CHAPTER 3G
AIRFRAME ICING DETECTION AND DE-ICING CONTROLS
(Completely revised)

LIST OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

Introduction

1. The services described in this chapter are:-

Ice detection.
Pilot's and air bomber's windscreen de-icing.
Front gunners windscreen de-icing
Wing and tail de-icing

The services are dealt with separately in the following notes. Each system is described and the positions in the aircraft of the various components illustrated. Routing charts will be found at the end of the chapter.

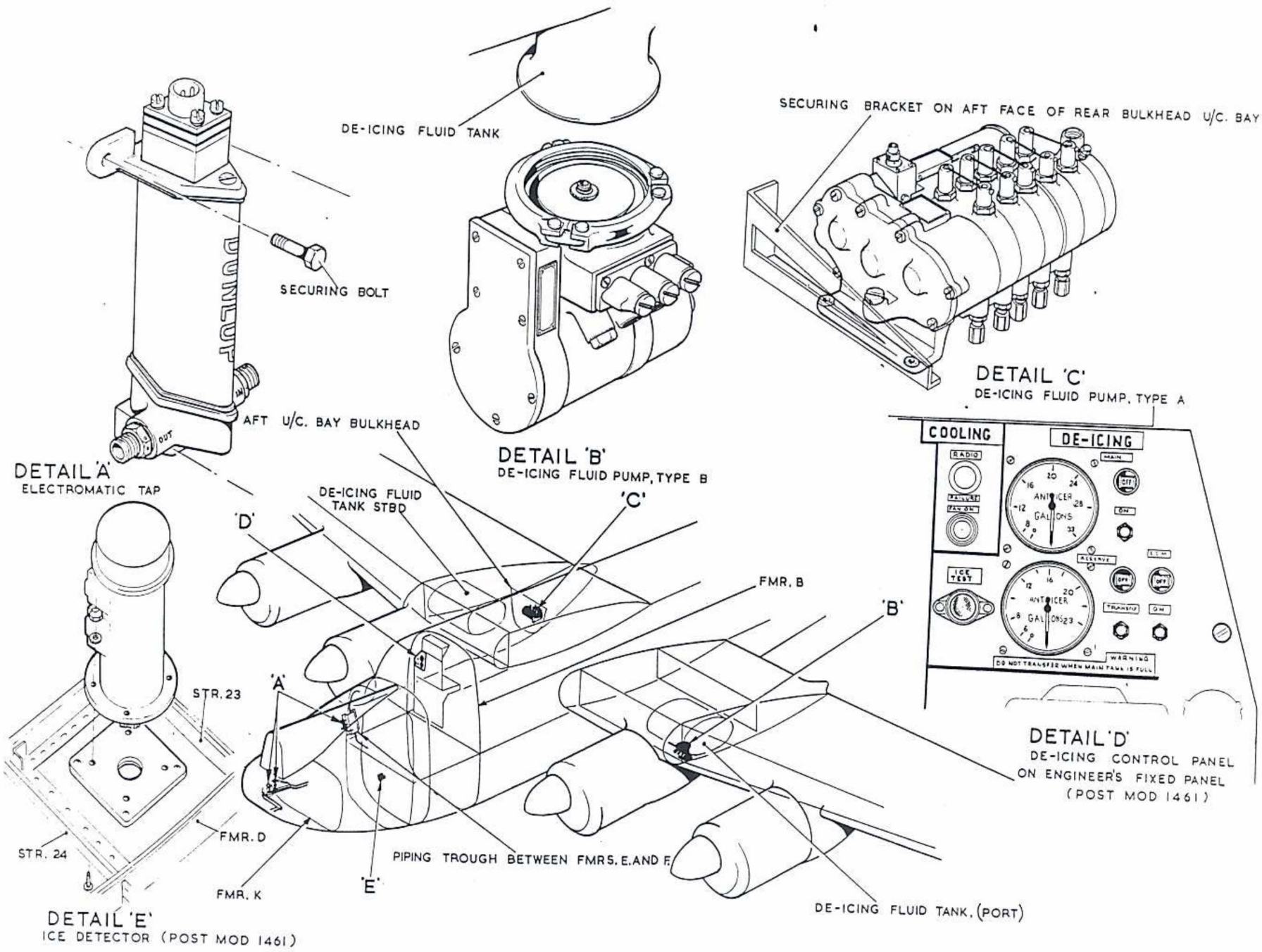

Fig. 1. Location of equipment

Mod 1461

DESCRIPTION AND OPERATION

Ice detection (Post Mod.1461)

