

## GENERATING SET 2 K.V.A. NO. 2 ONAN AMERICAN OTC-5BH

### GENERAL DESCRIPTION

1. The wireless generating set 2 K. V. A. ONAN AMERICAN OTC-5BH is to be used as the electrical supply source for wireless sets.

### ENGINE SPECIFICATIONS

2. The engine is an opposed twin cylinder, four stroke cycle, air cooled, petrol engine. It has a  $2\frac{5}{8}$ " bore, with a  $2\frac{1}{4}$ " stroke. The compression ratio is 5.9 to 1. This engine produces 3.4 horse power at 1800 r.p.m.

### Weights and Dimensions

3. The ONAN OTC-5BH generating set complete with accessories and frame weighs about 270 lbs.

Dimensions (overall): - Height  $21\frac{3}{4}$ "  
Length  $28\frac{1}{2}$ "  
Width  $21\frac{1}{2}$ "

### Crankcase

4. The crankcase is made of a cast iron or cast aluminium fastened to a removable oil base. The cast iron cylinders are removable from the crankcase. Any "blow-by" gases or water vapor in the crankcase are drawn out through the crankcase ventilator breather pipe to mix with the air being drawn into the carburettor.

### Crankshaft and Bearings

5. The cast steel alloy crankshaft has a drilled hole from each of the two main bearing journals to the adjoining connecting rod bearing journals to allow for the passage of oil. The front bearing for the end of the crankshaft is pressed into the crankcase, while the rear bearing is pressed into a rear bearing plate which is bolted to the crankcase. Both front and rear bearings are made of steel backed hi-lead bronze,  $1\frac{7}{8}$ " in diameter.

### Oil Seals

6. A leather and steel oil seal is used on each end of the crankshaft to prevent the oil from flowing out through the main bearings and working into the magneto mechanism in front or the generator in the rear. The front oil seal is pressed into the gearcase cover, while the larger rear oil seal is pressed into the rear bearing plate. The earlier units had a cork type oil seal pressed and cemented into the front gearcase cover instead of a metal oil seal.

### Connecting Rods

7. Connecting rods are of cast aluminium of the solid metal bearing type. The big end bearing is split and is retained in place by two cap screws. The aluminium of the connecting rod forms the bearing surface that

rides on the connecting rod bearing journal of the crankshaft. The gudgeon pin is a free fit in the little end which is of unlined aluminium.

(a) Some of the later models have a forged steel connecting rod with a steel backed babbitt bearing insert at the big end. In these rods, the little end will have a bronze bushing for the gudgeon pin.

### Piston

8. The piston is a three ring die cast aluminium type  $2\frac{5}{8}$ " in diameter. The gudgeon pin is a push fit in the piston and is retained by a circlip that snaps into a recess at each end of the gudgeon pin.

(a) Some of the later models may have three ring cast iron pistons. These cast iron pistons are interchangeable with the aluminium ones as long as both of the pistons in the engine are of the same type.

(b) On both types of pistons, there are three rings, two compression rings, and one oil ring. The two upper tapered rings have the word "TOP" stamped on the surface of the ring to be placed toward the head of the piston.

### Cylinders

9. The cast iron cylinders are fastened to the crankcase by five studs. Each cylinder has fins cast on the outer surface to aid in cooling the cylinder walls. The standard bore is  $2\frac{5}{8}$ " Stroke  $2\frac{1}{4}$ ". The total piston displacement is 24.35 cu. in.

### Cylinder Heads

10. The cast iron cylinder heads are separate for each cylinder.

### Camshaft

11. The cast iron camshaft operates the valves, the fuel pump, the plunger type oil pump and the magneto ignition breaker point plunger. The forward end of the cam shaft is supported by a ball bearing, while the opposite end of the shaft rides in a steel-backed babbitt-lined bearing. A Welch expansion plug prevents the oil from escaping out the rear camshaft bearing. This rear bearing is  $1\frac{1}{4}$ " in diameter.

### Timing Gears

12. The cast iron camshaft gear with its integral governor mechanism is driven by a helical cut steel gear on the crankshaft. The camshaft gear is pressed and keyed on the camshaft. The crankshaft gear which is keyed on the crankshaft, is held on by a large circular oil flinger nut. This nut has two holes in it for the prongs of a spanner wrench.

