Chapter 49

OVER-VOLTAGE INDICATOR UNIT, B.T.H., TYPE LPB-B1/3

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Over-voltage indicator unit, Type LPB-B1/3	*Stores Ref. 5CW/*
Voltage	*28 volts d.c.*
Maximum continuous rating of relay	*2 amp.*
Dimensions of case (over T.B.)	*$3\frac{7}{8}$ in. x 3 in. x $3\frac{5}{16}$ in.*
Distance between fixing centres	*$2\frac{5}{16}$ in. x $3\frac{1}{2}$ in.*
Weight	*14 oz.*

Introduction

1. The over-voltage indicator unit, Type LPB–B1/3, is a means of providing an indication if the voltage of the bus-bar to which it is connected rises abnormally. It has been designed for use on 28-volt d.c. systems, and is normally connected to a lamp or other warning device. It may, however, also be used to operate a relay, contactor, or similar item of control equipment to clear the faulty generator causing the excessive voltage. It is suitable for operation at altitudes up to 70,000 ft., over an ambient temperature range of −40 deg. to +45 deg. C.

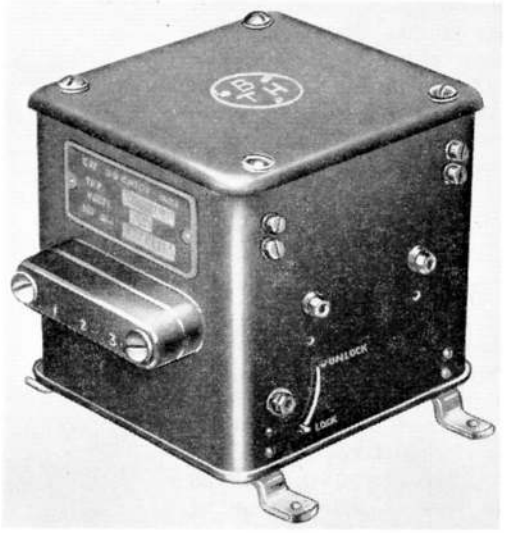

Fig. 1. Over-voltage indicator unit, Type LPB-B1/3

DESCRIPTION

2. The indicator unit (*fig.* 1 *and* 2) consists basically of a small relay which is controlled by a thermistor. When the relay operates, its contacts close and an indicating circuit is closed.

Principle of operation

3. A thermistor is a non-linear resistor with a high negative temperature co-efficient. When voltage is applied to its terminals, power is developed in the thermistor which causes a rise in its temperature and a corresponding decrease in resistance. As the voltage across the thermistor is increased, the current increases until a certain maximum value of voltage is reached. This point is the limit of stability, and thereafter the current through the thermistor increases very rapidly with a decrease in voltage across it.

4. The circuit diagram of the indicator unit is shown in fig. 4. The thermistor T1, which also embodies a small heater element, controls the relay; T2 controls the voltage applied to the heater of T1, so that the temperature inside the glass envelope remains constant over the specified range of ambient temperature.

5. Under normal conditions of bus-bar voltage, the thermistor T1 operates at a point high on the stable portion of its characteristic. A small current normally flows through the relay, but does not cause it to operate since the ampere-turns in each coil are equal and opposite. Under normal conditions the resistance of T1 is high, and its shunting effect on coil B of the relay is negligible.

6. If an over-voltage develops, the operating point of T1 moves over the peak of the characteristic and the current flowing in coil A of the relay increases considerably. Since under these conditions the resistance of T1 is very low, it acts as a shunt across coil B and the current in this coil is correspondingly decreased. The balance of ampere-turns in the relay is therefore upset and the relay contacts close, thus operating the indicating device.

7. The unit has an inherent time delay derived from the thermal characteristic of the thermistor bead. The value of this delay can be seen from fig. 3, which shows the operating characteristics of the unit when operating from 28 volts with various values of applied voltage. The time delay acts as a guard against nuisance tripping under transient conditions.

8. The operating point of thermistor T2 is always on the stable portion of its characteristic, its negative temperature co-efficient being used to vary the heater voltage inversely with the change in ambient temperature.

9. To compensate for manufacturing tolerances, the variable resistor R1 is used to adjust the unit to give the correct operating characteristics.

Construction.

