c. An open block opposite an item means the items is to be inspected and corrected. In each inspection, make sure that the items and its supporting member or connection are *in good condition, correctly assembled, secure, and not excessively worn.* If an item is found to be satisfactory, put a check mark (√) in the box. If an adjustment is needed put an X in the box. If a repair is required, use XX. If a replacement is needed, use XXX. When the repair, adjustment, or replacement is made, circle the mark.

d. Some of the boxes have letters in them. These letters mean that, *besides the usual inspection and correction,* perform one or more of the following special services: When the special services have been performed, circle the letter or letters.

(1) *C-Clean.* Using solvent (SD), remove oil, grease, or dirt; rinse and dry. *Gasoline will not be used as a cleaning fluid for any purpose.*

(2) *T-Tighten.* Use the correct wrench and do not overtighten.

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* *See Note page 88*

Make sure that locknuts, lockwashers, cotter keys, and locking wires are in place.

(3) *A-Adjust.* Make adjustments as directed in paragraph 45.

(4) *L-Lubricate.* Perform special lubrication as directed in paragraph 38.

(5) *Serve.* Perform special operations as directed in paragraph 45.

e. During a technical inspection, make only such adjustments, repairs, or replacements, and perform only those inspecial services which are necessary to restore the unit to a safe operating condition. Replace damaged parts after the inspection.

45. Specific Procedures *

Following are detailed instructions for the items in the work sheet (DA AGO Form 464) which apply to Power Unit PE-210 (FR).

a. Locating Inspection or Service To Be Performed. Look down the column marked for the inspection or service which is to be performed. At each place where an item number appears in the column, follow the instructions to the right of the number. On each item make a general inspection, whether or not it is mentioned.

b. Marking Work Sheet When Items Are Completed. As the items are completed, mark the work sheet accordingly and rule out all items not mentioned here, as they do not apply.

c. Items To Be Written in on Work Sheet. Numbered blank spaces have been provided in all blocks, or groups, on DA AGO Form 464 to cover any items not listed. In the following table of detailed instructions there are three items which do not appear among the various headings which are printed on this work sheet. These three items are shown below and must be written in, opposite the appropriate printed item number shown, at the time this work sheet is prepared:

Item No.	*Heading to be written in*	*Where heading is to be written in*
21	Noise and vibration	Opposite blank space No. 21 in engine and accessories group.
175	Temperatures	Opposite blank space No. 175 in generators group.
211	Final running test	Opposite blank space No. 211, below graders group.

Note. If the tactical situation does not permit a full engine test, be sure to perform item 204.

* *See Note page 88*

d. Table of Detailed Instructions for Work Sheet Items

Tech insp	Monthly insp	Weekly insp	Action
1	1	1	*Before-operation Services.* Follow the before-operation procedure given in section IV.
2	2	2	*Lubrication.* Refer to LO 11-947 (fig. 58).
3	3	3	*Tools and Equipment.* All standard tools should be present (see tool list, par. 5), in good condition, and properly stowed. See that tools with cutting edges are sharp. Sharpen if necessary.
5	5	5	*Publications.* Two copies of TM 11-947 and a supply of NME Form 110, WD AGO Form 460, and DA AGO Form 464 should be present and in legible condition.
7	7	7	*Modifications (Mwo's completed).* Check to see that all modification work orders and other directives have been complied with.
			ENGINE AND ACCESSORIES
11	11	11	*Cylinder Head, Manifold,, and Gaskets.* Remove muffler and inspect for carbon deposits in exhaust ports and muffler (par. 74). Remove carbon if necessary and inspect for leaks and cracks. Tighten all mounting bolts and connections. *Note.* This operation should be performed half-way between weekly services, because an excessive amount of carbon may accumulate in a week.
	11		Remove the carburetor, muffler, and cylinder head and inspect for carbon deposits in the cylinder head, exhaust, and intake ports, and on the top of the piston. Remove carbon if necessary. Whenever the cylinder head is removed, clean both the spark plug and spark plug adapter.
20	20	20	*Governor and Linkage.* Inspect the governor and all connecting linkage, and see that they are secure and in good operating condition. Check linkage connections to see that they are not excessively worn. Check the plunger linkage and the attached throttle shaft to see that the parts are working freely and do not bind. *Note.* The following item is to be written in opposite blank space No. 21 in engine and accessories group.
21	21	21	*Noise and Vibrations (Engine Mountings and Exhaust).* While operating the engine, listen for any unusual noises in the engine. Notice any any excessive vibration that might indicate loose engine mountings, or noise that might indicate damaged, loose, or inadequately lubricated parts. *Serve.* Tighten mountings securely.
			FUEL SYSTEM
39	39	39	*Carburetor and Linkage.* Check for good condition, correct assembly, and secure installation. Be sure the carburetor does not leak. Inspect choke, throttle, linkage, and governor.