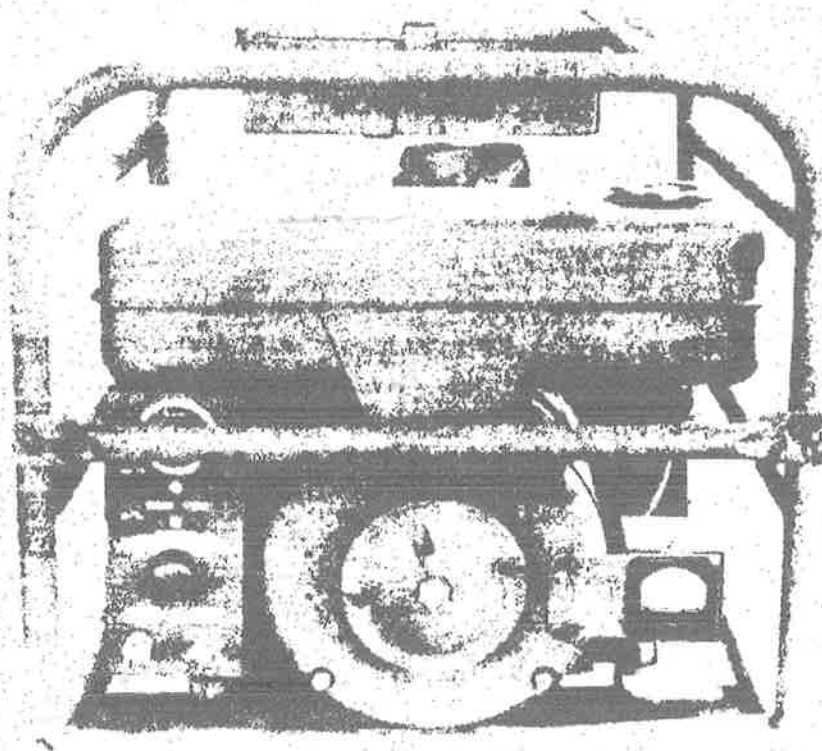


Figure 2. Rear view of ONAN AMERICAN OTC-5BII showing the control panel, rope sheave, frame, and location of tool kit and spare parts box.

### Starting Instructions

5. This plant can be started either manually or electrically.

a) When the plant is started manually, the starting rope must be wound around the rope sheave on the generator end of the unit. (See Fig. 2) in the direction indicated by the arrows on the pulley. The engine is cranked by pulling on the handle of the starting rope.

b) When the plant is started electrically, the batteries must be connected to the terminals on the control panel. Then by pushing the "Start" button on the control panel. (See Fig. 2) current from the batteries flows through the Series Field winding in the generator and through the armature. As a result of this current flowing through the generator windings, the generator starts to "motor" or revolve cranking the engine. If the self starter is used, the starter button should not be pressed continuously but in periods of not more than five seconds with equivalent stops in between until the engine starts.

### 6. Before starting,

- a) Check the oil level in the crankcase.
- b) Check that the petrol tank is full.  
Make certain the air vent in the fuel tank cap is clear, otherwise an airlock may be caused.
- c) Make certain the shut-off valve below the fuel tank is turned on; otherwise no petrol will get to the carburettor.
- d) Depress starter button. Or pull starter rope wound around the rope sheave in the direction indicated by arrows on the sheave for manual start.  
An automatic choke is used on the carburettor, so no manual choking is necessary.

7. In order to stop the plant, merely push in the stop button located on the control panel and hold it in until the plant comes to a complete stop.

END

CONTROL PANEL SPECIFICATIONS

20. A small control panel is mounted on the generator end of the plant. On this panel there is a D.C. ammeter, a variable rheostat, start-stop button, battery terminals, and A.C. load terminals. In the control

panel, there are condensers, a reverse current relay, and a start relay. On the other side of the generator housing, an A.C. voltmeter is mounted to record the A.C. output (See Fig. 2, E.M.E.R. 221 and Fig. 1 below).

