See AP 113C-0303-1 not held 'C'

Chapter 5

BATTERIES, TYPE K, 24-VOLT, 35 AMP. HR. (SAFT VOLTABLOC 20-VO-35)

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LEADING PARTICULARS

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Battery, Type K2, 24-volt, 35 amp. hr. .... *Ref. No.* 5J/3483

◀*Capacity—*

At 10-hour rate .... 40 *amp. hr.*

At 1-hour rate .... 35 *amp. hr.*▶

Used with—

Elcon connector .... *Ref. No.* 5J/3375

Overall dimensions of case .... 9·94 *in.* × 9·69 *in.* × 10·5 *in.*

Fixing centres .... 10·75 *in.*

Weight .... 76 *lb.*

Introduction

1. The battery, Type K, 24-volt, 35 amp. hr. ◀(SAFT Voltabloc 20-VO-35)▶, is a sintered-plate nickel-cadmium, alkaline battery ◀constructed on the principle described in A.P.4343, Vol. 1, Sect. 3, Chap. 7.▶ It is essentially interchangeable with the 24-volt, 25 a.h. lead-acid battery, Type H (*Ref. No.* 5J/3303), and the American AN3150, and is approximately the same weight. Because of the sintered plate construction, it is considerably lighter than a conventional alkaline battery of the same capacity, and has a better high rate performance.

2. The two variants, Types K1 and K2, use the same cell, and are identical in electrical characteristics, weight and dimensions. The main differences are in insulation and in the design of the terminal block; these are as summarised below:—

Type K1

Cell jackets—P.V.C.
Grids—bonded fibre glass
Bottom insulation—P.V.C. and perspex

Type K2

Cell jackets—polypropalene
Grids—moulded polypropalene
Bottom insulation — polypropalene sheet with moulded polypropalene supporting buttons
Terminal blocks—moulding strengthened
Terminal pins—threaded into connectors

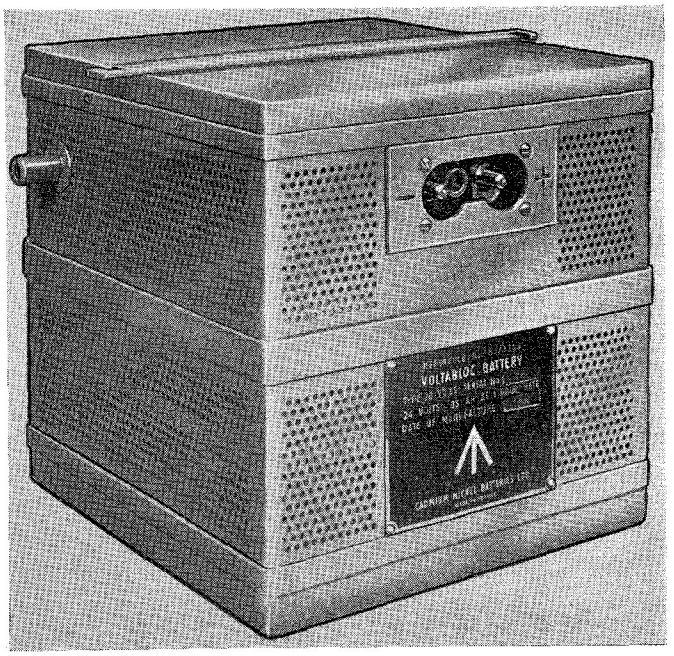


Fig. 1. Battery, Type K, 24-volt, 35 amp. hr.

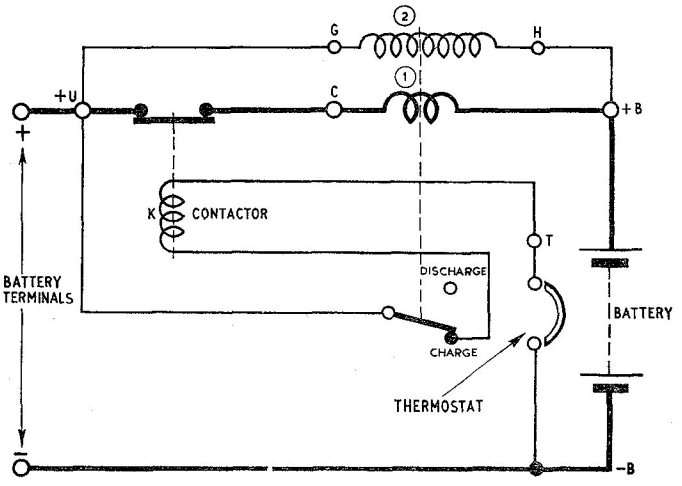


Fig. 2. Circuit diagram

socket [illegible] sutered with [illegible] dia. Thermistor [illegible] (Ref. No. 5F/2983).

