Chapter 8 MISCELLANEOUS (ELECTRICAL)

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LIST OF APPENDIXES

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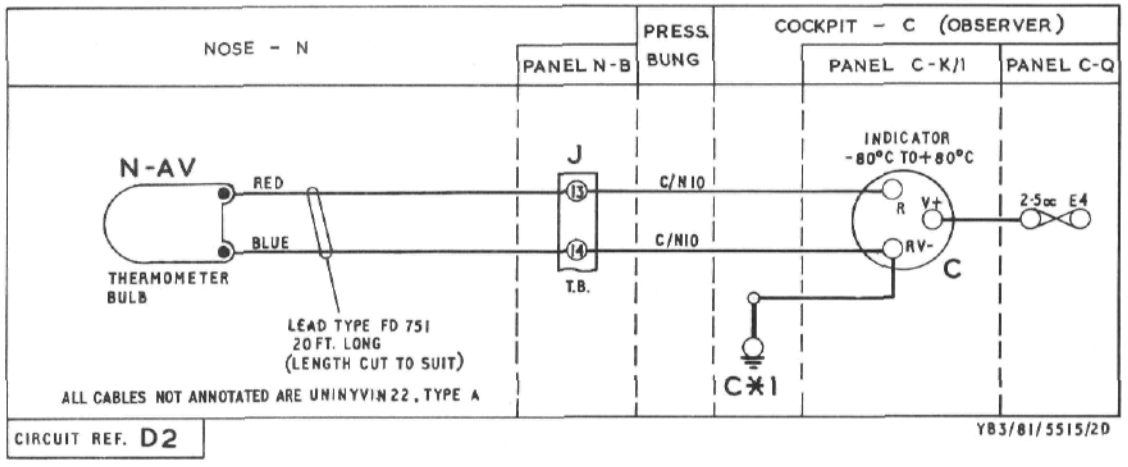

Fig. 1. Air temperature indication

Introduction

1. This chapter contains information on the miscellaneous electrically-operated instruments installed in the aircraft. Detailed information on the components of these circuits is in the Air Publications referred to in Chap. 1 of this Section; the same chapter also illustrates the location and means of access to the components.

Modification standard

2. This chapter includes Mod 12, 46, 214, 351 and 676.

AIR TEMPERATURE INDICATION

General

3. The ambient air temperature is measured by a thermometer comprising a resistance bulb, mounted on the underside of the fuselage adjacent to the port forward corner of the nose wheel bay, an indicator, labelled AIR TEMP, located on the observer's port console, and a connecting lead. The indicator is a ratiometer-type instrument with a scale graduated in degrees centigrade from −80 deg to +80 deg.

Operation *(fig 1)*

4. The supply for the thermometer is fed from fuse E4, in the normal d.c. fuse panel C-Q, to the indicator C on panel C-K/1. Any variation in ambient temperature is measured by the indicator, the arrangement being such that one coil of the indicator movement carries a reference current, while a current proportional to the resistance, and hence the temperature of the resistance bulb, flows through the other coil. The ratio of these two currents determines the position of the indicator pointer.

RADIO BAY TEMPERATURE INDICATION

General

5. The air temperature within the radio bay is measured by a thermometer which comprises a resistance bulb, mounted on the structure immediately beneath the auto-pilot computer in the radio bay, and an indicator, labelled RADIO BAY TEMP, located above the forward portion of the observer's port console. The indicator is a ratiometer-type instrument with a scale graduated in degrees centigrade from −50 deg to +100 deg.

