

CF-105 SERVICE DATA

ELECTRICAL SYSTEM

Section 28

ENGINE DE-ICING

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**CF-105 SERVICE DATA**  
SYSTEM DATA SHEET

SYSTEM <b>ELECTRICAL</b>	SUB-SYSTEM <b>ENGINE DE-ICING</b>	AIRCRAFT EFFTY <b>25201</b>	REF. NO. <b>11-8</b>
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**DESCRIPTION**

**General**

1. A de-icing system is fitted to prevent ice building up on the engine air intake ducts and ramps and on the engine guide vanes. The ducts and ramps are de-iced by electro-thermal boots, and the guide vanes by hot air from the engine compressor.
2. An electrical ice detection and control system governs current delivery to the de-icing boots and to the hot air shut-off valve.

**Ice Detection**

3. An ice detection circuit is provided for each engine air intake duct. Included in each circuit is a detector probe and a reference probe, both being mounted on a bracket positioned approximately 12 inches inside the duct. Each probe incorporates a heating element and has a number of holes in its forward and aft face. The reference probe is continuously heated from the main d-c bus, and the detector probe is heated intermittently during icing conditions.
4. The detector and reference probes are connected to opposite sides of a pressure switch. During ice free conditions, the airflow through the holes of both probes creates a pressure on both sides of the pressure switch, which keeps the switch contacts open.
5. When icing conditions are encountered, formation of ice on the forward holes of the detector probe decreases the pressure on the detector probe side of the pressure switch and the switch contacts close. This action relays a 28V d-c supply to the heating element in the detector probe and to a de-icing cycling time controller which initiates the operation of the de-icing circuits. The supply circuit to the de-icing cycling time controller is interconnected with the master warning system. This effects the illumination of the ICE indicator light on the master warning panel and the amber coloured master indicator light located on the main instrument panel.
6. When the heating element melts the ice on the detector probe, the pressure switch contacts open and interrupt the supply to the heating element and cycling time controller.
7. The pulse from the RH ice detection circuit to the cycling time controller is routed via the normally closed contacts of a RH ice detector relay.
8. The pulse from the LH ice detection circuit energizes a LH ice detector relay which has two pairs of normally open contacts. When this relay is energized, one pair of contacts completes the pulse circuit to the cycling time controller. The other pair energizes the RH ice detector relay which prevents pulses from the RH detector being fed to the controller. The controller feeds back a holding supply for this relay so that once it starts operating, the LH detector becomes the master detector.

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Engine Air Intake Ducts and Ramps De-icing

9. Two circuits are provided, one for the LH and one for the RH engine. These circuits are electrically identical, and independent but for the cycling time controller, which is common to both circuits. The following description, therefore, applies equally to each circuit.

10. The de-icing boots are manufactured from synthetic rubber and embody electrically heated elements. When the system is operative some of the elements are intermittently heated and the others are continuously heated. Those which are intermittently heated are arranged in groups, each group constituting a shedding area. The continuously heated elements are arranged to form a system of parting strips which circumscribe the shedding areas and separate them each from the other. The parting strips range in width between one-eighth inch and one-half inch. The number of shedding areas and parting strips contained in a particular boot depends upon the dimensions of that boot.

11. During icing conditions, the parting strips, being continuously heated, prevent the formation of large ice masses. The intermittent operation of the shedding areas melts the undersurface of any ice that forms between parting strips and permits it to be swept off by the airflow.

12. Seven de-icing boots, with a total of twelve shedding areas and sixteen parting strips are fitted over an area extending from the leading edge of the ramp to approximately 12 inches inside the air intake duct.

13. Of the twelve shedding areas, all but two are equipped with electro-thermal switches or sensors, each switch being attached to the underside of its shedding area. Two parting strips are also fitted with electro-thermal switches.

14. The shedding area sensors are connected in series and are in circuit with the supply line to the coil of a control relay in the load distributor. The two parting strip sensors are likewise connected and they are in circuit with the supply line to the coil of a parting strip power supply relay. If the temperature of a shedding area or parting strip exceeds 120°F, the appropriate sensor will operate and interrupt the supply circuits to the heating elements.

