

## Chapter 20

# CRASH TRIP RELAY BOXES WITH CRASH TRIP ELEMENTS

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#### Introduction

1. The crash trip relay boxes are used in conjunction with a number of crash trip elements, normally not exceeding eight, the number being determined by the particular requirements of each aircraft; which are mounted on vulnerable parts of the aircraft wing and fuselage surfaces. The crash trip

elements, under impact, will operate; causing the crash trip relay boxes to give visual warning and/or bring the aircraft emergency systems into operation. This chapter deals with crash trip relay boxes and crash trip elements in general, details of individual relay boxes and elements will be found in the Appendices to this chapter.

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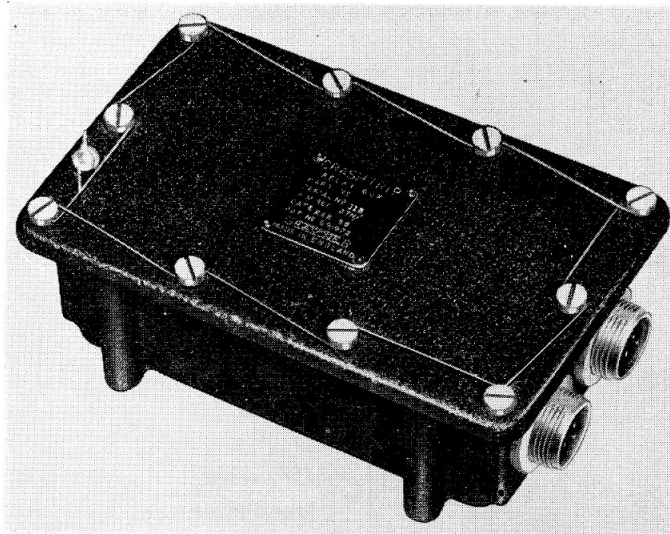


Fig. 1. Typical crash trip relay box, Type C470

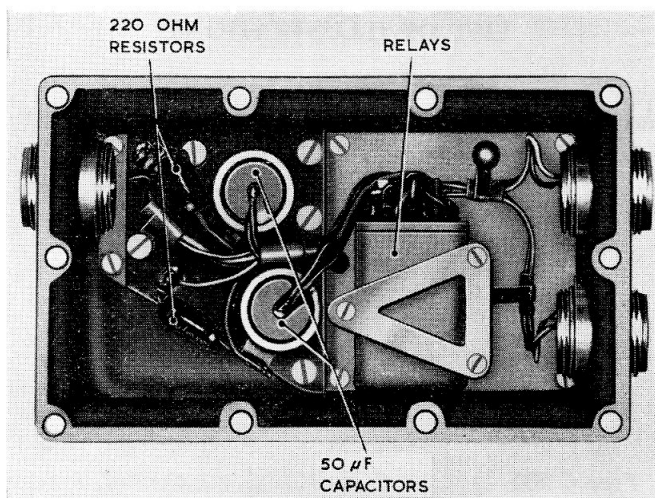


Fig. 2. Typical crash trip relay box, with cover removed

## DESCRIPTION

### Relay boxes

2. A typical relay box is illustrated in fig. 1 and 2, the one shown being the crash trip relay box Type C470. The boxes are hermetically sealed units containing either one or two relay circuits, each circuit incorporates, a miniature 12 volt relay, Type 4184GC, a 50mF, 70 volt d.c. tantalum

capacitor and a 220 ohm resistor. Single relay circuits have in addition a 2 ohm resistor and a metal rectifier. A circuit diagram of a double relay unit is given in fig. 3.

### Crash trip elements

3. A crash trip element is virtually a switch, capable of being operated only by a force

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such as would be sustained on impact. The elements are similar in construction and operation but differ in length and may be single or double-switch elements. The element illustrated in fig. 4 and 5 is the crash trip element Type 12c. Their construction is shown in fig. 5, the units consisting of three parallel, metal strip contacts, the outer contacts being of similar polarity and insulated by strips of rubber from the inner contact. The whole is contained in a rubber tube mounted on a light alloy frame and is secured to the appropriate part of the airframe. The elements are electrically connected to other elements and to the relay box; single-switch elements are connected in pairs to other pairs of elements and to the relay box.

