

<div> <div>AIRBUS TRAINING</div> <div>  <div> A310 SIMULATOR FLIGHT CREW OPERATING MANUAL </div> </div> </div>	ICE AND RAIN PROTECTION		1.13.00
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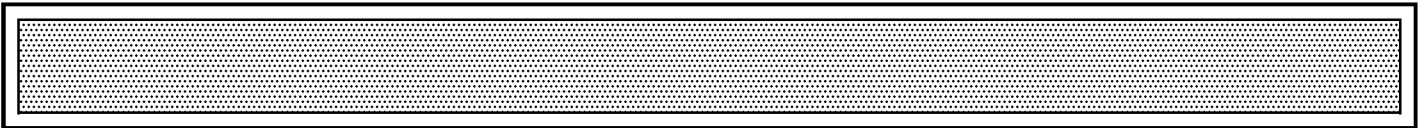
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ICE AND RAIN PROTECTION

GENERAL

DESCRIPTION

1.13.10

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REV 19

SEQ 000

The ice and rain protection system permits aircraft operation without restriction by icing conditions or heavy rain.

Aircraft ice protection is provided by heating of critical areas using hot air or electrical power.

Hot air heated areas :

- Part of center and outer slats of each wing,
- Engine air intakes.

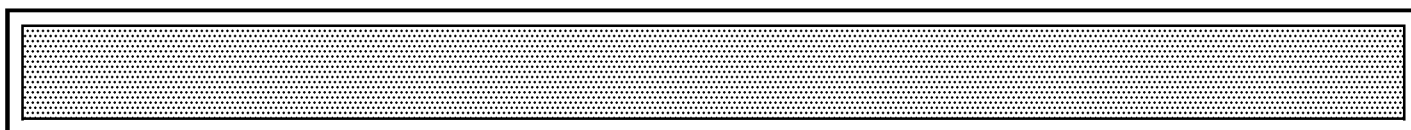
Electrical heated areas :

- Front windshields for ice protection, side windows for defogging,
- Probes, pitot tubes and static ports,
- Waste water drain masts.

For hot air heating the engines supply bleed air. APU bleed air may be used as an alternate source for wing anti-ice. For electrical heating the power is supplied by AC BUS 1, AC BUS 2, DC NORM BUS and DC ESS BUS.

R

Rain removal from the front windshields is achieved by windshield wipers and, in heavy rain only, by the rain repellent fluid system.



Ice protection for the wings is ensured by heating of the leading edges of center slats (outer half) and outer slats (full length). Hot air, supplied by engines or APU (up to 20 000 ft) is ducted in each wing, from the fixed leading edge supply duct into the outer slat through a telescopic tube.

Then the air is distributed along this slat by a piccolo tube, and also into the center slat piccolo tube, by a flexible connection across the slats gap. At last, the air, after having heated the concerned slats, exhaust overboard through vent holes distributed along the slat rear skin.

Each wing is equipped with two anti-ice solenoid controlled, pneumatically operated shutoff valves, normal and alternate, arranged in parallel.

- With engine bleed air supply, only one valve is active, as selected,
- With APU bleed air supply, both valves are active regardless of mode selection.

A flow limiting restrictor is fitted downstream of each valve.

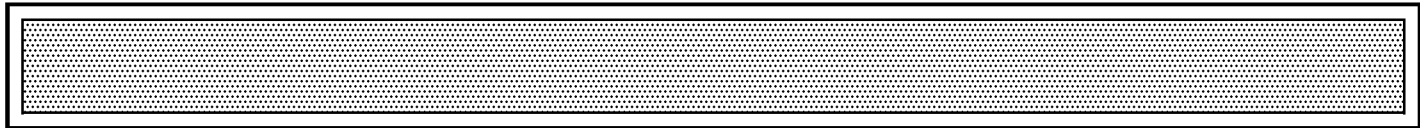
When WING ANTI-ICE SUPPLY is switched ON, a signal is passed to the pneumatic system which increases the hot air temperature at the precooler outlet (227° C instead of 177° C), and if operating on APU bleed air, the APU flow will be increased.

If during operation on engine bleed air an anti-ice valve fails to open, the other valve can be selected for operation. Without electrical or pneumatic supply the valves are springloaded closed.

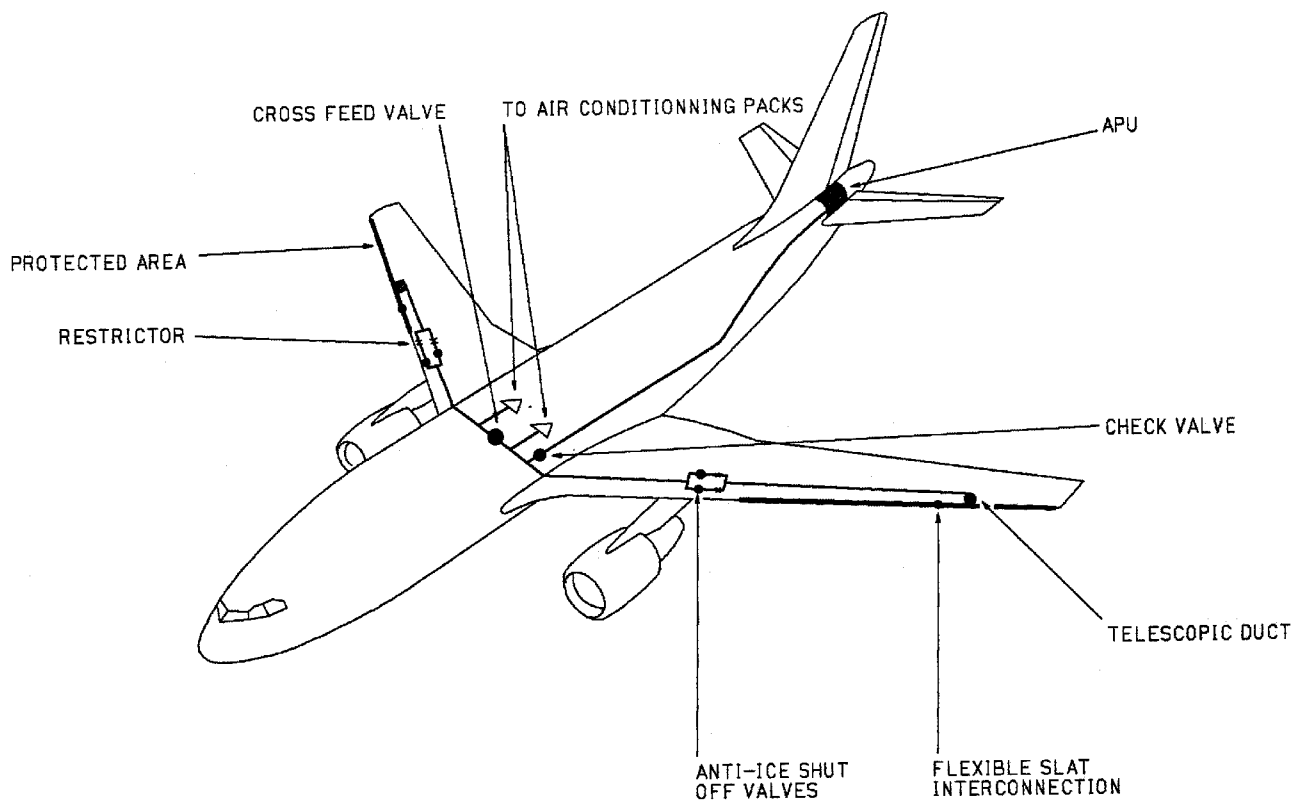
The wing anti-ice valves will close automatically if :

