**ON A/C ALL

30–00–00–001

ICE AND RAIN PROTECTION, GENERAL

Introduction

The Ice and Rain Protection System (IRPS) includes ice detection, de–icing, anti–icing and rain removal.

General description

The Ice Detection System (IDS) assists in determining ice build–up and sends this information to the pilots in the flight compartment so that they can take the appropriate action.

The Pneumatic De–ice System removes ice which has accumulated on the leading edges of the wings, horizontal and vertical stabilizers, and the inlet lip of the engine nacelles. The leading edges of the propeller blades are electrically de–iced.

The Anti–icing Systems are thermal, using electrical heating elements to prevent ice formation.

Conventional electrically operated windshield wipers provide rain removal of the pilot and copilot's windshields. The Ice and Rain Protection System (IRPS) has the sub–systems that follow:

- Airframe De–icing Systems (30–10–00)
- Air Intake De–icing (30–20–00)
- Pitot and Static Anti–Icing System (30–30–00)
- Windshield and Windows Ice and Rain Protection (30–41–00)
- Propellers Ice Protection (30–61–00)
- Ice Detection System (30–80–00).

Detailed Description

Refer to Figure 1.

The airframe deicing system is divided into two identical subsystems, one subsystem per engine. Each subsystem uses bleed air from its related engine to inflate boots on the leading edges of the wings, horizontal stabilizer, vertical stabilizer and nacelle air intakes. The inflation of the boots removes the accumulated ice from these surfaces. Both subsystems are connected to each other through an Isolation Shut–Off Valve (ISOV). The rear parts of the subsystems (in the aft fuselage) are also connected by a restrictor.

The nacelle air intake ice protection system consists of a separate pneumatic de–icing boot on the exterior of the nacelle and an anti–icing, engine intake adapter heater which has an integral electric heater within the nacelle, adjacent to the engine intake.

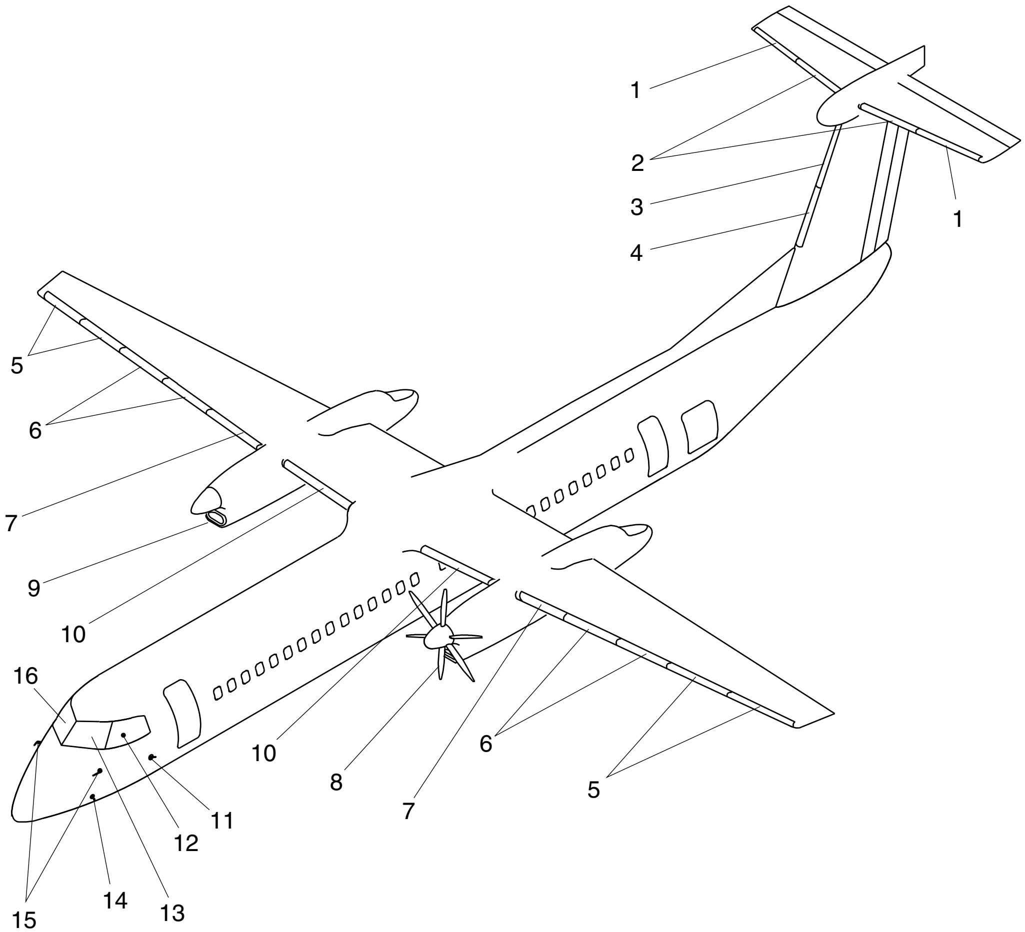
Three pitot–static probes incorporate electrical heating elements to prevent icing which can cause incorrect pitot or static measurements.

Both windshields and the pilot's side window have electronically controlled heater elements laminated into the panels to keep the windows at a predetermined temperature to prevent icing and misting.

Windshield wipers provide rain removal for the pilot's and copilot's windshields

The Propeller Anti–Icing System has electrical heating elements installed in the leading edge of each propeller blade to remove ice accumulations. When heat is selected ON, all six blades on one side of the aircraft are heated at one time, then the propeller on the other side is heated.

The Ice Detection System (IDS) provides early detection and indication of aircraft icing conditions and is activated when 115 Vac electrical power is available. When ice accumulation is sensed the words ICE DETECTED appear on the Engine Display (ED).



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LEGEND

1. Outboard Horizontal Stabilizer Boots.
2. Inboard Horizontal Stabilizer Boots.
3. Upper Vertical Stabilizer Boots.
4. Lower Vertical Stabilizer Boots.
5. Extension and Outboard Wing Boots.
6. Outboard and Inboard Centre Wing Boots.
7. Inboard Wing Boots.
8. Propeller Blade Heaters (All Blades).
9. Nacelle Inlet Lip Boot (Both Sides).
10. Centre Boots.
11. Angle of Attack Vanes.
12. Pilot's Side Window.
13. Pilot's Windshield.
14. Ice Detector Probe.
15. Pitot/Static Probes.
16. Copilot's Windshield.

NOTE

Right propeller removed for clarity.

Ice and Rain Protection Systems
Figure 1

**ON A/C ALL

30–10–00–001

AIRFRAME DEICING SYSTEMS

Introduction

The airframe deicing system uses engine bleed air to operate a series of inflatable/deflatable boots. The inflating and deflating action of the boots removes the accumulation of ice on the leading edges of the aircraft.

General Description

The airframe deicing system is divided into two identical subsystems, one subsystem per engine. Each subsystem uses bleed air from its related engine to inflate boots on the leading edges of the wings, horizontal stabilizer, vertical stabilizer and nacelle air intakes. The inflation of the boots removes the accumulated ice from these surfaces. Both subsystems are connected to each other through an Isolation Shut–Off Valve (ISOV). The rear parts of the subsystems (in the aft fuselage) are also connected by a restrictor.

Detailed Description

Refer to Figure 1.

Nineteen pneumatically inflatable rubber deicing boots are bonded to the airframe structure on the wing and tail leading edges. Bleed air from both engines is supplied to the boots causing them to inflate. The inflation of the boots breaks away the accumulated ice from the aircraft and sheds it into the airflow. The system operates at a regulated pressure of 18 psig (124 kPag).

The Isolation Shut–off Valve (ISOV) and the restrictor connect the left and right systems. Normally, the ISOV opens as soon as 28 Vdc electrical power supply is available. This makes surethat deicing air is available to both sides of the aircraft in the event of a failure on one side of the system.

Refer to Figures 2 and 3.

Three switches are used to control the deicing system. These switches are located on the ICE PROTECTION control panel and are labelled:

- AIRFRAME MODE SELECT
- AIRFRAME MANUAL SELECT
- BOOT AIR.