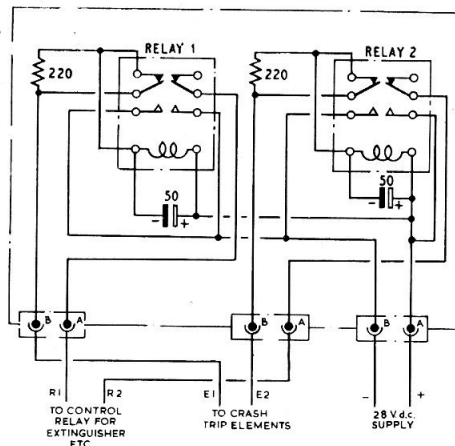


Fig. 3. Typical crash trip relay box, circuit diagram

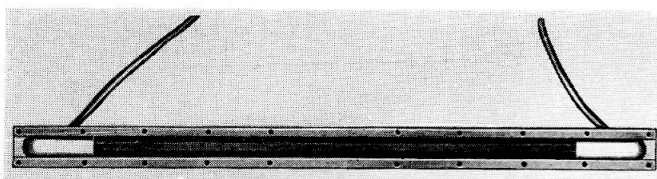


Fig. 4. Typical crash trip element

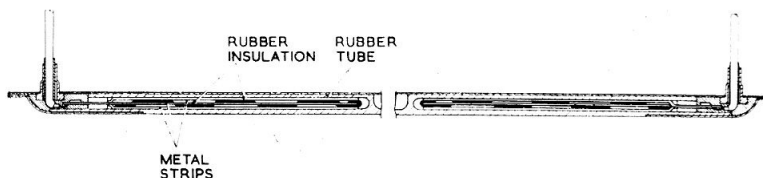


Fig. 5. Typical crash trip element, sectional view

#### OPERATION

4. Should only one side of a double-switch element, or only one of a pair of single-switch elements be operated, as would be the case if it were struck in flight by a stone or small bird one relay only would operate; this may be used to light a warning lamp.

In the event of a crash both sides of a double-switch element or a pair of single-switch elements would be operated, thus energising both relays and bringing the aircraft emergency system into operation.

5. Positive operation is ensured by the

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fitting of the 12 volt miniature relay which will operate with only a momentary signal from the crash trip elements; operation is also assisted by fitting the capacitor across the relay coil. The relay coil and the positive plate of the capacitor receive a positive supply from pin A of the supply plug whenever the emergency system bus-bar is "live". When any one crash trip element is operated, this momentarily completes the negative line of the circuit to the appropriate relay coil and capacitor, through the normally closed contacts of the relay. This charges the capacitor and closes the relay, whilst the relay is moving and the normally closed contacts are open the capacitor discharges through the coil. The relay is maintained closed by a "hold-on" circuit through the 220 ohm resistor, the operated contacts and negative (*pin B*) of the supply plug. The relay unit can be reset by breaking the supply to the relay box.

**Note . . .**

*The operation of single-relay, crash trip relay units is explained in Appendix 2 to this chapter.*

## INSTALLATION

6. Installation details of individual crash trip relay boxes and crash trip elements are dealt with in the Appendices to this chapter. For installation details of aircraft systems, reference should be made to the relevant Aircraft Handbook, since the location and number of components differ from aircraft to aircraft.

## SERVICING

7. Servicing of individual crash trip relays and crash trip elements is given in the Appendices to this chapter.

### Testing

8. Testing of an aircraft system can be carried out by manually operating the crash trip elements; both sides of a double-switch element or a pair of single-switch elements, with all the fire bottles and other emergency services disconnected and test lamps substituted. After the elements are operated, the crash trip relay box must be reset by breaking the supply to it before reconnecting the emergency services.

