Chapter 1

SWITCH, TORQUE, TYPE B

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Torque switch, Type B *EAP.124, Mod. 1* } *EAP.124, Mod. 2* }	*Auto pilot, Mk. 9 only...* *Stores Ref. 5CW/4310*
Torque switch, Type B1 *EAP.2312* } *EAP.2312, Mod. 1* }	... ... *Stores Ref. 5CW/5105*
Torque switch, Type B2 *EAP.2340*	... ... *Stores Ref. 5CW/5907*
Power consumption	... ... *6 ± 0·75 W at 0·34 power factor*
Overall dimensions	
Length	... ... *3·84 in.*
Mounting flange	... ... *2·5 in. sq.*
Weight	... ... *6·25 oz.*

Introduction

1. The torque switch, Type B, is used in the auto pilot, Mk. 9 (junction box) and electrical circuits of aircraft as a means of detecting whether the nominal 115-volt, 400 c/s a.c. supply, is within certain limits.

2. Torque switches, Types B1 and B2 can be used in conjunction with suitable relay circuits to change over automatically to stand-by supply in the event of the following:—

(1) The main supply output falling below a certain minimum.

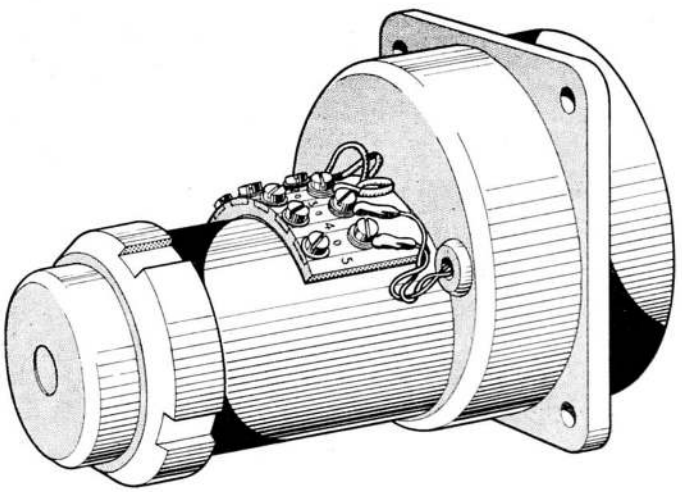

Fig. 1. Torque switch, Type B

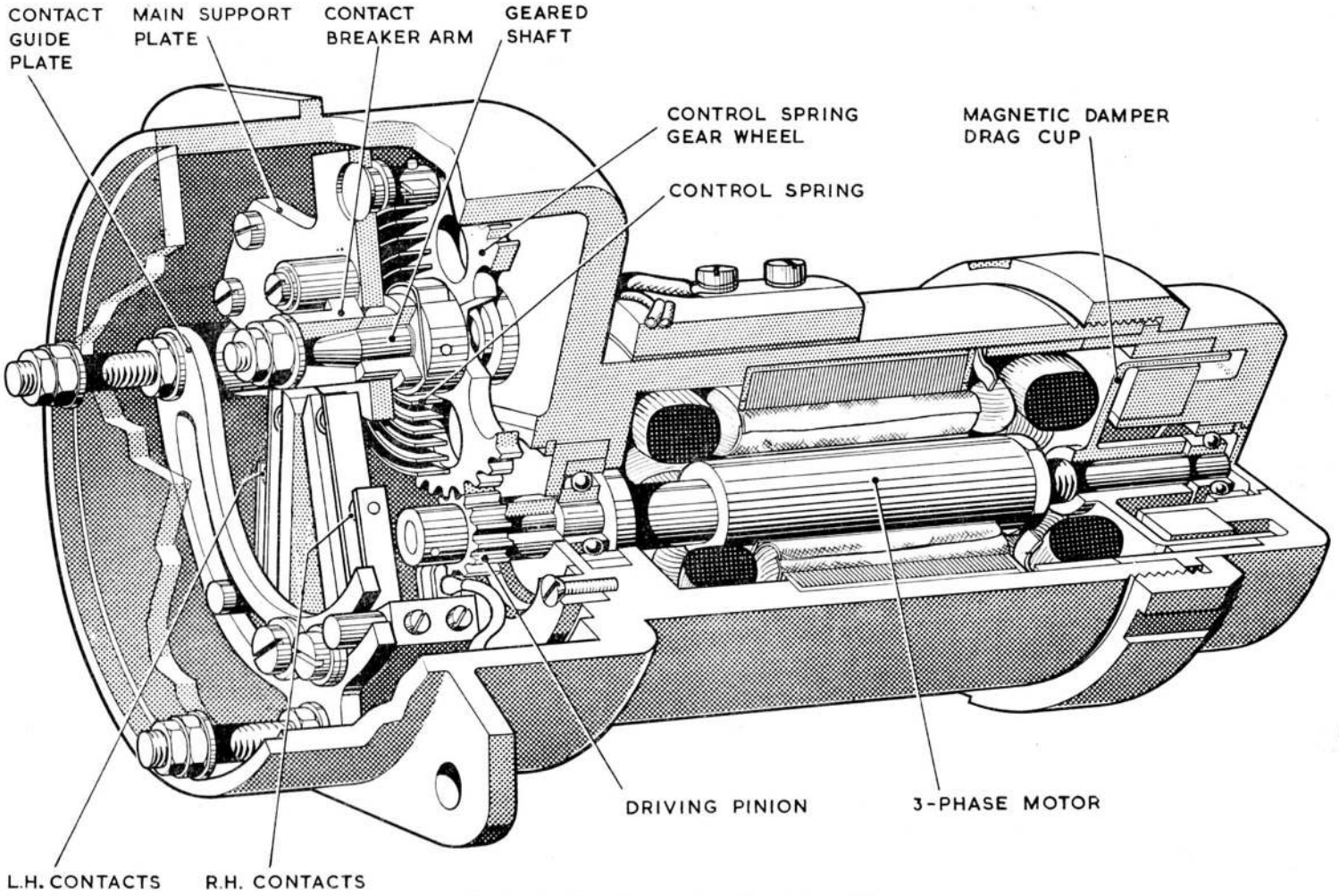

Fig. 2. Sectional view of switch (EAP. 124)

(2) Phase failure of the main supply.

(3) Incorrect wiring of the 3 phases during installation.

3. Alternatively it can be used to operate, by way of a relay circuit, a warning light or flag to indicate failure of the supply.

Versions of the switch

