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**1.13.60 PROBE HEAT**

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The ice and rain protection system permits aircraft operation in various environmental conditions and, in particular, in icing situations.

An ice detector, located on the left wing leading edge and connected to the CCAS, monitors ice accretion.

Aircraft ice protection is provided by :

- a pneumatic system operating on areas of the airframe :
  - outer, center and inner wing leading edges
  - horizontal tailplane leading edges
  - engine air intakes and gas paths.
- electrical heating of :
  - propeller blades
  - windshields
  - probes
  - flight control horns

For the pneumatic system, the engines supply bleed air through the LH and RH de ice valves regardless of the engine bleed valves position.

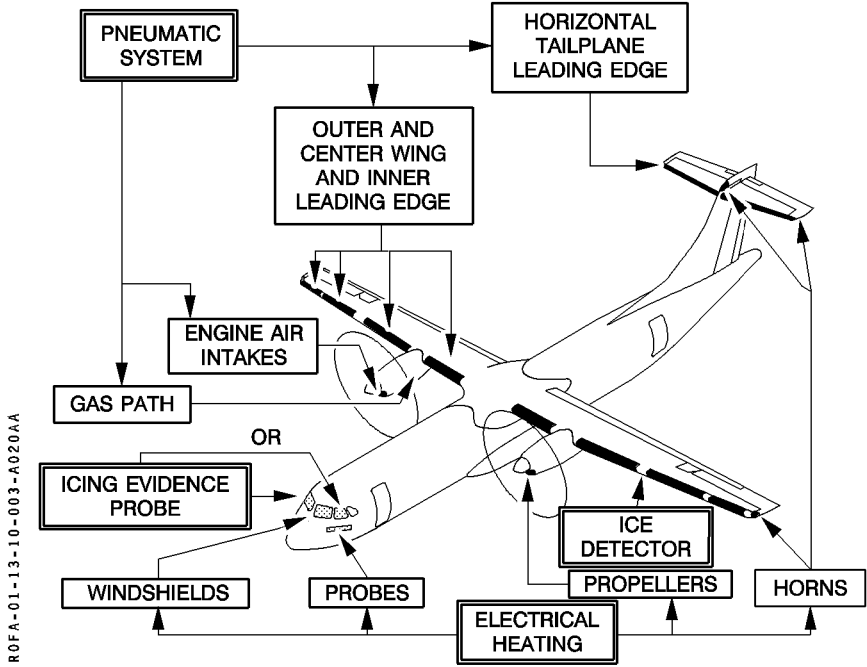
For electrical heating, the power is supplied primarily by AC wild current.


Rain removal from the front windshields is achieved by windshield wipers.

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**SCHEMATIC**



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## 20.1 DESCRIPTION

An anti icing advisory system (AAS) is installed.

The AAS system includes :

- An ice detector
- An icing evidence probe
- Three lights in the cockpit
  - icing (amber) and ICING AOA (green) lights on central panel
  - DE ICING blue light on memo panel

This system has been designed to alert the crew on the correct procedures to be applied when flying in icing conditions :

- Increase of minimum maneuver/operating speeds + selection of anti-icing
- Selection of the deicing system at first indication of ice accretion
- Switching the deicing system OFF when ice does not build up any more on the airframe.

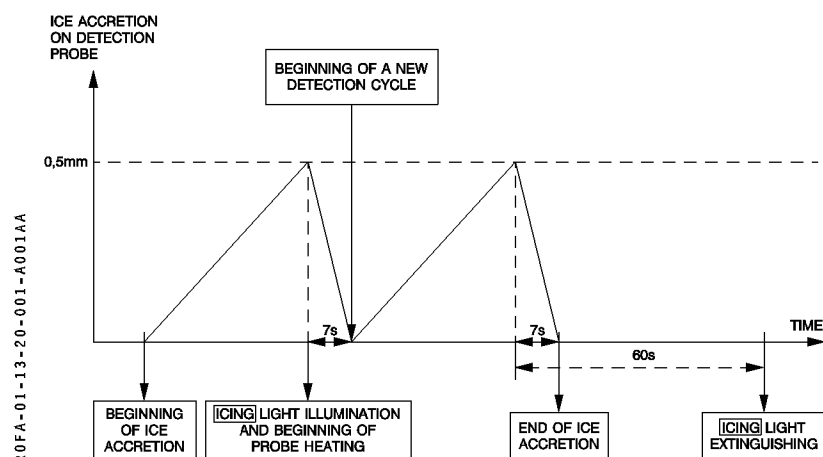
### ICE DETECTOR

The ice detector, located under the left wing, alerts the crew as soon as and as long as ice accretion is sensed by the probe.

Alert is generated by the amber ICING light on the central panel.

The system is self tested constantly, and any failure generates a FAULT light illumination with single chime.

Detection of ice accretion and associated alert are performed under following cycle :



### CAUTION :

The ice detector indicates ice accretion is building up on aircraft. Therefore, extinguishing of the ICING light must be regarded as an end of ice accretion and not as an absence of ice on aircraft. Consequently a visual check must be performed to assure aircraft is cleared of ice after having encountered ice accretion conditions.

