Chapter 32

SWITCH, MAGNETIC, TYPE 11A, No. 2 (ROTAX D9502/2)

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Switch, magnetic, Type 11A, No. 2	Stores Ref. 5CW/4758
Main contacts	
Voltage	112–V, d.c.
Current rating	200 amperes
Rating	Continuous
Auxiliary contacts	
Voltage	28–V, d.c.
Current rating	5 amperes
Voltage of coils	28–V, d.c.
Minimum operating voltage of closing coil ...	... 17·5–V, at 20 deg. C.
Resistance of closing coil at 20 deg. C. ...	2·75 ohm ± 5 per cent
Minimum operating voltage of trip coil ...	... 16–V, at 20 deg. C.
Resistance of trip coil at 20 deg. C.	4·75 ohm ± 5 per cent.
Operational temperature range ...	—65 deg. C. to + 70 deg. C.
Operational ceiling	60,000 ft.
Length	8·329 in.
Width	5·187 in.
Height (from mounting)	4·948 in.
Weight	9 lb.

Introduction

1. The Type 11A, No. 2 magnetic switch is designed for use in aircraft electrical systems which require a 112-V. contactor to be operated from a 28-V. control circuit. The current rating of the main contacts is 200 amperes. There are also three auxiliary switches for 28-V. circuits (one normally open, two normally closed) having a current rating of 5 amperes.

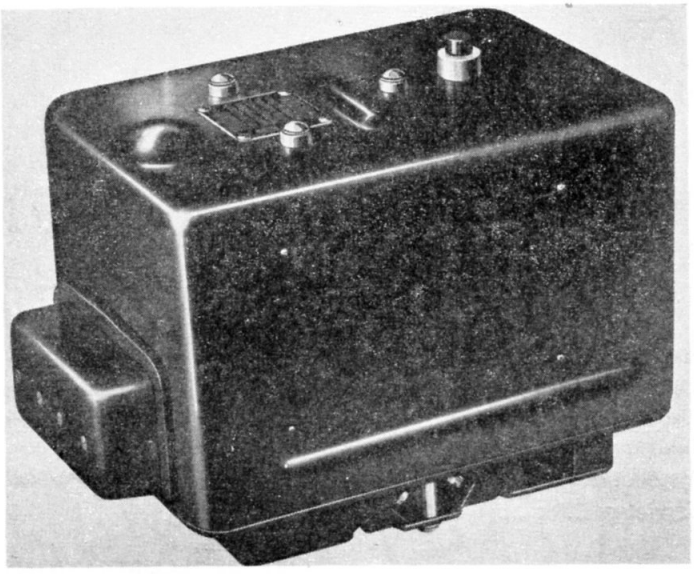

Fig. 1. General view of switch

DESCRIPTION

2. The unit is a single pole, latched in contactor with provision for manual and remote control tripping. There are two pairs of main contacts in series and each pair has arcing fingers projecting into moulded arc chutes. The main contacts are of the rolling butt type and have silver nickel faces.

3. The switch is built on a moulded base which has two main terminals, at one end, projecting through to the underside and enclosed by a moulded terminal box with a cover. The main moving contacts are connected to these terminals by copper braid. The main fixed contacts are integral with two studs projecting through the base at the other end and commoned by a connector bar. This conductor is enclosed within a moulded housing and is not normally accessible. An auxiliary terminal block is fitted to the underside of the base between the two mouldings of the main circuit.

4. The operating solenoid is supported above the main contacts by a switch frame within which a toggle mechanism is set. The toggle mechanism consists of five links; one end of the operating toggle (two links) is hinged to the main contact carrier and the other end to a swinging link which is pivoted to the main frame and connects the operating toggle to the trip toggle (two links). The solenoid plunger is connected to the centre pin of the operating toggle and this pin extends beyond the switch frame to operate the coil economy switch. This switch brings an economy resistance (*para.* 17) into circuit with the operating solenoid when the main contacts close. The economy resistance consists of four resistors grouped in parallel and mounted on pillars at the opposite end of the switch to the arc chutes.