The AIRFRAME MODE SELECT switch selects the operating mode of the deicing system. Four modes are available : FAST, SLOW, OFF and MANUAL. This switch commands the Timer and Monitor Unit (TMU) to control the automatic operation of the deicing system by regulating the inflation sequence of the pneumatic boots.

When the AIRFRAME MODE SELECT switch is in the MANUAL or OFF position, 28 Vdc is supplied from the right essential bus through a 5 A circuit breaker. This circuit breaker is located at the K8 position and is labelled AIRFRAME MANUAL CONT. Individual boot selection is possible in these modes. Automatic boot inflation and manual boot inflation switches are tied together, disabling the automatic mode in the MANUAL or OFF position.

In the automatic modes (FAST and SLOW), the airframe is deiced according to a predefined cycle controlled by the TMU. The cycle is divided into 6 sequences of inflation and a dwell period. Each sequence consists of inflation of an indivdual boot for 6 seconds followed by suck down of that boot (dwell period) until the next cycle. When in SLOW mode, the deice cycle lasts 3 minutes. When in FAST mode, the deice cycle lasts 1 minute. The deicing system heaters are still controlled by the TMU using the SAT data.

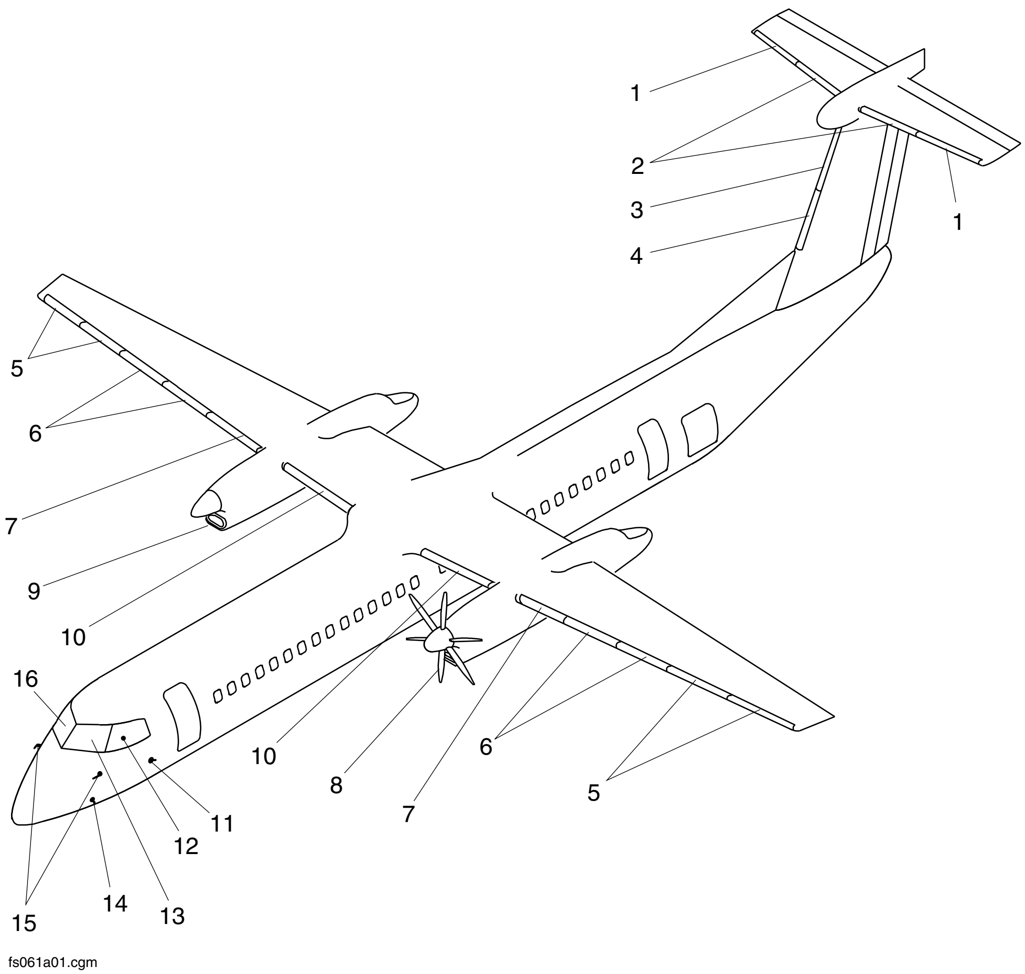
When the AIRFRAME MODE SELECT switch is in the MANUAL position, individual boots can be inflated using the second switch labelled AIRFRAME MANUAL SELECT. This switch has 8 positions, 6 positions for the 6 phases of airframe deicing cycle and two for the OFF position. Inflation of a single boot or a series of boots is possible by rotating the AIRFRAME MANUAL SELECT switch to the desired boot settings. When MANUAL mode is selected, the deicing equipment heaters are turned on but are no longer controlled by the TMU.

In the OFF mode, automatic deicing is inhibited and only manual deicing is permitted as in the MANUAL mode but the TMU controls the deicing system heaters.

The BOOT AIR switch has two positions: NORM and ISO. In the NORM position, the Isolation Shut–off Valve (ISOV) is open connecting the left and right deicing systems. In the ISO position, the ISOV is closed and the left and right deicing systems are isolated from each other.

Monitoring of the boot operation is done by observing eight wing boot advisory lights, the four tail boot advisory lights. and the two nacelle intake lights. All 14 advisory lights are located on the ICE PROTECTION control panel. A boot inflation advisory light comes on when there is sufficient pressure within that particular boot. Correct operation of all de–icing boots is compulsory for operation under icing conditions. It may be necessary to check their operation by advisory lights or by looking at the boots in the event a system malfunction is encountered.

Failure of the tail deicing boots allows ice to build up on the horizontal and vertical stabilizers. This will reduce the efficiency of the rudder and the elevators and lead to a hazardous situation if not detected.