Operation *(fig 2)*

6. The supply for the thermometer is fed from fuse P8, in the normal d.c. fuse

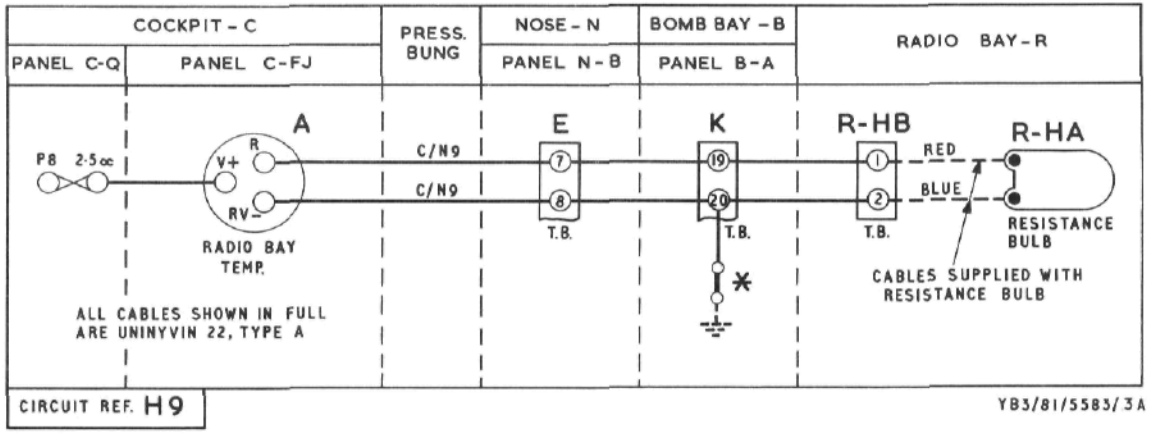

Fig. 2. Radio bay temperature indication

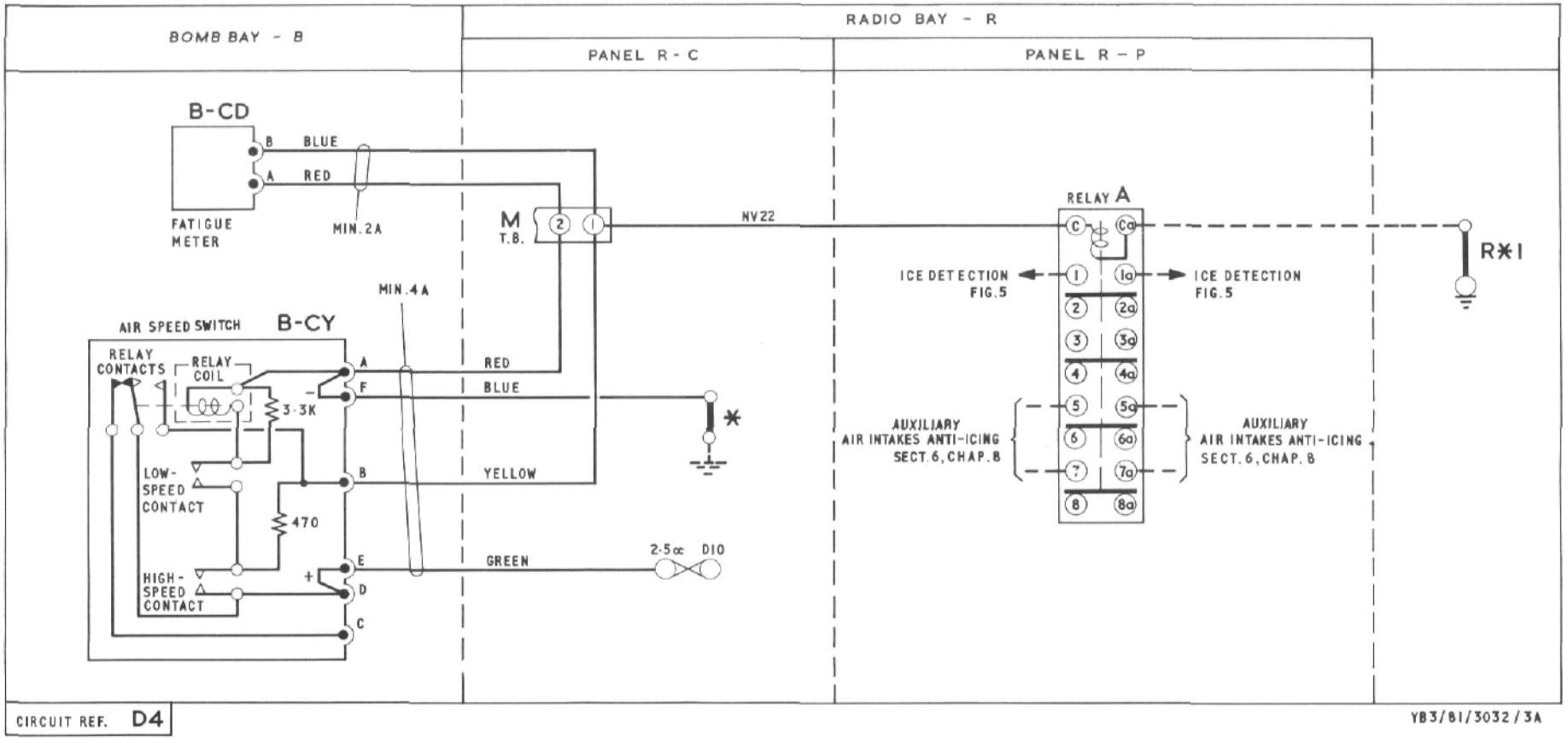

Fig.3. Air speed switch

◀ Corrections to annotations ▶

panel C-Q, to the indicator A on panel C-FJ. Any variation in the temperature within the radio bay is measured by the indicator in a similar manner to that described in para 4 for the air temperature indicator.

◀ AIR SPEED SWITCH

General

7. An air speed switch, B-CY operated ▶ by the main pitot-static system (*Chap.* 1, *this Section*), is mounted on the port side of the bomb bay. This switch receives an emergency 24V d.c. supply from fuse D10 in panel R-C; its purpose is to relay the supply to, or disconnect it from, certain instruments and other services at predetermined indicated air speeds.

Fatigue meter control

8. A fatigue meter, B-CD, fitted at the starboard side of the bomb bay, is required to measure and record positive and negative accelerations in excess of 0.4 'g', only when the aircraft is in flight. To ensure that this instrument always operates within the prescribed limits, the air ◀ speed switch acts as an automatic control ▶ unit.

Operation *(fig 3)*

9. When the indicated air speed rises to 145 knots, capsule-operated contacts and a relay, within the switch, connect the supply

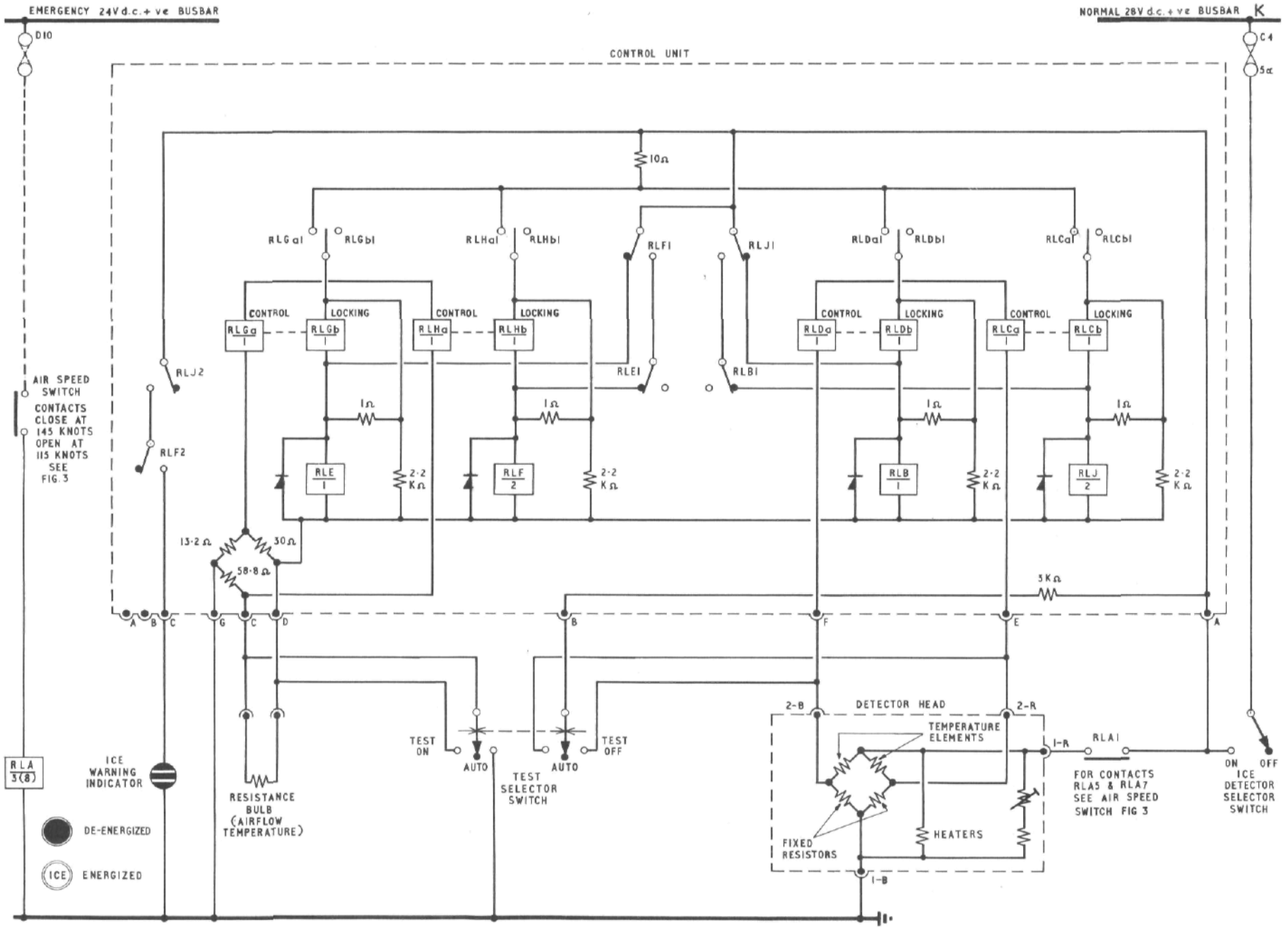

Fig.4. Ice detection – theoretical

◀ Corrections to annotations ▶

from fuse D10 to the fatigue meter and to relay A on panel R-P. The operation of relay A prepares the ice detection circuit (*para* 18), and the auxiliary air-intake anti-icing circuit (*Cover* 1, *Sect.* 6, *Chap.* 8), for subsequent selection. When the indicated air speed falls to 115 knots, the same capsule-operated contacts and relay, within the switch, are actuated to disconnect the supply, thus isolating the fatigue meter and the services controlled by relay A.