15. The configuration of each boot is as follows:

- |                                 |  |
|---------------------------------|--|
| Boot 1; ramp leading edge,      | 1 shedding area<br>1 parting strip   |
| Boot 2; ramp,                   | 4 shedding areas<br>4 shedding area sensors<br>5 parting strips<br>2 parting strip sensors |
| Boot 3; engine air intake duct, | 2 shedding areas<br>4 parting strips   |
| Boot 4; engine air intake duct, | 1 shedding area<br>1 shedding area sensor  |
| Boot 5; engine air intake duct, | 1 shedding area<br>1 shedding area sensor<br>2 parting strips                              |

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Boot 6; engine air intake duct,	2 shedding areas 2 shedding area sensors 2 parting strips
Boot 7; ramp, boundary layer bleed area,	1 shedding area 1 shedding area sensor.

16. The shedding areas are designed to impose a load demand of 3840 Va from the power source of 115 volts. To attain this figure, the shedding area of boot 1 is connected in parallel with one shedding area of boot 2. Likewise one shedding area of boot 3 operates in parallel with one shedding area of boot 6. The ten supply circuits for the shedding areas are connected via a terminal strip to a load distributor, the operation of which is controlled by the cycling time controller.

17. When the first pulse from the ice detection circuit is received by the controller, a supply circuit is completed via the parting strip sensors to the parting strip power supply relay. This relay, when energized, completes supply circuits from the A, B and C phases of the relevant LH or RH main a-c bus bars. The parting strip power demand is shared equally by the three phases.

18. When a preselected number of detection circuit pulses have been received by the controller, an enabling pulse circuit is completed to the load distributor. The pulses required by the controller before it supplies the enabling pulse can be adjusted to any number from 4 to 12.

19. A stepping contactor, incorporated in the load distributor, is set in motion by the enabling pulse. The stepping contactor provides a sequence of twelve 3-phase 115 volts a-c pulses of a preset duration, the supplies being derived from the relevant LH or RH main a-c bus bars. Ten of the twelve pulses are used, one to each shedding area, commencing with the ramp leading edge. The duration of the pulses can be adjusted as required between 4 and 12 seconds.

20. If insufficient detection circuit pulses are received by the controller to start an initial or subsequent cycle, it automatically initiates a clearing cycle of the shedding areas after a preselected waiting period. Upon completing this cycle the system reverts to the off condition. The duration of the waiting period can be adjusted as required between 40 and 160 seconds.

Guide Vanes De-icing

21. Individual, electrically identical circuits are provided for the LH and the RH engine. The following description is applicable to each circuit.

