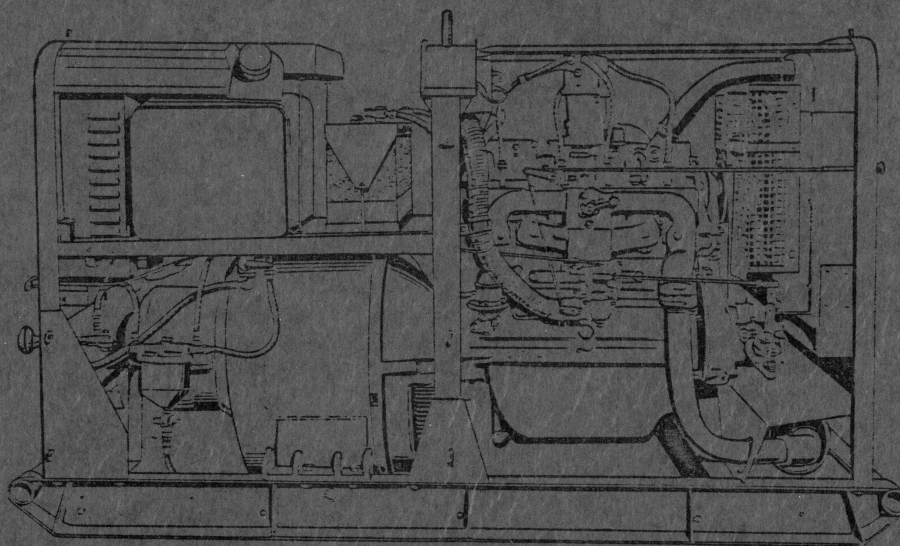


INSTRUCTION MANUAL

for ELECTRIC GENERATING PLANTS

POWER UNIT PE-95 (NSN-17)
ONAN MODEL 10HQ-3R/552B



Contract Number DA-36-109-ENG-4828
Purchase Order Number 29-6084-24
Serial Numbers 491860 thru 492255

D. W. ONAN & SONS INC.

MINNEAPOLIS 14, MINNESOTA

918-38

Litho in U.S.A.

SAFETY NOTICE

Do not attempt adjustments or changes on wiring while the unit is in operation. Be sure to open (OFF POSITION) the circuit breaker before making or changing load connections. This unit generates sufficient voltage to cause severe and possibly fatal shock. Use caution when operating on wet or damp ground. Disconnect battery before performing maintenance on the electrical engine accessories to avoid possible damage from accidental short circuiting. When connecting the battery cables, connect the ground cable last. When disconnecting the battery cables, disconnect the ground cable first. Be sure to provide proper ventilation when operating the unit in a confined space. Exhaust gases are poisonous and excessive exposure may cause severe sickness or death. Do not service wiring while the unit is in operation or if a radio transmitter is in use in close proximity. Avoid spilling gasoline on hot engine parts.