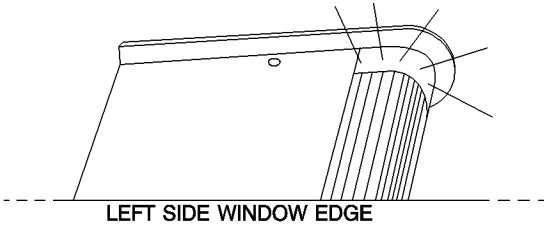
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**ICING EVIDENCE PROBE**

Located near left side window of the cockpit, the icing evidence probe is visible by both pilots. An integrated lighting, to evidence ice accretion, is controlled by NAV lights switch.

ROFA-01-13-20-002-A050AA



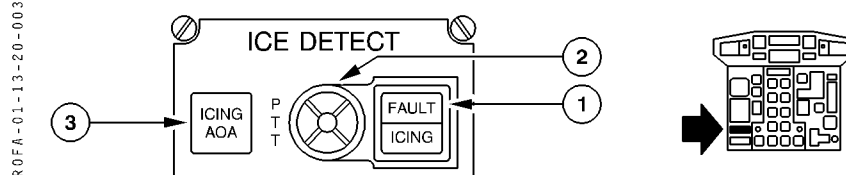
	ICE AND RAIN PROTECTION		1.13.20		
			P 3	180	
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## 20.2 CONTROLS

### ICE DETECTOR PANEL

ROFA-01-13-20-003-A180AA



#### ① ICE DET INDICATION LIGHT

- R ICING illuminates steady amber when ice accretion is detected, provided both horns anti icing and airframe de icing are selected ON.
- R ICING flashes amber when ice accretion is detected and horns anti icing and/or airframe de icing are not selected ON.
- R FAULT illuminates amber when a system failure is detected (detector fault, loss of power supply).

#### ② ICE DET PTT

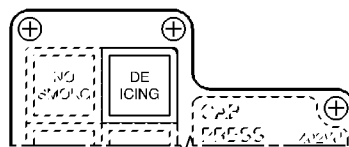
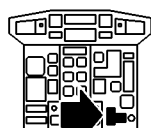
The push to test pb is used to check the ice detector correct operation.  
Press and hold test button for 3 seconds.

- ICING amber light flashes on central panel (with associated warning) if system works correctly.
- ICE DET FAULT illuminates, (with associated central warnings) if an ice detector failure is detected.

#### ③ ICING AOA pb


- ICING AOA It illuminates green as soon as one horns anti icing Pb is selected ON, reminding the crew of stall alarm threshold being lower in icing conditions.
- ICING AOA It can only be extinguished manually by depressing it, provided both horns anti icing are selected OFF. In this case, stall alarm threshold recovers the values defined for flight in normal conditions.

### DE ICING INDICATOR



ROFA-01-13-20-003-B180AA

- Illuminates Blue on memo panel when the airframe deicing system is selected ON.
- Flashes Blue on memo panel when the airframe deicing system is still selected ON five minutes after last ice accretion detection.

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## 20.3 ELECTRICAL SUPPLY/SYSTEM MONITORING

### ELECTRICAL SUPPLY


EQUIPMENT	DC BUS SUPPLY (C/B)	AC BUS SUPPLY (C/B)
ICE detector	– Nil –	ACW BUS 2 (on lateral panel ICE DET PWR SPLY)
ICING/FAULT light	DC EMER BUS (on lateral panel ICING CAUTION/ Boots A and B ind)	– Nil –
ICING AOA light	DC EMER BUS (on lateral panel DE ICING-AAS/ Boots A and B ind)	– Nil –

### SYSTEM MONITORING

The following conditions are monitored by visual and aural alerts :

- Ice detector failure
  - See ICE DETECTOR FAULT procedure in chapter 2.05.09.
- Ice accretion developing on aircraft
  - See adverse weather procedures in chapter 2.02.08.
- Airframe de icing system selected and no ice accretion for 5 minutes.
  - DE ICING blue light flashing on center panel. This condition is not monitored by aural alert.



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### 30.1 DESCRIPTION (See schematic P 9/10)

The operating principle is to sequentially inflate the boots in order to remove ice. The de ice valves control the delivery pressure to 1.4 bar (20.3 psi).

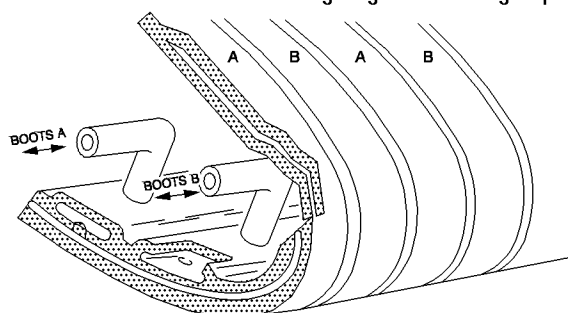
Seven distribution valves control air supply to the boots :

- valve ① to LH engine air intake and separation chamber,
- valve ② to RH engine air intake and separation chamber,
- valve ③ to LH outer wing leading edge,
- valve ④ to LH center wing leading edges and LH internal wing leading edge,
- valve ⑤ to RH outer wing leading edge,
- valve ⑥ to RH center wing leading edge and RH internal wing leading edge,
- valve ⑦ to horizontal tailplane leading edge

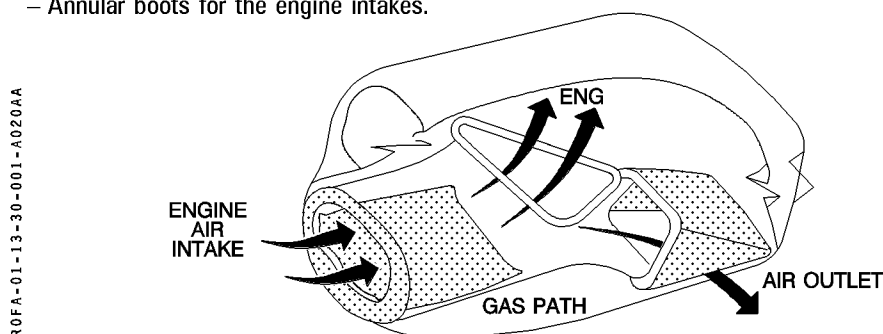
Each of these distribution valves has one input and two outputs A and B, each controlled by the MFC.