2. With the introduction of Mod.1461 an ice detection system is fitted to the aircraft and consists of the following equipment:-

Ice detector	Fitted into the lower section of the fuselage skin at former D, stringers 23 and 24.
Ice warning lamp indicator	Fitted on the pilot's centre panel 'C'.
Test push switch	Fitted on the engineer's De-icing panel.
Relay No.414	Fitted on the engineer's bulkhead at the rear of his panel.

Ice detector

3. The ice detector illustrated in fig. 3 and 4 is an electro-mechanical device designed to initiate ice warning at the commencement of and throughout an icing encounter. The detector consists of a small serrated rotor which is rotated adjacent to a fixed knife edge cutter by a small a.c. motor. The detector is fitted to a mounting plate at former D between stringers 23 and 24 so that the serrated rotor and knife edge are exposed to the airstream.

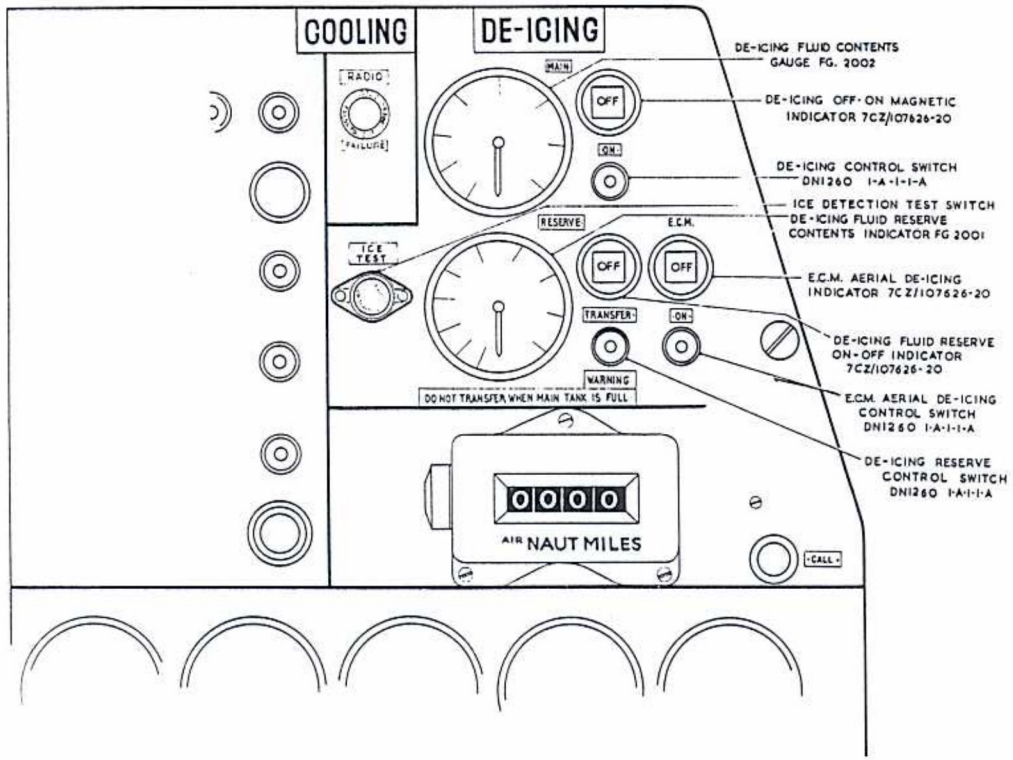

Fig.2 Icing detector and de-icing controls - engineer's station

4. The casing of the motor is connected to a micro switch via a spring loaded toggle bar. The motor is enclosed by a cylindrical housing which is sealed to withstand a pressure differential of 10 p.s.i. Silicone rubber 'O' rings interposed at the joints effect sealing from cabin pressure. Three holes through the assembly vent the unit to outside ambient conditions. Electrical connections are made via two 3-way terminal blocks.