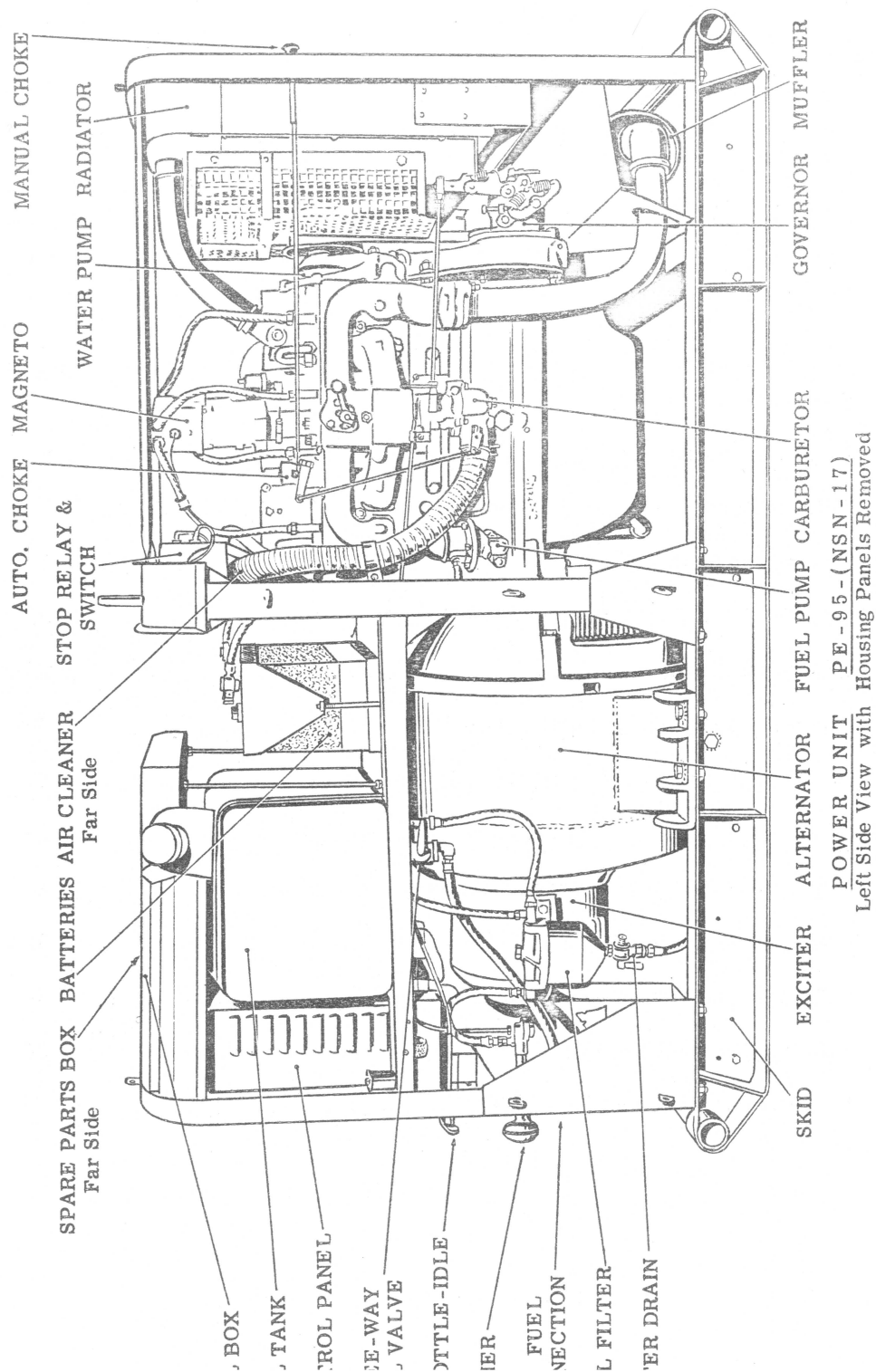
TABLE OF CONTENTS

SUBJECT	PAGE NO.
Description	
General Data	1
Engine Details	2
Generator Details, Control Details	3
Installation	
Location, Mounting, Ventilation	4
Exhaust, Underground Muffler, Fuel Supply, Batteries ...	5
Connecting the Load Wires	6
Remote Control Connections	7
Preparation	
Lubrication, Air Cleaner, Fuel, Radiator	9
Operation	
Starting the Plant Electrically, Starting the Plant Manually .	11
Stopping the Plant, Standby Service, Control of Ignition	
Circuit	12
Checking the Operation	13
High Water Temperature Switch, Low Oil Pressure Switch,	
Over-speed Switch	14
Emergency Operation	15
Abnormal Operating Conditions	
Low Temperatures	16
High Temperatures, Dust and Dirt	17
Periodic Service	
Daily Service, Weekly Service	18
Monthly Service	20
General Service-Suppression	22
Adjustments	
Carburetor, High Water Temperature Switch	29
Fan Belt, Choke, Manifold Heat	30
Governor	31
Maintenance and Repair	
Engine	33
Generator	38
Controls, Radio Noise Suppression	40
Torque Wrench Data, Trouble Shooting	41
Table of Clearances and Specifications	42
Service Diagnosis	
Possible Cause - Remedy	43
Storage	
Preparing Units for Storage	49
Returning to Service after Storage	50

LIST OF ILLUSTRATIONS

SUBJECT

Load Terminals
Lubrication Chart
Overspeed Switch
Bonding (Over-all), Suppression Details
Wiring Diagram
Control Panel, Suppression Details
DC Charge Regulator, Suppression Details
Magneto Stop Relay, Suppression Details
Brush Rigging, Suppression Details
Governor Adjustment
Cylinder Head Tightening Sequence
Timing Gear Alignment
Installing Brushes and Springs



DESCRIPTION

The Military designation for this Power Unit is, PE-95. (NSN-17) Power Unit is manufactured by D.W. Onan & Sons Inc. located at Minneapolis 14, Minnesota, U.S.A. The Onan Model designation is 10HQ-3R specification 552B, also written 10HQ-3R/552B. In reference to "Power Unit" the manufacturer refers to it as "generating plant".