## Appendix 1

### CRASH TRIP RELAY BOX, TYPE C470

#### LEADING PARTICULARS

|                                    |     |     |     |     |                               |                      |
|------------------------------------|-----|-----|-----|-----|-------------------------------|----------------------|
| Relay box, Type C470               | ... | ... | ... | ... | ...                           | Ref. No. 5CW/        |
| <i>Electrical connections</i>      |     |     |     |     |                               |                      |
| Supply plug, 3 pole miniature Mk.4 | ... |     |     |     |                               | Ref. No. 10H/0560060 |
| Outlet plug, 4 pole miniature Mk.4 | ... |     |     |     |                               | Ref. No. 10H/0560571 |
| Outlet plug, 4 pole miniature Mk.4 | ... |     |     |     |                               | Ref. No. 10H/0560572 |
| Weight                             | ... | ... | ... | ... | ...                           | 1 lb. 8 oz.          |
| Operating voltage                  | ... | ... | ... | ... | ...                           | 21 to 29 volts d.c.  |
| Overall dimensions                 | ... | ... | ... | ... | 6.6 in. × 3.725 in. × 2.4 in. |                      |

1. This unit is identical to that described and illustrated in the main chapter.

#### INSTALLATION

2. The relay box is secured by four 2 B.A. screws to the airframe structure.

#### SERVICING

3. The relay box should be examined for signs of damage and corrosion. Damaged units and units failing the functional or insulation test should be sent for repair in accordance with current authorised procedure.

##### Insulation test

4. Using a 250 volt insulation resistance tester, check the insulation resistance between each pin of the three plugs and the case; the reading should not be less than 20 megohms.

##### Note . . .

*It is essential that the tantalum capacitors, which are suitable for 70 volt working, should be shorted out by linking the appropriate pins of the relay box when making this test, since they would be damaged by the application of 250 volts.*

##### Functional test

5. Using a suitable 24 volt d.c. supply at the 3 pole supply plug and two crash trip elements or switches at pins B of the 4 pole, outlet plugs connected to the supply negative (—ve). Check that the relays operate individually as each switch is closed. A load, not exceeding 2 amps, can be connected across pins A of the 4 pole outlet plugs. When the switches are switched “off” check that the relays remain energised; switch “off” or disconnect the 24 volt supply from the supply plug and check that the relays reset to normal.

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## Appendix 2

### CRASH TRIP RELAY BOX, TYPE C500

#### LEADING PARTICULARS

|                                      |     |     |     |     |                               |
|--------------------------------------|-----|-----|-----|-----|-------------------------------|
| Relay box, Type C500                 | ... | ... | ... | ... | Ref. No. 5CW/6379             |
| Electrical connections:—             |     |     |     |     |                               |
| Supply plug, 3-pole, miniature, Mk.4 | ... | ... | ... | ... | Ref. No. 10H/0560060          |
| Outlet plug, 4-pole, miniature, Mk.4 | ... | ... | ... | ... | Ref. No. 10H/0560571          |
| Outlet plug, 4-pole, miniature, Mk.4 | ... | ... | ... | ... | Ref. No. 10H/0560572          |
| Weight                               | ... | ... | ... | ... | 1 lb. 7 oz.                   |
| Operating voltage                    | ... | ... | ... | ... | 21 to 29 volts d.c.           |
| Overall dimensions                   | ... | ... | ... | ... | 6.6 in. × 3.725 in. × 2.4 in. |

1. This unit is similar to that described and illustrated in the main chapter but has one relay circuit only, a circuit diagram is given in fig. 1. The two four-pole outlet plugs are connected; one to the aircraft emergency system in which pins C and D are not used, and one to the crash trip elements in which pin D is not used; pin C is wired in, but the crash trip elements are connected across pins A and B.