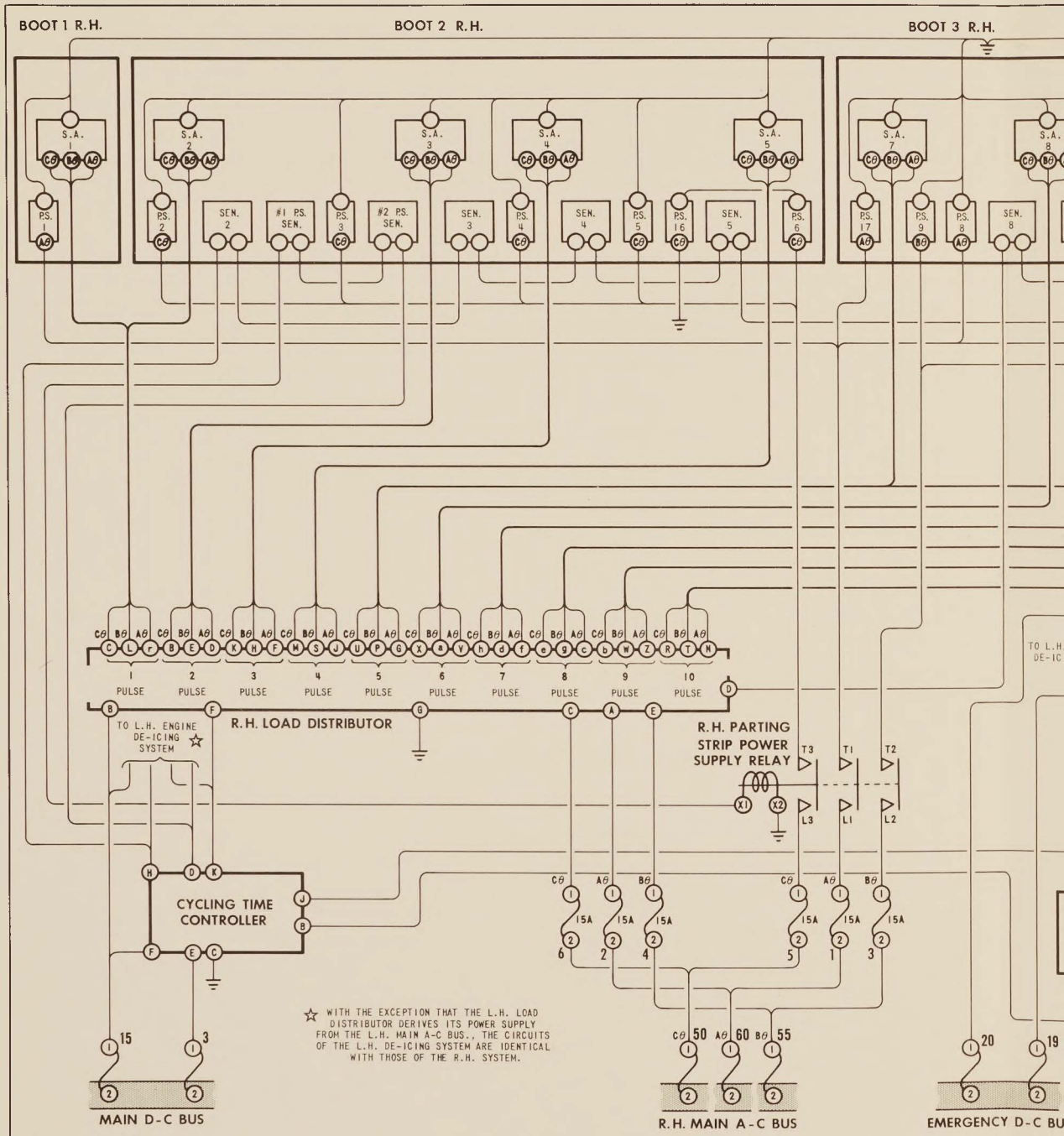
22. The operation of the guide vanes de-icing circuit is initiated by the cycling time controller when the first pulse is received from the ice detection circuit. The controller provides a power supply to energize a guide vanes de-icing control relay.

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This relay, when energized, transfers a supply circuit from the close field to the open field of a shut-off valve. This action permits hot air, bled from the engine compressor, to be directed onto the guide vanes. The shut-off valve supply is derived from the emergency d-c bus.

23. A characteristic of the shut-off valve is that once actuated it must complete its travel before it can reverse direction. To ensure that the valve will open fully, an electro-mechanical locking circuit operates in conjunction with the control relay. This circuit mechanically locks the control relay in the energized position. The lock is released by a relay energized by a supply circuit which is completed when the shut-off valve is fully open.

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☆ WITH THE EXCEPTION THAT THE L.H. LOAD DISTRIBUTOR DERIVES ITS POWER SUPPLY FROM THE L.H. MAIN A-C BUS, THE CIRCUITS OF THE L.H. DE-ICING SYSTEM ARE IDENTICAL WITH THOSE OF THE R.H. SYSTEM.