5. The switch is tripped either manually by the trip button or remotely by energizing the trip coil. Either method causes the trip toggle to overcentre, thereby permitting the operating toggle system to collapse.

6. An auxiliary switch moulding and a terminal block for internal connections are mounted on each side of the switch frame. Each switch moulding contains two pairs of contacts (one pair normally open and one pair normally closed) and these contacts are operated by pins projecting from the main contact carrier. Three pairs of contacts are used as auxiliary switches while the fourth pair, normally open, is connected in the trip coil circuit. The operating coil economy switch (*para.* 4) is fitted in order that the operating coil may be energized by a reduced current via the economy resistors (*para.* 4) when the toggle is latched "in".

Electrical connections

7. The main terminals are two $\frac{1}{4}$ in. B.S.F. posts protruding from the underside of the moulded base and enclosed by a terminal box and cover. The coil and auxiliary connections are made to eight standard 19 ampere S.B.A.C. sockets set in a twelve-way terminal block on the underside of the base.

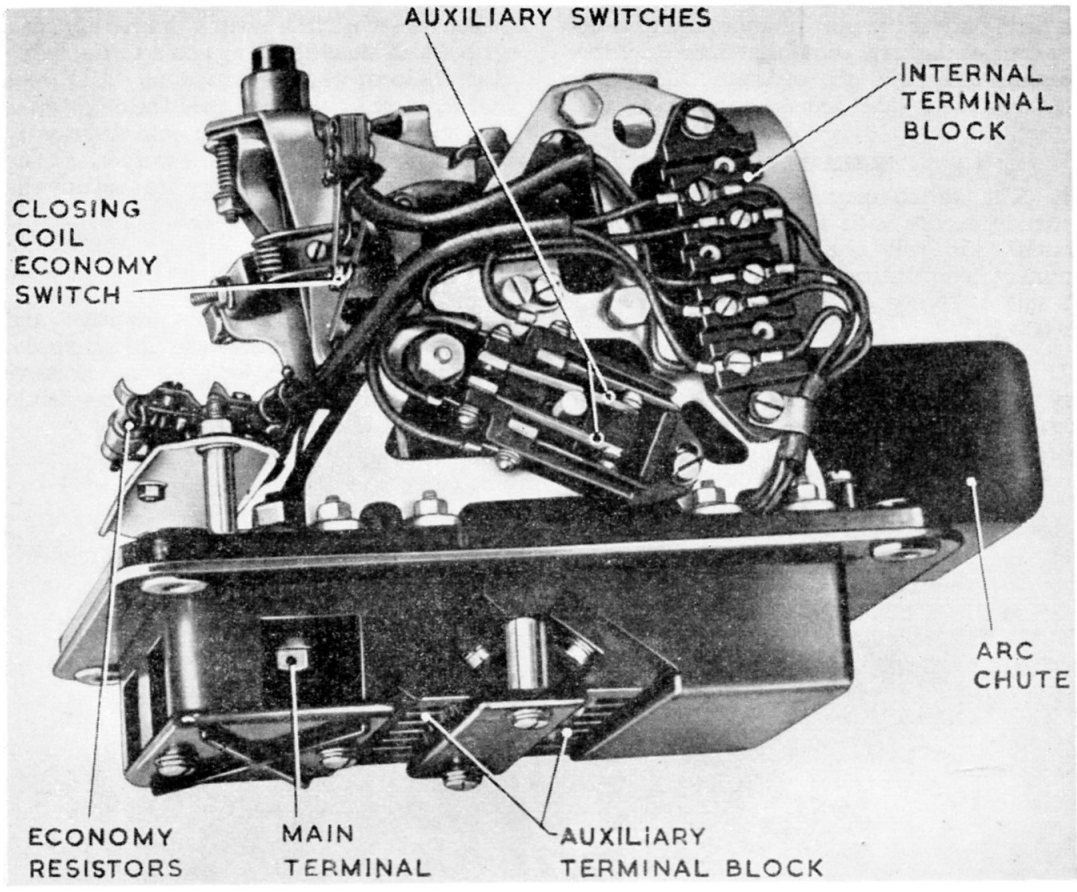

Fig. 2. View with cover removed

Operation

8. When the operating coil is energized (terminals 'SC' and '—') its plunger is drawn into the solenoid and the toggle linkage is drawn "overcentre", closes the main contacts and latches. As the main contacts close, the auxiliary switches are operated and the operating coil economy switch opens. The operating solenoid is then energized by a reduced current.