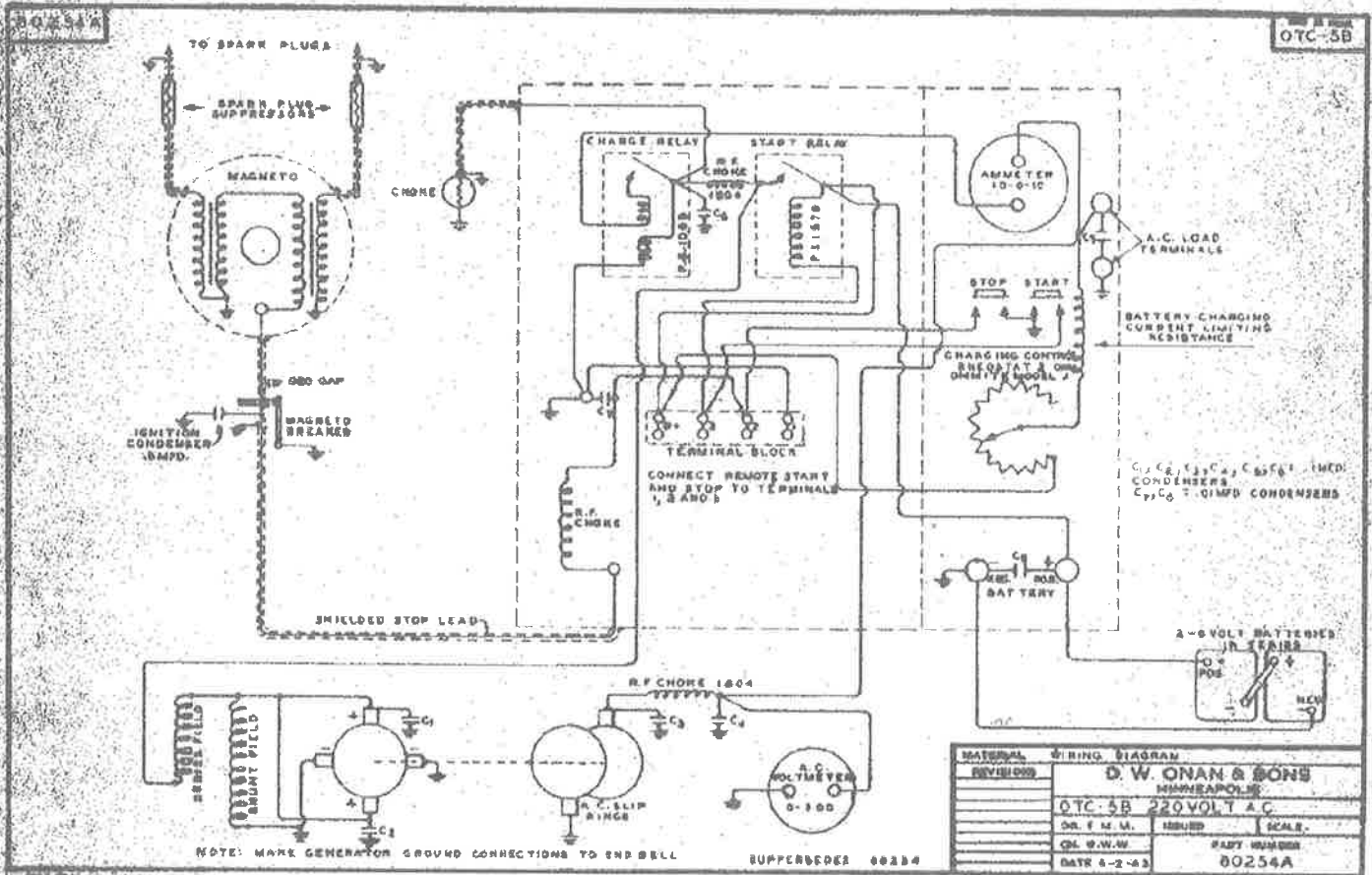


Figure 1. Wiring Diagram of OTC-5BH.

END

## GENERATING SET 2 K.V.A. NO. 2 ONAN AMERICAN OTC-5BH

### FIRST ECHELON MAINTENANCE

#### Daily Maintenance

1. **Petrol.** Keep the two gallon petrol tank nearly filled with clean petrol having an octane rating of from 68 to 82 octane.