Servicing

◀ **10.** The air speed switch can be function-tested on the ground by using the pressurizing equipment referred to in Chap.1 as follows:- ▶

(1) Connect the pressurizing equipment to the wing-mounted pressure head or, if the wings are folded, to the pitot pressure test valve in the port undercarriage bay.

(2) Ensure that a d.c. supply is available at the emergency busbar and that the services controlled by relay A (*para* 9) are selected to OFF.

(3) Gradually increase the pressure at the test set, to the equivalent of 145 knots IAS; check that the contacts and ◀ relay within the air speed switch have ▶ operated, and that relay A is energized.

(4) Gradually decrease the pressure at the test set to the equivalent of 115 knots IAS; check that the contacts and relay ◀ within the air speed switch have re- ▶ verted to normal, and that relay A is de-energized.

(5) Disconnect the pressurizing equipment and ensure that the pitot-static system is rendered safe for flight.

ICE DETECTION

General

11. The ice detecting system indicates to the pilot the presence in the atmosphere of the two factors responsible for the formation of ice, i.e., free water and a local temperature at, or below, freezing point. The system comprises a temperature sensitive resistance bulb, an ice detector head, a control unit, a two-position magnetic indicator, a single-pole supply switch and a double-pole test switch.

Function

12. When the aircraft enters an atmosphere of free water, the resistance of the detector head varies in relation to the temperature difference between the two bulbs of the detector head. The variation in resistance causes a proportional change in the current of a signal to the control unit. Similarly the resistance bulb monitors the ambient air temperature and varies the current of a second signal to the control unit. When icing conditions prevail, the current signal of each control circuit operates an associated relay sub-system in the control unit. The concurrent operation of both relay sub-systems connects an operating supply to the solenoid of the ice warning indicator which is energized to show ICE in black letters on a white background.

Description

Temperature sensitive resistance bulb

13. A platinum resistance bulb, N-CY, which is mounted to protrude through the skin of the nose wheel door, is employed in the system to sense the ambient temperature of the atmosphere. The resistance of the bulb varies with the temperature and forms the variable arm of a Wheatstone resistance bridge in the control unit (*para* 16).

Detector head

14. The detector head, N-CV, comprises two platinum resistance bulbs, each within a housing which incorporates a heater element, and two resistance spools. The bulbs and resistance spools are connected within the head to form a Wheatstone resistance bridge circuit. The bulbs of the detector head protrude through the nose wheel door and are aligned with the longitudinal axis of the aircraft so that the front bulb shields the rear bulb from the air stream. When the aircraft enters a water bearing atmosphere the shielded bulb does not cool at the same rate as the front bulb and the temperature difference between the two bulbs causes a proportionate variation in their resistance thereby unbalancing the resistance bridge circuit; this, in turn, varies the current value and the polarity of a d.c. signal to the control unit.

Supply and test switches

15. The d.c. supply for the operation of the ice detector system, fed from fuse C4 on panel C-Q, is selected by a single-pole on-off switch, R, on the pilot's starboard switch panel. A double-pole 3-position switch, Q, located to the right of the supply switch is marked TEST OFF – AUTO – TEST ON, and is spring-returned to the AUTO position from both the TEST OFF and TEST ON positions. The switch permits the ice warning indicator and the relays of the control unit to be tested during flight or on the ground under conditions other than operating conditions.