Two types of boots are used :

- Chordwise boots for the leading edges and the gas paths.




- Annular boots for the engine intakes.



When deflated, the boots are held to the structure thanks to a venturi supplied by bleed air.

**Note :** – The system is designed to remain operative with one engine inoperative through a common air manifold, except icing protection of the inoperative engine which is lost.

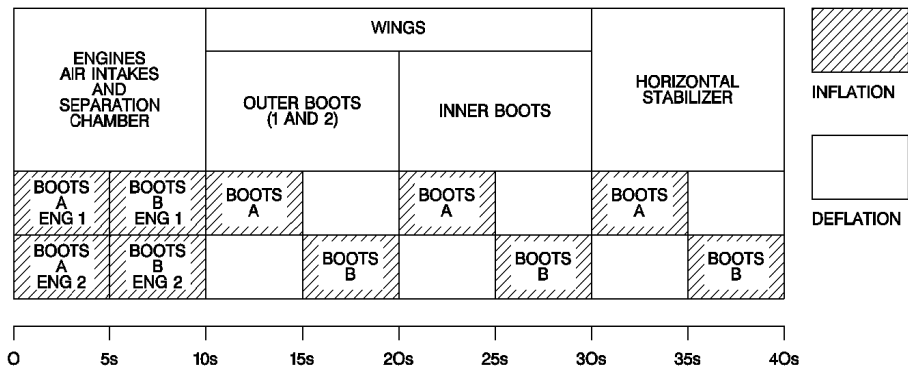
**CAUTION :** With this type of boot, there is no need to wait for ice accretion on airframe before selecting it ON. This system **MUST** be selected ON as soon as and as long as ice accretion develops on airframe.

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TIME SEQUENCE DIAGRAM

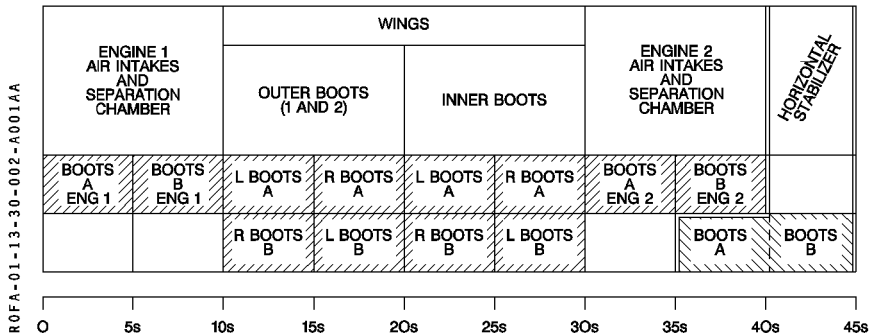
NORMAL MODE (PILOTED BY MFC)



BEGINNING OF THE FOLLOWING SEQUENCE AT :


- R - 60 sec (FAST MODE (SAT > -20°C))
- R - 180 sec (SLOW MODE (SAT < -20°C))

OVRD MODE (SEPARATED TIMER AND FAST MODE ONLY)



- R BEGINNING OF THE FOLLOWING SEQUENCE AT 60 SEC (FAST MODE)

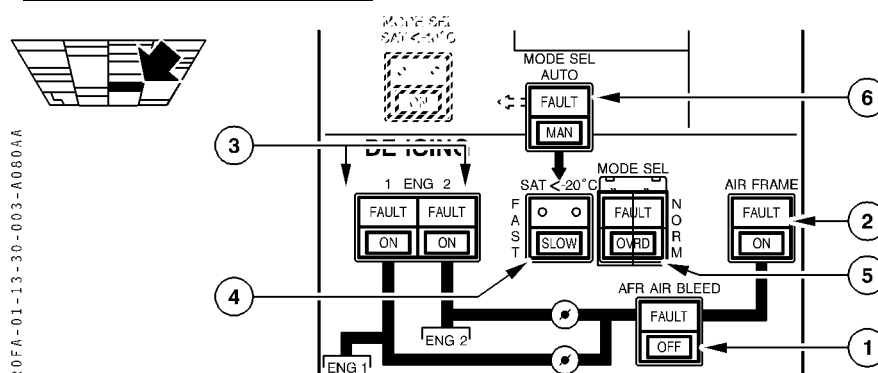
*Note : When de icing OVRD mode is selected, boots inflate according to a separate timer and MFC is totally by passed.*

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## 30.2 CONTROLS

### ENGINE/WING DE ICING PANEL



#### ① AIRFRAME AIR BLEED pb

Controls both de ice and isolation valves.

Pb pressed in Normal operation.

Both DE ICE and ISOLATION VALVES are open.

OFF (pb released) OFF light comes on white.

Both DE ICE and isolation valves are closed.

However engine de-icing may be used (engine de-icing selected ON will open de-ice valve).