This instruction manual is supplied to assist the operator in the installation and operation of the generating plant. Disregarding instructions may lead to unnecessary trouble and expense. Keep this manual accessible for reference.

Each electric generating plant is given an actual running test and is fully checked under various electrical load conditions before leaving the factory, to assure that it is free of defects and will produce its rated output. Inspect the plant for any damage which may have occurred during shipment. Any part damaged must be repaired or replaced before the plant is put in operation.

The generating plant consists, basically, of an internal combustion engine and a self excited alternating current generator. The engine is of the cylinder gasoline burning type. The generator is a four pole, field type, directly connected to the engine. A control panel is located at the rear end of the unit on which all necessary meters, terminals and controls are mounted. The complete unit is mounted on a steel skid base and is enclosed within a sheet metal housing. The housing is provided with doors and removable panels enabling the operator to reach any part of the equipment.

The radiator end of the plant is designated as "Front End" and the carburetor side is designated as "Left Side" of the plant by D.W. Onan & Sons Inc. "Left" and "Right" are determined by viewing from the front of the plant.

If it ever becomes necessary to contact the factory or an Authorized Service Station in regard to this generating plant, be sure to refer to the nameplate information as shown. This information must be kept in order to properly identify the plant and to enable proper advice to be given.

MODEL NO. SPEC. NO. SERIAL NO.

ONAN			
MODEL	SPEC.	SERIAL NO.	
10HQ-3R	552B	XXB123456	
IMPORTANT			
A.C. VOLTS	AMPS	WATTS	PHASE
D.C. VOLTS	AMPS	WATTS	
D. W. ONAN & SONS INC.			

ENGINE DETAILS

The engine is a Continental Model FS 162, specification 6007. It has 4 cylinders, L head, 3-7/16" bore, 4-3/8" stroke, 162 cu. inch total piston displacement, 6.8 to 1 compression ratio, 41.0 horse power at 1800 rpm. The weight of the basic engine less accessories is approximately 420 lbs.

The cooling system is approximately 10 quarts, U.S. standard measure. Full length water jackets surround the cylinder and valve seats. A belt driven, prelubricated, ball bearing water pump maintains circulation of the engine coolant. The temperature of the coolant is controlled by a thermostat and a by-pass. A pusher type fan forces cooling air out through the front of the radiator. The radiator cap is of the pressure type.

The crankcase oil capacity is 4 quarts (U.S. measure) plus approximately 1 pint used in the operation of the oil filter. A gear type oil pump supplies pressure lubrication to main, connecting rod, and camshaft bearings.

Main and connecting rod bearings are precision type replaceable liners. All valves are non-positive rotator type. Exhaust inserts are used. Valve tappets are adjustable self-locking. Firing order is 1-3-4-2. Governed engine speed is approximately 1800 rpm. with a separate manual throttle-idle control provided for optional use.

The impulse coupled magneto ignition assures easy, quick starting. The unit is radio noise suppressed. A 24 volt automotive solenoid shift type starter and a 24 volt charging generator, with charging rate automatically regulated, are used and require two 12 volt batteries of the military type 2HN connected in series with the negative post grounded.

The choke is automatic with a separate manual choke control provided for optional use.

The unit burns gasoline fuel and has an up draft carburetor with an adjustable main jet. A plunger type primer is provided to aid starting under adverse conditions. The mounted fuel tank is 6-1/2 gallon U.S. measure. A three-way valve, necessary lines and fuel drum adapter, adapts the unit for use of fuel from a remote source. The fuel filter has a permanent disc type element and a drain cock permits periodic draining of sediment from the bowl.

The diaphragm in the fuel pump as well as flexible fuel lines and hoses are suitable for low temperature operation.

Cut-off switches protect the engine from damage which might result from high water temperature, low oil pressure, or excessive speed.