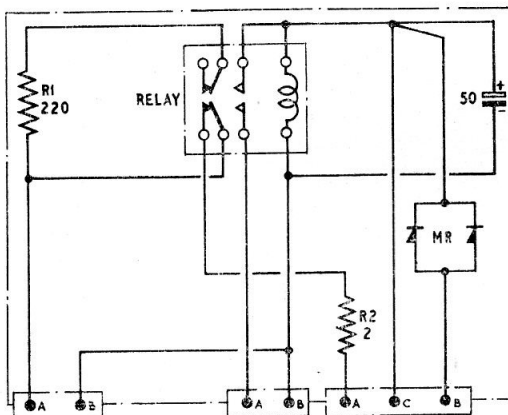


Fig. 1. Circuit diagram

#### OPERATION

2. On impact the circuit is completed; through the normally closed contacts, the 2 ohm resistor, pin A, the element switches, pin B and metal rectifier to the relay coil. Energising the relay and charging the capacitor. The capacitor assists in closing the relay, which is then held 'on' by a supply through the normally open contacts and 220 ohm resistor. Operation of the relay completes a supply to the aircraft emergency system. The relay used in the Type C500 box is a 12 volt relay Type 4184GC which ensures operation of the system with only a momentary signal. The relay box may be reset after operation by breaking the supply to the box.

#### INSTALLATION

3. The relay box is secured by four 2 B.A. screws, to the airframe structure.

#### SERVICING

4. The relay box should be examined for signs of damage and corrosion. Damaged units and units failing the functional or

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insulation test should be sent for repair in accordance with current authorised procedure.

#### **Insulation test**

5. Using a 250 volt insulation resistance tester check the insulation resistance between each pin of the three plugs and the case; the reading obtained must be not less than 20 megohms.

#### **Note . . .**

*It is essential that the tantalum capacitors, which are suitable for 70 volt working, should be shorted out by linking the appropriate pins of the relay box when making this test, since*

*they would be damaged by the application of 250 volts.*

#### **Functional test**

6. Using a suitable 24 volt supply at the supply plug and crash switch elements or a switch across pins A and B of the 4-pole outlet plug the following test should be made.

Check that the relay operates when the switch is closed, a load, not exceeding 2 amps can be connected across the other 4-pole outlet plug. When the switch is switched "off" the relay must remain closed until the supply is broken to the input plug, after the supply is broken check that the relay has reset.

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## Appendix 3

### CRASH TRIP RELAY UNIT TYPE C510

#### LEADING PARTICULARS

*Relay unit, Type C510, comprising:*

|                                             |     |     |     |     |                         |
|---------------------------------------------|-----|-----|-----|-----|-------------------------|
| <i>Relay unit, Type C509</i>                | ... | ... | ... | ... | <i>Ref. No. 27N/253</i> |
| <i>Base unit, Type C508</i>                 | ... | ... | ... | ... | <i>Ref. No. 27N/254</i> |
| <i>Electrical connections, in base unit</i> | ... | ... | ... | ... | <i>6 B.A. screws</i>    |
| <i>Weight</i>                               |     |     |     |     |                         |
| <i>Relay unit Type C509</i>                 | ... | ... | ... | ... | <i>14.4 oz.</i>         |
| <i>Base unit Type C508</i>                  | ... | ... | ... | ... | <i>6.4 oz.</i>          |

1. This unit is a "potted" version of the relay box Type C470, comprising a relay unit Type C509 and a base unit Type C508; shown in fig. 1 and 2. The unit is a double relay unit, which is identical in operation with that given in the main chapter, a circuit diagram is shown in fig. 3.

#### INSTALLATION

2. The relay unit, Type C509 is secured to the base unit by a 2 B.A. knurled headed screw and is correctly positioned by three locating pins; the base unit Type C508 is secured to the airframe structure by three 2 B.A. bolts.

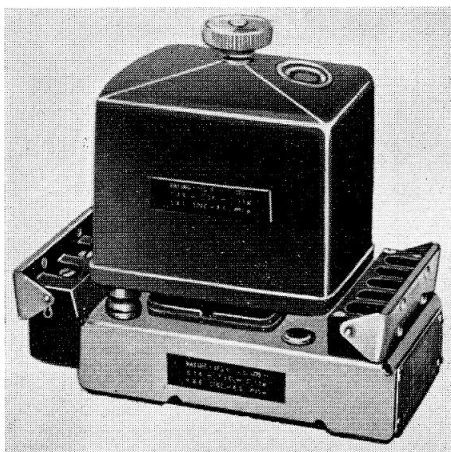


Fig. 1. Relay unit and base

#### SERVICING

##### Relay unit, Type C509

3. The relay unit is a sealed unit and should be examined externally for signs of damage and corrosion.

##### ◀ Insulation resistance test

4. Using a 500V insulation resistance tester measure the insulation resistance between each contact and the case (with the exception of the contact which makes with terminal No. 5 on the base unit). The reading obtained must be not less than 20 megohms. ▶