But airframe de-icing is never available.

FAULT The light illuminates amber and the CCAS is activated when :

- Air pressure downstream of the de-ice valves stays below 14 PSI for more than 10 seconds.

R

- Air temperature upstream of the de-ice valves exceeds 230°C.

The alert is inhibited when pb is released.

#### ② AIRFRAME pb

Controls the outputs A and B of both wings and stabilizers distribution valves.

ON (pb pressed in) Signal is sent to the MFC in order to initiate a de-icing cycle depending on MODE SEL pb.


ON light illuminates blue.

Pb released In normal operation. Associated boots stay deflated.

FAULT The light illuminates amber and the CCAS is activated when inflation sequencing of airframe boots A or B is not correct. :

- Associated distribution valve output has been controlled open but no downstream pressure has been detected, or
- Associated distribution valve output has been controlled closed but a downstream pressure is detected.

R

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③ ENGINE pbs

Control de-ice valves, as well as the outputs A and B of respective engine distribution valves.

ON (pb pressed in) De-ice valve is controlled open even if Airframe Airbleed is not selected ON, and a signal is sent to the MFC in order to initiate a cycle. ON light illuminates blue.

Pb released Associated boots stay deflated. Also controls associated de-ice valve in closed position, after Airframe Airbleed FAULT and ENG FAULT.

FAULT Light illuminates amber and CCAS is activated when :  
- Associated distribution valve output has been controlled open but no downstream pressure has been detected, or  
- Associated distribution valve output has been controlled closed but a downstream pressure is detected.  
- AIRFRAME AIRBLEED pb selected OFF and air temperature upstream of the de-ice valve exceeds 230°C.  
- Inflation sequencing of engine boots A or B is not correct.

④ DE ICING MODE SEL pb

Controls the selection of wings/engines boots inflation cycles when MAN is selected on MODE SEL AUTO pb ⑥

FAST (pb released) timing cycle = 60 s

SLOW (pb pressed in) timing cycle = 180 s - SLOW light illuminates blue.

⑤ DE-ICING OVERRIDE guarded pb


Controls the emergency de-icing operation.

The control panel enables control of all double valves (ENG and AIR FRAME).

NORM (pb released) Normal operation

OVRD (pb pressed in) The emergency de-icing activation is selected (timing cycle = 60 s), the light illuminates white and all de-icing lights extinguish. This position is used when the associated FAULT light illuminates.

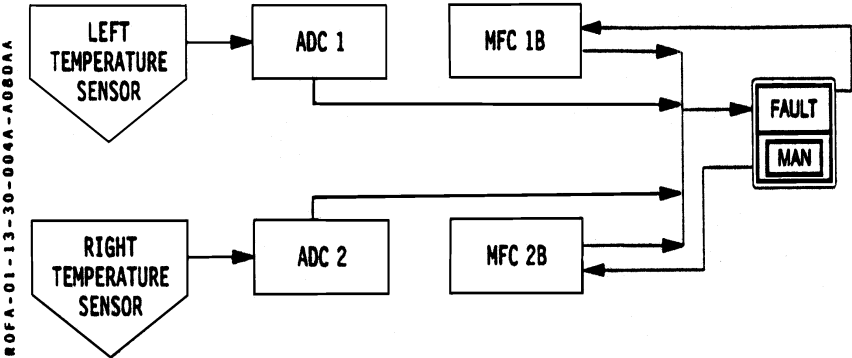
FAULT The light illuminates amber when both MFC modules associated to air intake boots control fail resulting in an incorrect inflation sequencing.


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6 MODE SEL AUTO pb

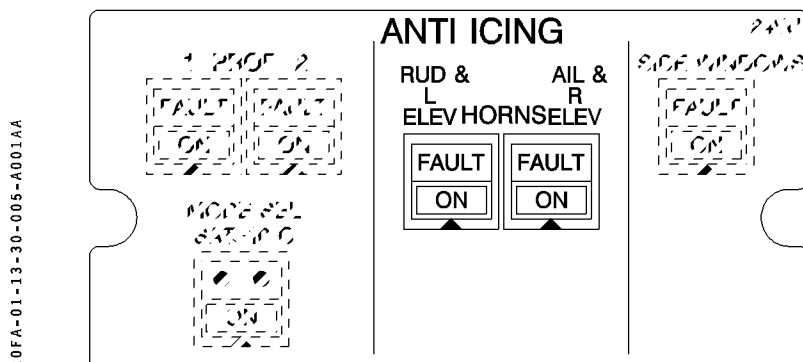
R R		Pb released Normal operation (automatic operating mode). The DE-ICING MODE SEL pb ④ is inoperative. The cycle selection is provided ADC1, MFC1B, ADC2 and MFC2B
	FAULT	Illuminates amber and the CCAS is activated when MFC (1B or 2B) and/or ADC failure occurs. The DE-ICING MODE SEL pb ④ is inoperative. In this case the FAST mode is automatically activated.
	MAN	(pb pressed in) The DE-ICING MODE SEL pb ④ is operative and allows the crew to select the appropriate timing cycle depending on SAT. MAN illuminates white.



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	<b>ENGINE AND WING PROTECTION</b>		P 5	001	
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AB

### HORNS ANTI ICING PANEL



### HORNS ANTI ICING pbs

Controls activation of following units :

- RUD and L ELEV : Rudder and left elevator horns anti icing
- AIL and R ELEV : Ailerons and right elevator horns anti icing


**ON** (pb pressed in) : associated anti icing units are activated. ON light illuminates blue.

**OFF** (pb released) : associated anti icing units are deactivated.

**FAULT** The light illuminates amber and the CCAS is activated when electrical power is lost on one of the associated units.