GENERATOR DETAILS

The output rating of the generator is 125/250 volt, 1 phase, 60 at 1800 rpm, 10,000 watt at 0.8 power factor.

The air cooled alternating current generator has two main components, the alternator, and the exciter. The alternator is a 4 pole, rev field type alternating current generator. The exciter generates current for exciting the alternator field. The alternator field and exciter armature are assembled into a single rotor which is directly connected to the engine flywheel. The rotor is supported at the end by the engine rear main bearing and at the exciter end by a double-sealed permanently-lubricated ball bearing. The large frame contains stationary armature windings of the alternator, from which main load is taken, and the smaller frame contains the stationary field.

The generator is specifically designed for high efficiency and excellent motor starting abilities. The KW rating is at 80% power factor to the inherent design of the generator, voltage regulation between load and full load is very close. The frequency of the current is determined by the engine speed, and is regulated by the engine governor. The speed is approximately 1800 rpm which results in 60 cycle frequency. The speed also affects the output voltage.

CONTROLS DETAILS

The unit is equipped with an instrument panel mounting a manual circuit breaker, meters, gauges, receptacle for light, and switch. This provides convenience in observing the performance and properly controlling the plant.

Terminals are provided so that the plant may be connected for control of starting and stopping.

DC output terminals are provided and fused for a maximum load of 15 amps, 24-volt dc.

A duplex receptacle is provided for a trouble lamp or other light within 15 amps, 125-volts. This receptacle circuit is not disconnected by the circuit breaker.

IMPORTANCE OF PROPER INSTALLATION. - Satisfactory and dependable performance of the generating plant is dependent to a great extent upon the proper installation. Location and ventilation are important factors to consider in the plant installation. Installation instructions given are of a basic nature and consequently do not specifically cover all applications.

LOCATION. - Locate the plant centrally in relation to the electrical load. For example, two buildings 500 feet apart are to be supplied with current from the generating plant. If the amount of the electrical load is approximately equal at each building, the ideal location for the generating plant would then be at a point midway between the two buildings. If most of the electrical load will be concentrated in one building, the generating plant should then be located in or near that building. Each installation differs in this respect.

Avoid as much as possible the use of long electric lines. Long lines require larger size wire to avoid excessive voltage drop. Be sure to use large enough wire, taking into consideration distance, electrical load, and permissible voltage drop. Consult a licensed electrician if in doubt.

Select a site for the generating plant which will be dry, clean, and well ventilated. Choice of either a damp or dusty location will require more frequent inspection and servicing of the plant. If practicable, install the plant inside a building or covered vehicle for protection from extremes in weather conditions.

MOUNTING. - For permanent installations, a raised platform of concrete or heavy timber on which to mount the plant will be a convenience in servicing the plant. The plant may be bolted down in position if desired. Allow at least 24 inches of space on all sides of the plant for convenience in servicing.

If the plant is mounted in a mobile vehicle, be sure that plant is bolted securely in place so that it can not shift when in transit. The plant must be set approximately level when in operation.

VENTILATION. - The plant generates a considerable amount of heat which must be dissipated by proper ventilation. Engine heat is removed by a pusher type fan which blows cooling air out through the front of the radiator. For room or compartment installations, provide an opening at least as large as the radiator area for exit of the heated air. This opening should be directly in front of the radiator, and as close to the radiator as practicable. It may be necessary to construct a duct from the front of the radiator to the outdoors. In cold weather, some method of controlling the air flow should be provided, so that the temperature of the room can be kept at a normal point. Generator cooling air is discharged from an air duct near the left rear of the engine. Provide an outlet for this heated air. See that the air heated by the

EXHAUST. - Exhaust gases are deadly poisonous and must be side if the plant is installed indoors. Excessive of exhaust gases may cause serious illness or death. Use pipe as large as the muffler outlet size for the first 10 feet and increase diameter one size for each additional 10 feet in length. Avoid turns as much as possible. If the line passes through an infla wall, shield the wall by passing the line through properly insulated metal collars. If the exhaust line is lengthy or rises from the muffler, provide a means of draining condensation periodically.

