LIGHTING EQUIPMENT FOR EXTERNAL WORKING PARTIES
Generating Sets and Accessories

1. General. The generating sets and batteries described in this instruction have been obtained from surplus service equipment to serve immediate needs and later sets will be designed specifically for the needs to be met. The Model L244 "Tiny Tim" Petrol-electric Generating Set, and associated equipment, to be used for lighting on external work is described in the following paragraphs. Instructions for the operation and maintenance are also included. The complete equipment is illustrated in Fig.1 and consists of:-

(a) Tiny-Tim Generating Set, 24v. 300 watt
(b) Batteries, 12v. 22 Ah. with non-reversible plugs and sockets
(c) Clip lamps
(d) Flex, lampholders, and bulbs.

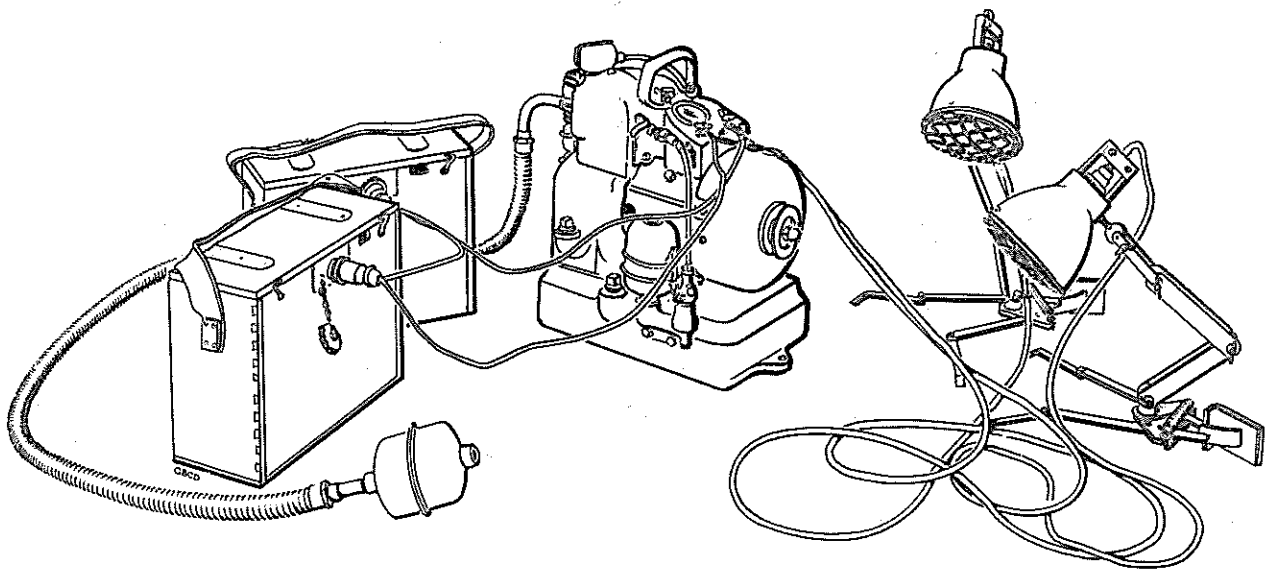

FIG.1. TINY-TIM PETROL-ELECTRIC GENERATING SET

2. The Generating Set is illustrated in Figs.2 and 3 and consists of a petrol engine directly coupled to a D.C. generator. The hollow cast-iron base forms the petrol tank and oil is contained in the engine crankcase. An output ammeter, output terminals, and starter push-button are located above the generator and a cut-out unit is fitted on the side of the generator. A starting pulley, silencer and flexible exhaust pipe are provided and a carrying handle is fitted on top of the set.

3. Engine. The engine is of the four-stroke single-cylinder type with coil ignition and is air-cooled by means of a ventilating fan incorporated in the flywheel which rotates on the crankshaft between the engine and generator. The air from the fan is directed by a cowl over the cylinder block. The engine speed is not governed automatically but may be adjusted by the throttle.