Note : As soon as at least one of the HORNS anti-icing p.b. is selected ON, stall alert threshold is reduced (refer FCOM 1.02).

Horns heating are inhibited on ground.

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### 30.3 ELECTRICAL SUPPLY/MFC LOGIC/SYSTEM MONITORING

#### ELECTRICAL SUPPLY

EQUIPMENT	DC BUS SUPPLY (C/B)	AC BUS SUPPLY (C/B)
De ice valves	DC BUS 2 (on lateral panel SO and REG VALVE 1 and 2)	– Nil –
Isolation valves	DC ESS BUS (on lateral panel ISOL VALVE 1 and 2)	– Nil –
Distribution valves (Boots A + ENG 1)	DC EMER BUS (on lateral panel ENG 1 and AFR-BOOTS A SPLY)	– Nil –
Distribution valves (Boots B + ENG 2)	DC BUS 2 (on lateral panel ENG 2 and AFR-BOOTS B NORM SPLY) and DC EMER BUS (BACK UP) (on lateral panel ENG 2 and AFR-BOOTS B EMER SPLY)	– Nil –
Controls and alerts	DC EMER BUS (on lateral panel CTL and CAUTION)	
Left elevator and rudder horns anti icing	– Nil –	115 VAC wild BUS 1 (on lateral panel L ELEV RUD)
Left elevator and rudder horns anti icing control	DC EMER BUS (on lateral panel L ELEV and RUD)	– Nil –
Right elevator and ailerons horns anti icing	– Nil –	115 VAC wild BUS 2 (on lateral panel R ELEV R AIL L AIL)
Right elevator and ailerons horns anti icing control	DC EMER BUS (on lateral panel R ELEV and AIL)	– Nil –

#### MFC LOGIC

See chapter 1.01.

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### **SYSTEM MONITORING**

The following conditions are monitored by visual and aural alerts :

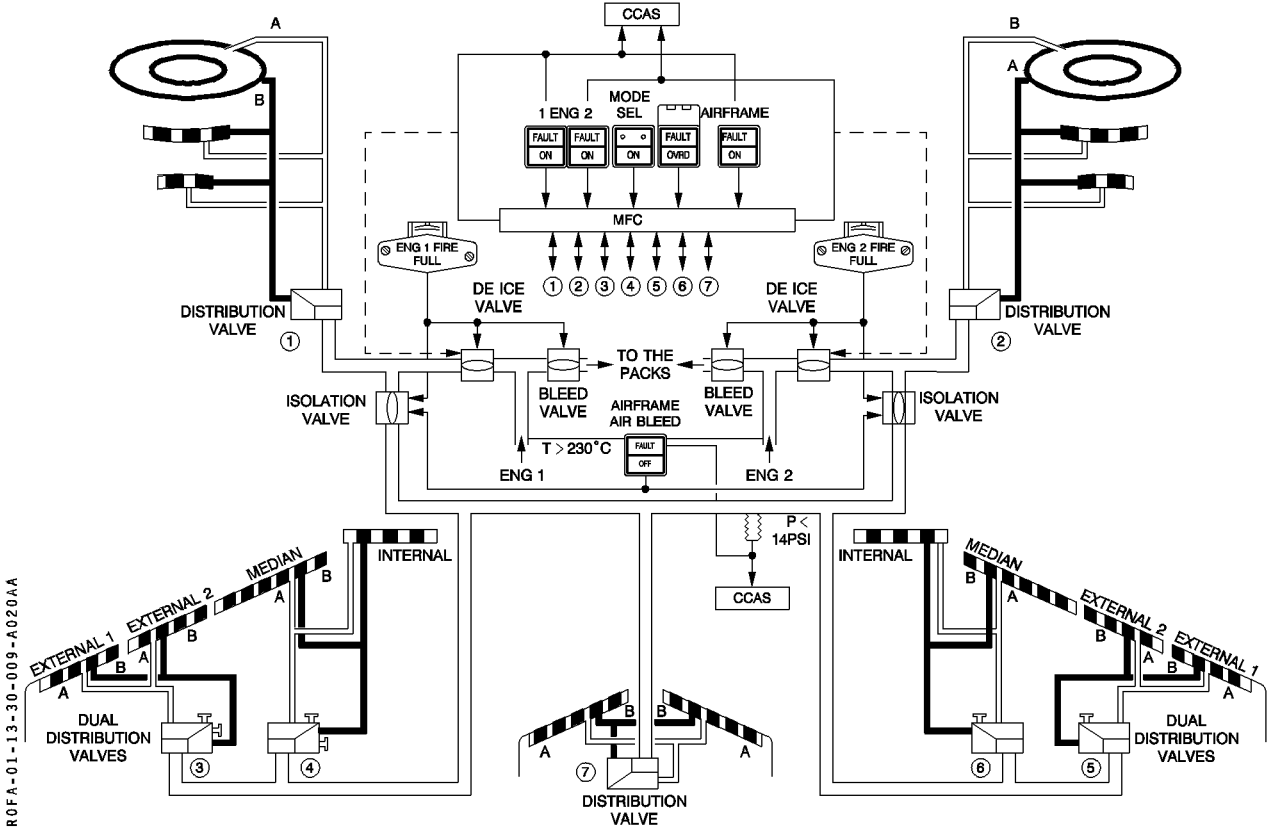
- LOW pressure in the de icing common air manifold ( $P < 14$  PSI and  $t > 6s$ ) or over temperature ( $T > 230^{\circ}C$ ) upstream the pressure regulating valve.
  - See AIRFRAME AIR BLEED FAULT procedure in chapter 2.05.09.
- Distribution valve output controlled open but no downstream pressure detected or controlled closed but downstream pressure detected.
  - See AIRFRAME DE ICING or ENG DE or ANTI-ICING FAULT procedure in chapter 2.05.09.
- Power loss on a horn anti-icing unit
  - See HORNS ANTI ICING FAULT procedure in chapter 2.05.09.
- Boots do not operate following MFC failure or both boots A and B of the same engine are supplied 200 sec after eng cycle beginning or Boots A (B) of both engines are supplied while boots B (A) are not supplied 20 sec after eng. cycle beginning.
  - See DE ICING MODE SEL FAULT procedure in chapter 2.05.09.
- R - MFC 1B or 2B and/or ADC failure. Discrepancy between outputs
  - See MODE SEL AUTO FAULT procedure in chapter 2.05.09.