4. There are different versions of the switch, identified by the various code numbers. Details of the variations between them are as follows:—

(1) Code EAP.124 (Mod. 1 and 2) has two pairs of switching contacts, but only one pair is used. This is the L.H. (lower) pair. The R.H. (upper) contacts are normally shorted out.

(2) Code EAP.2312 is basically the same as EAP.124 except for detail changes to allow the switch to be used for change-over applications.

(3) Code EAP.2312, Mod. 1 is a modified version of EAP.2312 in which the R.H. contact assembly is deleted.

(4) Code EAP.2340 is the same as EAP. 2312, Mod. 1 with a resilient stop fitted to prevent overrun of the cam. This switch is fully interchangeable with EAP.124 (Mod. 1 or 2), EAP.2312, and EAP.2312, Mod. 1.

DESCRIPTION

5. The switch (*fig.* 1 *and* 2) consists of a small 3-phase eddy current motor coupled to a switching device by a pinion and gear wheel.

6. The motor rotor is carried in two ball bearings, and the stator consists of a 3-phase star-wound distributed winding.

7. The front compartment of the switch casing houses the contact mechanism of the unit. This mechanism consists of a control spring connected by a gear wheel to the pinion on the rotor, and a contact breaker and 1 or 2 contact assemblies (R.H. and L.H.) both of which embody a fixed and a spring contact. The contact assemblies are adjustable in guide slots, and the contacts are set to open at a low operating pressure.