10. The components are fitted to a carrier which is freely suspended from the outer aluminium case by anti-vibration mountings. A view of the carrier removed from the case is shown in fig. 2, from which it can be seen that the relay and variable resistor are fitted uppermost, with the thermistors underneath. Special flexible leads are used to connect the carrier to the terminal board.

11. Sponge rubber pads are stuck to the inside faces of the case and its cover to prevent violent contact between the carrier and the case during severe vibration or acceleration of the aircraft. Provision is made for locking the carrier suspension so that the components do not become damaged during storage or transit.

Relay

12. The relay is a Type LAA10–B6, which is normally open. It is generally similar in

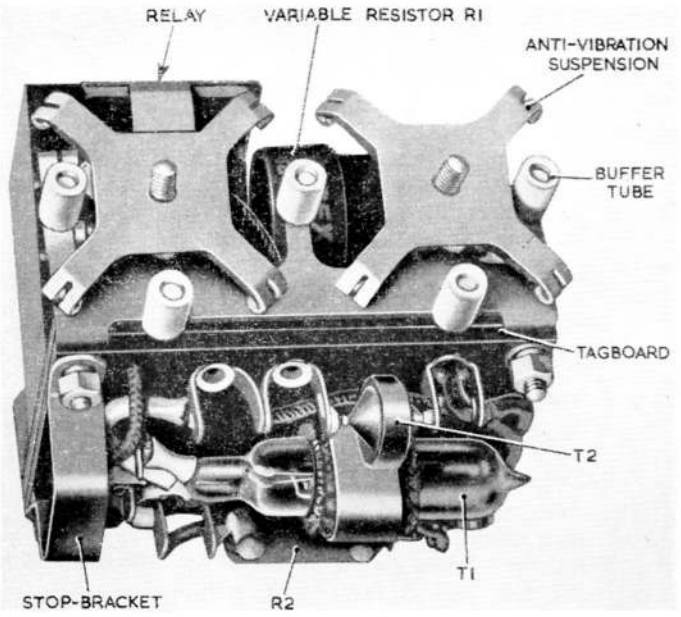

Fig. 2. View of carrier removed from case

construction to the LA series of relays, as described in A.P.4343, Vol. 1, Sect. 11, Chap. 15.

Thermistors

13. The thermistor T1 is an indirectly heated type, and is sealed in a glass envelope which is evacuated and gettered to produce a high vacuum. The thermistor element consists of a small bead of resistance material about the size of a pin head which is integrally formed on two parallel wires, connection being made to both ends of the wire to give greater rigidity and reliability. The heater element closely surrounds the bead, thus ensuring maximum concentration of heat on the resistance bead.

14. The thermistor T2, which is coated with a protective lacquer, consists of a pressed sintered block of thermistor material to which connection wires are attached.

INSTALLATION

15. The unit may be mounted in any attitude and four holes, drilled to accommodate 4 B.A. screws, are provided for the purpose. When the unit has been secured, the two levers that are provided to lock the carrier during storage and transit must be turned to the fully unlocked position.

16. As the unit is not waterproof, it must be situated in a position free from direct splash, such as wheel spray, leakage from windows, or condensation, and away from possible leakage or overflowing of the glycol, fuel, hydraulic fluid tanks, etc., which may drip on to the unit.