UNDERGROUND MUFFLER. - If exhaust noise from the stander will be objectionable, an underground muffler may be constructed. Use a heavy 10 gallon or larger drum. If the tank contained any inflammable material, be sure are exhausted before starting to work on it. Weld suitable pipe to the tank, for inlet and outlet pipes. Perforate the bottom of for condensation to drain out. Bury the underground muffler in gravel. Extend the outlet line at least 24 inches above the ground fit it with a gooseneck fitting to avoid entrance of rain or snow there is any possibility of an underground muffler filling with any time, the underground muffler can not be used.

FUEL SUPPLY. - Connect the remote fuel supply line to the fuel connection located below the manual pump, on the control panel end of the equipment. Make sure connections are airtight. An air leak at any point between the fuel tank and the fuel pump will prevent pumping of fuel. The fuel supply should be within a maximum lift of 6 feet. A fuel adapter fitting, to fit the threads of a fuel drum, is supplied. Power Unit. Place the three-way valve to draw fuel from the desired.

BATTERIES. - Two 12 volt batteries connected in series are Original equipment is type "2HN" batteries with the military design, long and narrow, and have positive and negative posts at the same edge rather than at opposite corners. Install batteries with posts toward the engine.

Connectings must be clean and tight. Use the short jumper cable to connect the positive post of one 12 volt battery to the negative second 12 volt battery. Connect the battery cable attached to solenoid switch to the remaining positive (+) post of the battery. Connect the battery cable which is grounded, to the remaining (-) post of the batteries. It may be necessary to spread the cable slightly to make it fit over the post. Do not pound on the clamps force them down on the posts! Tighten the clamps securely lightly with light grease or vaseline to minimize corrosion due

Batteries with the original equipment are supplied in a "dry, charged" condition, and must be prepared for use according to the instructions given on the tag attached to the batteries.

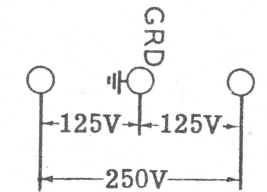
When installing batteries that have been used previously, see that the level of the electrolyte in each cell is at least 1/2 inch above the top of the separators. If it is not, add pure water but do not "overfill". IN FREEZING TEMPERATURES, START THE UNIT OR PLACE THE BATTERY ON CHARGE IMMEDIATELY AFTER ADDING WATER. Complete instructions on the care of storage batteries appears in TM9-2857.

CONNECTING THE LOAD WIRES. - Three AC output terminals studs, to which the load wires are to be connected, are located just below the control panel, and are accessible by lifting a narrow hinged flap. A good installation might include entry of the load wires through conduit from underneath the plant or through a knock-out hole in the rear panel of the plant. Either eye terminals may be soldered to the load wires, or solderless screw-type connectors may be used to attach the load wires to the output terminals. Be sure to use sufficiently large insulated wire. The connections should be made to conform to applicable electrical codes.

The three AC output terminals are located toward the left when facing the panel and are larger than the DC output and the remote terminals which are also located below the panel. The center AC output terminal is grounded, the other two are "hot".

For 125 volt current, connect the neutral load wire to the plant terminal post which is grounded. Connect the "hot" load wire to either of the two "hot" AC output terminals. Two separate 125 volt circuits are thus available with not more than 5,000 watts (1/2 the total plant rating) available on each circuit. Balance the load as closely as possible between the two 125 volt circuits.

For 250-volt current, connect the load wires to the two "hot" plant terminals, leaving the center "ground" terminal unused. If only 250-volt current is used the full rated capacity is available. Both 125 volt current and 250 volt current may be used at the same time provided the total requirement is within (10,000 watts), the plant capacity. A total of only 5,000 watts (which is 1/2 the plant rated capacity) is available on each 125 volt circuit.



LOAD TERMINALS

REMOTE CONTROL CONNECTIONS. - One or more remote switches of the momentary contact type, may be connected to the unit for remote starting and stopping. Three "REMOTE TERMINALS" are located just below the control panel and are accessible by lifting a narrow hinged flap. Refer to the wiring diagram. The outermost terminal is grounded; the middle terminal is in the stopping circuit; and the third terminal is in the starting circuit. Grounding the second terminal through the switch serves to stop the unit while grounding the third terminal through the switch serves to start the unit.

The connections should be made to conform to applicable electrical codes. The wire length from the plant to the switch determines the wire size necessary. Use No. 18 wire for a distance up to 60 feet, No. 16 wire up to 1035 feet, No. 14 wire up to 1550 feet, and No. 12 wire up to 2625 feet.