(9) Resistors, [illegible] ohm [illegible] between [illegible] nominal), [illegible] watts, Ref. No. [illegible] 99-011-9700 (20 in number).

(10) Clips, crocodile, Ref. No. 5X/9400856 (40 in number).

(11) Thermometer, Ref. No. [illegible] 9412937.

SERVICING PROCEDURE

4\. (1) [illegible] battery and examine for [illegible] corrosion.

(2) Damaged [illegible] replaced [illegible] the [illegible] remainder [illegible] torque [illegible] nuts [illegible] to 120 lb. in.

(3) Remove corrosion [illegible] brush [illegible]

(4) Retouch damaged areas of the battery case, [illegible] tective finish.

(5) Using item (6) [illegible] of the A.L.L., remove [illegible] plugs and place them in [illegible] filled water [illegible] dissolve any crystalline deposits which may have formed.

CAPACITY TEST

5\. (1) Charge the battery at a constant current of 4A until the battery temperature rises 6 deg. C (10 deg. F) above the ambient temperature. Measure the battery temperature in the area of the centre cells using a thermometer or a thermocouple. Check the battery temperature at half hourly intervals.

[illegible] CHARGE, [illegible] THAT THE [illegible] ONLY [illegible]

[illegible] of the [illegible] the correct level [illegible] vent plug [illegible] (para. 3, [illegible])

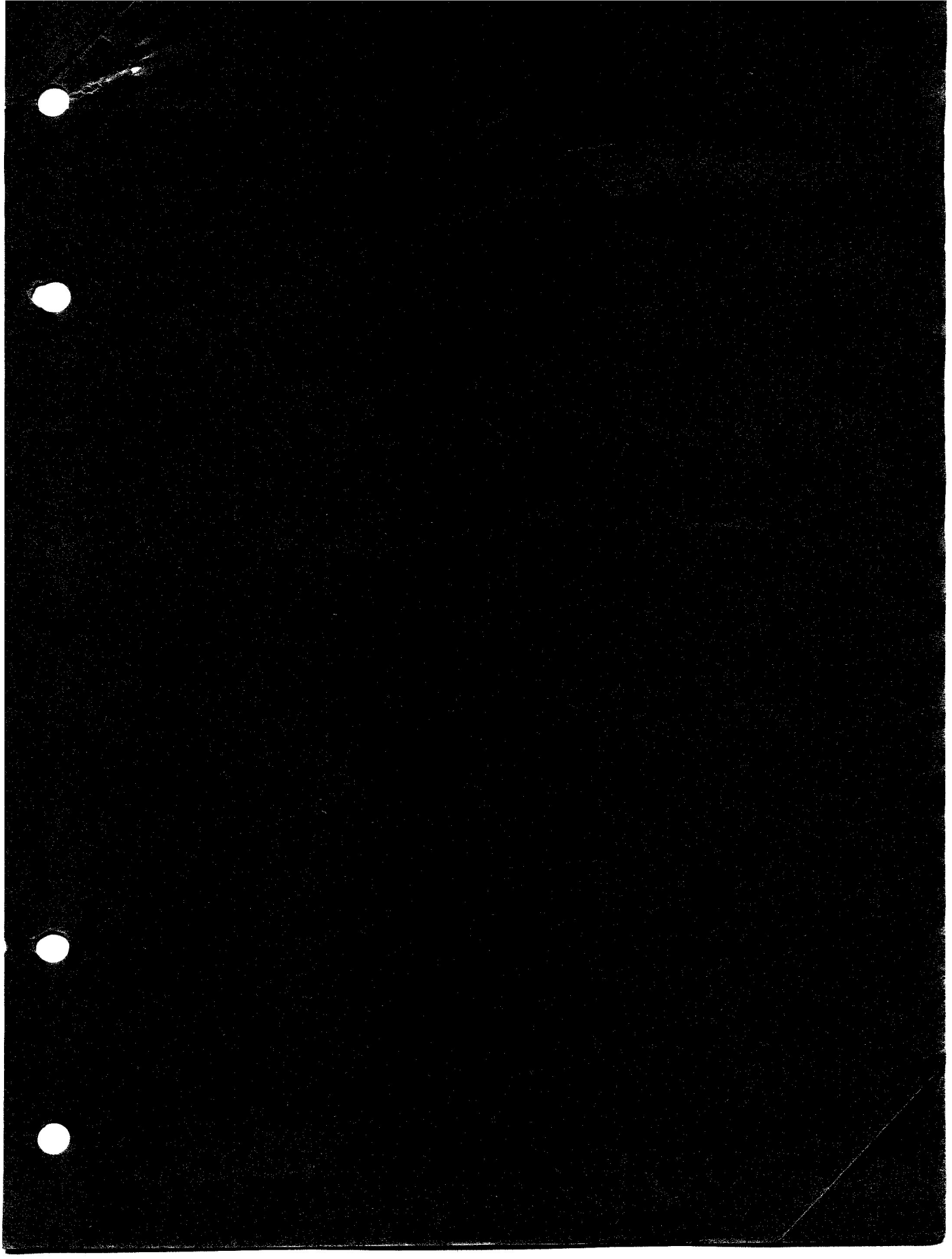
[illegible] at 55A [illegible] the [illegible]