Distribution:- 96 to 99,103, 160,171,173,174

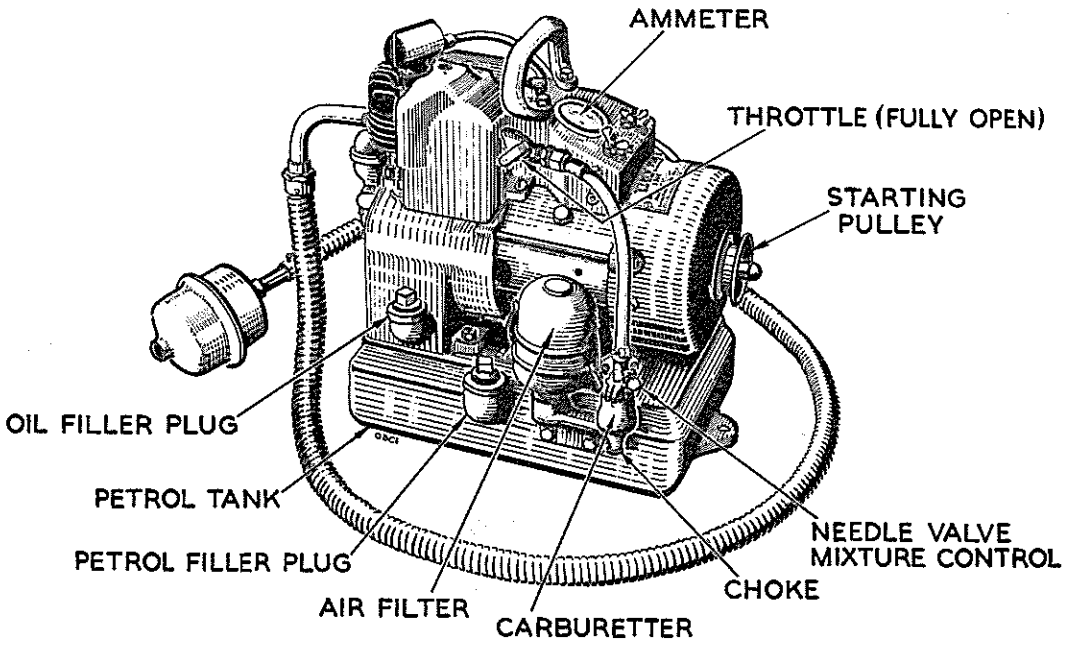

FIG. 2.

4. *Engine lubrication* is by the crankcase splash system and the oil filler-plug is on the elbow on the side of the crankcase. The crackcase oil-capacity is one pint and care should be taken not to over-fill or the output of the set will be reduced. A drain plug is provided and the crankcase should be drained after every 50-75 hours running and refilled with fresh oil. "Oil, Cylinder,Lorry" obtainable from any P.O. Garage should be used. A crankcase breather is fitted on the end of the set to prevent back pressure.