LUBRICATION CHART

POWER UNIT PE-95(NSN-17), 10KW, 125/250 V.
60 CYCLE, 1 PHASE. ONAN MODEL 10HQ-3R/552B.

Clean parts with THINNER, paint, volatile mineral spirits, or SOLVENT, dry cleaning. Dry thoroughly before lubricating.

INTERVAL SYMBOLS: D - Daily; W - Weekly; M - Monthly.

Intervals given are for normal 8-hour day operation. For abnormal operating conditions, intervals should be adjusted to compensate.

NOT LUBRICATE - Generator brushes, commutator, p rings, water pump, starter, ac generator bearing.

CLEANER - After each 8 hours of operation replenish oil to level marked on cup. Use crankcase grade for corresponding temperature. Weekly, remove cup, clean, and refill with OE as above. For sandy or dusty operation, shorten intervals.

FILTER - Monthly, to coincide with crankcase drain, remove cartridge and drain plug. Swab filter with clean oil. Install new cartridge, replace drain plug securely, add oil as required. Operate engine, check for leaks, and recheck oil level. Weekly, drain off sludge.

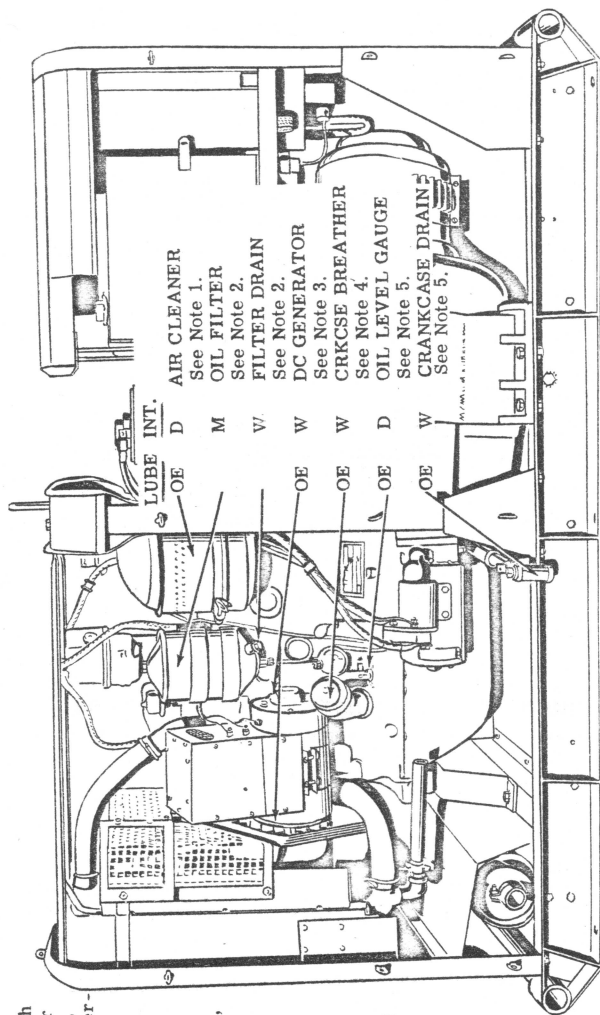
ARGING GENERATOR - Place 3 to 5 drops of OE in oil at each end.

ANKCASE BREATHER - Remove, clean with solvent, thoroughly and re-oil with OE of crankcase grade.

ANKCASE - Daily, check level on bayonet gauge. Add to bring level up to FULL mark on gauge. Weekly, clean, only when hot from operation, and refill with OE. Capacity is 4 quarts excluding filter.

LOWEST EXPECTED TEMPERATURE RECOMMENDED OE (Oil, lubricating, Engine)

Above 32°F.
32°F to 0°F.
Below 0°F.
MIL-O-2104 Grade 30
No. 2-104-8 Grade 10
OE-S conforming with Spec
MIL-O-10295



PREPARATION

PREPARATION FOR OPERATION. - Before putting the plant supply it with fuel, oil, (or antifreeze liquid). Comply with the following instructions

LUBRICATION. - Fill the crankcase with 4 quarts (U.S. Measure) as recommended below. Approximately 1 p remained in the oil filter when the crankcase was drained at t Do not use an oil heavier than Grade 10 in a plant being put in the first time. After the first oil change, use an oil of the pr according to the lowest temperature to which the plant will be as indicated in the following table. The temperatures indicate conditions where the plant will be standing idle long enough to to the surrounding temperatures.