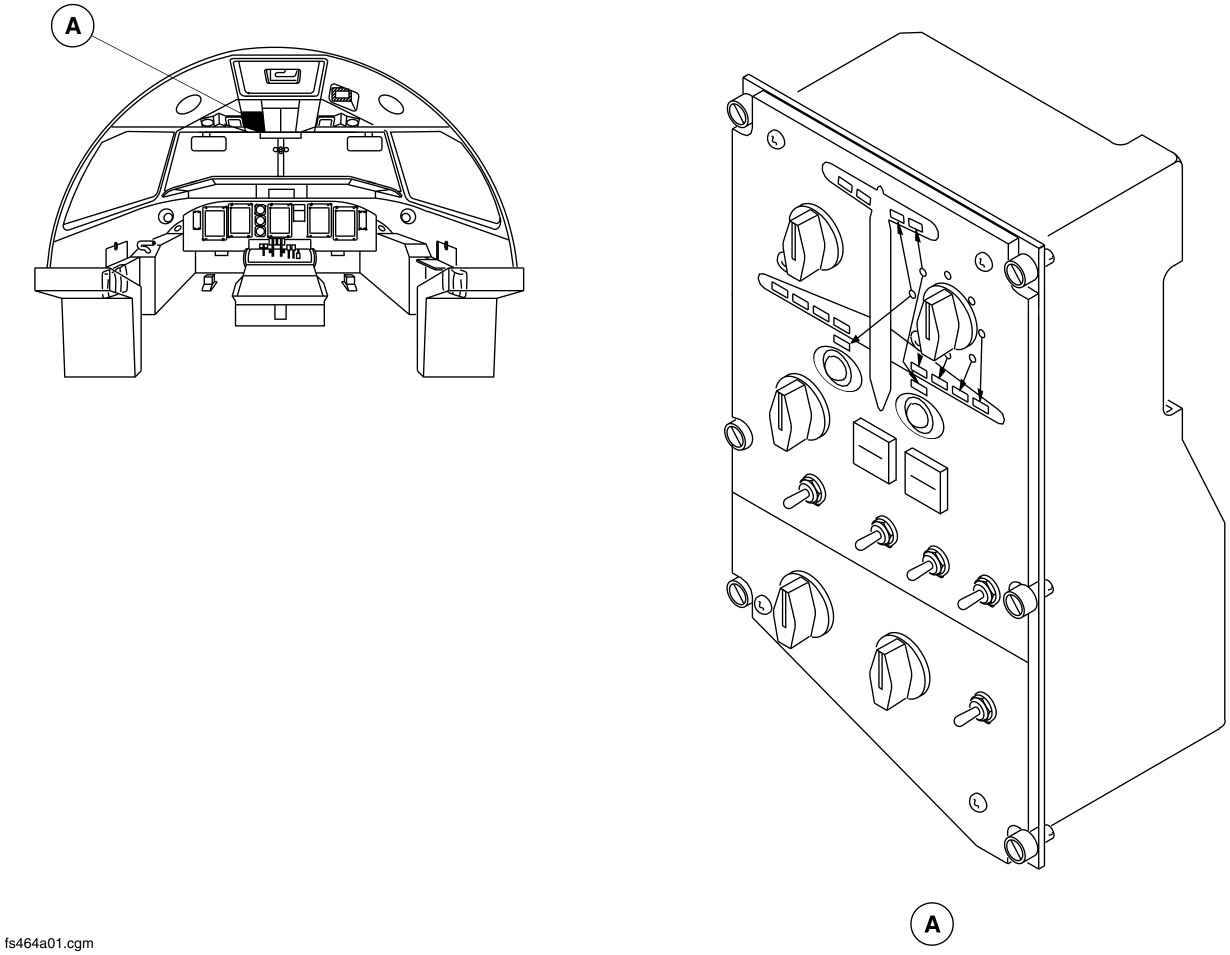
LEGEND

1. Outboard Horizontal Stabilizer Boots.
2. Inboard Horizontal Stabilizer Boots.
3. Upper Vertical Stabilizer Boots.
4. Lower Vertical Stabilizer Boots.
5. Extension and Outboard Wing Boots.
6. Outboard and Inboard Centre Wing Boots.
7. Inboard Wing Boots.
8. Propeller Blade Heaters (All Blades).
9. Nacelle Inlet Lip Boot (Both Sides).
10. Centre Boots.
11. Angle of Attack Vanes.
12. Pilot's Side Window.
13. Pilot's Windshield.
14. Ice Detector Probe.
15. Pitot/Static Probes.
16. Copilot's Windshield.

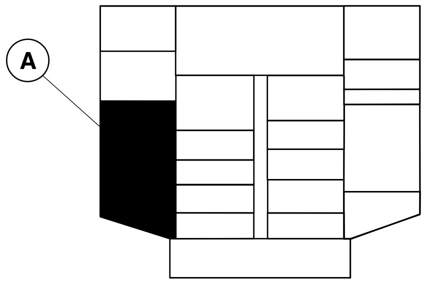
NOTE

Right propeller removed for clarity.

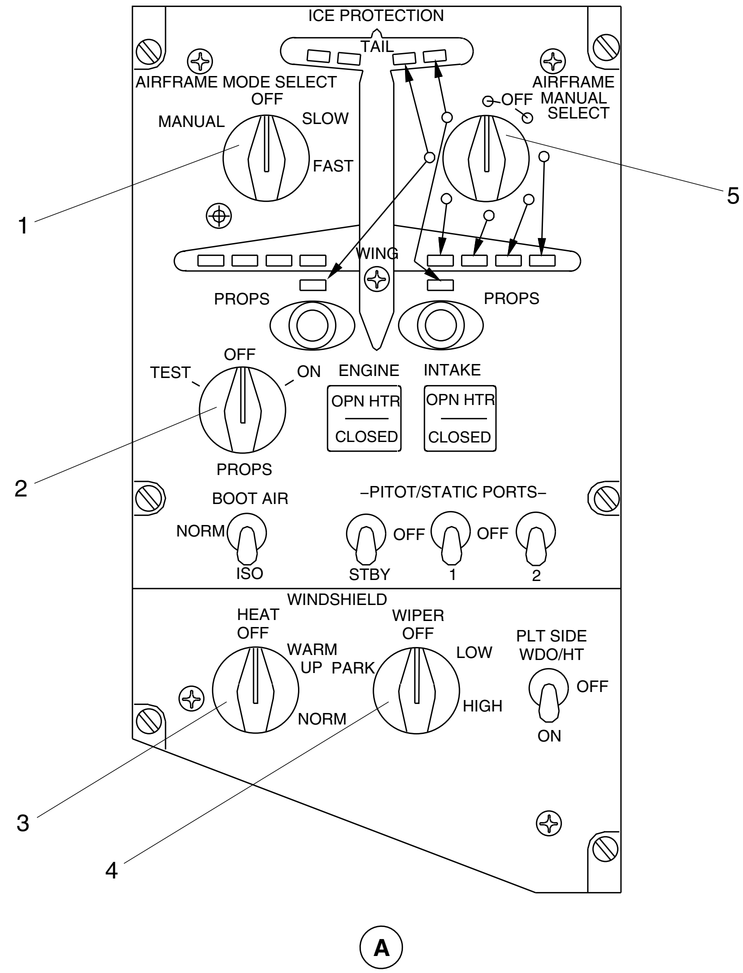
AIRFRAME DEICING SYSTEM
Figure 1



ICE AND RAIN PROTECTION SYSTEM PANEL LOCATOR
Figure 2



OVERHEAD CONSOLE



LEGEND

1. Airframe Mode Switch.
2. Prop De–ice Switch.
3. Windshield Heat Switch.
4. Windshield Wiper Switch.
5. Airframe Manual Switch.

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ICE AND RAIN PROTECTION SYSTEM PANEL DETAIL
Figure 3

**ON A/C ALL

30–11–00–001

AIRFRAME PNEUMATIC DEICING SYSTEMS

Introduction

Bleed air from the engines is supplied to the pneumatic de–icing boots to shed ice accumulation from the critical surfaces which would otherwise decrease aircraft performance.

General Description

Refer to Figures 1 and 2.

Nineteen pneumatically inflatable rubber de–icing boots are bonded to the airframe structure on the wing and tail leading edges. Rubber blankets (boots) cover the area where ice accumulation is anticipated. Within these boots are narrow tubes that can be inflated with compressed air.

The cyclic inflation of these tubes breaks and lifts the ice, which is carried away by the airstream.

A means of draining water is provided to avoid water accumulation inside the system or inside the boots, to prevent ice build–up and a decrease in aircraft performance.

The Aircraft Pneumatic De–icing System includes the components that follow:

– Unit, Timer and Monitor (30–11–01)
– Valves, Pressure Regulating and Relief (30–11–06)
– Valve, Isolation Shut–off (30–11–11)
– Valves, Dual Distributing (30–11–16)
– Check Valves, Non–heated (30–11–21)
– Restrictor (30–11–26)
– Switches, Low Pressure Warning (30–11–31)
– Valves, Automatic Drain (30–11–36)
– Transducers, Pressure (30–11–41)
– Check Valves, Heated (30–11–46)
– Selector, Airframe Auto (30–11–51)
– Selector, Airframe Manual (30–11–56)
– Switch, Boot Air (30–11–61)
– De–Ice Boots and Hoses, Outboard Wing (30–11–66)
– De–Ice Boots and Hoses, Nacelle (30–11–71)
– De–Ice Boots and Hoses, Inboard Wing (30–11–76)
– De–Ice Boots and Hoses, Horizontal Stabilizer (30–11–81)
– De–Ice Boots and Hoses, Vertical Stabilizer (30–11–86)
– Lines, Pneumatic De–icing (30–11–91).

Detailed Description

The Pneumatic De−icing System consists of two “L” −shaped manifolds, 0.75 in. diameter.

Refer to Figure 3.

Each manifold has a pressure transducer connected to a dual indicator in the flight compartment. The system is regulated at 18 +1.5/−1 psig (124 +10.34/−6.89 kPa), and cycles air to the boots in a sequence, causing the boots to inflate briefly and shed ice accumulations. The sequence consists of 6 boot inflation cycles of 6 seconds. The air is supplied from the engines through one Pressure Regulating Valve (PRV) with a Check Valve (CV) located in the nacelle.

The manifolds along the wing front spar have a normally open Isolation Shut−Off Valve (ISOV), . In each wing the manifold supplies air to the boots through two Dual Distributing Valves (DDVs), also referred to as Heated Dual Distributing Valves (HDDVs).

The two branches deliver air to the rear fuselage and through two more DDVs, one per side, to the horizontal stabilizer and vertical stabilizer boots. If one of the supply branches to the tail ruptures check valves prevent complete loss of pneumatic supply to the tail boots.