8. A contact breaker arm assembly is mounted on the tapered portion of a geared shaft which carries the control spring.

OPERATION

9. During normal operation, when the windings are energized by the correct supply, the rotor of the switch motor rotates and turns the pinion. The pinion turns the gear wheel attached to the control spring, and when the spring has turned through part of one revolution, the torsional resistance of the spring equals the torque being exerted by the motor and causes the motor to stop. Under this condition, both pairs of contacts are now closed.

10. If the supply voltage to the switch decreases, the motor torque is reduced and the geared shaft moves towards the de-energized position under the action of the control spring. This causes the contact breaker arm to move towards the L.H. contacts, and if the motor torque decreases sufficiently, the contact breaker arm opens the contacts and breaks the d.c. circuit.

11. The voltages at which the contacts open and close should be within the limits shown in the graphs (*fig.* 5).

12. If the motor torque rises or falls suddenly due to a surge in the a c. supply voltage, the rotation of the motor will be retarded by a drag-cup magnetic damper at the end of the rotor.

INSTALLATION

13. Before installing a switch in an aircraft, the switch should be examined for damage. If the switch appears to have been damaged it should be tested as described in para. 26 to 28.

14. The switch may be mounted in any convenient position to suit the particular aircraft installation, and the method of securing is by four 4 B.A. bolts.

15. Terminals 1, 2 and 3 on the switch must be connected in the correct phase sequence (*fig.* 3) to the 3 output leads from the main 115V. supply. The switch is directional and will not operate if the phase rotation is incorrect. The two remaining terminals, numbered 4 and 5, must be connected into that part of the d.c. circuit which includes the warning medium.

SERVICING

16. Lubrication of the bearings in the motor is not necessary during the normal life of the switch as the bearings are packed with grease during manufacture and reconditioning.

17. Examine all the cables for security on the switch, and examine the insulation for fraying and perishing. Renew all wires with damaged insulation, and tighten loose screws and nuts.

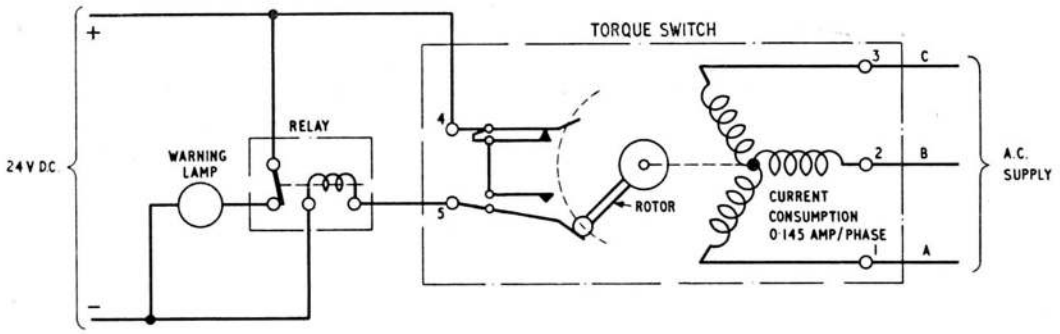

Fig. 3. Typical circuit diagram (warning light application)

18. Examine the contact points for pitting or overheating. Slight marking may be remedied by polishing with crocus paper, grade 0 (Stores Ref. 33C/537), but if the markings are more than slight, the switch must be returned for repair.

19. The switch cover is transparent and the switch mechanism may be observed without removing the cover. Check the operation of the switch and observe that the contact breaker arm and contacts operate smoothly.

Insulation resistance

20. Check the insulation resistance with a 250V insulation resistance tester. The resistance must be checked between each switch terminal and the metal casing, and between terminals 1 and 5. In each instance the resistance must be not less than 20 megohms. If any reading is less than 20 megohms, the switch will be unserviceable.