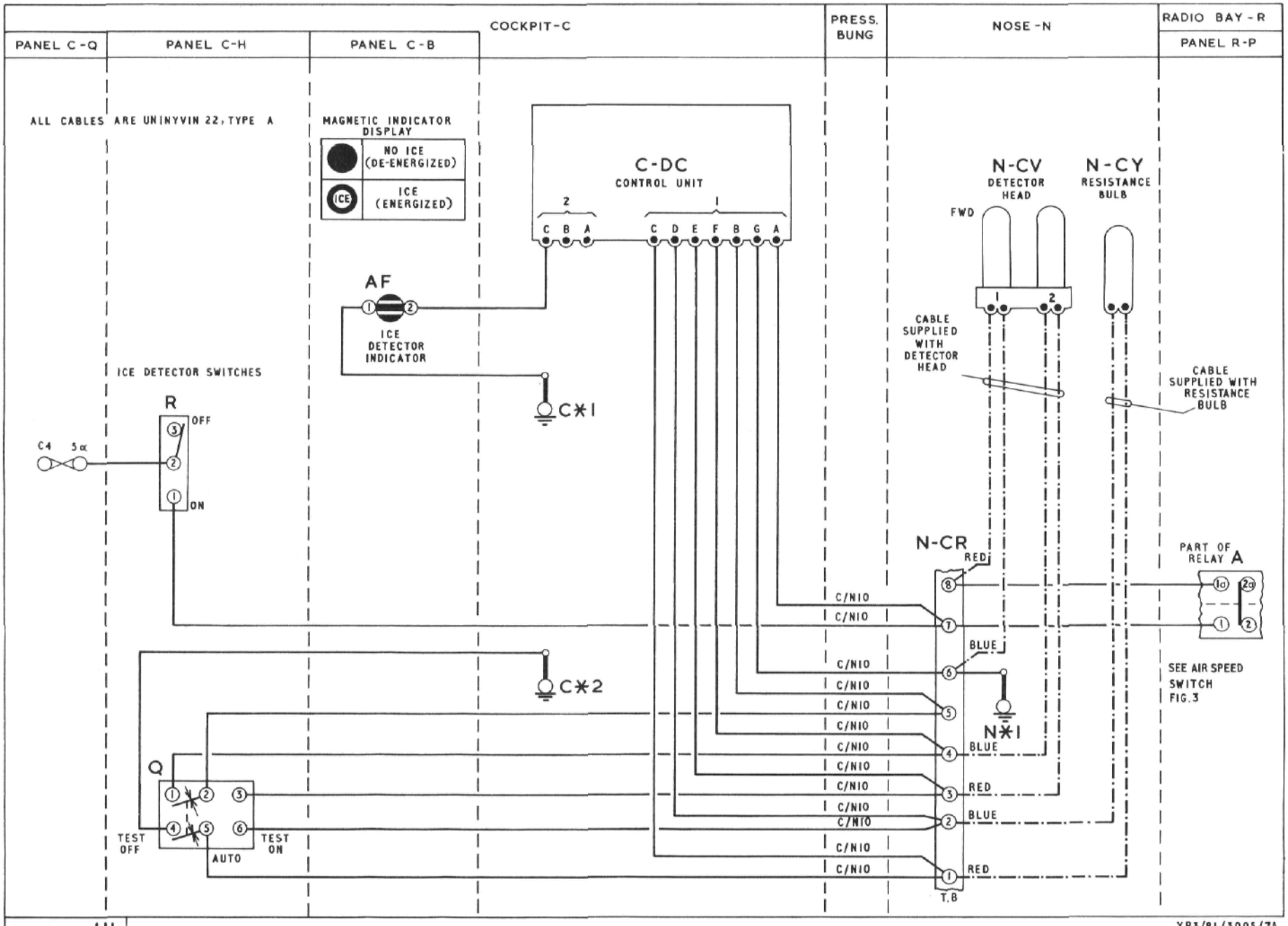

Fig.5. Ice detection

◀Cross-reference corrected ▶

Control unit

16. The control unit, C-DC, comprises a relay system and the fixed arms of a Wheatstone resistance bridge, the variable arm of the latter being the resistance of the temperature sensitive resistance bulb (*para* 13). The relay system comprises two sub-systems, one of which is controlled by variations in the resistance of the detector head and the other by variations in the resistance of the temperature sensitive resistance bulb. The conjunctive operation of both relay sub-systems connects a d.c. supply to the ice warning indicator.

Indicator

17. A two-position electro-magnetic indicator, AF, located centrally on the pilot's instrument panel and marked ICE WARNING, indicates the presence of icing conditions in the atmosphere. Under normal atmospheric conditions the solenoid of the indicator is de-energized and shows black. When icing conditions prevail the solenoid of the indicator is energized by a d.c. supply switched by the control unit and shows ICE in black letters on a white background.

Operation *(fig 4 and 5)*

Normal atmospheric conditions

◀ **18.** Provided the air speed switch functions (*para* 7) operation of this system is automatic when the supply switch R, on the pilot's starboard switch panel C-H, is set to ON. Contacts 2-1 of the switch connect a supply from fuse C4, in the normal d.c. fuse panel C-Q, via terminal 7 of T.B. N-CR, to the control unit C-DC and to contact 1 of relay A on panel R-P. The supply at the control unit selects the relay system ready for operation under normal atmospheric conditions and is also fed to the resistance bridge of the control circuit incorporating the resistance bulb N-CY. When relay A is energized, contacts 1-1a connect the d.c. supply to the control circuit formed by the detector head N-CV. ▶

Note...
To prevent overheating of the heater elements within the detector head the d.c. supply to the control circuit incorporating the detector head is only connected when relay A on panel R-P is energized. The d.c. supply for the operation of this relay is, in turn, switched by an air speed switch (para 7) *which causes the relay to be energized when the aircraft reaches a speed of 145 knots and to be de-energized when the aircraft speed falls to 115 knots.*

19. Under these conditions both control circuits remain stable but the operation of each is independent of the other. Their operations must concur to energize the ice warning indicator.

Icing conditions

20. *Temperature detecting control circuit.* If the ambient temperature of the atmosphere falls to, or below, freezing point the consequent change in the resistance value of the resistance bulb N-CY will unbalance the bridge circuit in the control unit. The unbalanced bridge causes a current with a particular polarity to flow through the solenoids of the control relays in the associated relay sub-system of the control unit C-DC. The function of the relay sub-system energizes a power relay which incorporates a set of contacts which are in series with the d.c. supply to the indicator AF on panel C-B. When the relay is energized the contacts close and, if the power relay of the water content detecting circuit relay sub-system is also energized, connect the d.c. supply to the indicator which, when energized, shows ICE in black letters on a white background.

21. *Water content detecting control circuit.* If free water is present in the atmosphere, the temperature differential between the two bulbs of the detector head N-CV causes a proportionate change in the resistance value of the variable arm of the resistance bridge formed by the detector head, thus unbalancing the bridge. The operation of the water content detecting control circuit is then similar to that described in para 20, the indicator only being energized if the power relay of the temperature detecting control circuit relay sub-system is also energized.

Reversion to normal atmospheric conditions

22. Any subsequent rise in the ambient temperature of the atmosphere above freezing point or dispersal of the free water in the atmosphere by evaporation causes the resistance bridge of the associated control circuit to reverse the polarity of the current flowing through the solenoids of the control relays in the particular relay sub-system. This de-energizes the relative power relay and its contacts open thereby disconnecting the d.c. supply to the indicator AF which, when de-energized, shows black. The system is then re-set for further operation.

Servicing

23. The indication circuit, and the relays in the ice detector control unit, can be tested for correct operation as follows:-