2. **Oil.** Check the oil level daily with the dipstick in the oil filler plug. See Figure 1. Add a good clean oil of the proper viscosity when the oil level is below the full mark. See paragraph No. 13 for the proper viscosity of oil to be used. **DO NOT OVER FILL.**

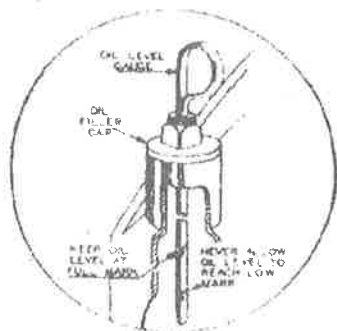


Figure 1. Oil filler opening and oil level gauge.

3. **Cleaning.** Keep the engine and generator parts clean, especially the fins on the cylinder head and block.

#### Weekly Maintenance

4. **Batteries.** Make certain the battery connections are clean and tight. Keep the electrolyte level about 1/8" over the plates by adding clean distilled water. Do not fill to overflowing.

5. **Minor Lubrication.** Place a drop of light lubricating oil on the following points: throttle shaft bearings of the carburetor, governor ball joints, governor paddle shaft, and the choke shaft of the carburetor.

#### Monthly Maintenance

6. The average monthly service covers about 200 hours of operation. If the plant is used more than that a month, then give the plant the following check up at the end of 200 hours instead of at the end of the month.

7. **Sparking Plugs.** Remove the cover from the sparking plugs and the sparking plugs from the cylinder heads. Clean and reset the plug point gap at 0.025". See Figure 2.

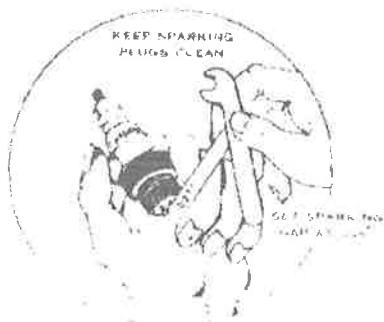


Figure 2. Checking the gap between the electrodes.

8. **Fuel System.** Remove the glass bowl from the fuel pump. Clean both the bowl and screen and then replace.

9. **Ignition.** Remove the cover from the ignition point breaker mechanism. Turn the engine over by hand until the breaker points are at their widest open position. Clean the points; set the gap at 0.020" unless otherwise specified on the breaker point cover. See Figure 3. This specified setting is very important, do not guess at the setting.

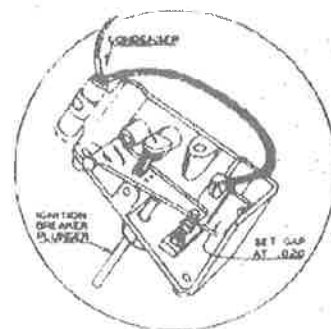


Figure 3. Ignition Breaker Mechanism with the cover removed.

10. **Air Cleaner.** Remove the air cleaner (See Fig. 4) and wash it out in petrol. Allow it to dry, then put a light oil on the filter element. Allow the excess oil to drain out, then replace the air cleaner.

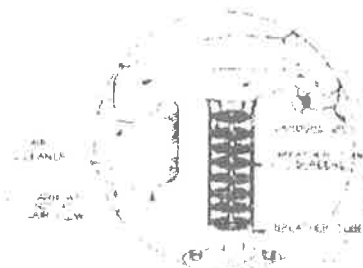


Figure 4. Air Cleaner, Crankcase Breather Tube and Breather Strainer.

11. **Generator.** Remove the cover band, and inspect the commutator and collector rings, clean if necessary. Wipe with a clean lintless cloth to remove any oil. Then if necessary, use a strip of fine sandpaper (never use emery cloth) to polish the commutator or collector rings. After that, check the brushes for good contact and easy riding in the brush holders. When the brushes are worn down to less than 1/4" long, replace them.

12. **Oil Change.** Drain the oil from the crankcase while the engine is warm. Replace the plug and fill with 2 1/2 American quarts of fresh oil. See Figure 1.

13. For all temperatures above 0° F. use 10 H.D. oil (previous British equivalent M120 or M120X). If the temperature is below 0° F. use 10 H.D. oil mixed with 10% (half pint) of good clean paraffin.