- an engine FIRE handle is pulled while the AIR BLEED X-FEED valve is closed,
- the main landing gear struts are compressed (weight on wheels),
- air bleed supply pressure < 10 psi
- On the ground, if the wing anti-ice system is selected ON, overheating of the slat structure is prevented by means of a time delay relay which limits the valve opening time to 10 seconds during the test operation.

R

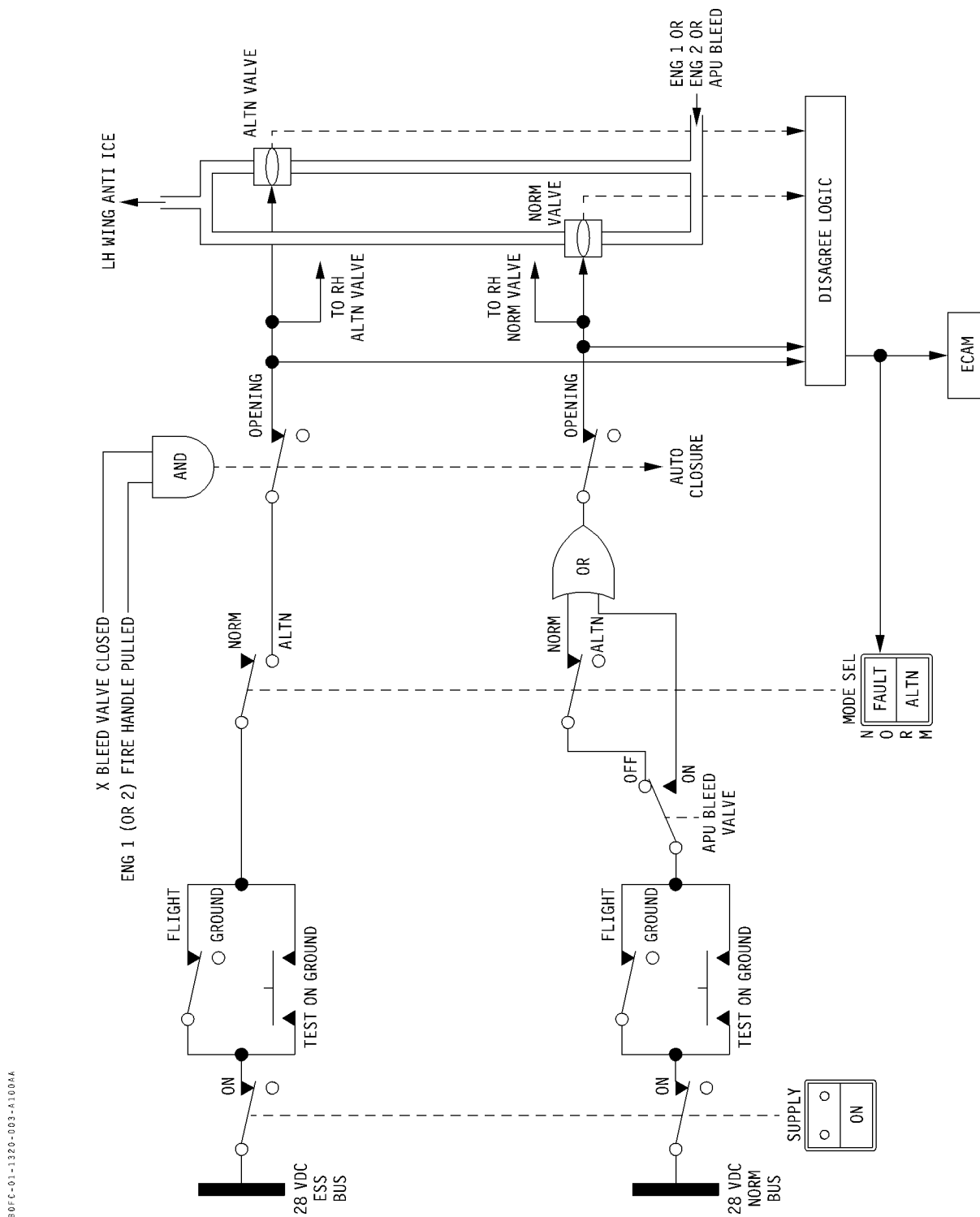


GENERAL ARRANGEMENT



OPS.FCO.B1.1320.002-00.000

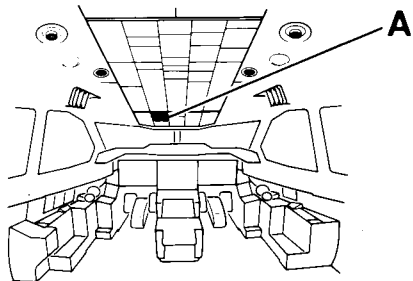
ARRANGEMENT AND LOGIC



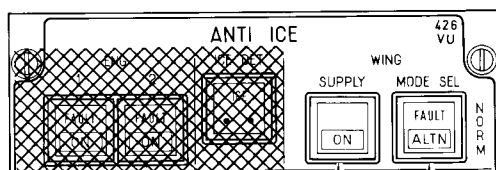
Mod : 5910

A. ANTI ICE PANEL

– Wing



FB1.1320.004-AA.000



(1)

(2)

(1) ANTI ICE WING SUPPLY Pushbutton Switch

Controls wing anti-ice system simultaneously on left and right side.