(1) Connect a d.c. electrical supply to the

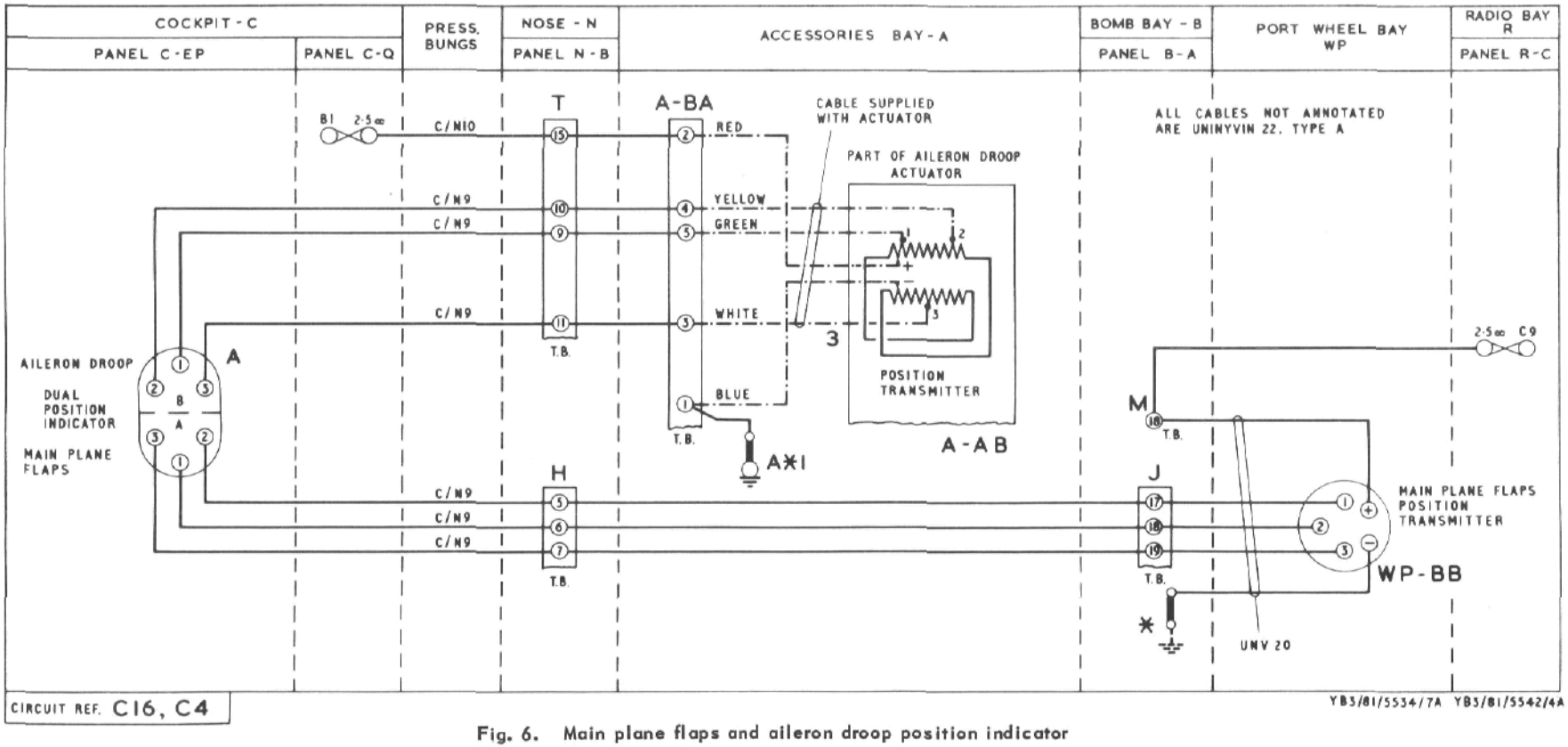

Fig. 6. Main plane flaps and aileron droop position indicator

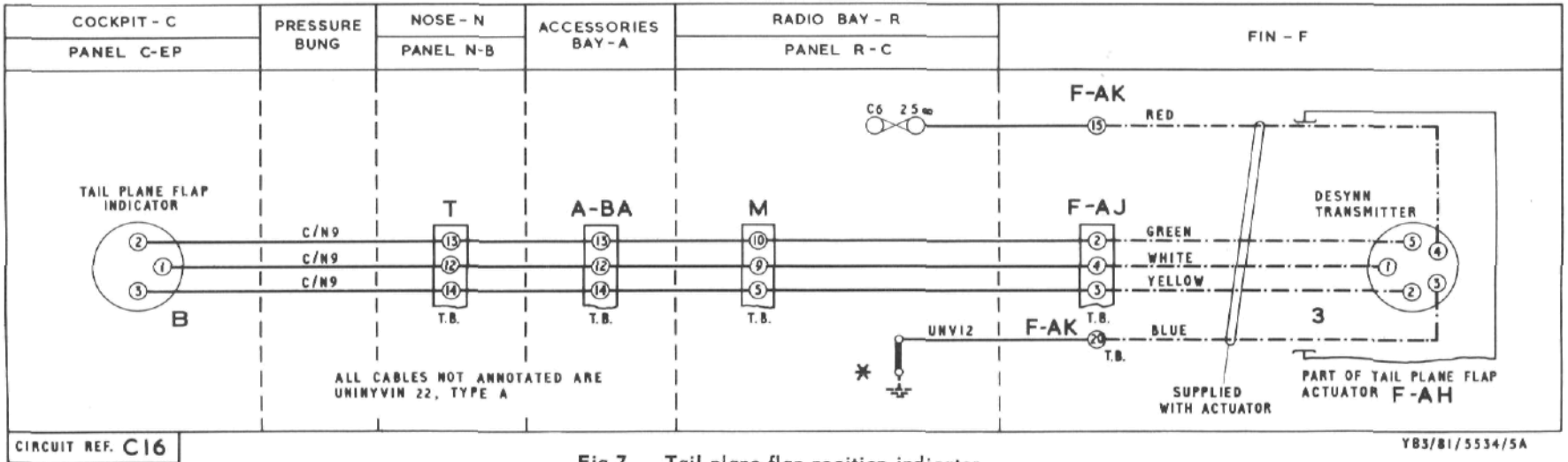

Fig.7. Tail plane flap position indicator

◀ Indicator ident corrected to B ▶

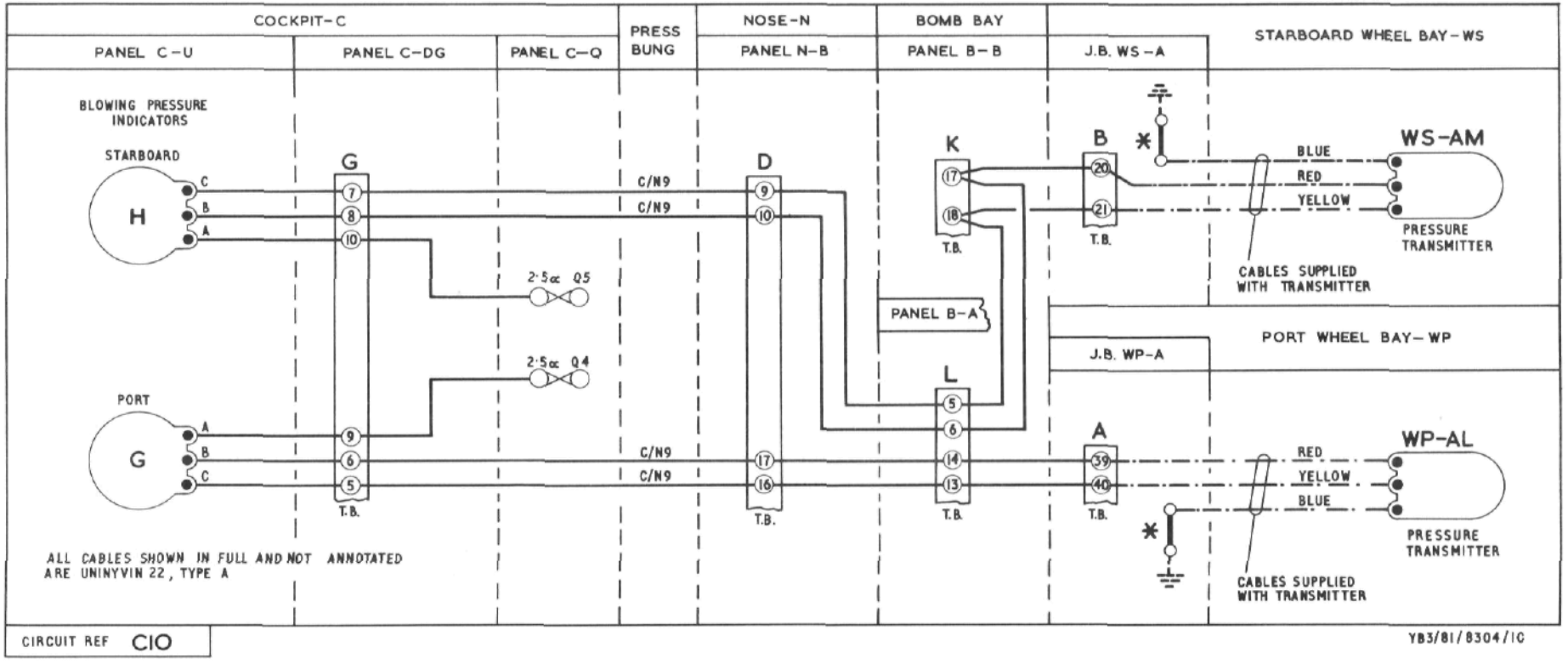

Fig. 8. Blowing system pressure gauges

aircraft external supply plug (*Cover* 1, *Sect.* 6, *Chap.* 1).