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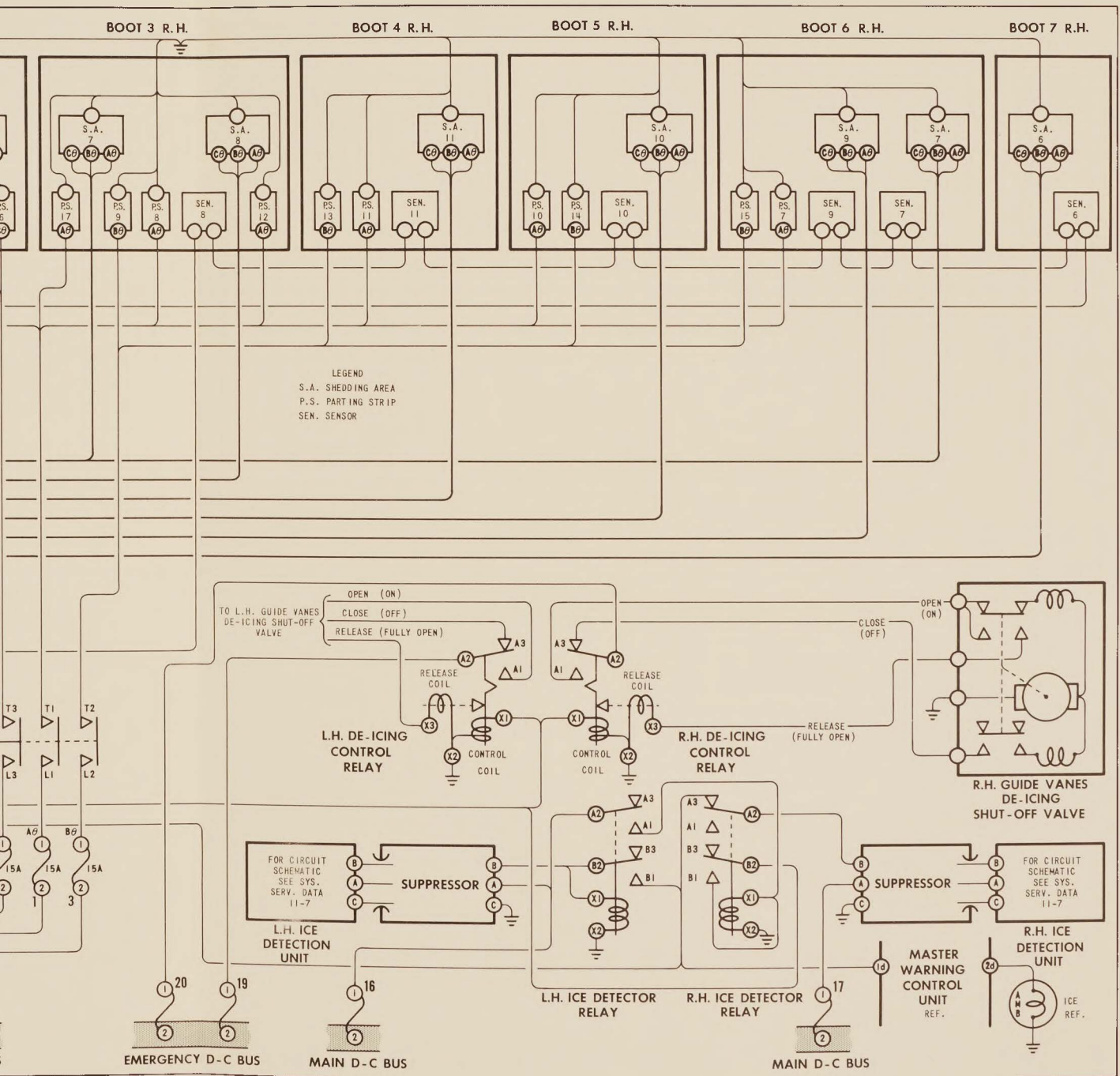


FIG. 1 ENGINE DE-ICING SCHEMATIC

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**CF-105 SERVICE DATA**  
**COMPONENT DATA SHEET**

SYSTEM <b>ELECTRICAL</b>	SUB-SYSTEM <b>ENGINE DE-ICING</b>	COMPONENT <b>Ice Detector - LH and RH</b>	REF. NO. <b>11-8-1</b>		
AVRO PART NO. <b>7-2055-27</b>	MANUFACTURER <b>PSC Applied Research Ltd.</b>	MAN'FR'S PART NO.	AIRCRAFT EFFECTIVITY <b>25201</b>		
OVERHAUL LIFE:      KNOWN-		ESTIMATED- <b>1500 hours</b>			
FUNCTION  To provide electrical impulses when icing conditions are present the frequency of the impulses being dependent upon the rate of icing.					
LOCATION  Protrudes into the relevant LH or RH engine air intake at station 214.					
ACCESS  Unobstructed upon removal of panel extending from station 214 to 228 on top of the engine air intake, 24 - 3/16 inch screws.			MEN X MINUTES  <table border="1" style="width: 100%; height: 100%;"><tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr></table>		
REPLACEMENT PROCEDURE  Fit and secure the unit to the structure - 3 bolts. Fit and secure one electrical connector. Refit and secure the access panel.			MEN X MINUTES  <table border="1" style="width: 100%; height: 100%;"><tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr></table>		