■ ON (P/B Switch Pressed – in)

The ON light comes on blue.

– With Engine Bleed Air Supply :

Two wing anti-ice valves open, as selected with MODE SEL switch NORM or ALTN, one on left and one on right side.

– With APU Bleed Air Supply :

All four wing anti-ice valves open.

Note : The indication WING ANTI ICE ON is displayed on ECAM MEMO page.

Note : When bleed air is supplied by the engines and when the TCC is operating, the opening of an anti-ice valve causes automatically a reduction of thrust limit indication.

■ OFF (P/B Switch Released – out)

Wing anti-ice valves close, the ON light goes off.

(2) ANTI ICE MODE SEL Switch

Controls the selection of the active wing anti-ice valves, when engine bleed air supply is used.

■ NORM (P/B Switch Pressed –in)

The normal valve on each side is selected for operation.

■ ALTN (P/B Switch Released – out)

the ALTN light comes on white. The alternate valve on each side is selected for operation.

■ FAULT

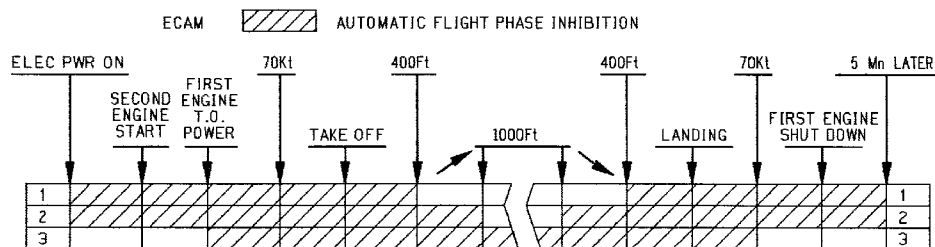
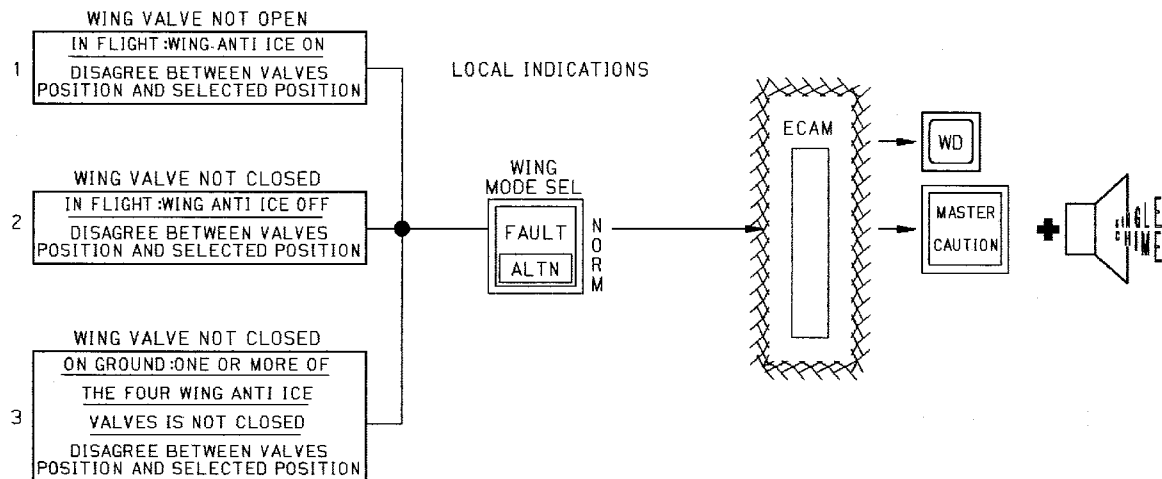
The light comes on amber, if any wing anti-ice valve position does not agree with the scheduled position (as defined by the switch selection or by the overriding automatic command).

The FAULT light comes on momentarily during wing anti-ice valve travel for opening or closure. If it comes on for more than 5 seconds, the ECAM system is activated.

Vers. : All

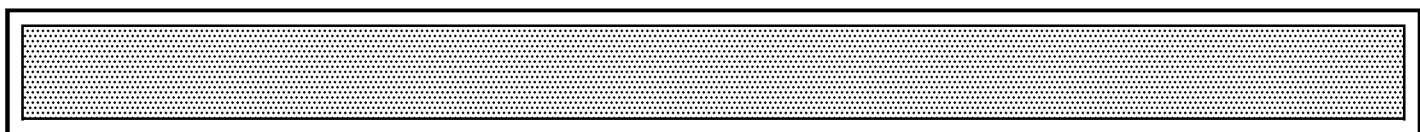
Eng. : All

WARNING LOGIC



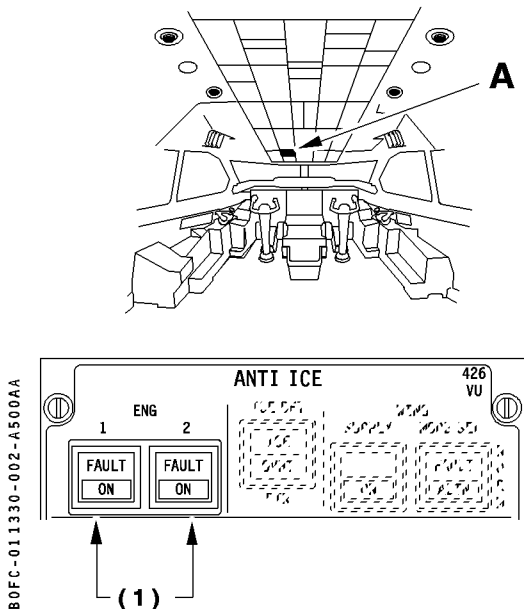
OPS.FCO.B1.1320.005-06.020

Mod. : 5051



A. ANTI ICE PANEL

– Eng



(1) ENG 1 or ENG 2 P/B Switch

Controls engine anti-ice system for the related engine 1 or 2.