(2) Select the ice detector switch at the pilot's station to ON.

(3) Select and hold the ice detector test switch to TEST ON; ensure that the electro-magnetic indicator displays the word ICE.

(4) Select the test switch to TEST OFF and ensure that the indicator display reverts to its de-energized condition, i.e., black.

(5) Allow the test switch to return to AUTO; the indicator display should remain unchanged at black, unless the ambient temperature of the external surroundings is at, or below, freezing point. In the latter case the indicator display should change to show ICE.

(6) Allow the test switch to remain at AUTO and select the ice detector switch to OFF; ensure that the indicator display reverts to black.

(7) Disconnect the external electrical supply from the aircraft.

AILERON DROOP POSITION INDICATOR

(fig 6)

24. The amount of aileron droop is shown by a Desynn-type indicator A located on panel C-EP to port of the pilot's instrument panel. The current from fuse B1, in the normal d.c. fuse panel C-Q, for the operation of the indicator is varied in relation to the amount of droop by a position transmitter incorporated in the aileron droop actuator A-AB located in the accessories bay. Although the indicator is a completely independent instrument, it is

incorporated in the same unit as that indicating the position of the main plane flaps.

MAIN PLANE FLAPS POSITION INDICATOR *(fig 6)*

25. The position of the main plane flaps is shown by a Desynn-type indicator A located on panel C-EP to port of the pilot's instrument panel. The current from fuse C9, in the d.c. distribution panel R-C, for the operation of the indicator is varied in relation to the angle of the flaps by a Desynn transmitter WP-BB which is mechanically linked to the port flap control assembly on the aft face of the rear spar in the port wheel bay. The indicator, although a completely independent instrument, is incorporated in the same unit as that indicating the amount of aileron droop.

TAIL PLANE FLAP POSITION INDICATOR *(fig 7)*

26. The position of the tail plane flap is shown by a Desynn-type indicator B located on panel C-EP to port of the pilot's instrument panel. The current fed from fuse C6, in the d.c. distribution panel R-C, for the operation of the indicator is varied in relation to the angle of flap by a Desynn transmitter incorporated in, and operated by, the tail plane flap actuator F-AH in the tail plane top fairing.

BLOWING SYSTEM PRESSURE GAUGES *(fig 8)*

27. The pressure of air being fed from the blowing system to the aileron blowing slit of each wing is detected by a pressure transmitter connected to the air duct immediately outboard of rib 80 in the inner wing. The transmitter controls a d.c. supply to an associated gauge which shows the pressure on a scale graduated from 0 to 120 lb/in^2 in 5 lb/in^2 divisions. The two gauges are mounted side-by-side on panel C-U, on the cockpit wall immediately above the pilot's port console and are marked BLOWING SYSTEM, PORT WING and STBD WING. The d.c. supply for the operation of each gauge is fed from the normal d.c. fuse panel C-Q; that for the port wing gauge from fuse Q4 and that for the starboard wing gauge from fuse Q5.

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◀ *Air speed switch (Mod 985)*	3 ▶

Appendix 1 MAIN PLANE FLAPS POSITION INDICATOR (Mod 452 Part B)

ILLUSTRATION

	Fig
Main plane flaps and aileron droop position indicator	1

1. On aircraft with Mod 452, Part B incorporated the transmitter, 132FL, Type C, in the main plane flaps position indicator circuit is replaced by an improved transmitter, 135 FL,Type D. As the new transmitter functions in the opposite sense to the previous one, i.e., anti-clockwise instead of clockwise, the wiring at the position indicator is revised to suit this, as shown in fig 1. The operation of the circuit is unchanged from that described in basic chapter.

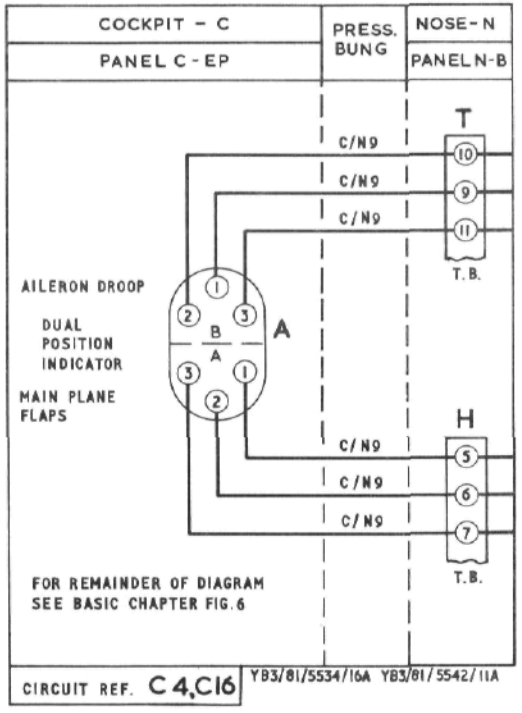

Fig.1. Main plane flaps and aileron droop position indicator
◀ Cross-reference corrected ▶

Appendix 2 MAIN WHEEL TYRE, RADIO BAY AND BOMB BAY TEMPERATURE INDICATION (Mod 836, Part A)

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ILLUSTRATION

	Fig
Main wheel tyre, radio bay and bomb bay temperature indication	1

General

1. On aircraft with Mod 836, Part A incorporated, the indicator A on panel C-FJ in the radio bay temperature indication system (*para 5 of the basic chapter*) is replaced by a different indicator which is used to show, in addition to the radio bay temperature, the temperature of the port main wheel tyre and the temperature in the bomb bay. The new indicator is labelled MISC TEMPS and is calibrated from 0 to 150 deg C. Additional temperature transmitters are introduced, one in the port wheel bay and one in the bomb bay, and a 2-pole, 6-way, rotary selector switch is mounted on panel C-UF above the observer's port console. The selector switch has six numbered positions, in addition to OFF, although only the first three positions are used, these being labelled 1. TYRE, 2. RAD. BAY, 3. BOMB B. One of the additional temperature transmitters, mounted on an arm extending from rib 56 in the port wheel bay, enables the observer to read off the tyre temperature when the undercarriage has retracted and switch position No. 1 is selected. Similarly, the existing transmitter beneath the autopilot computer in the radio bay, and the other additional transmitter, located between frames 354 and 370.5 on the port side of the bomb bay, enable the respective bay temperatures to be read off when switch positions No. 2 and 3 are selected.