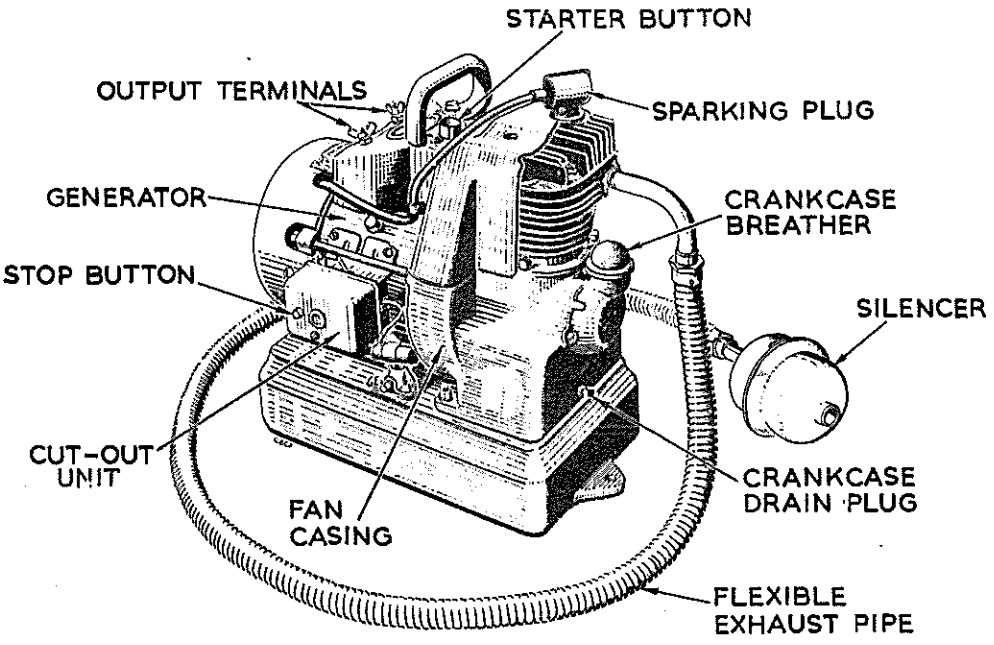

FIG. 3

5. The *petrol tank* is of one gallon capacity and is filled via the filler plug on the side of the base. The tank should be filled only to within ¼ in. of the top. Petrol as supplied from P.O. Motor Transport stocks should be used and oil should not be mixed with the petrol.

CAUTION:— This petrol contains lead and must not be used in blowlamps.

6. The *carburettor and inlet tube* arrangement is shown in Fig.4. The carburettor is of the self-lift type with needle valve adjustment. During the suction stroke, air is drawn through the air filter and choke and in passing through the carburettor duct creates a partial vacuum, and petrol is drawn from the tank through the petrol feed tube and through the needle valve into the duct where it mixes with the air. The air-petrol mixture then passes through the inlet tube throttle and inlet valve to the cylinder. The air-petrol mixture is weakened by rotating the needle-valve clockwise and is made richer by anti-clockwise rotation. The choke is closed by pulling down the disk at the base of the carburettor and is opened when the disk is released. A non-return valve is fitted in the petrol-feed tube to prevent petrol from draining back to the petrol tank on completion of the suction stroke. The air filter should be cleaned as necessary and replenished with lubricating oil up to the oil level.

7. The *exhaust silencer* may be screwed direct on the elbow from the exhaust port, or if additional silencing is required, the length of flexible metallic-tubing provided may be inserted between the elbow and the silencer.

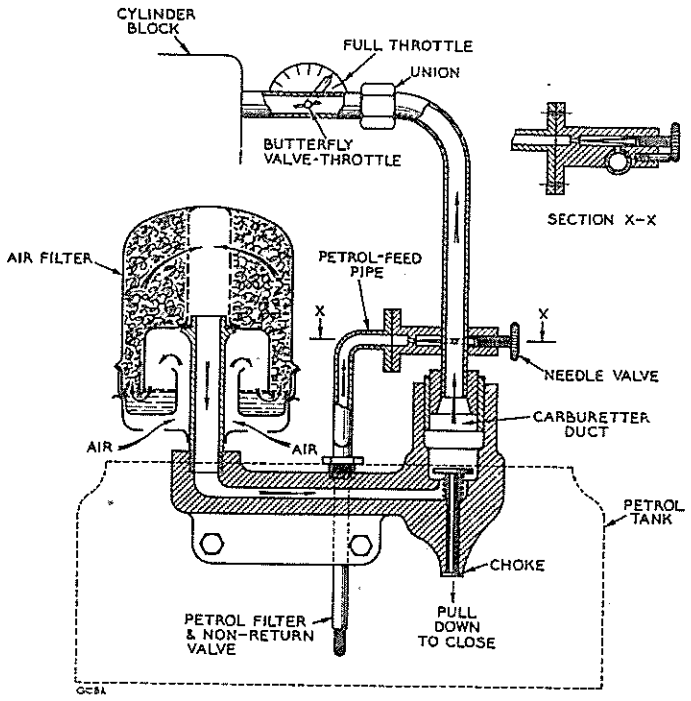

FIG.4. PETROL FEED ARRANGEMENT ON "TINY-TIM" GENERATING SET

8. The *ignition coil* and *breaker contacts* are located beneath the end-shield of the generator. The contacts are operated from a cam on the main shaft and the correct maximum clearance between contacts is 0.022 in. A 0.5 µF. condenser is connected across the contacts. The sparking plug gap should be between 0.020 and 0.030 in.