■ ON (P/B Switch Pressed-in)

The ON light comes on blue when anti-ice valve opens.
The indication ENG ANTI ICE is given on the ECAM MEMO page.

■ off (P/B Switch Released-out)

The ON light goes off. The valve closes.

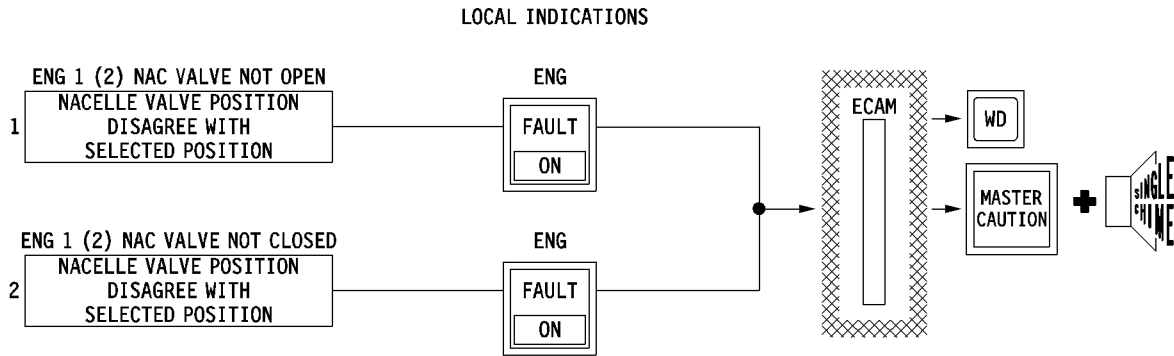
■ FAULT

The light comes on amber, if valve position does not agree with P/B switch selection.

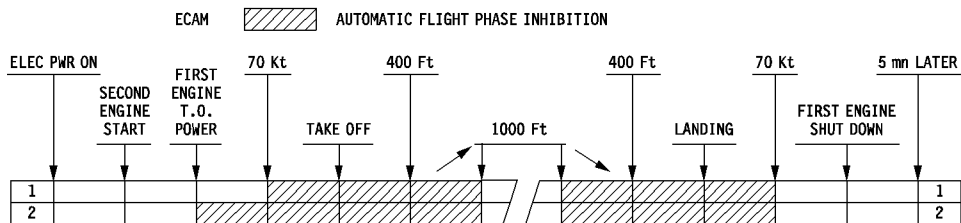
The FAULT light comes on momentarily during valve transit. If it remains on for more than 3 seconds the ECAM system is activated.

R Code : 1330I

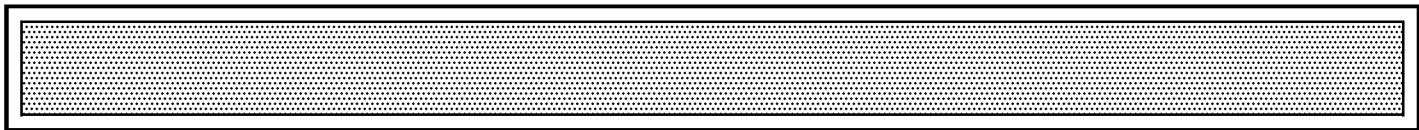
WARNING LOGIC



BOFC-011330-003-A500AA



R Code : 1330J



The cockpit windows are electrically heated ; the front windshields for ice protection and defogging, the side windows for defogging only.

Two anti-ice regulators control the front windshield temperatures to 35 °C/42 °C. A temperature sensor in each windshiedl signals the actual temperature to the related regulator, which accordingly activates or deactivates the heating power supply from regulator control to the heating elements of windshield and side windows.

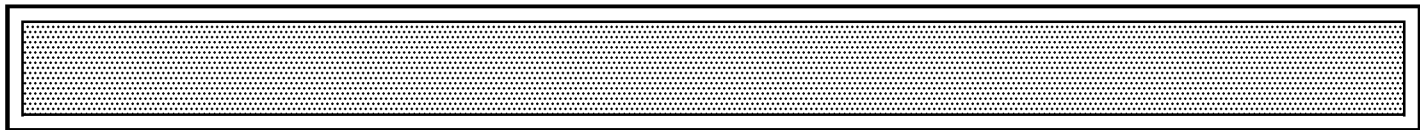
Side window heat is not temperature controlled.

A regulated failure results in illuminating the FAULT It on the WINDOW HEAT panel.

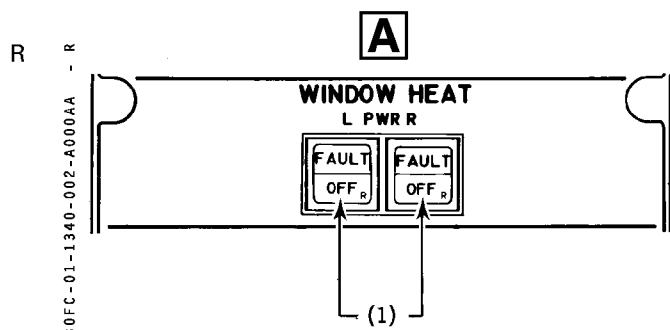
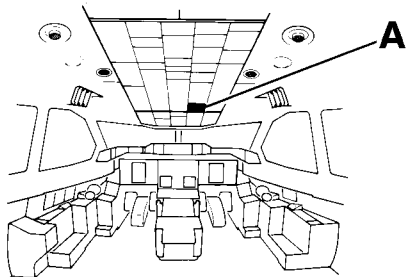
Front windshields are heated on two heating power levels. Low heating power is used on the ground. High heating power is used in flight.

Window heat failure warnings are provided by two FAULT indications and the ECAM activation.

On the lateral panel devices for testing the heating power supply an for testing the protection and warning circuits are installed.



A. WINDOW HEAT PANEL



(1) PWR L or R P/B Switch

Controls activation of window heat system left or right side.

■ ON (P/B switch pressed-in) :

Power is supplied to anti-ice regulator. Heating elements in the panes are supplied, front and side windows are heated.

■ OFF/R (P/B switch released-out) :

OFF/R light illuminates white. Window heat system is deactivated.