Operation *(fig 1)*

2. A d.c. supply from fuse P8 in the normal fuse panel C-Q, is taken to one of the wafers in the rotary selector switch. When the switch is selected to any of the first three positions the supply is fed to

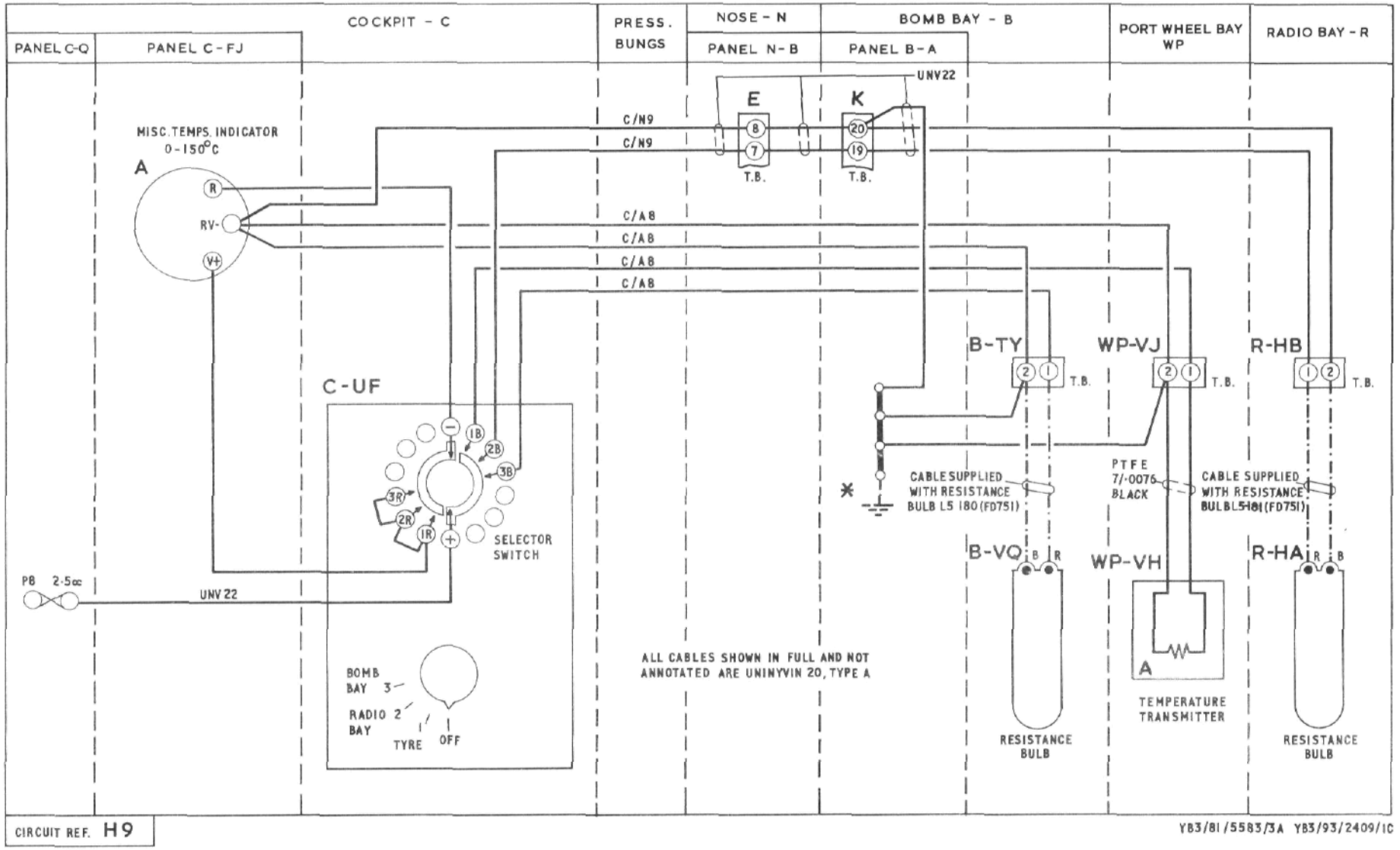

Fig. 1. Main wheel tyre, radio bay and bomb bay temperature indication

the indicator, and the appropriate temperature transmitter is connected to the indicator via a second wafer in the switch. A reference current is carried by one of the moving coils in the indicator, while a current proportional to the resistance obtained at the heat-sensitive transmitter is relayed back to influence the other moving coil. Thus the instrument monitors the ratio between these currents, and the resultant pointer movement registers in terms of ambient temperature.

Note...

Efficient performance of the temperature transmitter in the port wheel bay is critically dependent upon correct contact with the retracted tyre. Ensure, therefore that the arm to which the transmitter is attached is not distorted.

Function test

3. The system may be tested for correct functioning as follows:-

(1) Connect a d.c. electrical supply to the aircraft external supply plug (*Cover* 1, *Sect.* 6, *Chap.* 1).

(2) Place a standard mercury-in-glass thermometer adjacent to the temperature transmitter in the port wheel bay. Move the selector switch at the observer's station to position 1.

(3) After three minutes have elapsed, compare the reading on the mercury-in-glass thermometer with that on the indicator at the observer's station. The readings should be within ±3 deg C of each other.

(4) Remove the thermometer from the port wheel bay and place it adjacent to the temperature transmitter in the radio bay. Move the selector switch to position 2.

(5) Repeat operation (3).

(6) Remove the thermometer from the radio bay and place it adjacent to the temperature transmitter in the bomb bay. Move the selector switch to position 3.

(7) Repeat operation (3)

(8) Remove the thermometer from the bomb bay, return the selector switch to OFF and disconnect the external electrical supply from the aircraft.

◄ Appendix 3 AIR SPEED SWITCH (Mod 985) ►

LIST OF ILLUSTRATIONS

	Fig
◄ *Air speed switch ... ...*	*1* ►
Ice detection (post-Mod 985) – theoretical	*2*

1. On post-Mod 985 aircraft, the d.c. power supply for the services controlled ◄ by the air speed switch is taken from the ► normal d.c. busbar J instead of the emergency d.c. busbar as previously. The modification involves a minor wiring alteration, the cable previously connected to fuse D10 in panel R-C being re-identified and connected to fuse E10 in the the same fuse panel, as shown in fig 1 and 2.