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30.4 SCHEMATIC



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	PROPELLER ANTI ICING				JUN 97

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#### 40.1 DESCRIPTION

Propeller anti icing is performed by resistors installed near the surface of the inboard sections of the blade leading edges.

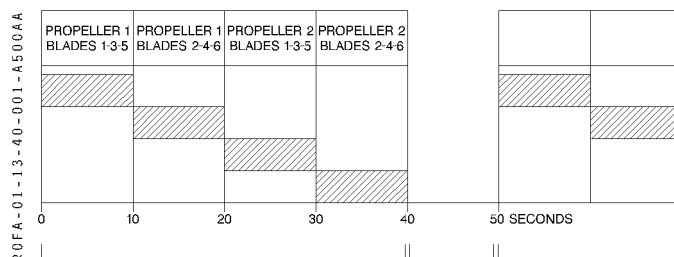
On each propeller, the heat elements are electrically connected in three blades (every other blade).

The system is supplied with 115 ACW. Two modes are available and automatically selected depending on the temperature.

#### TIME SEQUENCE DIAGRAM

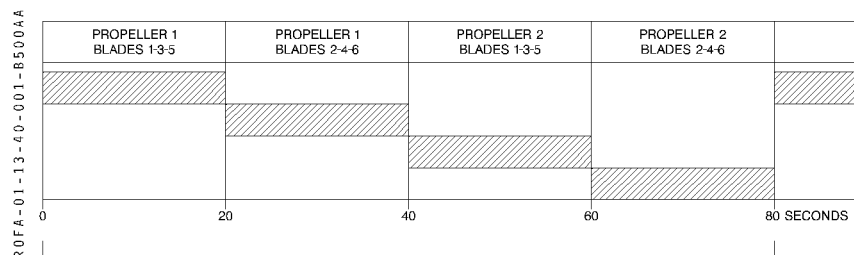
##### MODE SEL : NORMAL OPERATION

##### LOW POWER CYCLE




##### MODE SEL : ON

##### HIGH POWER CYCLE






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		P 2A	080	
	PROPELLER ANTI ICING			JUL 01

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③ MODE SEL AUTO pb (same pb as ENGINE AND WING PROTECTION)

pb released		Normal operation (automatic operating mode) The ANTI-ICING MODE SEL pb ② is inoperative.
R		The cycle selection is provided by ADC 1, MFC 1B, ADC 2 and MFC 2B
R		
R	FAULT	Illuminates amber and the CCAS is activated when MFC (1B or 2B) and/or ADC failure occurs (see schematic 1.13.30 p 4A). The ANTI-ICING MODE SEL pb ② is inoperative. In this case, the HIGH POWER CYCLE is automatically activated.
R		
	MAN	(pb pressed in) The ANTI-ICING MODE SEL pb ② is operative and allows the crew to select the appropriate timing cycle depending on SAT. MAN illuminates white.

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#### 40.3 ELECTRICAL SUPPLY/MFC LOGIC/SYSTEM MONITORING

##### ELECTRICAL SUPPLY

EQUIPMENT	DC BUS SUPPLY (C/B)	AC BUS SUPPLY (C/B)
Propeller 1 anti-icing PWR	- Nil -	AC wild BUS 1 (on lateral panel PROP1 ANTI ICING PWR SPLY
Propeller 2 anti-icing PWR	- Nil -	AC wild BUS 2 (on lateral panel PROP2 ANTI ICING PWR SPLY
Prop anti-icing CTL and Ind	DC EMER BUS (on lateral panel PROP CTL and IND)	

Note : Propeller anti icing is inhibited when Np is below 63%.

##### MFC LOGIC


See chapter 1.01.

##### SYSTEM MONITORING

The following conditions are monitored by visual and aural alerts :

- One or more blade heating unit (s) inoperative.
  - See PROP ANTI-ICING FAULT procedure in chapter 2.05.09.
- MFC 1B or 2B and/or ADC failure, discrepancy between outputs.
  - See MODE SEL AUTO FAULT procedure in chapter 2.05.09.