9. On energizing the trip coil (terminals "ST" and "—") or depressing the manual trip button, the operating toggle collapses and all contacts revert to their normal position. If the plunger is still energized, however, the centre pin of the toggle remains in the overcentre position maintaining the economy switch open. In this condition, the switch cannot be operated again until the operating coil supply is interrupted, thereby allowing the toggle to reset.

10. When the main contacts open, their arcing fingers break contact just after the main contacts open so that arcing takes place only between these fingers within the arc chutes, thereby protecting the main contacts. The fingers are easily renewable when they become unserviceable. To fit a new fixed arcing finger, unlock and unscrew the nut which secures its stud (accessible after removing the moulded housing and connector bar) and lift the terminal from its position in the base. The unserviceable arcing finger can now be removed and a new one fitted. An adjustable link is fitted in order to obtain the contact "override" of ·040 in. ± ·010 in. and it is important to ensure that this override is maintained by setting the slotted screw adjustment (*fig.* 3) in the contact carrier link of the toggle. To fit a new moving arcing finger, remove the two hexagon bolts which secure it to the top of the main

contact. The shims under the arcing finger should be adjusted, if necessary, to maintain an arcing finger pressure of approximately 30 per cent of the total contact pressure (i.e. the pressure required to separate the main contacts when the arcing fingers are not fitted).

INSTALLATION

11. The switch may be mounted in any attitude except with the arc chutes downwards. It will operate satsifactorily in ambient temperatures of between −65 deg. C. and + 70 deg. C. and at altitudes up to 60,000 ft.

12. Four steel inserts, tapped $\frac{1}{4}$ in. B.S.F., are provided in the moulded base for mounting. The fixing centres form a rectangle 6·156 in. by 4·187 in. The switch cover must be removed when mounting the switch in order to secure the switch frame earthing strip which should be connected to the fixing bolt adjacent to main terminal 'A'. This bolt requires to be longer than the other three and must project above the base sufficiently to accommodate the plain washer, spring washer and nut necessary to secure the earthing strip.

SERVICING

13. Inspect the switch for damage and ensure that it functions satisfactorily. Examine all contacts for signs of excessive pitting or burning; the arcing contacts should be renewed if necessary (*para.* 10).