■ FAULT :

The light illuminates amber if the related window heat system has failed. Heating power is disconnected and disconnection latched in the event of :

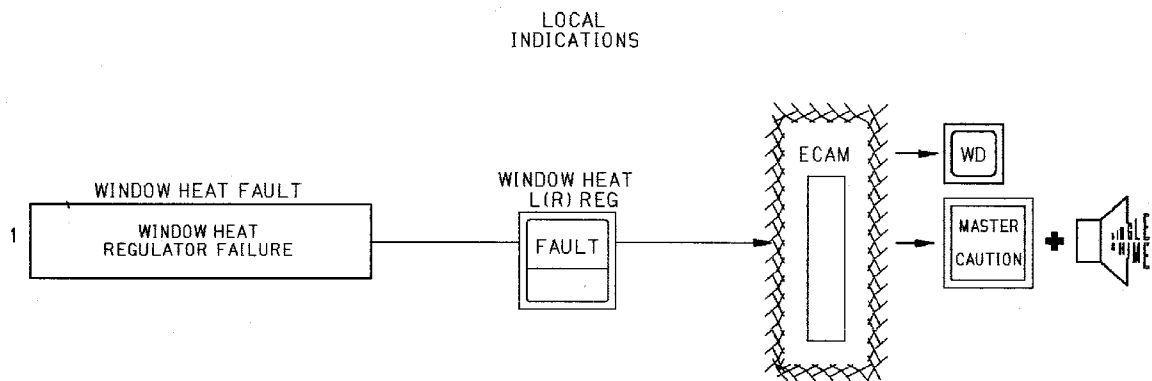
- Front windshield temperature is less than -60°C or greater than $+60^{\circ}\text{C}$
- Failure of sensing or regulative circuit
- Loss of 28VDC supply to regulator

The FAULT light will extinguish after :

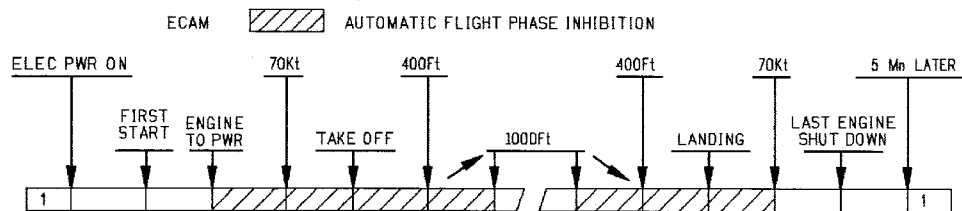
- Recovery of 28VDC supply to anti ice regulator.
- Selection of PWR P/B switch to OFF/R.

Illumination of the FAULT light is accompanied by ECAM activation.

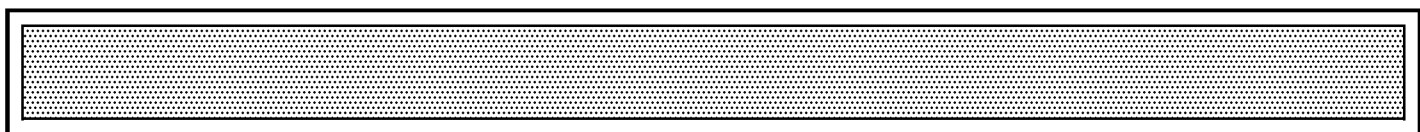
WARNING LOGIC



BOFC-01-1340-003-A020AA - R



Mod. : 5051



R To prevent the formation of ice on air data sensors electrical probe heating is provided for

- Pitot tubes
- Static Ports
- Alpha (angle of attack- α) probes
- EPR (compressor inlet total pressure – PT2) probes
- TAT (total air temperature) probes.

The system is arranged in three independant channels (CPT/FO/STBY).
 Pitot tubes have two heating levels. Change over occurs automatically from low heating level on the ground to high heating level in flight.

Two parts of alpha probes are heated (case and vane).

Only failure of vane heating will be indicated to crew.

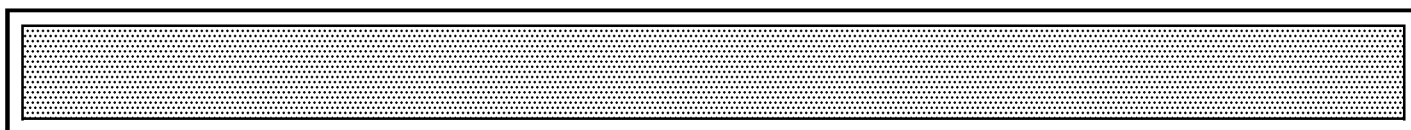
The TAT probes are not heated on the ground to avoid erroneous indications.

The TAT probe light will not illuminate on the ground even with system ON.

If probe heat is not selected ON or if any failure or discrepancy of probe heating occurs, the respective PROBE HEAT lights on the overhead panel will illuminate.

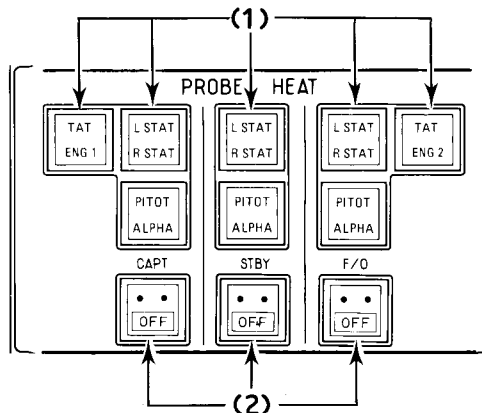
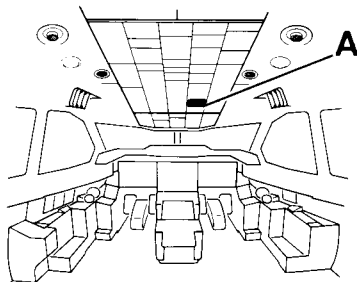
Vers. : All

PW Eng. : All



A. PROBE HEAT PANEL

FB1.1350.002-AA.000



(1) TAT, ENG 1 or 2, L or R STAT, PITOT, ALPHA Lights

Lights come on amber, if

- respective probe heat circuit not selected On,
- probe heating supply failed,
- probe heating control failed :
- . If a PITOT light comes on on ground, in addition to the above causes the system may be in the high heating mode due to failure of switchover.
- . If a PITOT light comes on in flight, in addition to the above causes the system may be in the low heating mode due to failure of switchover.