Circuit operation

5. With the landing gear selected UP (Chap.3D) and with reference to fig.6 it will be seen that relay No.414 will be energised to close its contacts 1-2. A 115-volt, single phase, 400 c.s. supply via fuse BC8 (No.1 or No.3 inverter running) will now be connected to the ice detector motor. The rotor is continuously driven by the motor so that its periphery revolves within 0.002 in. of the cutter. The torque required to drive the rotor under non-icing conditions will be very slight. Under icing conditions however ice will accrete on the rotor and a subsequent shaving action by the knife edge cutter will produce a rise in torque. This increase in torque will cause the motor to turn in its mounting and operate the toggle against a spring tension. The micro switch plunger which is in contact with the toggle bar will operate to switch 28-volt d.c. supply via fuse VV2 to light the red warning lamp on the pilot's centre panel.

6. When the icing encounter has passed and the cutter ceases to shave ice the torque will be reduced. The spring tension on the toggle bar will return the motor to the non-icing position to operate the micro switch and cancel the warning indication.

Engineer's test

7. With the aircraft on the ground and the No.1 or No.3 inverter running the engineer can test the operation of the detector motor by pressing the test push-switch on his panel. In this case the warning light will not operate as the motor rotor will be turning with very little torque. Refer to para.19 for other test.

Pilot's warning indication

8. The filament on the pilot's warning indicator can be tested by pressing the top of the assembly.

WINGS AND TAIL DE-ICING

9. The build up of ice on the leading edges of the wing and tail is minimised by pumping a fluid to the affected area. When the fluid mixes with the ice it produces a slush which is swept away by the airstream. A description of this form of de-icing (T.K.S.) will be found in A.P. 1464D, Vol.1, Sect.4. The system fitted to this aircraft is of a modified form, in that the ice detector and controller is not used. This means that the motor driven pumps will be working at full capacity whenever they are switched on.

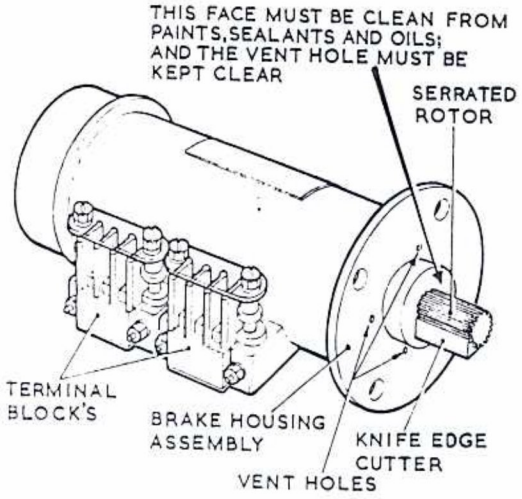

Fig.3 Ice detector - general view

10. Fluid for the de-icing of the leading edges of the main planes, tail plane and fins is carried in two tanks (main and reserve) fitted aft of the rear spar in the port and starboard main wheels compartment. A.T.K.S. Type B, pump is mounted on the underside of the main tank. A.T.K.S., Type A, pump for the reserve tank is fitted on the rear face of the bulkhead below the rear spar at the aft end of the starboard mainwheel. Type B4 suppressors are fitted for each pump motor.

11. Main and reserve fluid contents gauges, Smith's, Type FG.2002 and magnetic indicators Plessey, Type 7CZ/107626/20, are fitted to the engineer's main panel. The main and reserve control switches, Dowty Type DN1260 1-A-1-1A, are also fitted to the engineer's main panel. The fluid contents transmitters are of the float type (Sect.7, Chap.6).