The left manifold has a 0.25 in. branch pipe which supplies air to the Door Seal System (Refer to Chapter 52–00–00).

Monitoring of the boot operation (or DDV output status) is done by the boot inflation advisory lights on the ICE PROTECTION control panel, or by looking at the boots. The four tail advisory lights correspond to the four horizontal stabilizer boots. The four wing advisory lights correspond to the four groups of boots listed below:

- Extension and Outboard boots
- Outboard center and Inboard center boots
- Inboard boots
- center Wing Boots.

There are two advisory lights that correspond to each engine intake boot.

As any de−icing boot inflates an advisory light comes on to show that the related boot is inflated. The detection of the boot inflation is done by the Low Pressure Switch (LPS) in the Dual Distributing Valve (DDV).

If more than one wing advisory light fails to come on, observed by the flight crew monitoring the advisory lights, the AIRFRAME MODE SELECT switch is rotated to MANUAL to de−ice engines and tails only.

The boot inflation sequence is as follows:

1. Outermost pair of outboard wing de−ice boots on left and right wing.

2. Central pair of outboard wing de−ice boots on left and right wing.

3. Right innermost outboard wing de−ice boot and left inboard wing de−ice boot.

4. Left innermost outboard wing de−ice boot and right inboard wing de−ice boot.

5. Left and right innermost horizontal stabilizer de−ice boot, upper vertical stabilizer de−ice boot, and No.1 engine intake deice boot.

6. Left and right outermost horizontal stabilizer de–ice boot, lower vertical stabilizer de–ice boot, and No. 2 engine intake deice boot.

Unit, Timer and Monitor

Refer to Figures 4 and 5.

The Timer and Monitor Unit (TMU) sequences the Dual Distributing Valve (DDV), also referred to as Heated Dual Distributing Valve (HDDV) operation according to a pre–defined cycle. It commands the DDV to distribute air supply through one of its outputs. After the inflation cycle time, it commands the DDV to let air flow back and exhaust through the ejector. During this cycle, the timer monitors the operation of the low pressure switches incorporated in each DDV output to confirm the operation of the DDV. The timer controls the de–icing cycles according to the selected operating mode, SLOW or FAST, and also controls the heaters of all heated equipment of the de–icing system. The Static Air Temperature (SAT) information through an ARINC link with the avionics is used to activate the heaters. When Static Air Temperature (SAT) falls below a pre–set value, the heaters are activated; when Static Air Temperature (SAT) rises above this value, the heaters are de–activated.

The Timer and Monitor Unit (TMU) also monitors the two Engine Intake Adapter Heaters and automatically activates the spare heater when a main heater has failed.

The Timer and Monitor Unit (TMU) monitors the following Air Data Sensor Heaters:

- Two (2) 115V AC Pitot/Static Probes
- One (1) 28V DC Pitot/Static Probe (Standby)
- Two (2) 115V AC Angle of Attack (AOA) Sensors.

Refer to Figure 6.

When no current flows into the heating element of one pitot/static probe or when the timer is not powered a PITOT HEAT 1, PITOT HEAT 2 or PITOT HEAT STBY caution light comes on. A failure signal is recorded in the Timer and Monitor Unit (TMU) and is sent to the avionics system (Stall Protection Modules 1 and 2) when no current flows into the heating element of one Angle of Attack (AOA) vane. The TMU compares the command signal and the Low Pressure Switch (LPS) signal to determine if the DDV operation is normal.

If the TMU commands one output to open and the related LPS does not send a signal back to the TMU, the fault is as follows:

- the Dual Distribution Valve output did not open
- Or a boot has burst and pressure cannot increase.

If the TMU receives a signal from a LPS associated with an output that has not been commanded, then the DDV operation is not normal. In both cases, the TMU sends a discrete signal to the Caution and Warning panel and the DEICE PRESS caution light comes on.

The timer also stores maintenance messages in Random Access Memory (RAM). When interrogated, it sends these messages to the flight compartment through the Aeronautical Radio Incorporated (ARINC) link with the avionics.

The Dual Distributing Valves (DDVs) can be commanded either by the Timer and Monitor Unit (TMU) (auto modes) or by the pilots in the manual mode. Each output of the DDVs is commanded according to cycle sequence.

Valves, Pressure Regulating and Relief

Refer to Figures 7 and 8.

Each part of the system is supplied with bleed air from the engines. The Pressure Regulating and Relief Valve (PRRV) regulates the pressure according to the bleed flow and provides regulated air supply to the system.

Pressure regulation is done with a diaphragm which opens or closes to provide the de–icing system with a constant pressure. In the event of overpressure in the system, the relief port will allow pressure to decrease in the equipment. A failure of one PRRV does not prevent the system from operating normally. Failure of both PRRVs would lead to a total loss of the pneumatic supply and therefore the total loss of airframe de–icing.

Valve, Isolation Shut–off

Refer to Figures 9 and 10.

The Isolation Shut–off Valve (ISOV) is normally closed when not energized. When an engine is started, it is energized and then opens automatically. In the event of a loss of pressure in the system, it may be closed by the flight crew to isolate the two sides. Isolation is electrically commanded using the BOOT AIR ISO switch on the ICE PROTECTION control panel. A failure of the ISOV (fails open) does not prevent the system from operating normally. If a duct ruptures, and the ISOV 'has failed open, this will cause the loss of air supply. If the two sides of the system cannot be isolated, this combination of failures would lead to a total loss of airframe de–icing including the empennage.

Valves, Dual Distributing

Refer to Figure 11.

The Dual Distributing Valve (DDV), also referred to as Heated Dual Distributing Valve (HDDV) must be commanded by the flight crew. The DDV is supplied with air from the system and distributes it to the boots through two separate electrical valves. Each valve is commanded separately, one after the other, according to timer sequencing or manual operation. The Low Pressure Switch (LPS) incorporated on each DDV output closes when the pressure rises above 15 ± 1 psig (103.4 ±6.89 kPa) at boot inflation which sends a signal to the Timer and Monitor Unit (TMU). This signal is used to confirm that the commanded valve has opened normally and that pressure was sufficient to inflate the boots normally. At boot deflation, the electrical valve allows air to flow back to the DDV and to exhaust the system through the ejector. The LPS opens when pressure is less than 11 +2.5/–1 psig (75.8 ±17.2/–6.89 kPa) indicating to the timer that the commanded valve has operated normally. Air from the boots is removed using a venturi effect. This allows the boots to flatten on the leading edge when they are not inflated. The Dual Distributing Valve (DDV) is heated to prevent the electrical valves and the ejector from freezing and to avoid moisture on the connector.

Check Valves, Non–Heated

Refer to Figure 12.

The Non–Heated Check Valves (NHCVs) prevent moisture from flowing back in the wing system in the event of a failure. A faulty NHCV would not prevent the de–icing system from functioning.

Restrictor

Refer to Figure 13.

The restrictor lets air flow from one side of the aft system to the other side. It provides the necessary communication between the two parts of the system to ensure that the tail is correctly de–iced in the event of a failure upstream of one of the Heated Check Valves (HCVs). It also reduces the amount of air loss in case of a failure downstream of one of the HCVs, which allows partial de–icing of the tail.

Switches, Low Pressure Warning

Refer to Figure 14.

The Low Pressure Warning Switch (LPWS) senses low pressure in the system. The LPWS is closed when the pressure inside the system is below 15 ±1 psig (103.4 ±6.89 kPa) and opens when the pressure exceeds 12.5 psig (86.2 kPa). When the LPWS is closed, it sends signals to the Caution and Warning Panel to illuminate the DEICE PRESS caution light. The LPWS signal is also sent to the Timer and Monitor Unit (TMU) for maintenance purposes.

Two LPWS's are installed in front of the front spar, in the wing to body fairing area.

Valves, Automatic Drain

Refer to Figure 15.

The Automatic Drain Valve (ADV) collects the water that has condensed in the system. The valve drains the water when the pressure in the system drops below 3 psig (20.7 kPa) at engine shutdown. When pressure in the system rises above 3 psig (20.7 kPa), the valve closes to avoid leakage. The ADV is heated to prevent trapped water from freezing and restricting pipe flow.