##### Base unit, Type 508

5. With the base cover removed the base unit should be examined for signs of damage and corrosion; the spring contacts checked for freedom of movement. The wiring should be checked for secure connections, signs of overheating and deterioration.

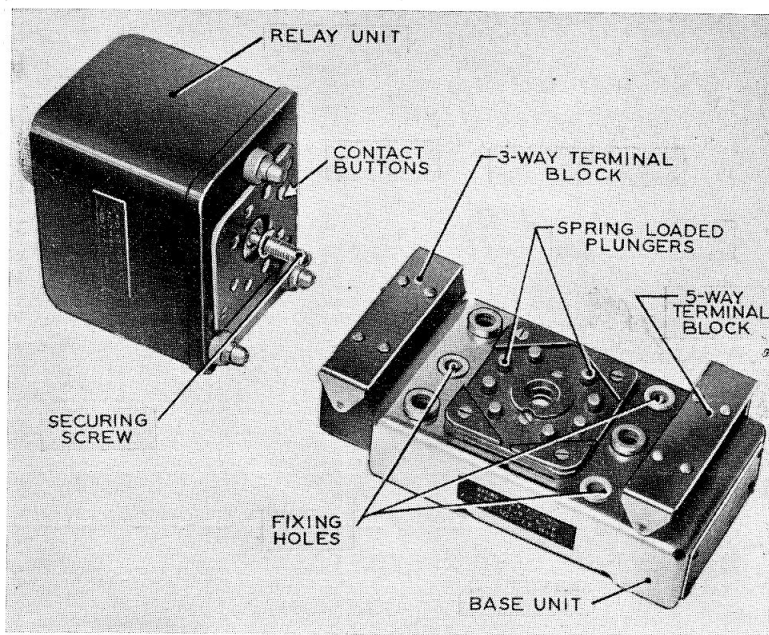
##### Continuity test

6. The continuity of the base wiring should be checked between each terminal screw and the appropriate moving contact.

##### ◀ Insulation resistance test

7. Using a 500V insulation resistance tester, measure the insulation resistance between each terminal screw (with the exception of terminal No. 5) and the case. The reading obtained must be not less than 20 megohms. ▶

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**Fig. 2. Relay unit separated from base**