Illumination of a PROBE HEAT light is accompanied by ECAM activation.

R *Note : The TAT light remains off when switched ON*
R *on ground although the probe is not heated.*

(2) CPT, F/O, STBY P/B Switches

Control the activation of probe heating of their respective circuits.

■ ON (P/B Switch Pressed-in)

Probe heating is activated. Respective PROBE HEAT lights will extinguish.

■ OFF (P/B Switch Released-out)

The OFF light comes on white. Probe heating is deactivated. Respective PROBE HEAT lights come on amber.

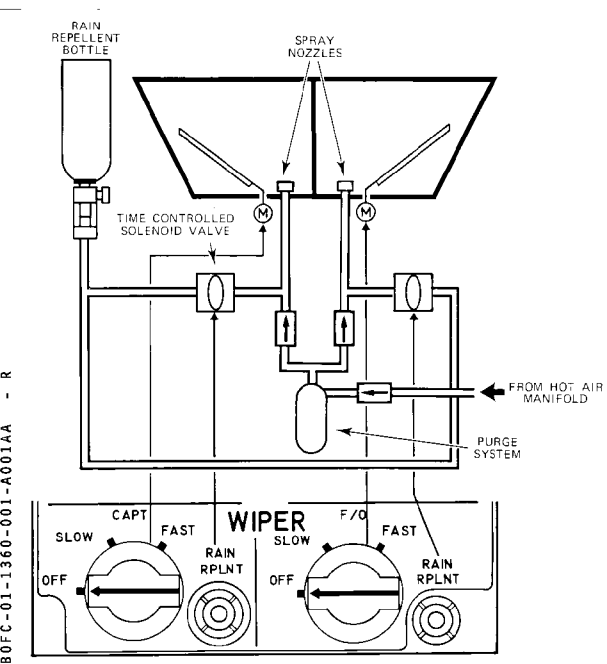
Rain removal from front windshields is provided by two wipers. Each wiper is driven by a two – speed electric motor. They are controlled by two WIPER selectors on the overhead panel, one for the captain, and one for the F/O.

The system has a parking position of the wiperblade with the scraper, just lifted from the window face, to avoid accumulation of sand and scratching of the glass.

The rain repellent system is provided as an aid to improve visibility through front windshields in heavy rain. It includes a pressurized bottle, which supplies rain repellent fluid through two time-controlled solenoid valves to the spray nozzles, and two pushbuttons for operation, one for each side. Timing devices limit the amount of rain repellent fluid for one application cycle.

The system is automatically purged by air from the hot air manifold.

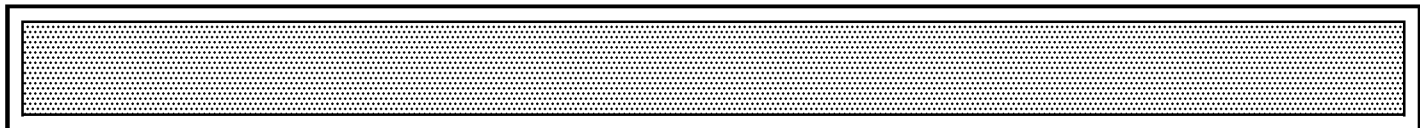
ARRANGEMENT



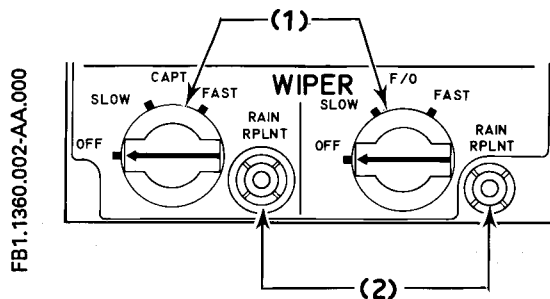
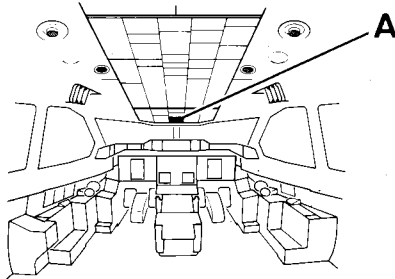
CAUTION

Rain repellent fluid contains a highly TOXIC substance. This is scented similar to orange peel, or lemon. If a similar smell is noticed in the cockpit a rain repellent leak may be suspected. The SMOKE/TOXIC FUMES REMOVAL procedure should be followed.

R
R
R
R
R



A. WIPER PANEL



(1) CAPT – F/O WIPER Rotary Selectors

The rotary selectors control the windshield wipers on each side.

- R ■ **FAST**
Wipers operate at 150 cycles/min.
- R ■ **SLOW**
Wipers operate at 75 cycles/min.
- R ■ **OFF**
Wiper operation stops in parking position, wipers are out of view.

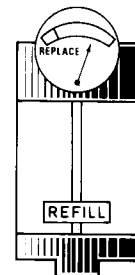
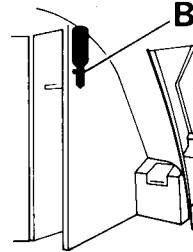
(2) CAPT or F/O RAIN REPLNT Pushbutton

Controls the application of rain repellent fluid to the respective front windshield.

When pressed, the timer applies a measured quantity of fluid. To repeat the cycle, the pushbutton must be released, then pressed again.

CAUTION : RAIN REPELLENT MUST NOT BE USED AS WINDSHIELD WASHER, AND NEVER BE APPLIED TO A DRY WINDSHIELD.

B. RAIN REPELLENT BOTTLE



The pressurized bottle is installed on the LH rear cockpit wall.

(1) Pressure Indicator

Indicates the nitrogen pressure in the bottle.

- **Green band**
Pressure is sufficient.
- **Yellow band**
Pressure is low, bottle should be replaced.