TESTING

21. To ensure that the switch will operate at the required voltages and frequencies, it is necessary to subject the switch to a bench test. If the switch is found to be unsatisfactory, no attempt is to be made to adjust it.

Equipment required

22. The following equipment will be required for the test:—

(1) Testmeter, Type D (Stores Ref. 10S/10610).

(2) Frequency meter, 300–400–500 c/s (Stores Ref. 5Q/154).

(3) Continuity tester. This is needed to test the operation of the switch contacts during voltage variations.

Power supply

23. The power requirement for testing the switch is a 115-volt, 400 c/s, 3-phase a.c. supply which can be adjusted to give voltages variable from 90 to 110 volts, with frequencies lying between 380 and 420 c/s. This supply may be obtained by modifying an inverter, Type 100A (Stores Ref. 5UB/4938) with a control panel, Type 12 (Stores Ref. 5UC/4939). With this arrangement it will be possible to obtain the voltage and frequency necessary for the test, by setting the two additional resistors (which comprise the modification to the inverter).

24. The inverter may be modified by disconnecting and removing the shunt resistor and inserting a variable resistance of 0 to 100 ohms (rating not less than 1·5 watts).

25. At the control panel, remove the plate carrying the voltage trim adjusting screw. At the back of this plate, connect a variable resistance of 0 to 2,500 ohms (rating not less than 1 watt) in parallel with the existing fixed resistor (1,250 ohms vitreous enamel type).

Test procedure

26. Connect the switch and meters to the inverter as shown in fig. 4, and the inverter to a 28-volt d.c. supply. ◄Care should be taken to ensure that the test rig is not subject to vibration during testing. It is important that the ambient temperature should be 20 ± 5 deg. C; at temperatures outside these limits, the operating characteristics of the switch will vary from those given below. ►

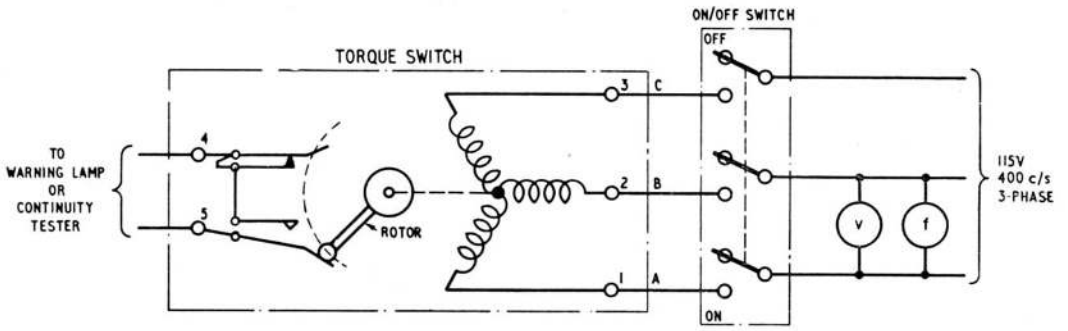

Fig. 4. Test circuit diagram

27. Close the on/off switch, and vary the resistors until the contacts operate. On a rising voltage, with a frequency of 400 c/s, switch operation should be indicated at 102 $\pm$ 5 volts; on a falling voltage, with a frequency of 400 c/s, the switch should open at 96 $\pm$ 5 volts.

28. If the power supply at the moment of closing or opening of the switch is not 400 c/s, there will be 1 volt variation for every 5 c/s departure from the nominal 400 c/s, i.e., a supply at 390 c/s will drop the contact operating voltage by 2 volts from the stated figure. The required voltage values, with frequencies between 380 and 420 c/s, are shown in graphical form in fig. 5; switch operation should lie within the band shown for contacts closing or contacts opening, as appropriate.

Note . . .

During testing, the switch should be lightly tapped to assist the operation of the contacts.