Transducers, Pressure

The pressure transducers are sensors that measure pressure and send signals for display on a dual indicator in the flight compartment.

Check Valves, Heated

Refer to Figure 16.

The Heated Check Valve (HCV) lets air flow into the aft part of the de–icing system. It prevents air from flowing back to the wing system in the event of a failure upstream of the Check Valve (CV). This will ensure that the tail is still correctly de–iced when a failure occurs in one side of the wing system. In the event that one HCV fails open, the tail system is still operational. If one HCV fails closed it will not prevent the tail system from operating normally, but the other DDV is no longer supplied with pneumatic supply and the tail section is not completely de–iced. If the second HCV fails closed air would no longer be supplied to the tail section.

Selector, Airframe Auto

Refer to Figure 17.

The AIRFRAME MODE SELECT switch selects the operational mode:

– MAN
– OFF
– SLOW

– FAST.

Two automatic modes are available: SLOW and FAST. When the SLOW mode is set, the de–ice sequence lasts 183 ±2.5 seconds. If the FAST mode is set, the de–ice sequence lasts 63 ±2.5 seconds.

When the AIRFRAME MODE SELECT switch is set to SLOW or FAST (automatic modes), manual operation of the de–icing system is inhibited from the AIRFRAME MANUAL SELECT switch.

Selector, Airframe Manual

Refer to Figure 18.

For manual operation of the de–icing system, the AIRFRAME MODE SELECT switch is set to MAN or OFF position and AIRFRAME MANUAL SELECT knob is rotated to any of the six positions. This activates the Dual Distributing Valves (DDVs) individually, allowing inflation of the related boots.

Switch, Boot Air

Refer to Figure 19.

The BOOT AIR ISO switch commands the Isolator Shut–off Valve (ISOV) to close in order to isolate the left from the right side of the system. An example of a situation in which this may be required is a pipe burst on one side of the aircraft.

De–Ice Boots and Hoses, Outboard Wing

Refer to Figure 20.

Ten de–ice boots (five on each wing) are located on the outboard wing leading edges.

The two outermost outboard wing de–ice boots are interconnected and will inflate/deflate together. The next adjacent set of outboard de–ice boots located towards the nacelles are interconnected and will inflate/deflate at the same time.

The left innermost outboard wing de–ice boot is interconnected with the right inboard wing de–ice boot and will inflate/deflate together. Similarly, the right innermost outboard wing de–ice boot is interconnected with the left inboard wing de–ice boot.

De–Ice Boots and Hoses, Nacelle

Two nacelle de–ice boots (one per nacelle) form the air intake lips to remove ice build–up. The air for the nacelle de–ice boots is independently supplied.

De–Ice Boots and Hoses, Inboard Wing

Two inboard wing de–ice boots are located (one per wing) between the nacelle and fuselage.

The left inboard wing de–ice boot is interconnected with the inner right outboard de–ice boot and will inflate/deflate at the same time.

The right inboard wing de–ice boot is interconnected with the inner left outboard de–ice boot and will inflate/deflate together.

De–Ice Boots and Hoses, Horizontal Stabilizer

Four de–ice boots cover the horizontal stabilizer leading edge to shed ice accumulation. The horizontal stabilizer boots are supplied with air from two separate tubes with fail–safe design considerations.

The outer left and inner right horizontal stabilizer boots are independently inflated/deflated, whereas the inner left and outer right boots are interconnected with the vertical stabilizer boot to inflate and deflate at the same time.

De–Ice Boots and Hoses, Vertical Stabilizer

One de–ice boot, divided into two sections, covers the vertical stabilizer leading edge to shed ice accumulation.

The upper section of the vertical stabilizer de–ice boot is interconnected and will inflate/deflate at the same time with the outer right horizontal stabilizer boot.

The lower section of the vertical stabilizer de–ice boot is interconnected and will inflate/deflate at the same time with the inner left horizontal stabilizer de–ice boot.

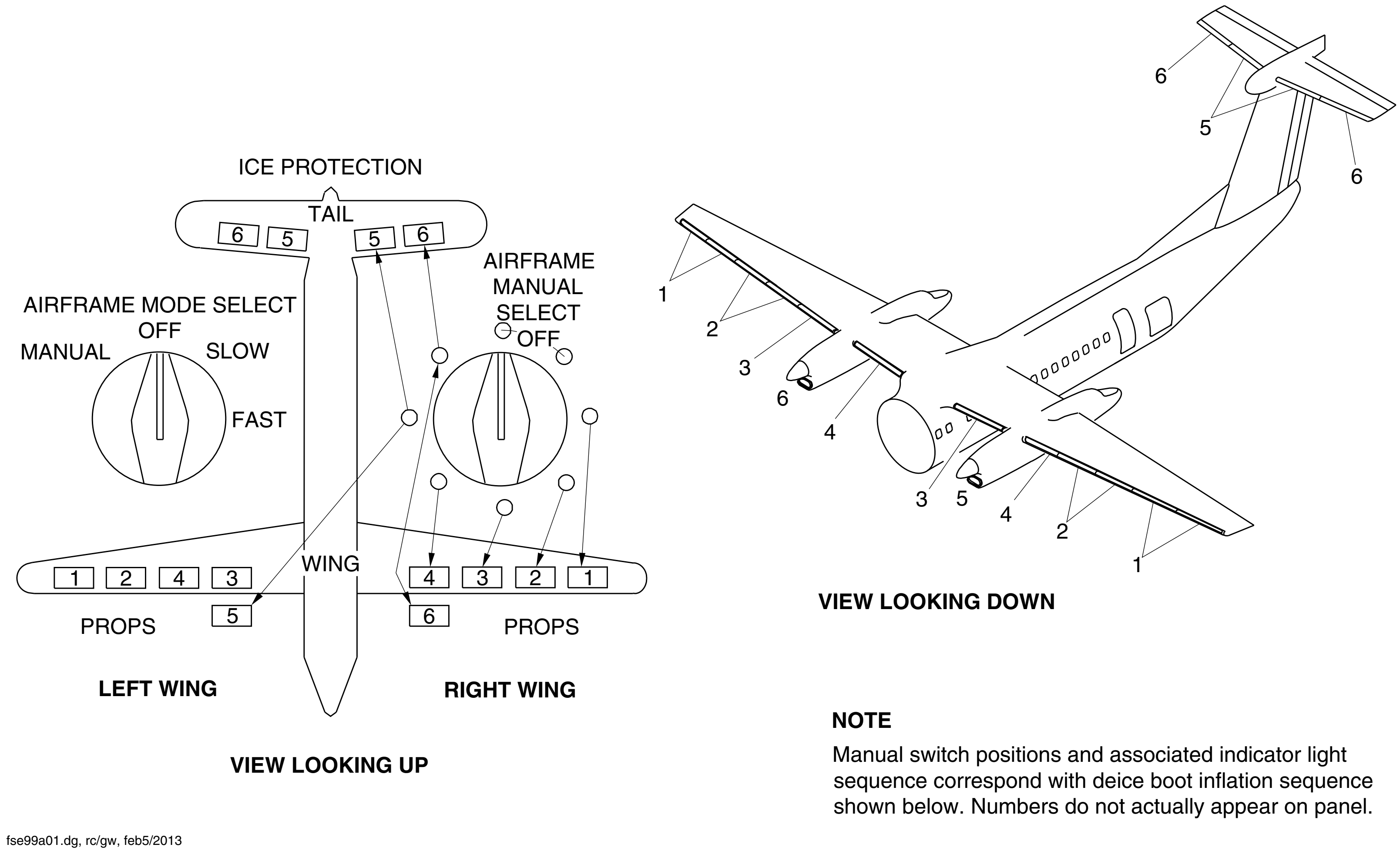
Lines, Pneumatic De–Icing

Pneumatic de–icing tubes let bleed air from the nacelle flow through a regulating valve, where it is regulated to 18 psi (124 kPa). It then routes the air through a Check Valve (CV) where it can then flow to the left or right side de–icing boots or aft to the horizontal and vertical stabilizer de–icing boots.

Both sides of the aircraft pneumatic de–icing system are interconnected and isolated by a restrictor, and an isolating valve.

Training Information Points

Due to high pressure, extreme caution should be used at times when working around pressurized ducting. Personnel involved with testing must wear ear and eye protective equipment.