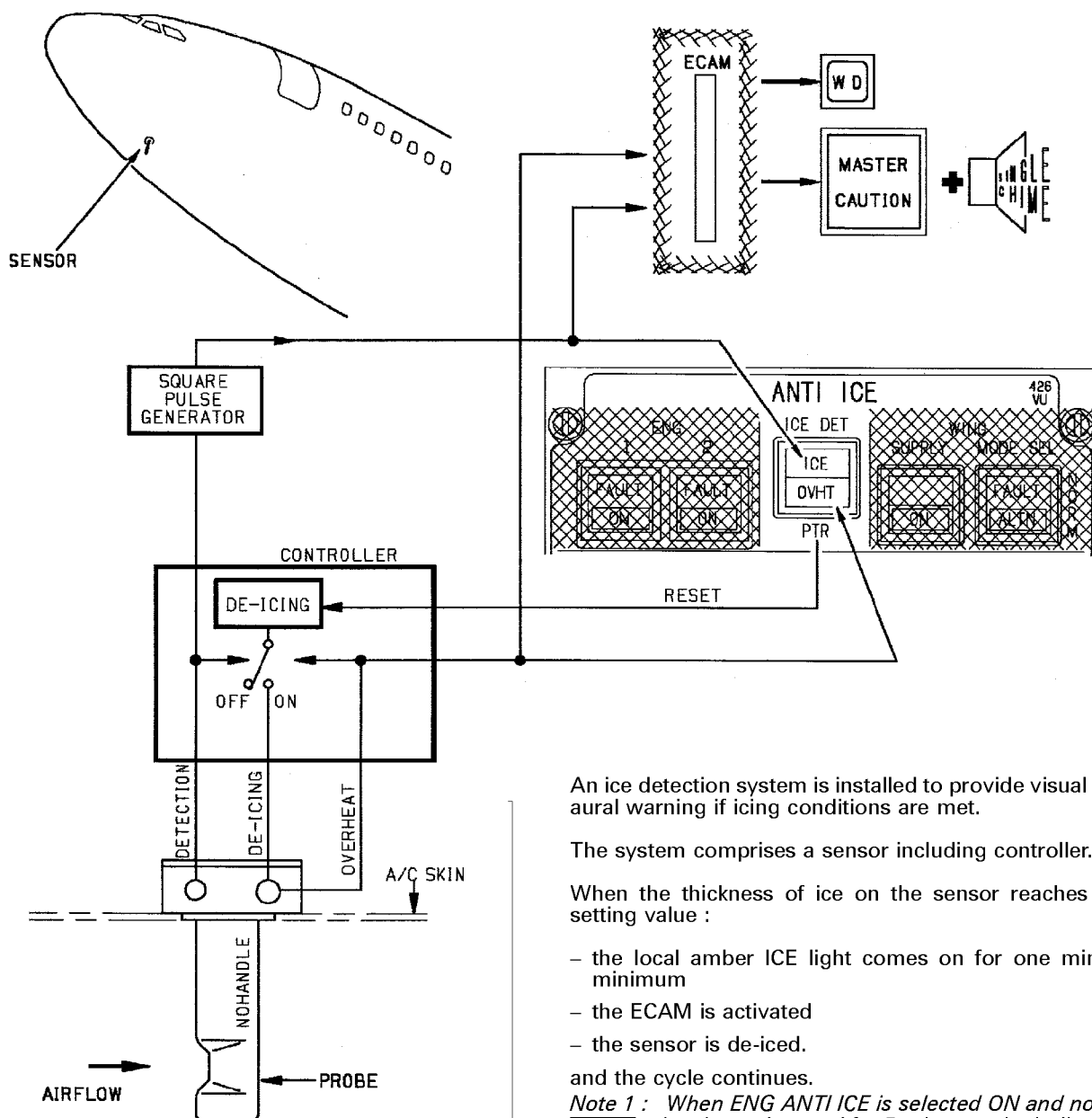
(2) Quantity Indicator

If the REFILL float is in view, the bottle should be replaced.

Vers. : All

Eng. : All

AUTOMATIC DETECTION SYSTEM



An ice detection system is installed to provide visual and aural warning if icing conditions are met.

The system comprises a sensor including controller.

When the thickness of ice on the sensor reaches the setting value :

- the local amber ICE light comes on for one minute minimum
- the ECAM is activated
- the sensor is de-iced.

and the cycle continues.

Note 1 : When ENG ANTI ICE is selected ON and no ice has been detected for 5 minutes, the indication ENG ANTI ICE ON on ECAM MEMO page flashes. This informs the crew of the necessity of checking icing conditions.

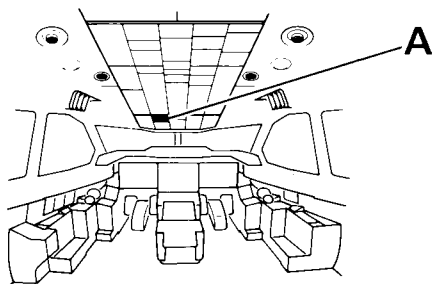
Note 2 : The ice detection system is inhibited on ground.

OPS.FCO.B1.1370.001-AA.060

Mod. : 2753 + 5051 + 5381

A. ANTI ICE PANEL

– Ice Det



The sensor de-icing system is then automatically cut-out.

Illumination of the OVHT light is accompanied by ECAM activation.

The light goes off when the overheat condition disappears.

FB1.1370.002-AA.030



(1)

(1) PTR Pushbutton

The pushbutton allows to reset the de-icing system of the sensor after an overheat detection.

▪ Momentarily Pressed

The de-icing system of the sensor is reseted after an overheat detection.

▪ ICE

The light comes on amber during one minute minimum when the thickness of ice accretion on the sensor reaches a setting value, provided the aircraft is in flight.

Simultaneously, the sensor is de-iced by heating. When it is fully de-iced, the sensor is ready to detect other ice condition.

