

## Chapter 8

### SWITCH, STARTING, TYPE 3A, No. 1 (ROTAX U2302)

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#### LEADING PARTICULARS

Switch, magnetic, starting, Type 3A, No. 1	Stores Ref. No. 5CW/4398
(Modified to V.A. drg. 67436, Sht. 689)	Stores Ref. No. 5CW/5704
Starting resistance at 20 deg. C. (first stage)	0.1 ohm. $\pm$ 10 per cent
Starting resistance at 20 deg. C. (second stage)	0.085 ohm. $\pm$ 10 per cent
Coil resistance at 20 deg. C. (both stages) ...	85 ohm. $\pm$ 10 per cent
Pull-in voltage (first stage) ...	40-V. d.c.
Pull-in voltage (second stage) ...	75-V. d.c.
Rating ...	22 min.
Operational ceiling ...	50,000 ft.
Operational temperature range...	- 70 deg. C. to + 50 deg. C.
Length ...	12.312 in.
Width (including mounting lugs) ...	8.749 in.
Height ...	5.655 in.
Weight ...	13 lb. 6 oz.

#### Introduction

1. The Type 3A, No. 1 two stage starter unit is designed for use in circuit with a 112-volt d.c. motor in order to protect the motor armature from an initial heavy surge of current at the moment of switching on. The two contactors, which form a part of this unit, are designed to have a constant pull-in voltage under all conditions of acceleration. The first stage contactor has one normally open and one normally closed pair of auxiliary contacts.

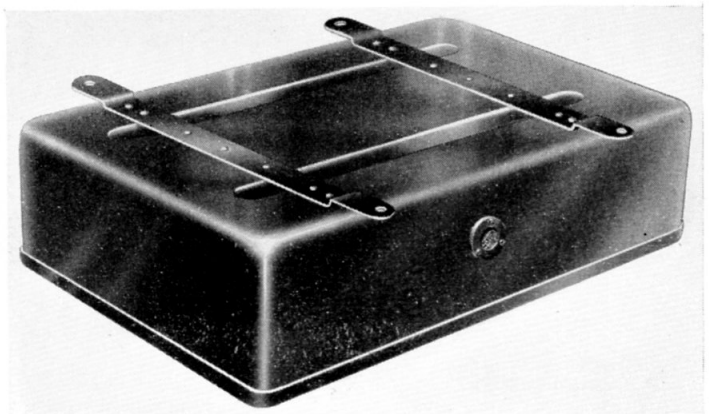


Fig. 1. Type 3A, No. 1, starting switch

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## DESCRIPTION

2. Two starting resistors are set on aluminum spacers and are supported by insulating spacers, the complete assembly being mounted on a sheet metal base. Two contactors are also mounted on the metal base. The first stage contactor has a moulded extension, housing the auxiliary contacts, which extends beyond the metal case of the unit. The starting resistors are linked together and connected to a main terminal of each contactor; these terminals are also commoned. The remaining two main contactor terminals and the remaining terminations of the starting resistors are connected to terminals 1 and 2 by copper conductors. The contactor coils and their ballast resistors, which are mounted on brackets above the starting resistances, are connected to the secondary terminals (3 and 4) by glass covered flex. The cover which encloses the unit has two flame proof cowls for ventilation and has two strips riveted across it which, projecting on either side, form four mounting lugs.

3. Each contactor consists of a solenoid having two co-axial plungers each of which is connected by a lever to a crank, one on each side of a pin to which a moulded contact carrier is pivoted. A moving contact plate is spring mounted on the carrier and is fitted with two contacts. The mating fixed contacts are set in a moulded housing and are integral

with the main contactor terminal posts. When the solenoid is energized, the two plungers draw in towards one another and their levers rock the contact carrier so that the contacts close, commoning the main terminals. The opposed plungers ensure constant pull-in voltage under all conditions of acceleration. The auxiliary contacts of the first stage contactor are operated by a dolly spindle when the main contacts close.

## External connections

4. The main terminals (1 and 2) are  $\frac{1}{4}$  in. B.S.F. studs insulated from the base by moulded bushes and washers. The secondary terminals (3 and 4) are 2 B.A. studs similarly set in the base. The auxiliary terminals (5, 6, 7 and 8) are 4 B.A. screw and washer terminations set in the auxiliary contact housing.

## Operation

5. The operation of the unit depends upon the starting resistances being connected in series with the motor armature and the operating coils circuit being in parallel with the armature. When the motor is switched on, the starting resistances limit the current surge through the armature but, as the motor gathers speed, and the potential drop across the armature (due to generated back e.m.f.) reaches 40-volt, the first stage contactor operates, shorting out the first stage starting