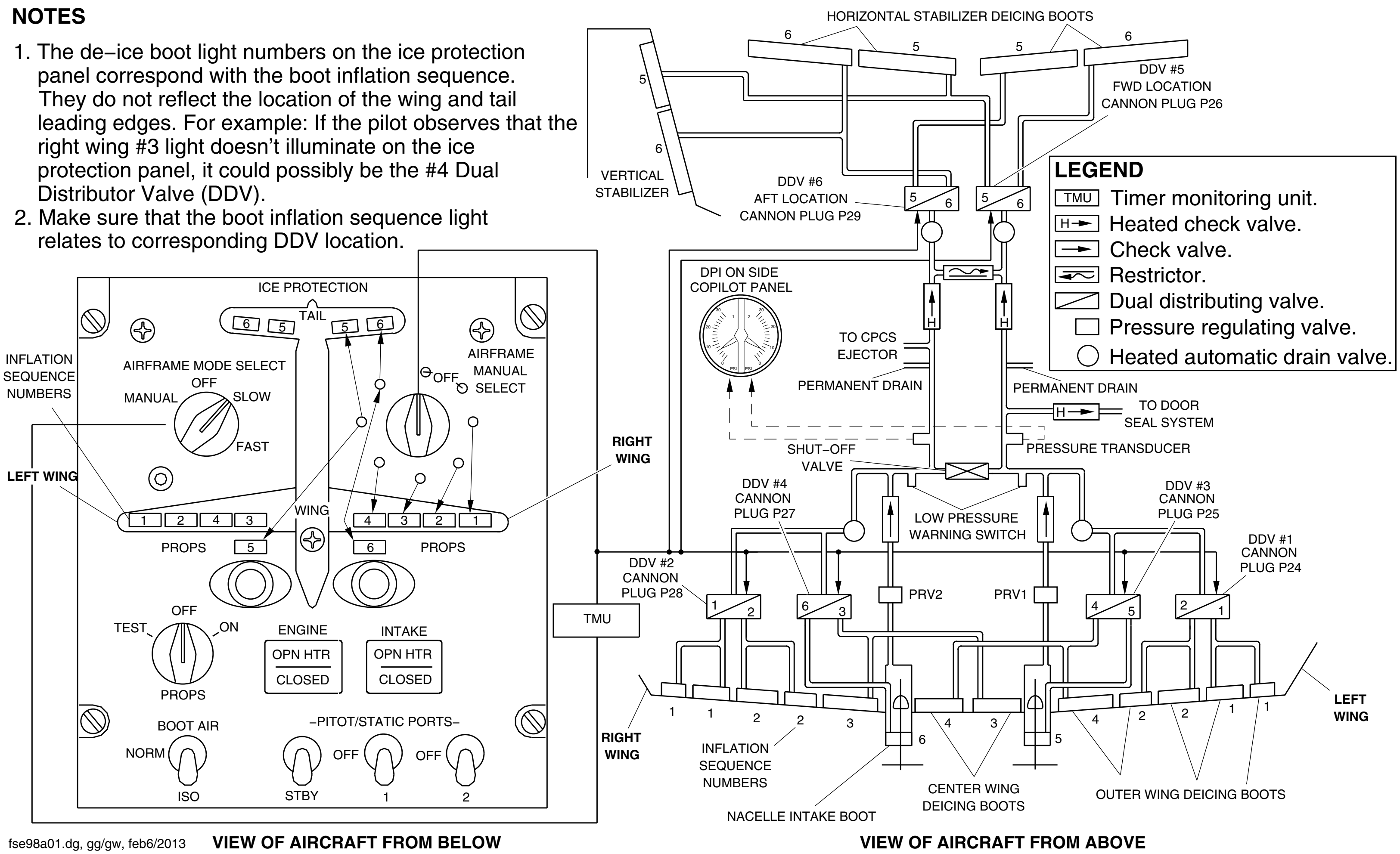
NOTE

Manual switch positions and associated indicator light sequence correspond with deice boot inflation sequence shown below. Numbers do not actually appear on panel.