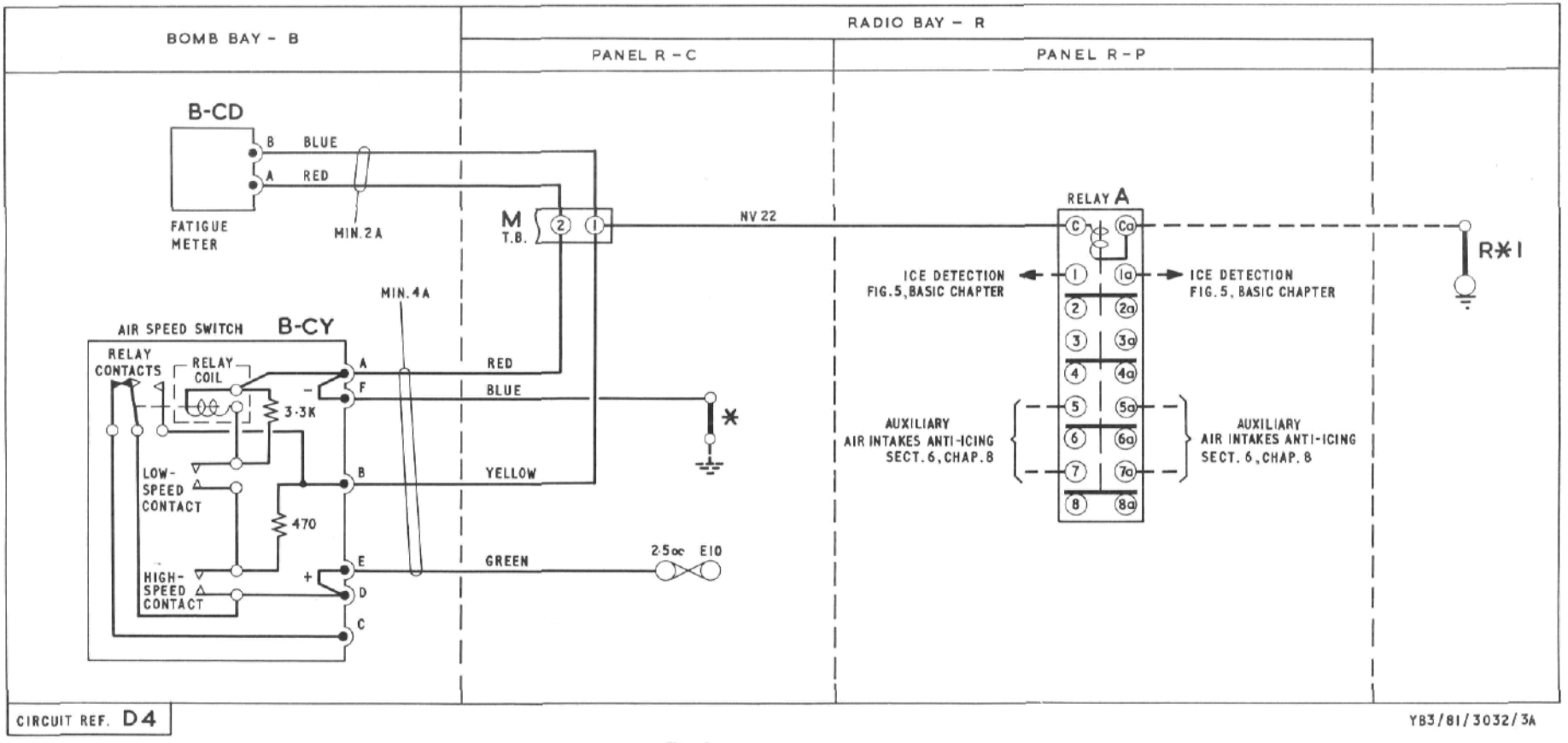

Fig.1. Air speed switch
◄ Corrections to annotations ►

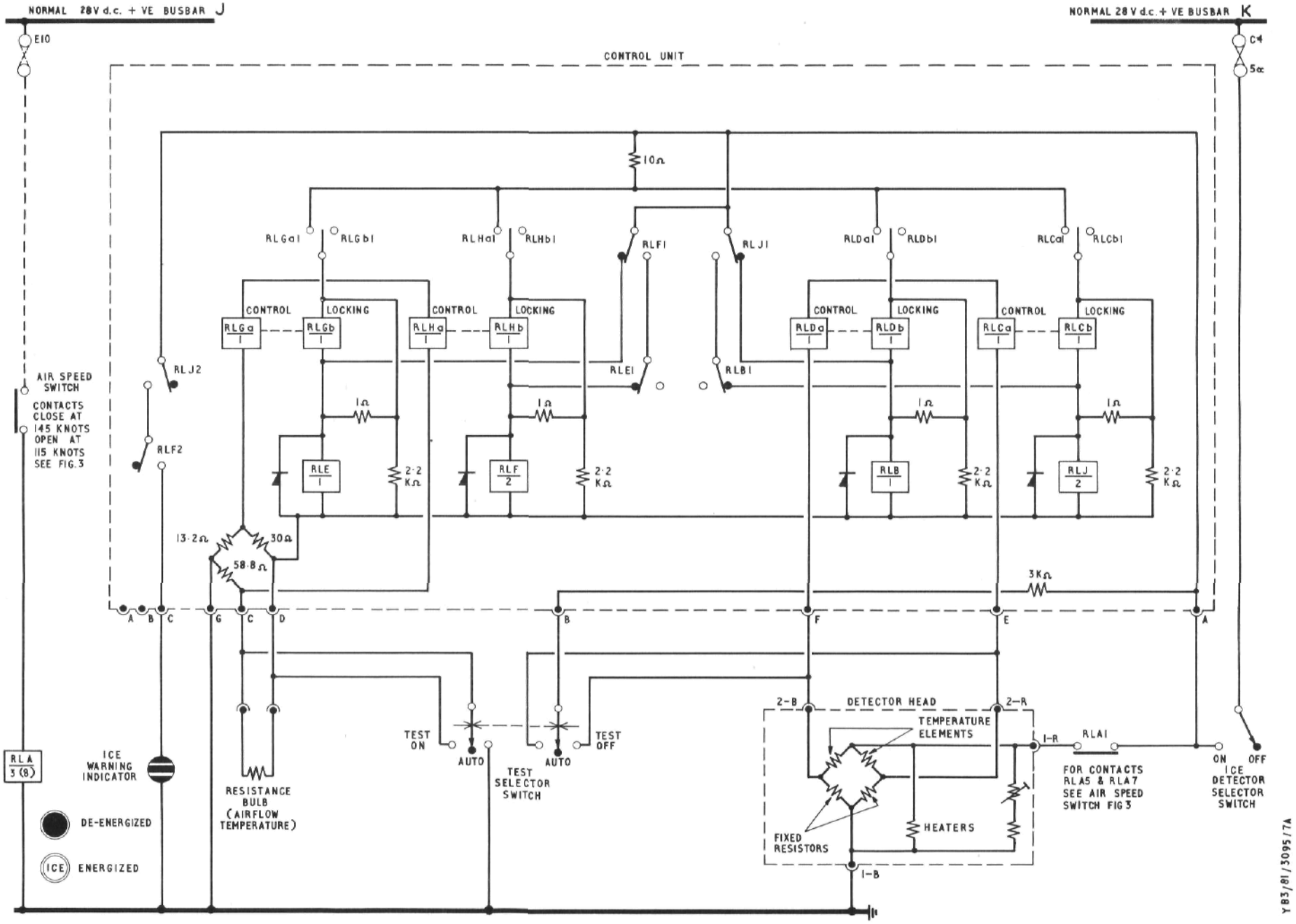

Fig.2. Ice detection (post-Mod 985) – theoretical

◀ Corrections to annotations ▶