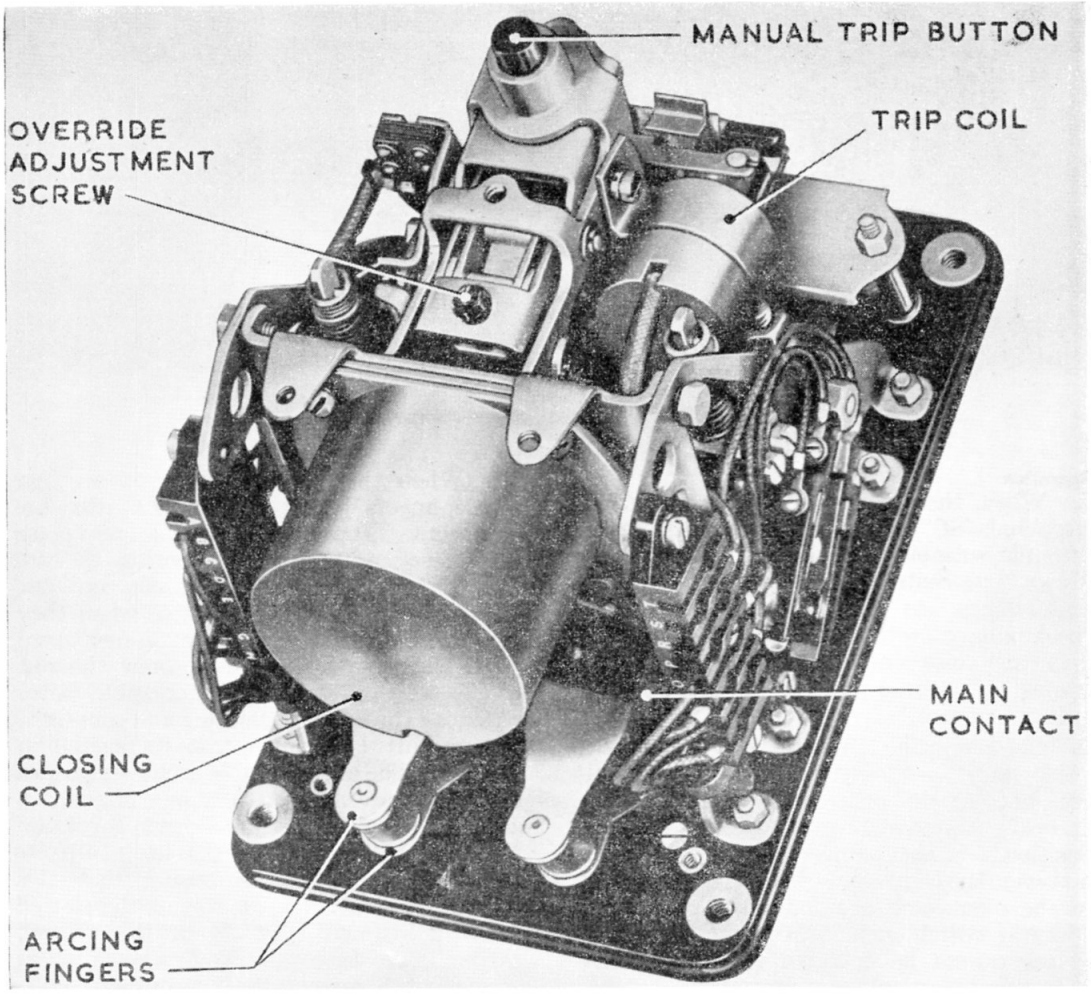

Fig. 3. View with cover and arc chute removed

Coil resistance tests

14. Measure the resistance of the operating coil between terminals "SC" and "—" of the auxiliary terminal block. When corrected to 20 deg. C. the value should be 2·75 ohm ± 5 per cent. The resistance of the trip coil, measured between terminals "ST" and "—" of the auxiliary terminal block (with the switch latched closed) should be, when corrected to 20 deg. C., 4·75 ohm ± 5 per cent.

Pull-in voltage tests

15. The minimum current necessary to close the contactor completely should be between 4·6 amperes and 5·9 amperes. The product of the minimum pull-in current and the exact resistance obtained in the resistance test (para. 14) should be between 12-V. and 17·2-V.

Note . . .

Any movement of the contact arms to the extent of closing the contacts must always produce the full amount of follow through.

16. The minimum current necessary to trip the contactor should be between 2·8 amperes and 3·5 amperes. The product of the minimum tripping current and the exact resistance obtained in the resistance test (*para.* 14) should be between 12-V. and 16·6-V.

Economy resistance

17. The value of the economy resistance should be 37·5 ohm ± 5 per cent when corrected to 20 deg. C. i.e. the reading obtained between terminals "SC" and "—", with the contactor latched closed, should be between 38·26 ohm and 43·34 ohm.

Millivolt drop tests

18. Allow the rated current of 200 amperes to flow through the main circuit (contactor latched closed) and measure the potential drop across each mating pair of main contacts. A reading not exceeding 25 millivolt should be obtained across each pair. The potential drop across the main terminals should not exceed 120 millivolt.

19. The potential drop across each pair of auxiliary contacts should not exceed 40 millivolt with 5 amperes flowing, whilst the potential drop across the trip coil switch should not exceed 10 millivolt with 1 ampere flowing. The potential drop across the contacts of the operating coil economy switch should not exceed 20 millivolt with 2·50 amperes flowing.