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	<b>ICE AND RAIN PROTECTION</b>  PROPELLER ANTI-ICING	1.13.40		
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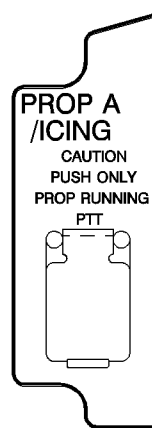
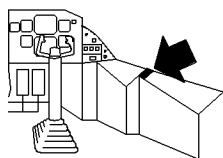
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#### 40.4 LATERAL MAINTENANCE PANEL

On the RH Maintenance panel, controls are provided for maintenance purposes only, to check propeller anti-icing system.

#### PROPELLER ANTI-ICING TEST PUSH-BUTTON

R0FA-01-13-40-004-A001AA



This guarded push-button is used to check the propeller anti-icing system functioning. It must only be operated on ground, with propellers above 63 % NP.

Test procedure :

- Aircraft on ground, propellers > 63 % NP.
- Mode select (overhead panel) : NORM.
- Push test Button.
- The system performs a short anti-icing cycle.

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	WINDOW HEAT				DEC 96

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## 50.1 DESCRIPTION

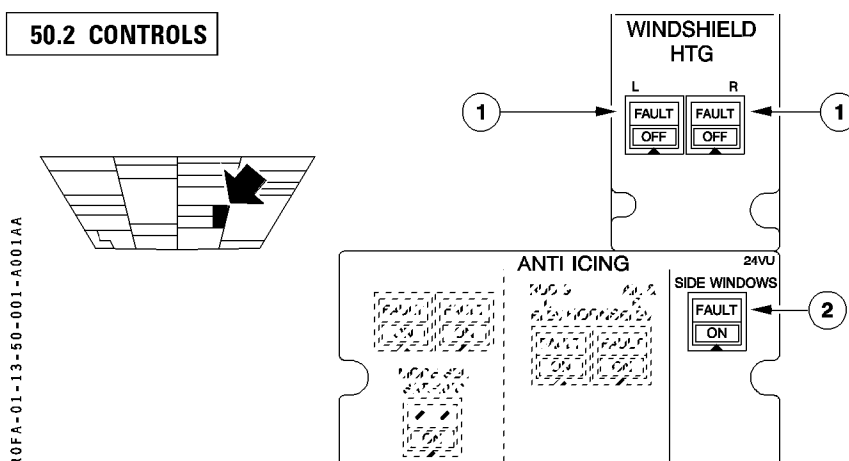
The cockpit windows are electrically heated :

- The front windshields for ice protection and defogging.
- The side windows for defogging only.

The front windshields are protected against ice formation by an electrically heated transparent film incorporated between two plies of glass. It is supplied with 200 VACW, and temperature is controlled by an electronic controller which keeps the outer windshield temperature over 2°C (35°F). The inner surface remains above 21° C (70° F) to prevent mist formation.

The side windows are protected by an electrically heated system consisting of small wires embedded between two plies of glass. It is supplied with 28 volts DC and keeps the inner temperature over 21°C (70°F).

## 50.2 CONTROLS



### ① WINDSHIELD HTG L or R pb

Controls activation of window heat systems :

- Pb pressed in      Power is supplied to the associated window heat system.  
OFF                      (pb released) Window heat system is deactivated. The OFF light illuminates white.
- FAULT                      The light illuminates amber and the CCAS is activated when there is a power loss. The light also illuminates during MFC test.

### ② SIDE WINDOWS pb

Controls activation of side windows heat systems.

- ON                      (pb pressed in) Power is supplied to both side windows heat systems. ON light illuminates blue.
- Pb released              Side windows heat systems are deactivated.
- FAULT                      The light illuminates amber and the CCAS is activated when there is a power loss.

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### 50.3 ELECTRICAL SUPPLY/MFC LOGIC/SYSTEM MONITORING

#### ELECTRICAL SUPPLY

EQUIPMENT	DC BUS SUPPLY (C/B)	AC BUS SUPPLY (C/B)
LH Front windshield supply	– Nil –	AC Wild BUS 1 (on lateral panel L FRONT WINDOW HTG)
Front windshield control	– Nil –	ACW BUS 1 (on lateral panel FRONT CTL and CAUTION)
Front windshield alert	DC BUS 2 (on lateral panel WDSHLD IND L)	– Nil –
Side window supply and control	DC BUS 1 (on lateral panel SIDE WDO L CTL)	– Nil –
RH Front windshield supply	– Nil –	AC wild BUS 2 (on lateral panel R FRONT WINDOW HTG)
Front windshield control	– Nil –	ACW BUS 2 (on lateral panel FRONT CTL and CAUTION)
Front windshield alert	DC BUS 1 (on lateral panel WDSHLD IND R)	– Nil –
Side window supply and control	DC BUS 2 (on lateral panel SIDE WDO R CTL)	– Nil –
Side windows alert	DC ESS BUS (on lateral panel side window CAUTION)	– Nil –

#### MFC LOGIC

See chapter 1.01.

#### SYSTEM MONITORING

The following condition is monitored by visual and aural alerts :

- Loss of window heating.
  - See WINDOW HTG FAULT procedure in chapter 2.05.09.



	<b>ICE AND RAIN PROTECTION</b>  WINDOW HEAT	1.13.50		
		P 3	001	
				DEC 96

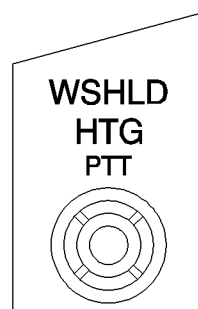
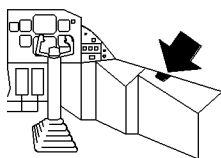
AA

#### 50.4 LATERAL MAINTENANCE PANEL

On the RH Maintenance panel, controls are provided for maintenance purposes only, to check windshield heat system.