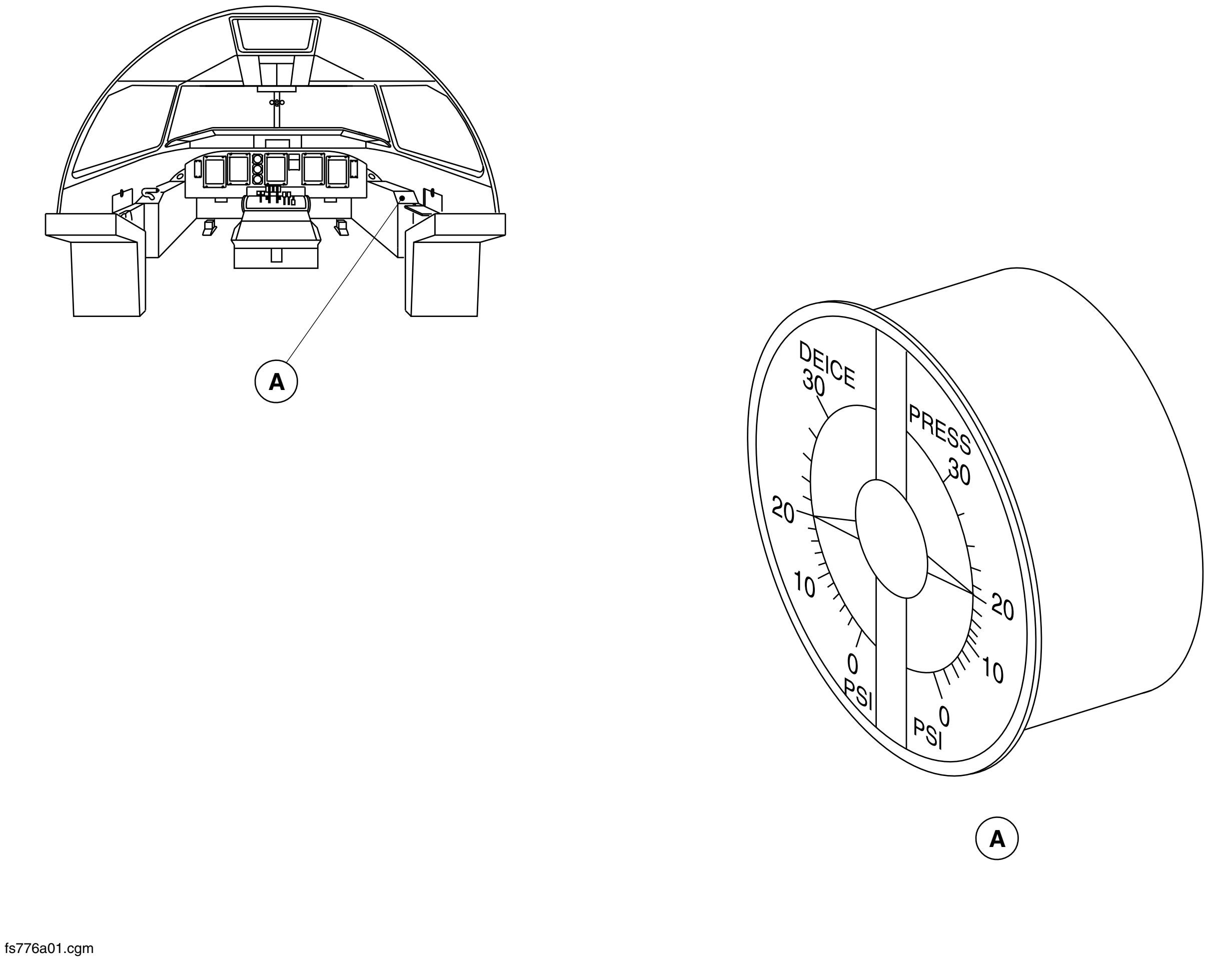
De–icer Boots
Figure 1

NOTES

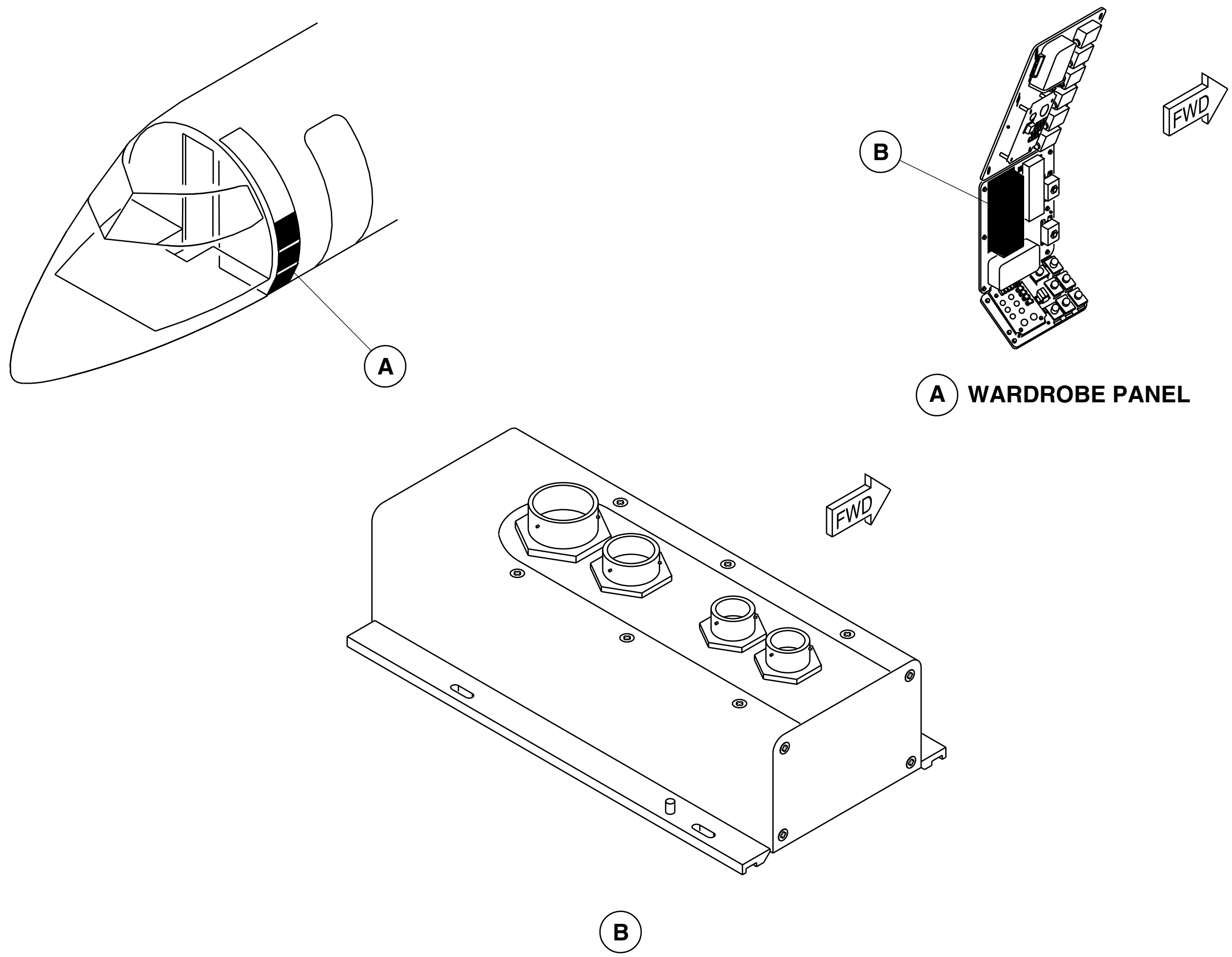
1. The de−ice boot light numbers on the ice protection panel correspond with the boot inflation sequence. They do not reflect the location of the wing and tail leading edges. For example: If the pilot observes that the right wing #3 light doesn't illuminate on the ice protection panel, it could possibly be the #4 Dual Distributor Valve (DDV).
2. Make sure that the boot inflation sequence light relates to corresponding DDV location.