INSPECTION		MEN X MINUTES	
Examine the unit, electrical wiring and connector for cleanliness, security, and damage. Check that the holes in the probes are not blocked.			
FUNCTIONAL CHECKS		MEN X MINUTES	
GROUND HANDLING AND GROUND TEST EQUIPMENT			
SPECIAL TOOLS TO REMOVE OR SERVICE			
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SYSTEM <b>ELECTRICAL</b>	SUB-SYSTEM <b>ENGINE DE-ICING</b>	COMPONENT <b>Suppressor - LH and RH</b>	REF. NO. <b>11-8-2</b>
AVRO PART NO. <b>7-2055-105</b>	MANUFACTURER <b>PSC Applied Research Ltd.</b>	MAN'FR'S PART NO.	AIRCRAFT EFFECTIVITY <b>25201</b>
OVERHAUL LIFE:      KNOWN-		ESTIMATED- <b>1500 hours</b>	
FUNCTION  To suppress RF interference which may be generated by the ice detector.			
LOCATION  Top of the relevant LH or RH engine air intake at station 228.			
ACCESS  Unobstructed, upon removal of panel extending from station 214 to 228 on top of the air intake, 24 - 3/16 inch screws.			MEN X MINUTES
REPLACEMENT PROCEDURE  Fit and secure the unit to the structure - four bolts. Fit and secure one electrical connector. Fit and secure the prefitted cable to the ice detector unit. Refit the load distributor see 11-8-4. Refit and secure the access panel.			MEN X MINUTES

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INSPECTION							MEN X MINUTES		
Examine the unit, electrical wiring and connector for cleanliness, damage and security.									
FUNCTIONAL CHECKS							MEN X MINUTES		
GROUND HANDLING AND GROUND TEST EQUIPMENT									
SPECIAL TOOLS TO REMOVE OR SERVICE									
REMARKS									
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SYSTEM <b>ELECTRICAL</b>	SUB-SYSTEM <b>ENGINE DE-ICING</b>	COMPONENT <b>Cycling Time Controller</b>	REF. NO. <b>11-8-3</b>
AVRO PART NO. <b>7-2052-13</b>	MANUFACTURER <b>B.F. Goodrich Co.</b>	MAN'FR'S PART NO.	AIRCRAFT EFFECTIVITY <b>25201</b>
OVERHAUL LIFE:      KNOWN-		ESTIMATED- <b>1500 hours</b>	
FUNCTION  To initiate the operation of the air intake and duct de-icing and the guide vane de-icing upon receiving a preselected number of from 4 to 12 pulses from the ice detection circuits.			
LOCATION  Top of the LH engine air intake aft of station 214.			
ACCESS  Unobstructed upon removal of panel extending from station 214 to 228 on top of the air intake, 24 - 3/16 inch screws.			MEN X MINUTES
REPLACEMENT PROCEDURE  Locate the unit in its mounting tray and secure by turning the fastener clockwise. Wirelock the fastener. Fit and secure one electrical connector. Refit and secure the access panel.			MEN X MINUTES

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INSPECTION							MEN X MINUTES		
<p>Examine the unit, electrical wiring and connector for cleanliness, security and damage. Check the wirelock on the fastener for security and corrosion.</p>									
FUNCTIONAL CHECKS							MEN X MINUTES		
GROUND HANDLING AND GROUND TEST EQUIPMENT									
SPECIAL TOOLS TO REMOVE OR SERVICE									
REMARKS									
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SYSTEM <b>ELECTRICAL</b>	SUB-SYSTEM <b>ENGINE DE-ICING</b>	COMPONENT <b>Load Distributor - LH and RH</b>	REF. NO. <b>11-8-4</b>
AVRO PART NO. <b>7-2052-12</b>	MANUFACTURER <b>B.F. Goodrich Co.</b>	MAN'FR'S PART NO.	AIRCRAFT EFFECTIVITY
OVERHAUL LIFE:      KNOWN-		ESTIMATED- <b>1500 hours</b>	
FUNCTION  To provide a sequence of twelve 3-phase a-c pulses with provision for adjusting the duration of the pulses between 4 and 12 seconds.			
LOCATION  Top of the relevant LH or RH engine air intake aft of station 214.			
ACCESS  Unobstructed upon removal of panel extending from station 214 to 228 on top of the engine air intake, 24 - 3/16 inch screws.			MEN X MINUTES
REPLACEMENT PROCEDURE  Locate the unit in its mounting tray and secure by turning the fastener clockwise. Wirelock the fastener. Fit and secure two electrical connectors. Refit and secure the access panel.			MEN X MINUTES