Circuit operation

12. With the main de-icing switch selected to ON, a supply from fuse GG1, in the main power panel, will be fed to the main pump motor. At the same time the supply will be connected to the main magnetic indicator to show ON.

13. When the fluid in the main tank is running low, operation of the transfer switch to TRANSFER, will start up the second pump motor via the supply from fuse WW1 in the main power panel. At the same time the transfer magnetic indicator will be operated to show that fluid is being pumped into the main tank. Observation of the reserve tank contents gauge will show the quantity of fuel being transferred. It should be noted that the transfer switch must not be operated when the main tank is full. The fuses for the transmitters are GG2 for the main tank and WW2 for the reserve tank, both fuses being in the main power panel.

PILOT'S, GUNNER'S AND AIR BOMBER'S WINDSCREEN DE-ICING

General

14. The formation of ice on the pilot's front gunner's and the air bomber's windscreens is prevented by spraying the screens with a de-icing fluid. This fluid is contained in a tank situated in the forward fuselage, in a position which makes it possible to refill from inside the aircraft. The tank is pressurised at 7 p.s.i. from the aircraft pneumatic system. From the tank, pipe lines are taken via electrically operated valves to sprinklers on the windscreens, so that the fluid will be sprayed whenever the valves are opened. Separate control switches, Dowty Type DN1260-1-A-1-1-A are fitted for each windscreen. Physical aspects of the system will be found in Book 1, Sect.3 of this publication.

Control valves

15. The control valves fitted are Dunlop Type AC11326. Two are fitted on the air bomber's de-icing panel, these control the supply of de-icing fluid to the gunner's and air bomber's windscreens. A similar control valve for the pilots' windscreen supply is fitted in the pipe run on the starboard side of the nose. Fuses are WW4 in the main power panel (pilot's) BP4 (air bomber's) and BP5 (gunner's), on the air bomber's panel.

SERVICING

Ice-detector

16. Examine the terminal blocks and wiring on the detector for cleanliness and general condition. Under no circumstances must the terminal blocks be removed from the unit as these are sealed to the casing by a special compound.

Insulation resistance checks

17. Disconnect external wiring to the terminal blocks. Measure the resistance between the metal case of the unit and terminals 4 and 6 (in turn) on the red terminal block. This resistance must not be less than 20 megohms, 500-volt d.c. applied for 15 seconds.

18. Measure the resistance between the metal case of the unit and each terminal (in turn) on the black terminal block. This resistance must not be less than 20 megohms for 15 seconds.

Torque test

Aircraft on ground

19. If a torque test indicator, (Ref.No. 1H/456), is available a torque test of the detector can be carried out using the engineer's test push-switch as follows:-

(1) With d.c. power switched to the aircraft bus-bars, start up the No.1 inverter.

(2) Insert the blade of the torque test indicator into the slot of the serrated rotor (fig.5).

(3) Operate the test push-switch on the engineer's panel to start up the ice detector motor. Check that the warning lamp on the pilot's centre panel lights as the ratchet on the test indicator slips.

(4) Remove the test indicator and ensure that the ice detector warning lamp goes out. Release engineer's push-switch.

(5) Switch off the No.1 inverter and then the d.c. power supplies.

Defective units

20. If a unit is proved to be defective it must be removed from the aircraft and returned to the appropriate repair depot.

De-icing system

21. Periodical checks should be made to ensure that the connections are secure at the components, and that the wiring is free from external damage. Instructions for checking the complete system will be found in Sect.3 of this publication.