TEMPERATURE

GRADE OF OIL RECOMMENDED

Above 32°F. (0°C.)	MIL-O-2104 Grade 30
32°F. to 0°F. (0°C. to -18°C.)	No. 2-104-8 Grade 10
Below 0°F. (-18°C.)	OE - S conforming with O-10295 (OE-S = Oil, Subzero)

Keep the crankcase oil level at or near the upper level mark on level gauge, but never above it. Do not attempt to check the oil level while the plant is running. If the crankcase is overfilled, the rods may strike the oil, causing improper lubrication and excessive consumption. Never allow the oil level to fall to the low level on the oil level gauge.

AIR CLEANER. - Remove the bottom cup of the air cleaner and replace with the "OIL LEVEL" mark with oil of the same number as that used in the crankcase. Be sure the bottom cup is properly reinstalled.

FUEL, GASOLINE. - Do not fill the tank completely full of gasoline. Expansion of the gasoline as the plant runs may cause the gasoline to overflow, creating a fire hazard. The gauge on the control panel registers the amount of fuel in the tank only when the plant is running. Do not fill the tank when the plant is running.

Use fresh, clean "regular" grade gasoline. Do not use any heavy or leaded premium gasoline. If highly leaded gasoline is used, more carbon and lead removal, valve grinding and spark plug service will be necessary. However, do not use a low octane fuel, such as "gas".

RADIATOR. - The capacity of the cooling system is 10 quarts.

If the plant will be exposed to freezing temperatures, use a permanent type, antifreeze solution. Use the correct proportion of antifreeze as recommended by the anti-freeze manufacturer, depending upon the lowest temperature to which the plant may be exposed. To avoid the loss of antifreeze through the radiator overflow pipe, due to expansion of the coolant as the plant warms up, fill only to between 1 or 2 inches below the bottom of the filler neck. Attaching of a warning tag "Radiator contains anti-freeze" will help prevent accidental draining of the anti-freeze.

After the instructions under INSTALLATION and PREPARATION have been carefully complied with, the plant should be ready for operation. However, before starting the plant, carefully study the sections headed OPERATION and ABNORMAL OPERATING CONDITIONS immediately following.

PRELIMINARY. - Before starting the plant, be sure that it is properly installed and prepared for operation on the fuel supply and check for leaks, correcting any that may be found. Be sure that no electrical load is connected to the generating unit. Do not confuse the START-STOP switch which is located on the panel with the stop relay switch which is located near the magneto.

STARTING THE PLANT ELECTRICALLY. - The plant may be started electrically, either at the plant or at a remote station. The stop-relay switch must be in the STOP position. Press the START switch to electrically crank the engine. If a plant being started for the first time, or one which has run on gasoline, it will be necessary to operate the primer or to allow the engine to crank long enough to allow the fuel pump to become primed with gasoline to the carburetor. Do not crank steadily, but in short cranks of approximately five seconds each, with five seconds intervals between crankings.

When the carburetor receives sufficient fuel, the plant should start. Carburetor choking is automatic. As the engine starts to fire, remove the START switch in contact until the plant has picked up running.

After the first start, the plant should start within a few seconds after cranking. Failure to start promptly is usually an indication of trouble in the fuel or ignition systems, and the cause of the trouble should be found and corrected.

NOTE: Sometimes, when the plant is stopped for a short time and an attempt to restart is made while the engine is still hot, it may be necessary to operate the manual choke. Operate the manual throttle-idle control momentarily while cranking. The engine normally starts at full open throttle position, but in some cases so many require some choking or closing of the throttle in certain hot conditions.

STARTING THE PLANT MANUALLY. - If the starting battery is exhausted or has insufficient power to crank the engine, or the engine can not be cranked electrically for some other reason, the plant can be started manually.

To start the plant manually, see that the fuel system is ready for operation, as explained under STARTING ELECTRICALLY. Throw the stop relay switch to the HAND CRANK position. Engage the manual crank and crank the engine, using a quick upward pull on the crank handle. Do not "spin" the crank. The automatic choke provides full choke only when the START switch is in contact, so it is necessary to operate the manual choke manually. After the plant starts and has reached running speed, throw the stop relay switch to the RUN position.