9. *The generator* is of the four-pole, four-brush, shunt wound D.C. type rated at 300 watt at 24V. and is intended primarily for charging. With the set running at full throttle, the terminal voltage during charging varies from 26 to 31 depending on the state of charge of the battery. The output wing-nut terminals are marked B– and B+ and the B– is connected direct to the frame of the set. The ammeter registers the approximate current being delivered from the set, but owing to the

inaccuracy of the instrument, check readings with a more accurate ammeter should be taken if the actual current value is required. The generator is cooled by air drawn through the air passages by the ventil-

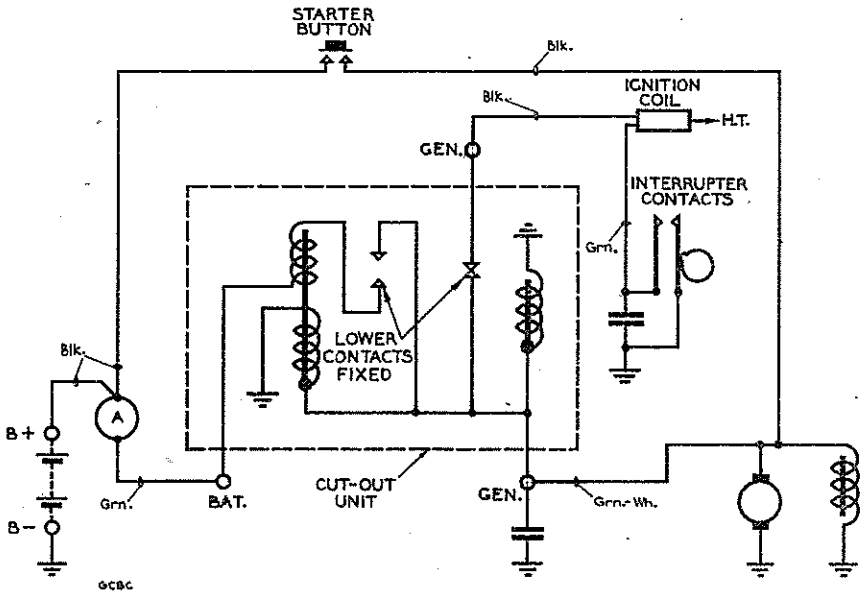

FIG.5. TINY TIM L 244 GENERATING SET. 24V. 300W. ELECTRICAL CONNEXIONS

ating fan. Periodical lubrication of the generator is not necessary. The electrical connexions of the set are shown in Figs.5 and 6.

10. The *cut-out unit* consists of two relays, one of which (reverse current cut-out) has two windings, a low-resistance winding connected in series with the generator and a high-resistance winding connected across the generator (see Figs.5 and 6). The contacts of this relay are normally open and close when the voltage across the high-resistance coil (i.e. across the generator) rises to 26. With the contacts closed, the output current passes through the series coil which assists the voltage coil to keep the contacts closed. If the current is reversed, due to the generator voltage falling below that of the battery, (e.g. due to the engine slowing down) the series coil opposes the voltage coil and the relay releases and disconnects the battery from the generator.

11. The second relay, (automatic voltage relay cut-out) is provided to stop the set automatically when the battery is fully charged or when the reverse current relay operates and operates when the terminal voltage rises to 31 approximately (i.e. about 2.6v. per cell). The contacts are normally closed and are connected in series with the primary winding of the ignition coil so that when the relay operates, the ignition coil is disconnected and the engine stops.

12. The cut-out unit parts should be inspected periodically for dirt or dust and cleaned if necessary. CAUTION - THE BATTERY SHOULD BE DISCONNECTED DURING THE INSPECTION. ATTEMPT SHOULD NOT BE MADE TO READJUST THE RELAYS.

13. A *stop button* is fitted in the cover of the cut-out unit and when pressed, operates the armature of the voltage relay, thus disconnecting the ignition circuit and stopping the set.

14. The *starter push button* is located at the top of the set beneath the carrying handle. When the battery is connected to the set, and the button is pressed, current flows through the generator armature to the frame and the generator, acting as a motor, rotates the engine crankshaft and as the ignition coil is also fed from the battery when the starter button is pressed, starts the set. When the engine is running at full speed, the ignition coil is fed from the generator, so that, on releasing the starter button, the engine continues running. When the set is started from the