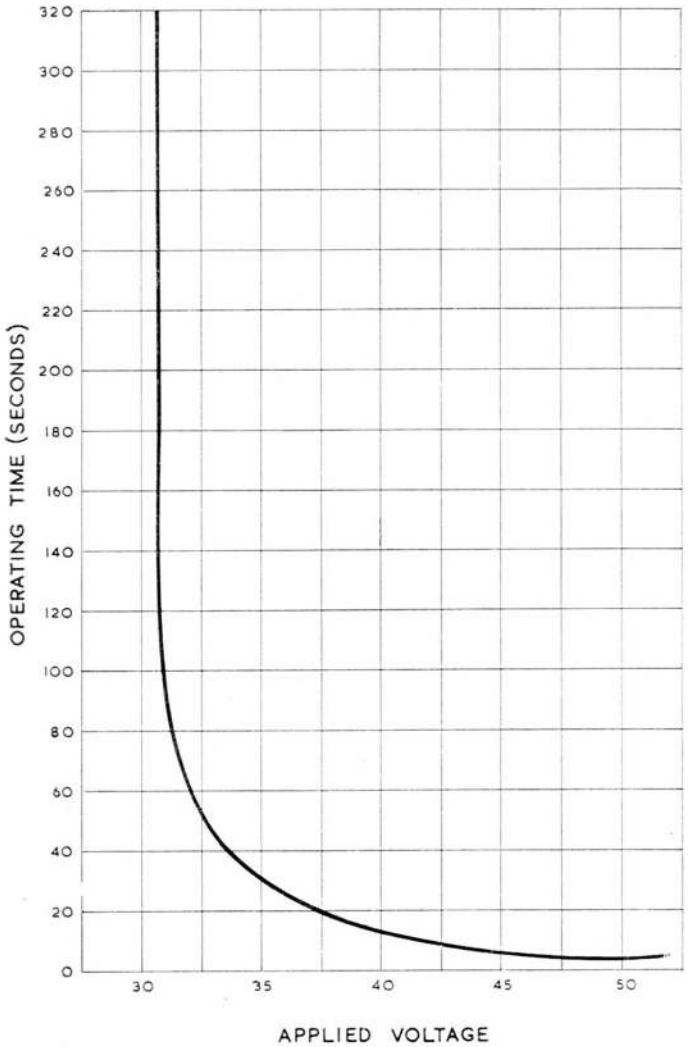

Fig. 3. Operating characteristics of unit

SERVICING

17. The unit should be periodically inspected and tested for correct operation. After removing the unit from the aircraft, take off the top cover, and having marked the position of the base plate with respect to the case, remove the base plate by unscrewing the 6 B.A. nuts which also secure the mounting brackets.

18. Clean out any dust that may have accumulated using a jet of dry compressed air or a pair of bellows. Inspect the unit for any obvious defects such as loose or broken components, broken suspension springs, frayed insulation covering on the leads or unsound soldered joints. Examine the buffer pads and buffer tubes, and renew any that have become perished. New and insecure pads should be stuck in position with Bostik C adhesive.

Testing

19. A d.c. supply, variable between 0 and 35 volts, is required for the purpose of setting the indicator unit. It is essential for the voltage to

be precisely controlled, and measured preferably with a precision-grade voltmeter.

20. Connect terminal 1 of the unit to the supply positive and terminal 2 to the supply negative. Connect a 24-volt lamp between terminals 2 and 3; this will light to indicate that the unit has operated.

(1) Apply 28·0 volts to the unit for approximately 15 minutes to enable it to reach its normal working temperature. Increase the voltage to 30·5 volts, and the lamp should light after an interval of 5 to 8 minutes.

Note . . .

This time interval is dependent upon 28·0 *volts having been applied previously. A different result will be obtained after the application of any other voltage.*

(2) If the unit does not operate within these limits, adjust the variable resistor R1, turning it clockwise (looking at the terminal block end) to decrease the time interval, and anti-clockwise to increase it.

(3) When R1 has been adjusted so that the unit operates in accordance with the above requirements, apply 29·5 volts to the unit; if it has not operated within one hour, the setting of R1 can be considered satisfactory. Lock the spindle of R1 with a spot of white enamel.

21. Check that the insulation resistance measured with a 250-volt insulation resistance tester between the case and all terminals wired together is not less than 10 megohms.

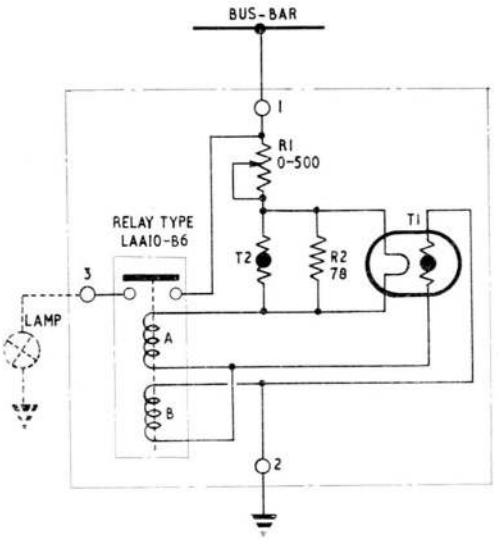

Fig. 4. Circuit diagram

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