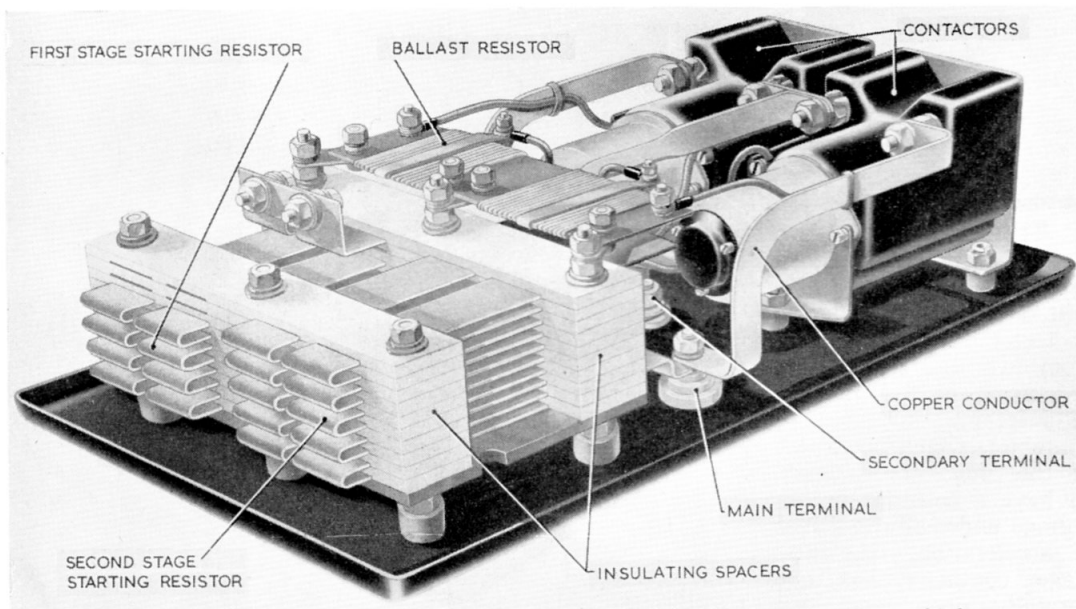


Fig. 2. Switch unit with cover removed

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resistance. When the potential drop across the armature reaches 75-volt the second stage contactor operates, shorting out the remaining starting resistance, so that full voltage is applied to the motor. The auxiliary contacts operate with the first stage contactor. All contacts return to normal when the motor is switched off.

#### INSTALLATION

6. The unit may be mounted in any attitude. Four 0.257 in. diameter holes are provided for mounting; their fixing centres form a rectangle 8.125 in.  $\times$  6.875 in.

#### SERVICING

7. The tests detailed in paras. 8, 9, 10 and 11 are sufficient to ensure satisfactory operation of the unit. In addition a visual inspection should be made to ensure that there is no superficial damage.

#### Resistance tests

8. Measure the value of each starting resistance and each relay coil (it will be necessary to disconnect a lead from one of the ballast resistors in order to isolate the coils). When corrected to 20 deg. C., the first stage starting resistance should be 0.1 ohm  $\pm$  10 per cent and the second stage starting resistance should be 0.085 ohm  $\pm$  10 per cent; the resistance of each contactor coil should be 85 ohm  $\pm$  10 per cent.

#### Pull-in voltage tests

9. Measure the minimum pull-in voltage of each contactor as applied across terminals 3 and 4. The first stage contactor should operate when the applied voltage is between 39-volt and 41-volt and the second stage contactor should operate when the applied voltage is increased to between 74-volt and 76-volt.

#### Millivolt drop tests

10. Energize both the contactors of the unit and allow 150 amperes to flow through the main contacts. The potential drop between terminals 1 and 2 should not exceed 260 millivolt. The potential drop between terminals 5 and 6 (main contacts open) and between

terminals 7 and 8 (main contacts of first stage contactor closed) should not exceed 20 millivolt with 5 amperes flowing.

#### Insulation resistance tests

11. Measure the insulation resistance between the following points with a 250 volt insulation resistance tester.

Terminal 1 and terminals 2 and 5

Terminal 3 and terminal 5

Terminal 7 and terminal 8

Terminals 3 and 5 and frame  
(contactors de-energized)

Terminal 1 and terminals 3 and 7

Terminal 3 and terminal 7

Terminal 5 and terminal 6

Terminals 1 and 7 and frame  
(contactors energized)

A reading of at least 2 megohm should be obtained in each test.

#### Note . . .

*The values given in these tests apply to units being tested under normal workshop conditions. Due allowance must be made for 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.*

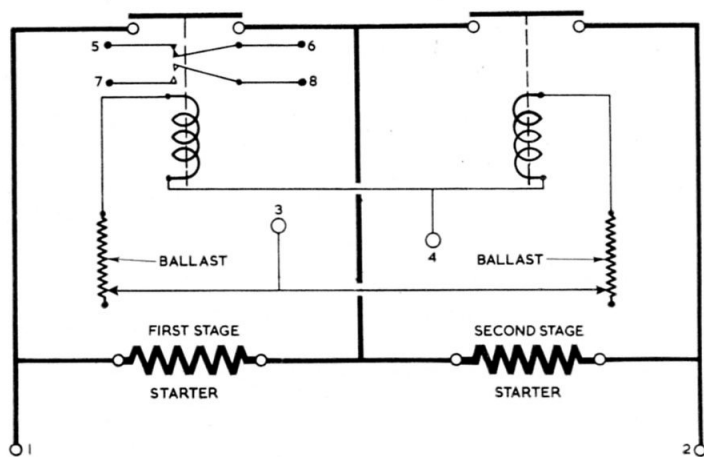


Fig. 3. Diagram of internal connections

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