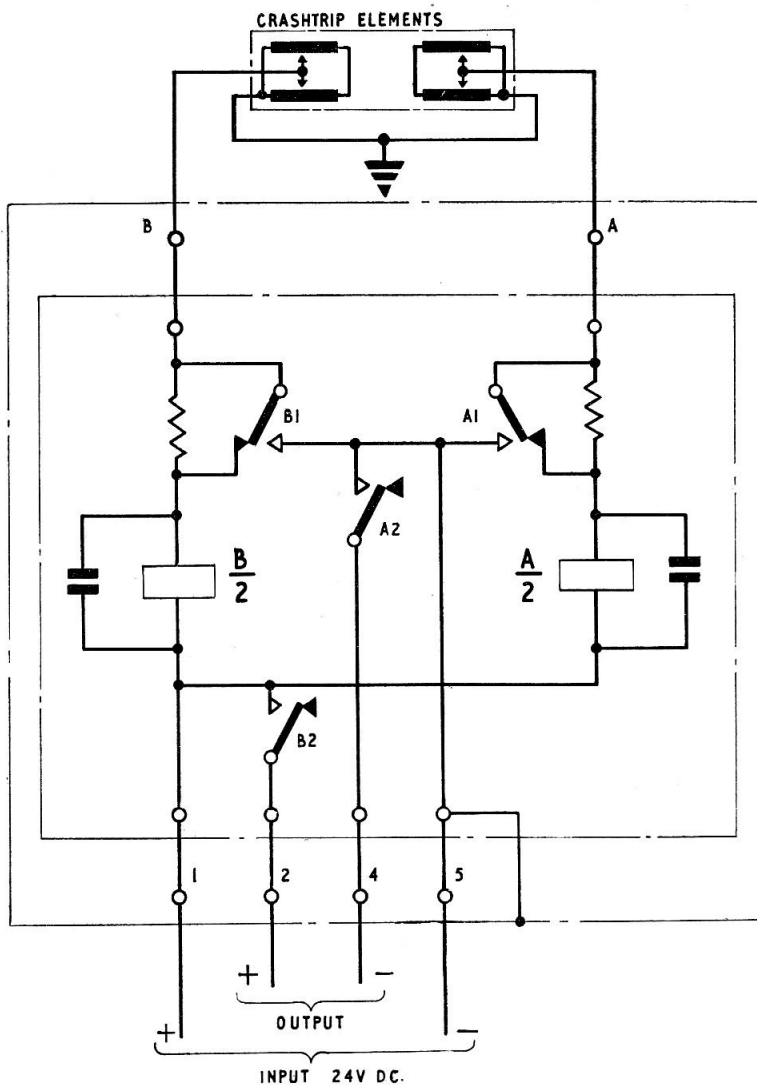
#### **Function test**

8. With the relay unit and base unit combined and connected as shown in fig. 2, with the output connected to suitable indicator loads, not exceeding two amp. in each output line, check for correct functioning. Operate each switch in turn and check that the appropriate indicator operates, open each switch and check

that the indicators remain on. Break the supply to the unit and ensure that the indicators go out showing that the relays have reset.

9. Relay units which fail the above tests should be returned for repair in accordance with current authorised procedure.

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**Fig. 3. Crash trip relay unit, Type C510  
circuit diagram**

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## Appendix 4

### CRASH TRIP ELEMENT, TYPE 12c

#### LEADING PARTICULARS

|                                             |     |     |     |                               |
|---------------------------------------------|-----|-----|-----|-------------------------------|
| <i>Crash trip element, Type 12c</i>         | ... | ... | ... | <i>Ref. No. 27N/256</i>       |
| <i>Overall dimensions</i>                   | ... | ... | ... | 20.5 in. × 1.3 in. × 7/16 in. |
| <i>Weight</i>                               | ... | ... | ... | 9 oz.                         |
| <i>Operating force</i>                      | ... | ... | ... | 25—75 lb.                     |
| <i>Connecting cables (two × 2 ft. long)</i> | ... | ... | ... | <i>Duprensheath 6</i>         |

1. This crash trip, element is identical to that described and illustrated in the main chapter, and is a double switch element. The active switches being 4 in. long and 2.75 in. from each end, with a central 8 in. non-active gap. This element supersedes the Type 11c element.

#### INSTALLATION

2. The crash trip element, Type 12c, is secured to the airframe by twenty 4 B.A. bolts. New elements are supplied undrilled and great care must be taken to drill new elements in accordance with the Drilling Instructions transfer on the rear plate of each unit i.e.

Drill required number of holes, .152 in. dia., along parallel centre lines .930 in. apart and equidistant from the centre line of the crash trip element. The holes to be .375 in. from each end and with a 2 in. pitch.

#### SERVICING

3. No servicing of the element switches is possible, servicing should be confined to

examination for signs of damage or corrosion and inspection of the 2 ft. cables for deterioration.

#### Insulation resistance test

4. Using a 500V insulation resistance tester and measured between the cables and the element case, and between the cable cores at each end; the insulation resistance must be not less than 20 megohms.

#### Functional test

5. The element should be checked for range of operation by applying a load of increasing force at each switch and checking that the switches operate at 25—75 lb. applied load. Note the load required to operate the switch.

#### Millivolt-drop test

6. Using the load found in para. 5 +10 lb. and with a voltage of 24 volts d.c. applied to the switch, passing a current of 250 milli-amp. check the millivolt drop across the switch, the millivolt drop must not exceed 75 millivolts.