[illegible] the [illegible]

[illegible] STATE OF [illegible] BE [illegible] BELOW [illegible] DISCHARGE [illegible] THIS [illegible] ON [illegible]

[illegible] using resistors [illegible] (sub-para. 3, A.L.L.) singly across each of the cells and stand the battery with the resistors fitted for at least 16 hours. Measure cell voltages after five hours (sub-para. (8) and (9)). Proceed to (7), (8) or (9).

[illegible] of the [illegible] was [illegible] the [illegible] and



(See AIL 2/67)

DESCRIPTION

3. This battery (*fig.* 1), which is a semi-sealed type, incorporates a thermal switch and control equipment, which operates when the battery reaches a pre-determined temperature and switches the battery out of the charging circuit until it returns to its normal working temperature. Should the generator fail, the battery will be automatically returned to the line. As a safety measure, each cell is fitted with a pressure release valve. The battery comprises 20 cells, having a nominal voltage of 1·3 volts per cell, and a 21st space which houses the control device.

Cell construction

4. Each cell is constructed of thin sintered nickel-plated steel plates, impregnated with nickel hydroxide for the positive and cadmium hydroxide for the negative, which offer an extremely low internal resistance. The plates are welded to two connecting pieces, and insulated by thin nylon fabric separators which are impervious to the action of electrolyte, in this battery potassium hydroxide solution. The whole is fitted into a nickel-plated steel container, and the lid welded in position to seal the battery. A release valve is fitted for each cell to allow the escape of gases should the pressure build up with increase of temperature under abnormal conditions.

Control equipment

5. In comparison with a conventional lead-acid battery, the characteristics of the Type K battery differ considerably. The initial period after take-off when the charging current of a partially discharged battery is high will be comparatively short, since this battery recovers its capacity quickly, and the charging current then settles down to a steady figure. Should the aircraft voltage be high due to incorrect voltage regulation, the overload with a fully-charged battery will cause a sudden rise in temperature, which is used to operate a thermostatic protective device to break the charging circuit, when the battery temperature exceeds a safe figure.

6. The thermostat is mounted on one of the cells, and the other control equipment, consisting of a polarized relay and a contactor, are housed inside the adjacent 21st compartment of the battery, near the main terminals.

7. The polarized relay has two windings, one heavy winding (1) in fig. 2, in series with the battery, and a second winding (2) of fine gauge wire. When a current of between 3 and 4 amp. passes through winding (1) in the direction C to B, the relay contacts are in the **charge** position, i.e., closed. If a voltage of 0·8 volts is applied across the fine winding (2) in the direction H to G, the contacts will move over to the **discharge** position.

8. The contactor is a normally-closed relay rated at 200 amp. for continuous operation and 1,000 amp. for peak loads of short duration, with its coil in series with the thermostat and polarized relay contacts. Under normal operating conditions, when the temperature of the battery is below the preset temperature, the thermostat contacts are open, therefore the contactor remains closed and the battery charges and discharges normally.

9. When the temperature rises above the preset value, the thermostat contacts close, and the contactor is controlled by the polarized relay. If the battery is on charge with a current higher than 3 or 4 amp., the relay contact moves over to the **charge** position, the contactor is energized, and the contacts open to break the charging circuit.