(3) Unprotected and exposed equipment will be affected by the high ambient temperatures existing during the day and by condensation at night. Midday temperatures in desert areas become abnormally high and unshaded equipment quickly absorbs the heat generated by the rays of the sun. Operation of the equipment under such conditions quickly raises its temperature to unsafe heights.

b. Power Unit PE-210 (FR)

(1) *Lubrication.* Clean all exposed or affected parts before applying the lubricant. Daily inspection of lubrication points is a must. Never add fresh lubricant to old dirt-bearing grease or oil.

(2) *Air Cleaner.* Remove and clean daily or oftener. Replace clogged or damaged element. Under any circumstances, do not operate the power unit without an air cleaner.

(3) *Shelter.* Power Unit PE-210 (FR) must be protected against windblown dust and sand. A roof must be placed over the equipment shelter that will effectively keep out the rays of the sun as well as sand. The unit is air-cooled and depends upon air circulation around the generator-armature and field coils and around the cylinder-cooling fins for cooling heated parts to safe operating temperature. Provide the shelter with adequate ventilation louvers and an outlet for the exhaust. Also place the door away from the prevailing wind. Place the canvas cover over the power unit during idle periods. (Wait until the unit cools sufficiently). Store fuels, lubricants, and other supplies in a suitable shelter to avoid the entrance of sand into the containers. Always strain fuel and oil of which the sand and dirt content is doubtful.

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PART FOUR

REPAIR INSTRUCTIONS

Section XI. THEORY OF EQUIPMENT

50. Principle of Two-cycle Engine (fig. 9).

a. When the piston travels away from the crankshaft, a charge of fuel vapor in the cylinder is compressed. At the same time, a partial vacuum, created in the crankease, causes the reed valve, attached to the carburetor, to open. A fuel-air mixture is then admitted into the crankcase (fig.9 (1)). At the end of the compression stroke of the piston (fig.9 (2)), the spark plug ignites the compressed fuel vapor in the combustion chamber, and the explosion, which follows, forces the piston toward the crankshaft on its power stroke (fig.9 (3)).

b. As the piston moves towards the crankshaft on its power stroke, it compresses the fuel vapors which have been admitted into the crankcase through the reed valve. When the piston passes the exhaust port openings, the ports are uncovered and most of the burned gases pass out of the cylinder and into the exhaust.

c. Just after the exhaust ports open, the piston uncovers the intake port openings and compressed fuel vapors from the crankcase pass through the bypass and intake port holes and into the cylinder. Fuel vapors are directed upward by a deflector located on the piston head (fig.9 (1)). The momentum of the flywheel carries the piston through the compression stroke. The continuous succession of these cycles produces a constant, smooth flow of power.

d. In engines of this type, lubrication of internal parts is accomplished with oil that is mixed with gasoline (fuel) that is drawn into the base of the engine in the form of vapor.

51. Engine Ignition System

The magneto has a rotating, permanent magnet in the flywheel (rotor) and a stationary coil (stator). The primary winding of the coil is in series with the breaker points. The secondary winding is connected to the spark plug. As the permanent magnet (flywheel) rotates, the magnetic flux through the coil is repeatedly reversed, and an induced current flows in the primary circuit when the contact points are closed. When the contact points open, the primary current stops flowing and the magnetic

field immediately collapses, thus inducing a very high voltage in the secondary winding of the coil. This potential is fed through the magneto cable to the spark plug where it jumps the spark-plug gap. (See TM 10-580, Automotive Electricity, for a more complete discussion of magnetos).

52. Theory of Generator Operation (fig. 10)

If a wire is moved through (cuts) a magnetic field, a voltage is induced in that wire. If the ends of that wire are connected to a load, current will flow in that wire or circuit. The induced voltage will be greater if the wire is longer, if the wire moves faster, or if the magnetic field is strengthened.

a. Generator GN-52-B is a d-c generator whose armature consists of coils of insulated wire wound through slots running axially on the armature surface. As the armature revolves, these coils are carried past the magnetic fields which are generated in the electromagnetic coils of the field windings. Voltages thus induced in the armature windings are picked up by the carbon brushes (fig.48) which are in contact with the ends (commutator segments) of the armature coils.

b. Once the field poles are magnetized, they usually retain some of the magnetism (called residual magnetism) even though there is no current in the field winding when the generator is not running. When the armature starts to rotate, the armature windings pass through, or cut, the field flux of this residual magnetism. This generates a small amount of voltage in the armature, which causes current to build up and flow in the field, thus strengthening it. This action increases until the full output voltage of the generator is reached.