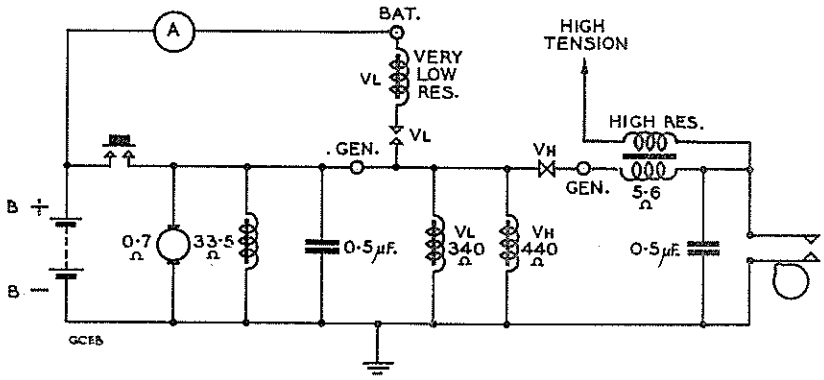

FIG. 6

battery, a heavy current flows, and if difficulty is experienced in starting, the battery should not be abused by pressing the button repeatedly, but starting should be assisted manually (see par.23).

15. The **12v. batteries** for use with the set are of the lead-acid type and have a capacity of 22 A h. at the 10-hour discharge rate and 19 Ah. at the 5 hour rate. The cells are contained in wooden boxes with carrying strap and the terminals are wired inside the box to a non-reversible plug output-socket. One non-reversible plug is supplied with each battery. Instructions for filling, charging and maintaining the batteries are fixed inside the lid of each battery box.

16. Two batteries are required for each generating set and should be connected in series by wiring the plugs in series as shown in Fig.7 "Cable, E.L., 250v.,.0045 sq.in., 7/.029" should be used for the connecting leads, which should be as short as possible. Black cable should be used for the lead from the negative battery terminal to terminal B- on the set and red cable for the positive lead to B+ and care should always be taken to connect the batteries correctly.

17. The *charging rate* of the batteries should not exceed 5A. If the generating set is supplying only the charging current, i.e. no lighting or other load is connected, the charging current at full speed is excessive, and the speed should be reduced by adjustment of the engine throttle to lower the charging rate.

18. When a lighting load is fed from the set in addition to the charging load, the charging current will depend on the lighting current. The approximate simultaneous charging and lighting currents are given in Table 1 for full speed of the set.

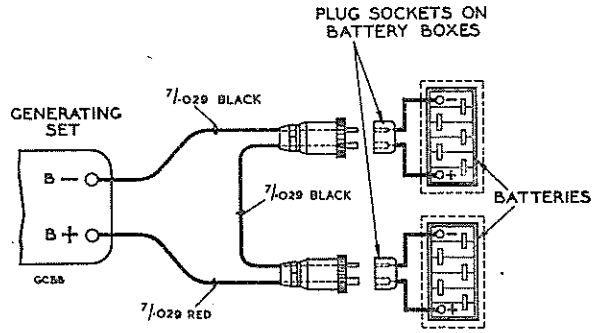

FIG. 7

TABLE 1

No. of 25v. 40w. lamps connected	Set running at full speed		Remarks
	Lighting current approx. (amp.)	Battery charging current (approx.) (amp.)	
1	1.7	7.4	Speed of set should be adjusted to reduce the total current output to 6A. (Ammeter reading)
2	3.4	5.7	Speed of set should be adjusted to reduce the total current output to 7.5A. (Ammeter reading)
3	5.1	4.0	Set may be run at full speed
4	6.8	2.3	" " " " " " "

When the total load from the set exceeds 300 watts, part of the load current is drawn from the battery.

19. Gassing will occur near completion of a charge and if the filler plugs are left in the cells, acid is likely to be blown through the vents on to the top of the cells. Plugs should, therefore, be removed during charging, and to prevent excessive gassing, the charging rate should be reduced by throttle adjustment near the end of a charge. The set stops automatically when the batteries are fully charged, see par.11.

20. The *discharge periods* of a fully-charged battery for various loads are as detailed in Table 2.

TABLE 2

No. of 25v. 40w. lamps connected	Approximate discharge current (amps.)	Safe period of discharge (hrs.)
1	1.6	13
2	3.2	6
3	4.8	3.5
4	6.4	2

CARE SHOULD BE TAKEN NOT TO OVER DISCHARGE THE BATTERIES OR DIFFICULTY WILL BE EXPERIENCED IN RESTARTING THE SET.