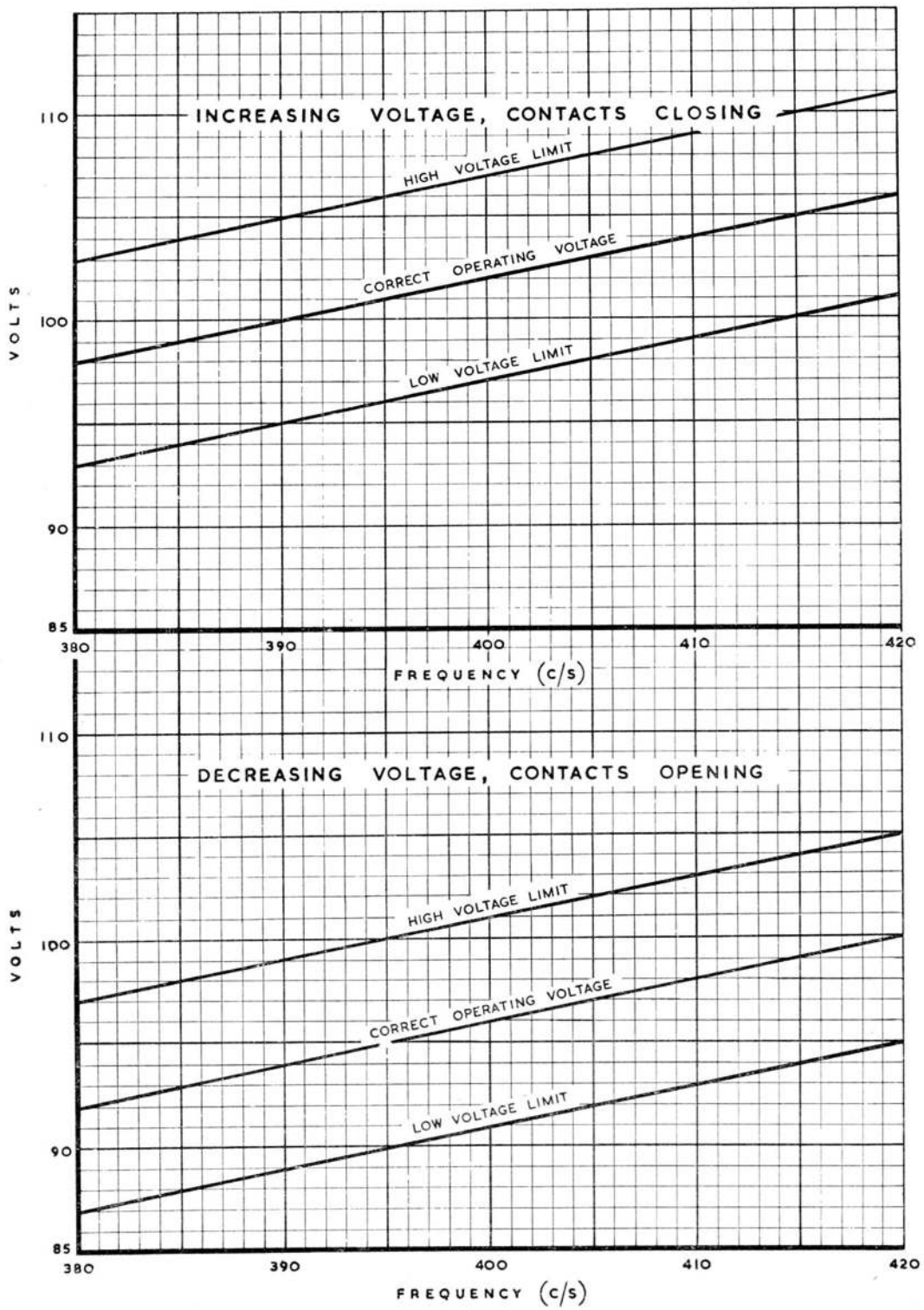

Fig. 5. Graphs of operating voltages