INSPECTION		MEN X MINUTES	
<p>Examine the unit, electrical wiring and connectors for cleanliness, security and damage. Check the wirelock on the fastener for security and corrosion.</p>			
FUNCTIONAL CHECKS		MEN X MINUTES	
GROUND HANDLING AND GROUND TEST EQUIPMENT			
SPECIAL TOOLS TO REMOVE OR SERVICE			
REMARKS			
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**CF-105 SERVICE DATA**  
**COMPONENT DATA SHEET**

SYSTEM <b>ELECTRICAL</b>	SUB-SYSTEM <b>ENGINE DE-ICING</b>	COMPONENT <b>Limiter Panel - LH and RH</b>	REF. NO. <b>11-8-5</b>
AVRO PART NO. <b>7-2055-53 LH 7-2055-54 RH</b>	MANUFACTURER <b>Avro Aircraft Ltd.</b>	MAN'FR'S PART NO.	AIRCRAFT EFFECTIVITY <b>25201</b>
OVERHAUL LIFE:      KNOWN-		ESTIMATED- <b>1500 hours</b>	
FUNCTION  <p style="text-align: center;">To mount the current limiters of certain circuits of the engine de-icing system.</p>			
LOCATION  <p style="text-align: center;">Top of the relevant LH or RH air intake at station 228.</p>			
ACCESS  <p style="text-align: center;">Unobstructed upon removal of panel extending from station 214 to 228 on top of the engine air intake, 24 - 3/16 inch screws.</p>			MEN X MINUTES
REPLACEMENT PROCEDURE  <p style="text-align: center;">Fit and secure the panel to the structure - nine bolts. Connect and secure the circuit wiring. Refit and secure the access panel.</p>			MEN X MINUTES

INSPECTION							MEN X MINUTES	
Check that the panel is securely mounted and that the circuit wiring is securely and properly connected. Check that the limiters are not discoloured and are serviceable.								
FUNCTIONAL CHECKS							MEN X MINUTES	
GROUND HANDLING AND GROUND TEST EQUIPMENT								
SPECIAL TOOLS TO REMOVE OR SERVICE								
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SYSTEM <b>ELECTRICAL</b>	SUB-SYSTEM <b>ENGINE DE-ICING</b>	COMPONENT <b>Terminal Panel - LH and RH</b>	REF. NO. <b>11-8-6</b>
AVRO PART NO. 7-2055-67 LH 7-2055-68 RH	MANUFACTURER <b>Avro Aircraft Ltd.</b>	MAN'FR'S PART NO.	AIRCRAFT EFFECTIVITY <b>25201</b>
OVERHAUL LIFE:      KNOWN-		ESTIMATED- <b>1500 hours</b>	
FUNCTION  <p style="text-align: center;">To serve as a break point for the air intake and ramp de-icing circuit wiring.</p>			
LOCATION  <p style="text-align: center;">Top of the relevant LH or RH air intake at station 214.</p>			
ACCESS  <p style="text-align: center;">Unobstructed upon removal of panel extending from station 214 to 228 on top of the engine air intake, 24 - 3/16 inch screws.</p>			MEN X MINUTES
REPLACEMENT PROCEDURE  <p style="text-align: center;">Fit and secure the panel to the structure - four screws. Connect and secure the circuit wiring. Refit and secure the access panel.</p>			MEN X MINUTES

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INSPECTION		MEN X MINUTES	
Check that the panel is securely mounted and that the circuit wiring is securely and properly connected.			
FUNCTIONAL CHECKS		MEN X MINUTES	
GROUND HANDLING AND GROUND TEST EQUIPMENT			
SPECIAL TOOLS TO REMOVE OR SERVICE			
REMARKS			
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