21. The clip lamp to be used with the set is shown in Fig.8 and consists of a clip suitable for attachment to cables, cable bearers and other manhole fittings. The lamp is pivoted on a flexible arm, and a reflector with wire lamp-guard and cord grip is attached by ball socket to the end of the flexible arm. The clip lamp is issued without lampholder and flex and will be available initially in small quantities only. Lampholders No.13 and "Cord, Flexible, EL.,250v., .001 sq.in., 23/.0076, Class D2" should be used with the clip lamps, and where clip lamps are not available, the lampholder should be used without a reflector and methods of suspension for manhole use should be improvized locally. "Lamps, G.S., 25v., 40w., B.C. vacuum, clear" will be issued for use with the set.

22. Operation of set. *Starting.*

(a) Fill the crankcase to the level of the bottom of the filler elbow with Oil, Cylinder, Lorry (par.4). The crankcase will then contain approximately 1 pint.

(b) Fill the petrol tank to within ¼ in. of the top. Tighten the oil and petrol-filler plugs and check that the oil drain-plug is tight.

(c) Connect the battery and lamp leads to the set *making certain that the positive lead from the battery is connected to the B + terminal on the set.*

(d) Open the throttle, i.e. turn the throttle lever to right-hand end stop

(e) Close the choke

(f) Press the starting button

(g) When the engine is running at full speed, open the choke

(h) Adjust the carburettor needle-valve after the warm-up period if the engine is not running smoothly

(j) Reduce the speed by the throttle, if necessary, to reduce the charging rate.

23. If there is insufficient charge in the battery to rotate the engine, starting should be assisted by winding a rope anti-clockwise round the starting pulley, catching the inner end in the slot. Then close the choke, press the starting button and pull on the rope at the same time. Two men will be required for hand-starting. To avoid excessive drain on the battery, the starting button should be pressed only while the crankshaft is rotating. If the engine does not start, even after manual assistance, fresh batteries should be obtained for starting, and the discharged batteries should be recharged from the set.

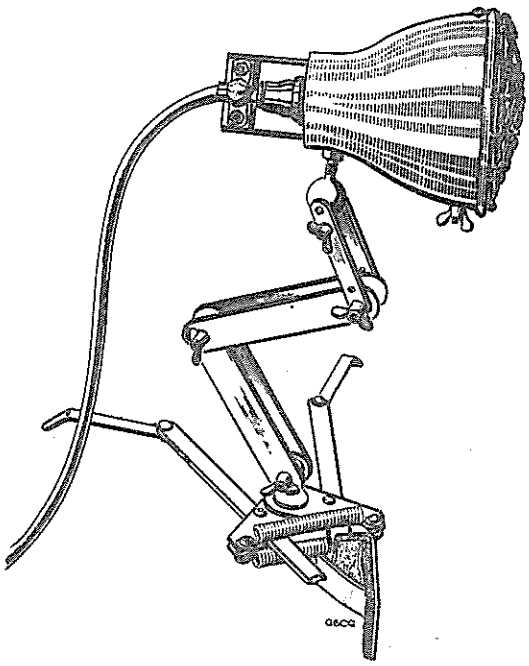

FIG. 8

*24. To *stop* the engine before the battery is fully charged, press the stop button on the cut-out unit cover. If the set does not stop, remove the battery and lamp leads from the output terminal B+. (It is not always sufficient to remove the battery lead only as with heavy-lamp loads the set will continue running without a battery.)

NOTE:- (i) Generating sets and batteries must not be operated inside any underground structures owing to the risk of poisoning and explosion.

(ii) Generating sets and batteries must always be situated within the guarded area round the jointing chamber entrance (see LINES, Underground, J 1150).

(iii) When refuelling, stop the engine and disconnect the batteries. The petrol container must not be rested on top of the battery terminals.

25. Distribution of Generating Sets and Batteries. The generating sets are of American manufacture, obtained from surplus Service equipment and difficulty may be experienced in obtaining spare parts. The number of sets issued to Regions has been made sufficient to enable a reserve to be set up to facilitate replacement of faulty and worn out sets. Any serviceable parts from sets taken out of service will be retained for maintenance purposes. The batteries are of British manufacture and have also been obtained from surplus Service equipment. The number of 12V. batteries allocated to Regions is sufficient to provide two batteries for each set supplied and an additional quantity for replacements as necessary. A reserve of batteries should therefore also be set up.