10. If, however, the voltage drops and becomes lower than that of the battery by more than 0·8 volts, the relay contact will move over to the **discharge** position due to the action of the fine wire winding (2). This de-energizes the contactor, which closes to complete the charging circuit one more. This also acts as a safety measure to place the battery on the line automatically should the generator fail.

11. External electrical connection to the battery is made by means of an Elcon quick-release connector. The battery is held in position by slots at each end of a securing bar on the lid.

SERVICING

12. The battery should be thoroughly cleaned, and the terminals and connections lightly greased with protective PX-7.

13. The diameter of each terminal post should be measured, using a vernier micro-

meter or other suitable gauge. The dimension should be 0·375 in. ± 0·005 in.; if either post is outside this dimension, the battery should be classified as repairable and dealt with accordingly.

Charging

14. New batteries are normally delivered filled with electrolyte and in a discharged condition, and should be charged before being put into use.

(1) *Normal charging.*—Charge at 4 amp. until the temperature of the battery rises 5 deg. C, i.e., 10 deg. F above ambient. To check the temperature, insert a thermometer between two cells after taking off the lid. The voltage of the battery during charging varies between 26 and 30 volts.

(2) *Discharged batteries.*—Completely discharged batteries may be given either a charge of 25 amp, for 1 hour, followed by 4 amp. until the temperature rises 5 deg. C (10 deg. F), or 15 amp, for 2 hours, followed by 4 amp. until the temperature rises 5 deg. C (10 deg. F).

15. Before batteries are placed in long-term storage, they should be discharged at a current of between 5 and 35 amp. until the on-load voltage of the battery is 21 volts. Charge as in para. 14, sub-para. (1) or (2) before the battery is put into service. After charging, batteries should be thoroughly dried, cleaned externally and lightly greased with protective PX-7.

16. To check the state of charge of a battery, the open-circuit voltage should be measured.

(1) If the no-load voltage is equal to, or higher than, 25 volts, the battery is at least 50 per cent charged.

(2) If the voltage is lower than 25 volts, the battery should be charged as in para. 14, sub-para. (1) or (2).

◀Adjustment of electrolyte level

17. With the battery out of the aircraft and the lid removed, remove the safety valves and nylon seating washer using a suitable box spanner; this should have the exterior insulated to minimize the risk of a cell short-circuit.

18. The battery should be charged at 4 amp. for 12 hours from the fully discharged condition. If the loss of electrolyte has been severe, indicated by failure of the battery to accept charge, it may be necessary to add about 10 cc. of distilled water to each cell before commencing the charge. During the last hour of this charge, and with the charging current still flowing, top up with distilled water to a level which is to be adjusted to not higher than 16 mm. below the rubber washer on which the nylon washer and safety valve seat.

Note . . .

In the discharged and semi-charged conditions, the electrolyte level is lower than in the fully-charged on charge condition.

19. Finally adjust the electrolyte level by withdrawing any excess electrolyte; this may conveniently be done as follows:—

(1) With a hydrometer adapted by using a glass tube of a diameter such that it enters the cell, connected to the hydrometer rubber tubing of a diameter such that it butts against the rubber washer at the cell top, the length of the glass tube being maintained at 16 mm. $\pm^{2}_{0}$ mm; excess electrolyte can be drawn off by releasing the previously depressed hydrometer bulb, ensuring at the same time that the tube inserted into the cell is in the correct position relative to the top of the cell. or

(2) Using a material not affected by potassium hydroxide, manufacture a tube which has at one end an effective diameter such that it enters the cell, of 16 mm. length, having a rim which butts against the rubber washer at the cell top, and an extension of a size and shape that will accommodate a bulb for transferring or withdrawing water.

20. Remove the charging source and after thoroughly cleaning the cell tops, the safety valves and nylon washers, refit the washers and safety valves.▶

Capacity test

21. The battery should be discharged at a rate not exceeding 15 amp. to a voltage of 21·6 volts on load, and then recharged for 13 hours at 3 amp. It should be considered as serviceable if it then has an amp. hr.

capacity in excess of 75 per cent of the rated capacity at the 10 hour rate, the voltage of any cell not having fallen below 1 volt on load.

22. ◀A battery which fails this test should be thoroughly cleaned and re-charged, and have its electrolyte level adjusted according to the instructions contained in para. 18 and 19. If it still fails, it should be considered defective.▶

Insulation resistance test

23. Using a 250-volt insulation resistance tester, check the insulation resistance between the battery terminals and the metal case; the reading should not be less than 0·5 megohm.