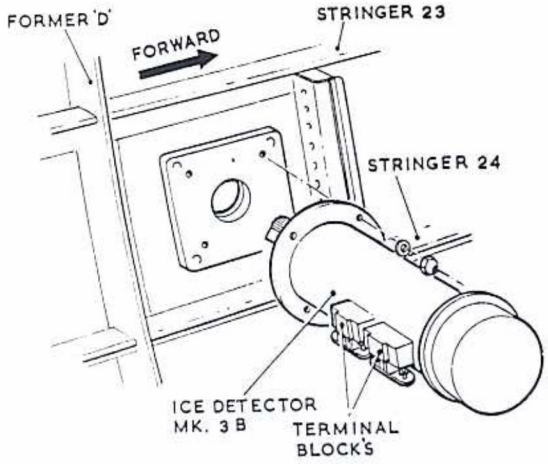

Fig.4 Ice detector - assembly to A/C

TABLE 1

Major items of equipment

Equipment	Type	A.P. Reference
Ice detector	NF.0075/1120	◀ A.P.107C-0104-1 ▶
Control valves	Dunlop A.C.11326	-
Pump	T.K.S. A	◀ A.P.107C-023-1 ▶
Pump	T.K.S. B	

REMOVAL AND INSTALLATION

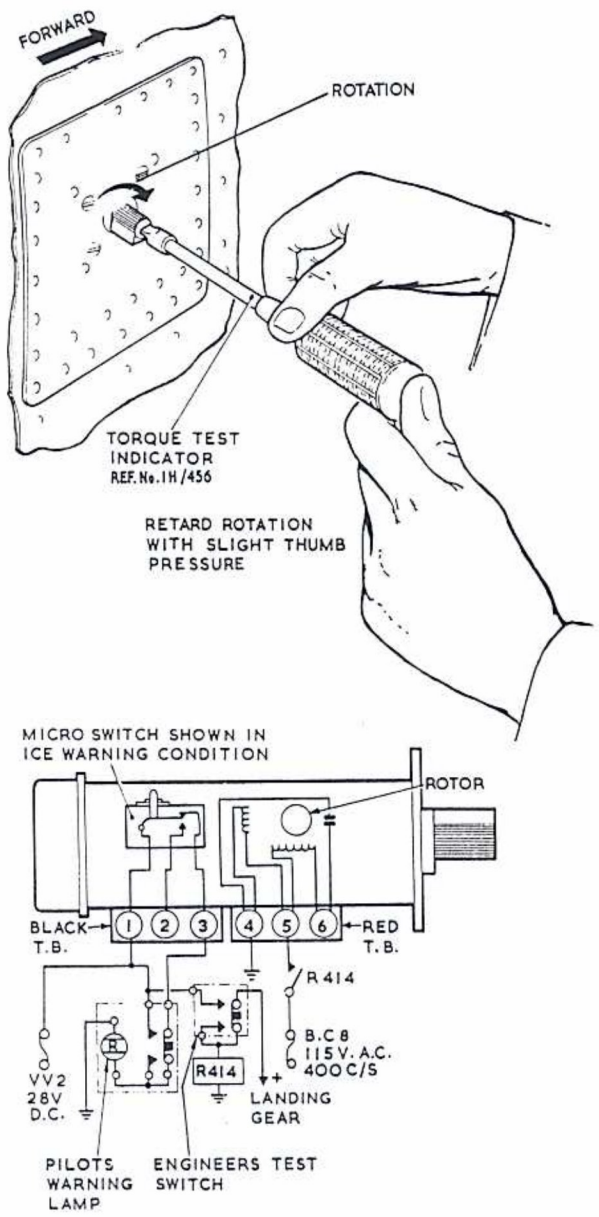

Fig.5 Ice detector - method of torque testing

Detector unit

22. The detector unit is easily removed from the aircraft as follows:-

(1) Remove fuses VV2 (main power panel) and B.C.8 (A.C. supplies panel).

(2) Disconnect wiring from the two terminal blocks, protect and stow.

(3) Remove the four bolts holding the unit to the mounting plate and retain the four bolts for refitting.

(4) When re-fitting the detector ensure that the cutter is downstream of the splined rotor in relation to the airstream.

De-icing equipment

23. Removal and installation of the various components in the airframe de-icing system is fully covered in Sect.3 of this publication.