Distribution:- 96 to 99, 103, 127, 160, 171, 173, 174

26. The numbers of sets and batteries (on a basis of 2 per set) to be placed in service initially, will depend on local conditions, but should not exceed 70% of the number of sets supplied, so that at least 30% sets will be held in reserve. The reserves of sets and batteries should be under the control of the Area Engineer. All sets and batteries should be unpacked and examined on receipt and superficial damage should be notified to the carriers and to the Eng. Dept. (Cn 3/1).

27. *Filling and initial charge of batteries.* The batteries will be delivered dry, and those batteries to be put into service immediately should be filled with acid, and given an initial charge in accordance with the instructions inside the lid of the battery box. The filling and initial charge will be carried out at M.T. Central Battery Repair Shops by arrangement with the R.M.T.O. except where special arrangements can be made for Engineering staff to do the work. *The batteries to be held in reserve should be left dry until required.*

28. *Petrol cans.* Not more than one two-gallon petrol can should be allocated to each generating set. The T.M. should advise the R.M.T.O. of the number of such cans required if sufficient cannot be made available locally from stocks released by the projected change-over from unleaded to motor transport petrol for non-transport purposes other than petrol blowlamps (covered by General, A 0501 and 0503 and Vehicles, K 0011).

29. Supplies of Flex, Lampholders and Clip Lamps. Flex, bulbs and lampholders (see par. 21) are available on requisition from the Supplies Dept. and as it is necessary at present to conserve supplies, the quantities requisitioned should not exceed the following average quantity per set:-

20 yds.- Cord, Flexible, E.L., 250 V., .001 sq.in., 23/.0076, Class D2
2 - Lampholders No. 13
4 - Lamps, G.S., 25 V., 40 W., B.C., Vacuum, Clear (N.R.B.)

These stores should not be ordered for sets to be held in reserve. Regions have already been advised of the initial quantity of clip lamps allocated. If this lamp is found satisfactory, additional quantities will be provided.

30. Control. The method of control of the generating sets and batteries should be as for mechanical aids (see Mechanical Aids, A 1020). The sets and batteries should be recorded separately on the cards for the Major Works Control Centre and the card A 803 held by the Transport Control Officer or Section Stock Storekeeper. The serial and engine numbers of the generating sets should be entered on the cards. The batteries bear no individual distinguishing number and should be numbered in one series for each Area, the number being prefixed by the Area code e.g. BD-Bradford LS-Leeds. The number should be painted prominently on the battery box and should be entered on the record cards. Cards should be prepared for all sets and batteries allocated to the Area, including the equipment to be held in reserve. The issue and return of the sets and batteries should be controlled as described in Mechanical Aids, A 1020.

31. The flex, lampholders, bulbs, and clip lamps should be held on individual tool lists.

32. *Maintenance. Day-to-day maintenance* should be carried out by the user and should be as follows:-

(a) Generating sets - Clean the set, replenish oil and petrol, clean sparking plug and adjust gap (see par.8), drain crankcase oil after every 50-75 hours running and refill with clean oil (old oil should be drained immediately after engine has been running for at least 15 minutes), clean air filter and replenish with oil. The acorn nut at the starting-pulley end of the crankshaft should be kept tight to prevent excessive play and whip of the crankshaft.

(b) Batteries - Clean, keep top of cells free from acid; keep terminals coated with petroleum jelly and connexions free from corrosion. Top up electrolyte with clean tap-water to 3/16 in. above separators when battery is discharged. Never leave battery discharged. *Do not over-discharge.*

33. Major repairs and overhauls will be carried out normally by the R.M.T.O. and on receipt of the sets and batteries, the R.M.T.O. should be advised of the number and location of all sets and batteries (including reserve equipment). The R.M.T.O. will then advise the T.M. of the Mechanic-in-Charge responsible for the maintenance of the equipment. If difficulty is experienced in operating the equipment, the matter should be reported to the Mechanic-in-Charge.

References:- (Cn)
General, A 0501, A 0503
Mechanical Aids, A 1020
Vehicles, K 0011
GENERAL, General, A 08C8
LINES, Underground, J 115C

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