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## Appendix 5

### CRASH TRIP ELEMENT, TYPE 34c

#### LEADING PARTICULARS

|                                     |     |     |     |                              |
|-------------------------------------|-----|-----|-----|------------------------------|
| <i>Crash trip element, Type 34c</i> | ... | ... | ... | <i>Ref. No. 27N/255</i>      |
| <i>Overall dimensions</i>           | ... | ... | ... | 6.8 in. × 1.3 in. × 7/16 in. |
| <i>Weight</i>                       | ... | ... | ... | 5 oz.                        |
| <i>Operating force</i>              | ... | ... | ... | 25—75 lb.                    |
| <i>Connecting cable, 3 ft. long</i> | ... | ... | ... | Duprensheath 6               |

1. This crash trip element is similar in construction and operation to that described in the main chapter, but is a single switch element, shown in fig. 1. The elements are connected in pairs, a number of pairs being connected to each crash trip relay unit. Being shorter than the 11c and 12c elements the Type 34c element is more suitable for use on certain locations of the airframe.

#### INSTALLATION

2. The crash trip element Type 34c is secured to the airframe by eight 4 B.A. bolts. New units are supplied undrilled and great

possible, servicing should be confined to examination for signs of damage or corrosion and inspection of the 3 ft. cable for deterioration.

#### Insulation resistance test

4. Using a 500V insulation resistance tester and measured between the cables and the element case and between the cable cores at each end; the insulation resistance must be not less than 20 megohms.

#### Functional test

5. The element should be checked for range

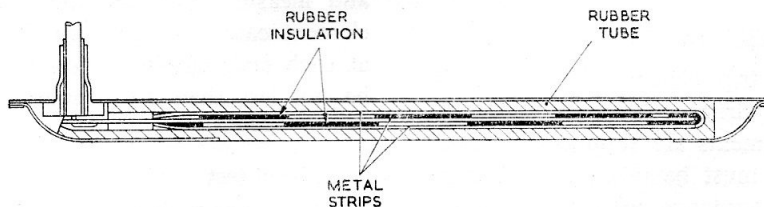


Fig. 1. Crash trip element, Type 34C sectional view

care must be taken to drill new elements in accordance with the Drilling Instructions transfer on the rear plate of each unit, i.e.

Drill required number of holes .152 in. dia. along parallel centre lines .930 in. apart and equidistant from the centre line of the crash trip element. The holes to be .375 in. from each end and with a 2 in. pitch.

#### SERVICING

3. No servicing of the element switches is

of operation by applying a load of increasing force at each switch and checking that the switches operate at 25—75 lb. applied load. Note the load required to operate the switch.

#### Millivolt-drop test

6. Using the load found in para. 5 + 10 lb. and with a voltage of 24 volts d.c. applied to the switch, passing a current of 250 milliamp. Check the millivolt drop across the switch the millivolt drop must not exceed 75 millivolts.

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## Appendix 6

### CRASH TRIP ELEMENT, TYPE 11c

#### LEADING PARTICULARS

|                                            |     |     |     |                               |
|--------------------------------------------|-----|-----|-----|-------------------------------|
| <i>Crash trip element, Type 11c</i>        | ... | ... | ... | <i>Ref. No. 27N/139</i>       |
| <i>Overall dimensions</i>                  | ... | ... | ... | 20.5 in. × 1.3 in. × 7/16 in. |
| <i>Weight</i>                              | ... | ... | ... | 9 oz.                         |
| <i>Operating force</i>                     | ... | ... | ... | 25—75 lb.                     |
| <i>Connecting cable (two × 2 ft. long)</i> | ... | ... | ... | <i>Duprensheath 6</i>         |

1. This element is similar to the crash trip element, Type 12c which is a later element and supersedes the 11c. The Type 11c element differs from the Type 12c in the length of the non-active gap between the switches. In the Type 11c the non-active gap is  $1\frac{1}{2}$  in.

2. Installation and servicing is identical to that given for the Type 12c element in Appendix 4 to which reference should be made. Crash trip element Type 11c will be replaced by 12c elements.

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