#### WINDSHIELD HEAT TEST PUSH-BUTTON

R0FA-01-13-50-003-A001AA



Test push-button

Is used to check the windshield heat controller functioning.

Test procedure :

- Press and hold test button for 3 seconds.
- The B.I.T.E. executes a programmed check of the controllers, ending with de-energization of both overheat power relays.
- MFC magnetic indicator illuminates on the RH maintenance panel when a failure has been detected during the windshield heating cycle.

 <b>ATR 72</b> <b>F.C.O.M.</b>	<b>ICE AND RAIN PROTECTION</b>		1.13.60		
			P 1	001	
	PROBE HEAT				DEC 96

AA

### 60.1 DESCRIPTION

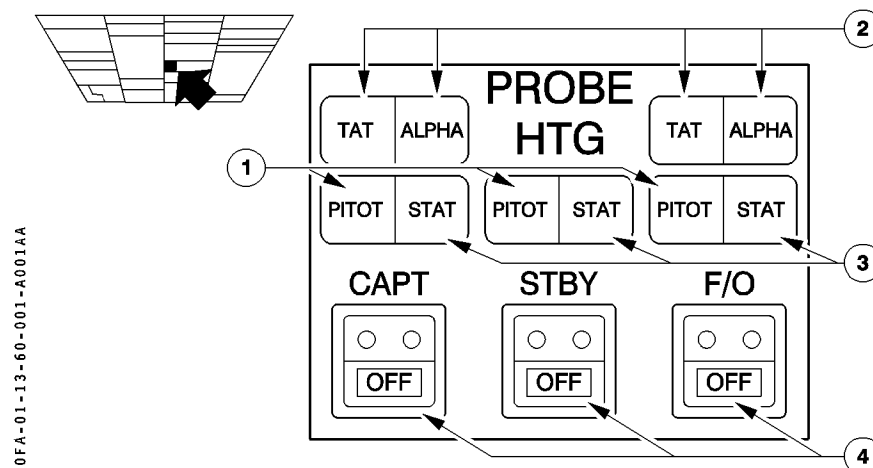
To prevent icing on air data sensors, electrical heating is provided for :

- CAPT, F/O, STBY pitot tubes
- CAPT, F/O, STBY left and right static ports
- F/O alpha (angle of attack) probe
- CAPT alpha (angle of attack) probe
- TAT probes

The probes are heated both on the ground and in flight, except TAT sensors heating which are inhibited on the ground.

### 60.2 CONTROLS

#### PROBE HEAT PANEL



#### ① PITOT lights

Illuminate amber and the CCAS is activated if :

- In flight or on the ground, the associated pitot is not heated

#### ② ALPHA, TAT lights

Illuminates amber on the CCAS is activated when the respective probe is not heated.

#### ③ STAT lights

Illuminate amber and the CCAS is activated when the respective probe is not heated. In flight, static ports are not monitored by CCAS.

#### ④ CAPT STBY F/O pbs

Control the activation of probe heating of their respective circuits.

ON : (pb pressed in) Probe heating is activated.

OFF : (pb released) Probe heating is deactivated. OFF light illuminates white. Respective PROBE HEAT light illuminates amber.

R0FA-01-13-60-001-A001AA

	<b>ICE AND RAIN PROTECTION</b>  PROBE HEAT	1.13.60		
		P 2	001	
				DEC 96

AA

## 60.3 ELECTRICAL SUPPLY/SYSTEM MONITORING

### ELECTRICAL SUPPLY

EQUIPMENT	DC BUS SUPPLY (C/B)	AC BUS SUPPLY (C/B)
<b>CAPT</b>		ACW BUS 1
Pitot tubes	– Nil –	(on lateral panel PITOT)
Alpha probe	– Nil –	ACW BUS 1
		(on lateral panel ALPHA)
Static ports	DC BUS 1 (on lateral panel)	– Nil –
Alerts	DC ESS BUS (on lateral alert CAUTION)	– Nil –
TAT probe	– Nil –	ACW BUS 1
		(on lateral panel CPT TAT)
<b>F/O</b>		ACW BUS 2
Pitot tubes	– Nil –	(on lateral panel PITOT)
Alpha probe	– Nil –	ACW BUS 2
		(on lateral panel ALPHA)
Static ports	DC BUS 2 (on lateral panel)	– Nil –
Alerts	DC BUS 2 (on lateral panel CAUTION)	– Nil –
TAT probe	– Nil –	ACW BUS 2
		(on lateral panel F/O TAT)
<b>STBY</b>		ACW BUS 1 and 115 VAC
Pitot tube	– Nil –	STBY BUS
		(on lateral panel STBY PITOT NORM SPLY and EMER SPLY)
Static ports	DC BUS 1 (on lateral panel LEFT, RIGHT)	– Nil –
Alerts	DC ESS BUS (on lateral panel CAUTION)	– Nil –

### SYSTEM MONITORING

The following condition is monitored by visual and aural alerts :

- Probe (s) not heated
  - See ALPHA PROBE HTG FAULT procedure or PROBE HTG FAULT (except ALPHA PROBES) procedure in chapter 2.05.09.