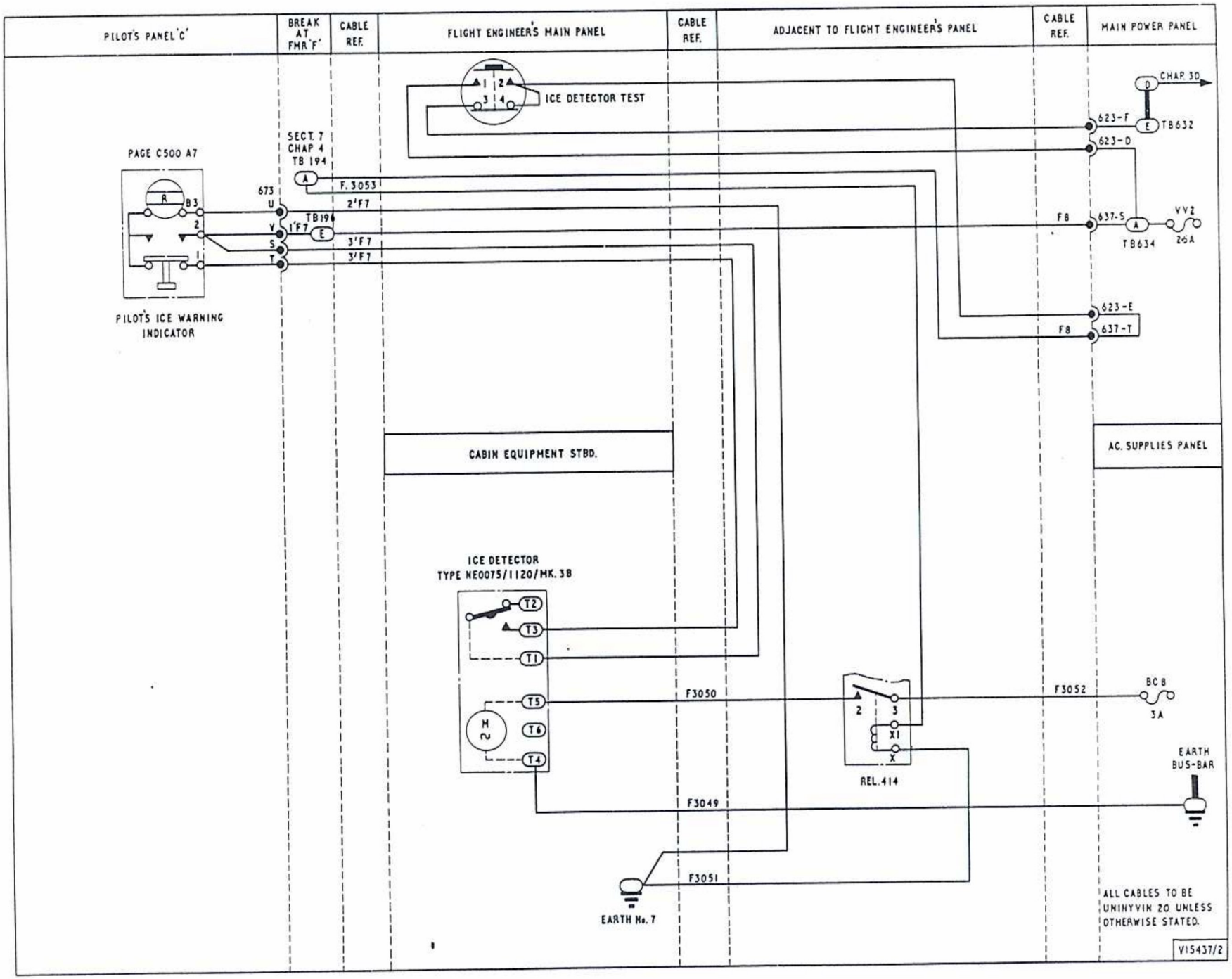

Fig. 6 Ice detection

‹Relay 414 terminal numbers