14. **Important.** If an oil and 10% paraffin mixture is being used in the engine, the mixture must be drained from the crankcase, and a new mixture put in every 50 to 60 hours of operation. If the average temperature is above 80° Fahrenheit or below 50° Fahrenheit, the oil should be changed every 100 hours of operation. If the average temperature is between 50° and 80° Fahrenheit, the oil should be changed every 200 hours of operation.

**Valves**

13. The valves are of the conventional poppet valve type; they are operated by adjustable valve lifters which are in contact with the camshaft. The correct valve clearance is 0.010" for the intake and exhaust valves.

**Lubrication System**

14. The lubrication system makes use of both the pressure and spray methods in lubricating all of the moving parts of the engine. The oil filler opening is located in the top of the crankcase. In it, there is a screw plug which has a bayonet or dipstick incorporated in it for measuring the oil level. A positive displacement piston type pump located in the bottom of the oil sump and operated by an eccentric on the camshaft forces oil to the crankshaft main bearings. From there, the oil is forced through the drilled crankshaft to the big end connecting rod bearings. The oil is then sprayed from the crankpins and bearings to lubricate all other internal parts of the engine.

- (a) The old oil may be drained by removing a pipe plug in the lower part of the oil base.
- (b) The lubricating system holds 2½ American quarts of oil.
- (c) Some of the later models have a gear type oil pump which is driven from the crankshaft gear.

**Fuel System**

15. The petrol is drawn from the two gallon tank by a standard automotive type AC fuel pump. The petrol is then forced into either a Zenith TU3Y1 downdraft type carburettor or a Marvel-Schebler VD downdraft type carburettor (both types have been used). Any petrol with an octane rating of 68 to 82 can be used in this engine. Each carburettor has two adjustments, an adjustable main jet, and an adjustable idle mixture jet.

- (a) The automatic choke consists of a thermostat mounted directly on the choke butterfly shaft of the carburettor. This thermostat element is heated by a nichrome heating element obtaining current from the D.C. winding of the generator.
- (b) The air for the carburetor is drawn through a dry type air filter.

**Ignition System**

16. The ignition current is supplied from a flywheel type magneto. Two permanent magnets are fastened on the inside edge of the flywheel. Two complete ignition coils, primary and secondary in each one, are mounted on stationary laminated steel cores within the flywheel. A set of ignition breaker points in the

primary circuit are operated by a non-metallic plunger from an eccentric on the camshaft. The high tension current travels to the standard size sparking plugs where it ignites the gases in the cylinder. The complete system is shielded to suppress electrical interference.

**Governor**

17. The governor is composed of a series of steel balls operating in ramps cut in the cast iron camshaft timing gear. The ramps are so designed that as the speed of the engine increases, the balls, which tend to move outward from the center of the shaft, also move forward and force the governor cup away from the face of the timing gear (See Fig. 7 E.M.E.R. 223). A thrust bearing located at the center of the cup presses against the governor shaft paddle, causing it to move forward; this in turn rotates the governor shaft at the top of which is located the governor arm linked to the throttle arm of the carburettor. A spring with adjustable tension is fastened to the governor arm. This spring holds the governor arm against the movement of the governor cup and steel balls. When the centrifugal force on the steel balls balances the spring tension, then the engine runs at that set speed. By changing the spring tension we change the engine speed. The speed is maintained at about 1800 r.p.m.

**Cooling System**

18. This air cooled type engine has cooling fins cast on the outside of the cylinder head and cylinder block. Cooling air is forced over these fins by blower fins which are cast integral with the magneto flywheel. The air stream from the blower fan is directed and controlled by a sheet metal blower housing.

**GENERATOR SPECIFICATIONS**

19. The generator is of the combined A.C. D.C. type with both windings wound on the same armature core. A series and shunt winding provide the field for both windings on the armature. The direct current has an output of about 10 amps. at 15 volts for charging two 6 volt batteries in series. The alternating current has an output of about 8 amps. at 230 volts of 60 cycle A.C. current for operating the wireless sets.

- (a) There are four brushes on the commutator and two brushes on the slip rings or collector rings for a total of six brushes.
- (b) The outer end of the armature is supported by a sealed ball bearing.
- (c) The inner end of the armature shaft is tapered and fits into the end of the crankshaft. A through bolt fits through the hollow armature shaft, and holds the armature against the crankshaft. The inner end of the armature is supported by the rear main crankshaft bearing.