Insulation resistance tests

20. Measure the insulation resistance between the following points, using a 250-V insulation resistance tester.

(1) With the main contacts open
- (*a*) Terminal "A" and terminal "B".
- (*b*) Terminal "A" and terminals 1, 2, 3, 4, 5, "ST", "SC", and "—",
- (*c*) Terminal "B" and terminals 1, 2, 3, 4, 5, "ST' "SC", and "—",
- (*d*) Terminal "A" and frame.
- (*e*) Terminal "B" and frame.
- (*f*) Terminal 1 and terminals 2, 4, 5, "ST", "SC" and "—".
- (*g*) Terminal 2 and terminals 3, 4, 5, "ST", "SC", and "—".
- (*h*) Frame and terminals 1, 2, 3, 4, 5, "ST", "SC" and "—".

(2) With the main contacts closed
- (*a*) Terminal "A" and terminals 1, 2, 3, 4, 5, "ST", "SC" and "—".
- (*b*) Terminal "A" and frame.
- (*c*) Terminal 1 and terminal 3.
- (*d*) Terminal 3 and terminals 4, 5, "ST", "SC" and "—".
- (*e*) Terminal 4 and terminals 5, "ST", "SC" and "—".
- (*f*) Terminal 5 and terminals "ST", "SC" and "—".
- (*g*) Frame and terminals 1, 2, 3, 4, 5, "ST", "SC" and "—".

A reading of not less than 50,000 ohms should be obtained in each test.

Note . . .

The value of insulation resistance given in the above test applies to units being tested under normal workshop conditions. Due allowance should be made for the climatic conditions of the locality and those of the aircraft servicing area or dispersal point where the tests are being conducted. In particularly damp climates; the readings may be low enough to give apparently sufficient reason for rejection and in these instances, discretion should be exercised.

(A.L.84, Oct. 56)

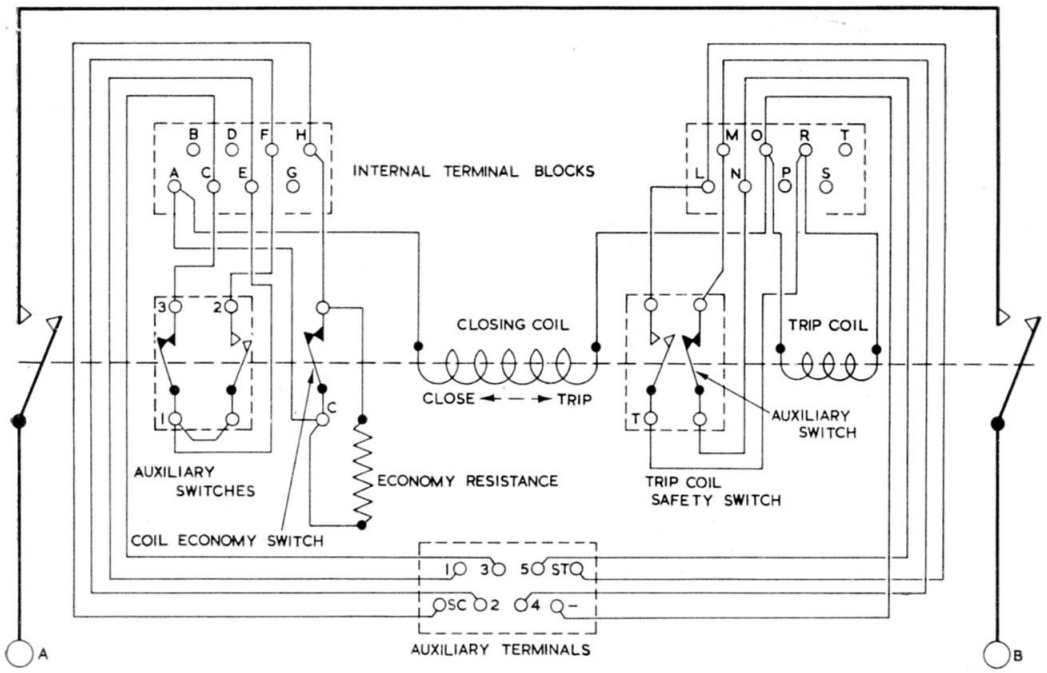

Fig. 4. Diagram of internal connections