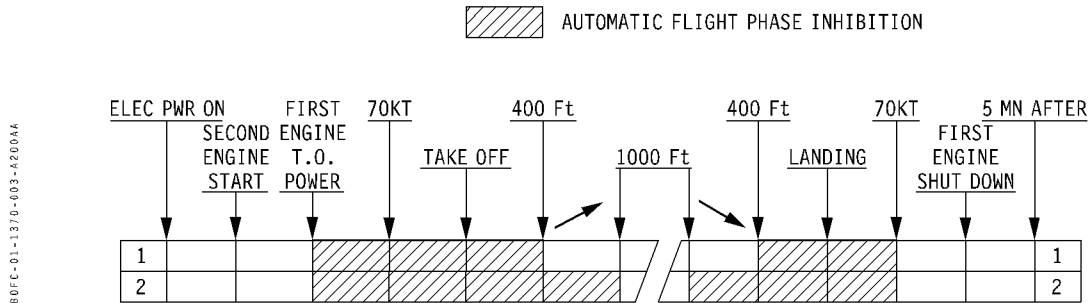
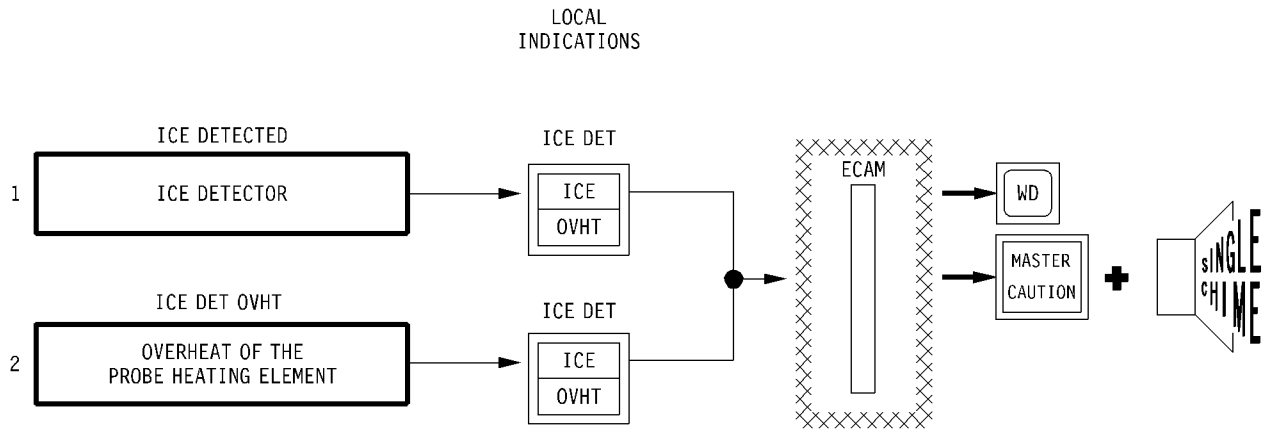
Illumination of the ICE light is accompanied by ECAM activation.

▪ OVHT

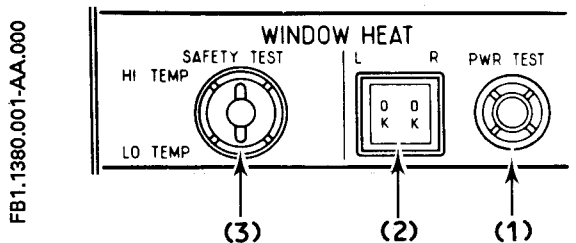
The light comes on amber when an overheat is detected in the heating element.

Mod. : 2753 + 5381

WARNING LOGIC



A. WINDOW HEAT PANEL



(1) PWR TEST Pushbutton

Activates test of heating power supply to front windshields and side windows, simultaneously for both sides.

Before test the PWR P/B switches on the overhead panel must be selected ON.

When the pushbutton is pressed, the TEST OK lights will come on if the heating power supply is satisfactory. The duration of test is limited by a time relay to 10 seconds.

(2) OK Lights

The lights come on white during PWR TEST to indicate satisfactory condition of window heat power supply.

(3) SAFETY TEST Selector

Controls test of temperature control and warning circuits. Before test the PWR P/B switches on the overhead panel must be selected ON. The SAFETY TEST selector is springloaded to neutral (center position).

■ HI TEMP

Front windshield temperature in excess of 60 ° C is simulated.

- Both FAULT lights come on on the overhead panel,
- Heating power supply is disconnected,
- ECAM is activated

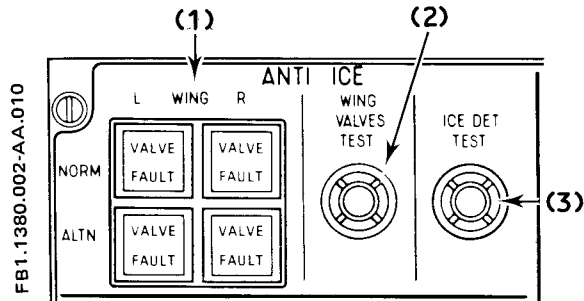
■ Neutral

Test circuit is de-energized. To cancel the warnings and to reset the system the PWR P/B switches must be selected OFF/R after test.

■ LO TEMP

Front windshield temperature in excess of – 60 ° C is simulated. Indications will be identical to test in TEMP HI position.

B. ANTI ICE PANEL



(1) WING VALVE FAULT Lights

For each wing anti-ice valve a light is provided for monitoring of valve operation. A failure is indicated after 3 seconds (Maintenance information only).

(2) WING VALVES TEST Pushbutton

The wing anti-ice system can be tested on the ground, with or without bleed air supply. Extent of test and the resulting indications differ respectively.

Before test the ANTI ICE WING SUPPLY P/B switch must be selected ON, the ON light on, no ANTI-ICE warnings activated,

■ Pressed and Held

System is tested for 10 seconds,

– With Bleed Air Supply

Wing anti-ice valves are induced to open ;
all four when on APU bleed air,
one of each side when on engine bleed air.

The ANTI ICE WING FAULT light comes on during valve transit, then goes off.

If it remains on during the 10 seconds test period, one of the four valves has failed to open. If it remains on after the 10 seconds test period has elapsed, one of the valves has failed to close, with activation of the ECAM system.

After 3 seconds a failure to open or to close results in illumination of the corresponding WING VALVE FAULT light (if ANN LT switch is selected READ).

– Without Bleed Air Supply

Valves do not open. Only failure warnings are tested, as selected NORM or ALTN.

The ANTI ICE WING FAULT light must come on for the duration of the test with activation of the ECAM system.

■ Released

Test circuit is de-energized

After successful test the ANTI-ICE light and FAULT light must be off.

(3) ICE DET TEST Pushbutton.

■ Pressed and Held

An ice detection is simulated by procuring an equivalent tension to the controller

The ICE light comes on ANTI ICE panel accompanied by ecam activation to indicate positive test.

■ Released

Test circuit is de-energized.

Mod. : 2753