changed›

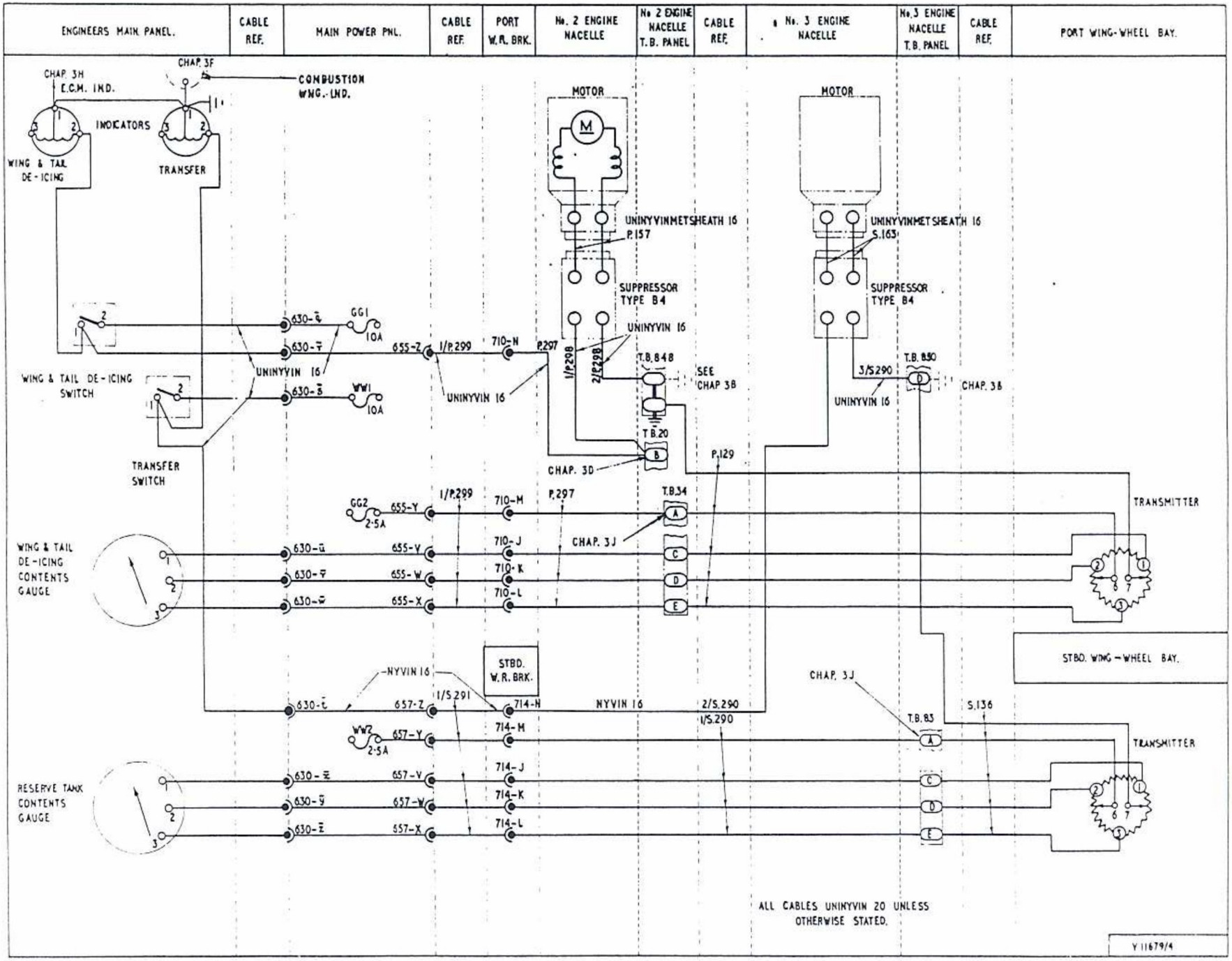

Fig. 7. Wing and tail de-icing.