53. Control Box

Operation of the control box is explained in connection with the governor (par. 54).

54. Electric-governor Operating Principle (fig. 13)

a. Mounted above the carburetor is a small, solenoid-type, electric governor. Its function is to control the engine speed and, in so doing, control the generator output voltage. A small rheostat in the control box provides the means of adjusting generator voltage by changing both the engine speed and the generator-field resistance.

b. The solenoid is made up of copper wire wound around a hollow tube, a plunger or armature inside the tube, a link and lever connecting the plunger to the carburetor shaft, and a

spring to position the plunger in response to the magnetic pull of the solenoid.

c. A portion of the electric current from the generator is supplied to the solenoid. This current produces a downward pull on the plunger, which tends to position it in the center of the tube. The downward movement of the plunger closes the carburetor throttle by means of the connecting link and lever. The small tension spring, attached to the top of the plunger, balances the solenoid pull and tends to position the engine throttle so that the correct engine speed to produce the proper voltage is obtained.

d. One lead of both the governor and voltage coil of the reverse-current relay is connected to one side (upper) of the generator (fig.12). The other leads of both are connected to the right end of the 12-ohm rheostat. The arm of the rheostat is connected to the other side (lower) of the generator. Thus, both the governor and reverse-current relay are subjected to a definite fraction of the generator voltage, depending on the position of the arm of the rheostat. For example, with the arm in the extreme position to the right *on the diagram* (full counterclockwise position of the control knob on the control box), full generator voltage is supplied to the governor and relay and both will close at approximately 6 volts. When the control knob is moved in the clockwise direction, less generated voltage is supplied to the governor and relay. However, since approximately 6 volts are required by the governor for any control knob position, engine speed and generator voltage must increase with the clockwise movement of the control knob in order to supply this required governor voltage.

54.1. Theory of Carburetor Function (fig.22)

a. A constant fuel level must be maintained in the carburetor float bowl and all channels of the carburetor at all times. This is controlled by the inlet needle and seat assembly (C) and the float (F).

b. At low or idle speed, the throttle shutter (G) closes the venturi (R) and causes fuel to enter the engine through the idle discharge ports (H). Fuel flows by the main adjustment screw (T), through channel (W), and into the idle tube (L). High vacuum ahead of the throttle shutter (G) draws this fuel upward and out of the orifice (M). The fuel from the idle tube orifice mixes with air from channel (J) and the resulting air-fuel mixture is drawn into the engine through the idle fuel discharge ports (H). Additional air, passing the slightly open throttle shutter, is mixed with the fuel as it passes toward the engine.

c. When the engine is operating at other than idle speed or

pulling a load, the throttle shutter (G) is no longer closed. This reduces suction in the carburetor and minimizes the fuel discharge at (H). The opening of the throttle shutter increases, to a high velocity, the flow of air through the venturi (R). This rapidly flowing air draws fuel from the main nozzle (Y). As the engine speed or load is increased, air is bled automatically into the main nozzle through tube (U). This causes a proper proportion of fuel in relation to the main nozzle adjustment.

Section XII. TEST EQUIPMENT USED IN TROUBLE SHOOTING

55. Test Unit I-176

Test Unit I-176 is a multimeter using a high-resistance voltmeter, an ammeter, a milliammeter, and an ohmmeter. All ranges may be read on one instrument and are generally adequate for trouble shooting the electrical parts of Power Unit PE-210.

56. Application of Test Unit I-176

Use the ohmmeter range to determine the presence of shorts between any individual commutator segment and shaft of the armature. Disconnect alternate paths in the circuit under test. Consult the schematic and wiring diagrams (figs. 11 and 12) for wire colors and their terminals, to avoid the necessity for disassembling the generator or control box. The very low values of resistance of armature and field coils as well as the voltage and current coils in the control box will cause very slight readings on the instrument. Consideration must also be given to the higher resistance values of heated wire. Capacitors used on the control box and generator must be disconnected for high-resistance continuity tests.

57. Repairs

Generator GN-52-B must be turned in for repair if it is defective. The same procedure must be followed for defective control boxes.

Section XIII. TROUBLE-SHOOTING PROCEDURES

58. General

No matter how well equipment is designed and manufactured, faults will develop during service. When faults occur, the repairman must locate and correct them as rapidly as possible. The