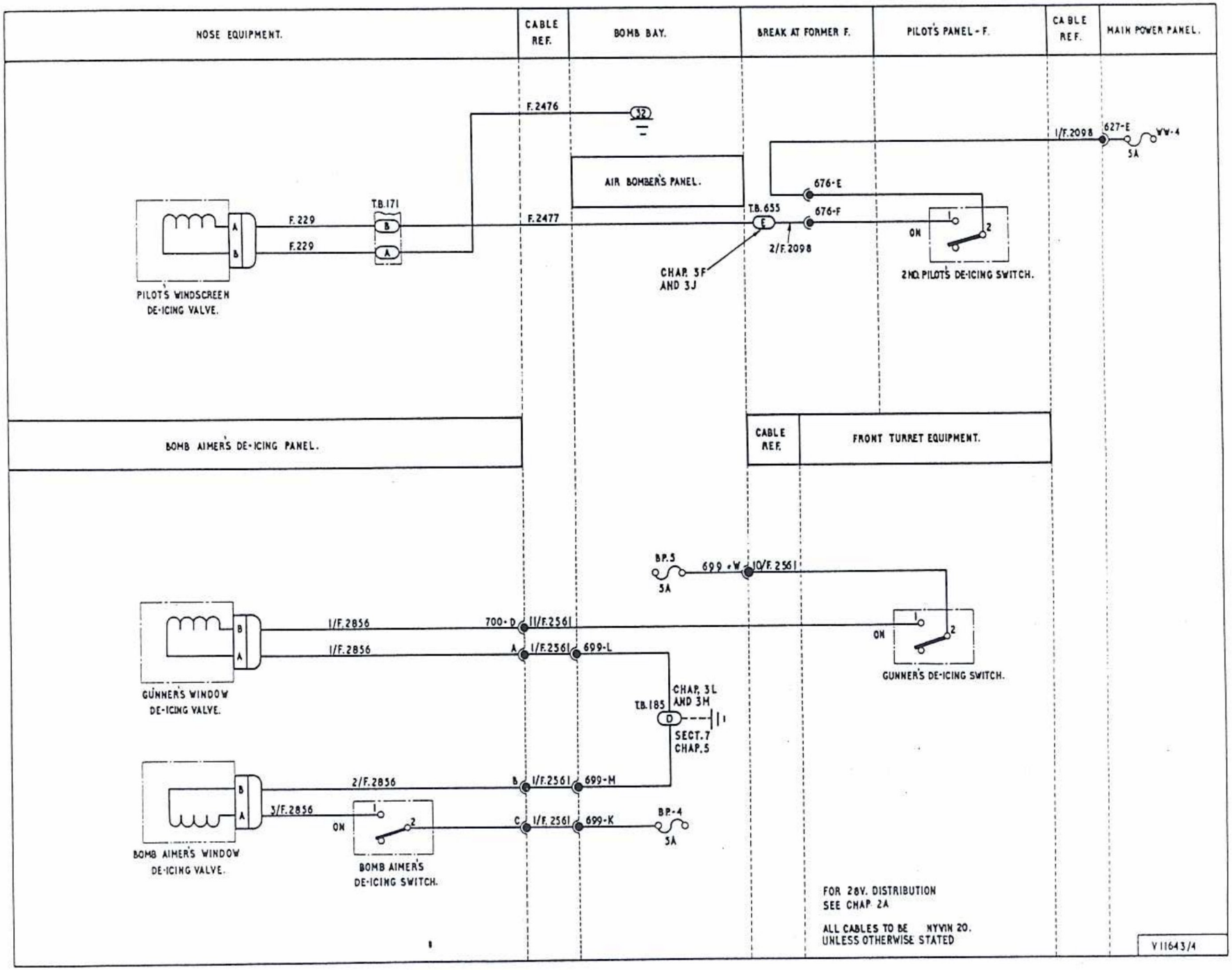

Fig. 8 Pilot's and air bomber's windscreen de-icing.

◄ *Cross refs added* ►