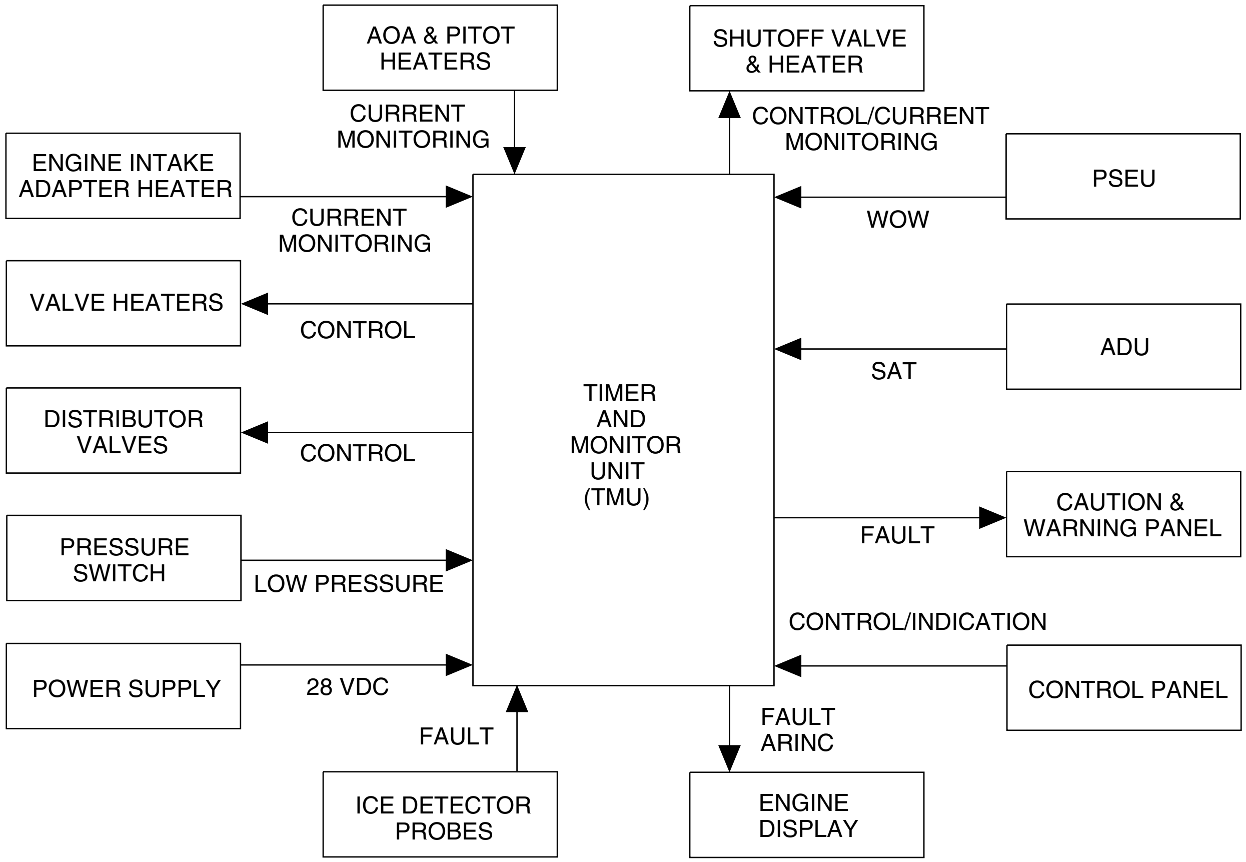
De−icer Boots and Controls
Figure 2



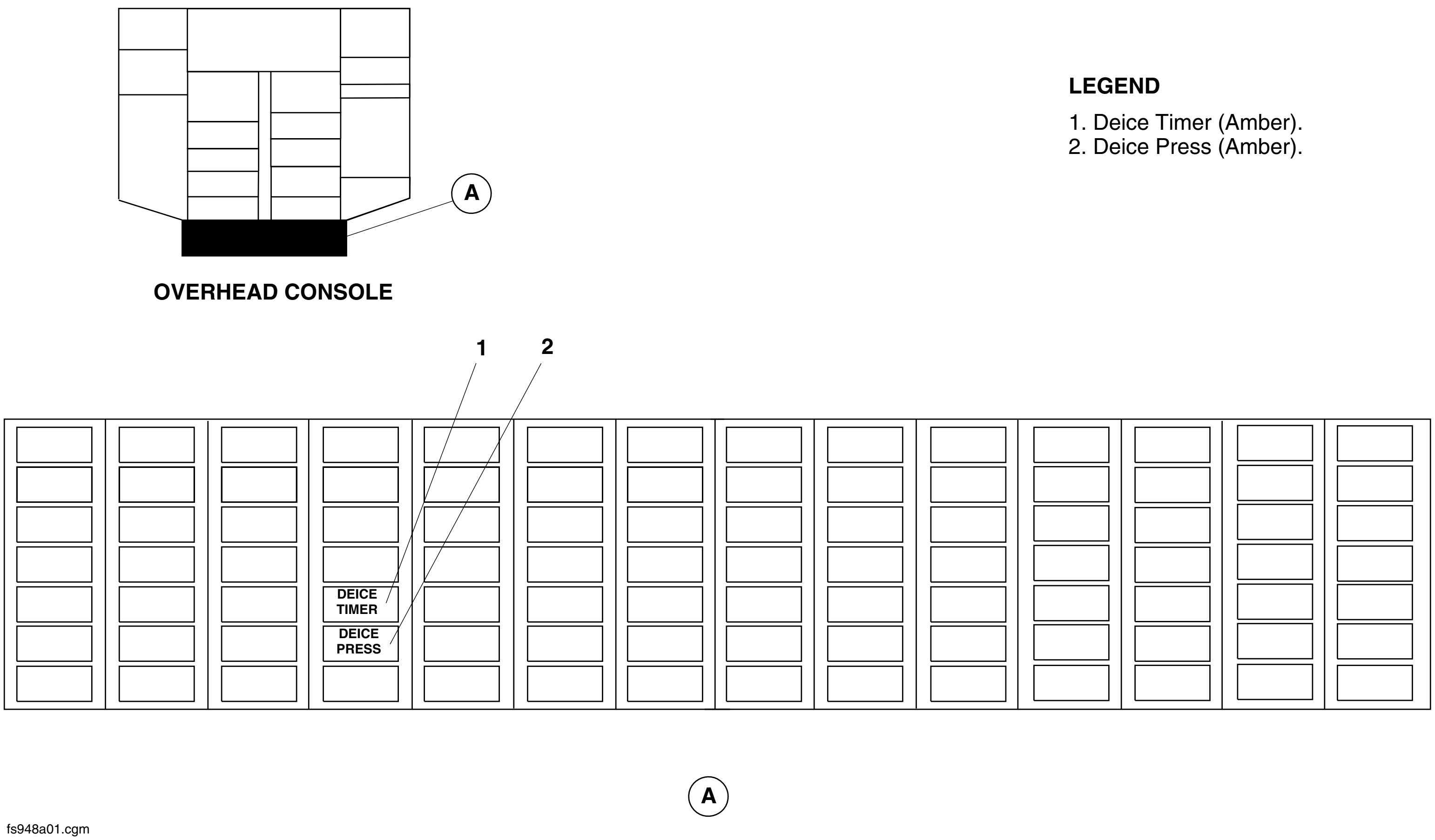
DUAL DE–ICE PRESSURE INDICATOR LOCATION
Figure 3



TIMER AND MONITOR UNIT LOCATION
Figure 4



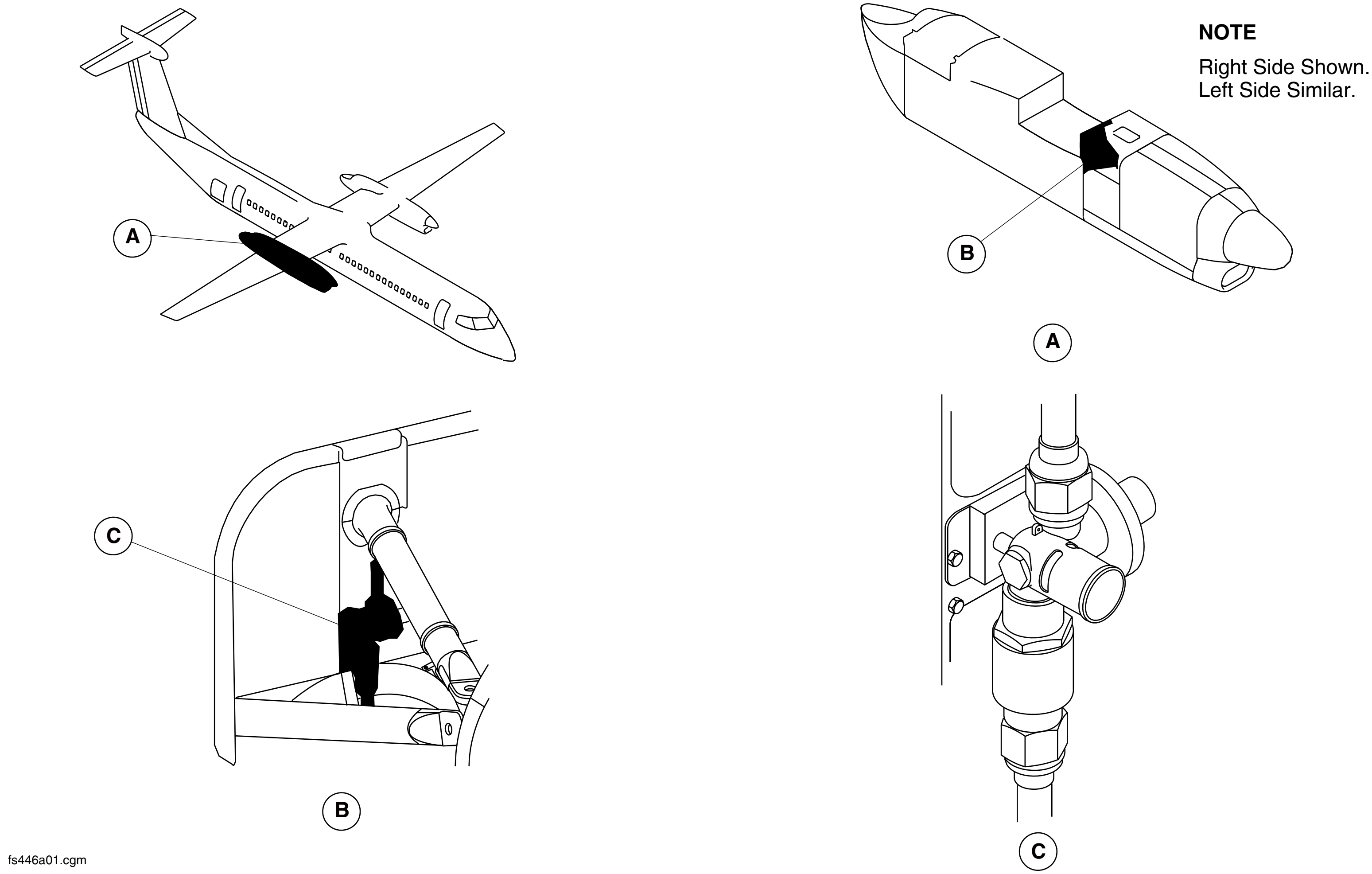
TIMER AND MONITOR UNIT BLOCK DIAGRAM
Figure 5



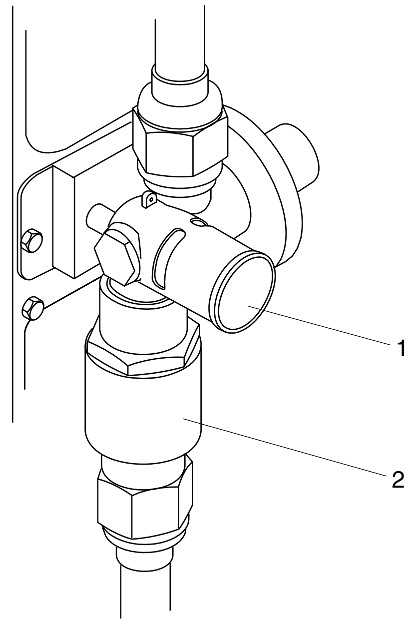
LEGEND

1. Deice Timer (Amber).
2. Deice Press (Amber).

DEICE PRESSURE AND TIMER CAUTION LIGHTS
Figure 6



PRESSURE REGULATING AND RELIEF VALVE LOCATION
Figure 7

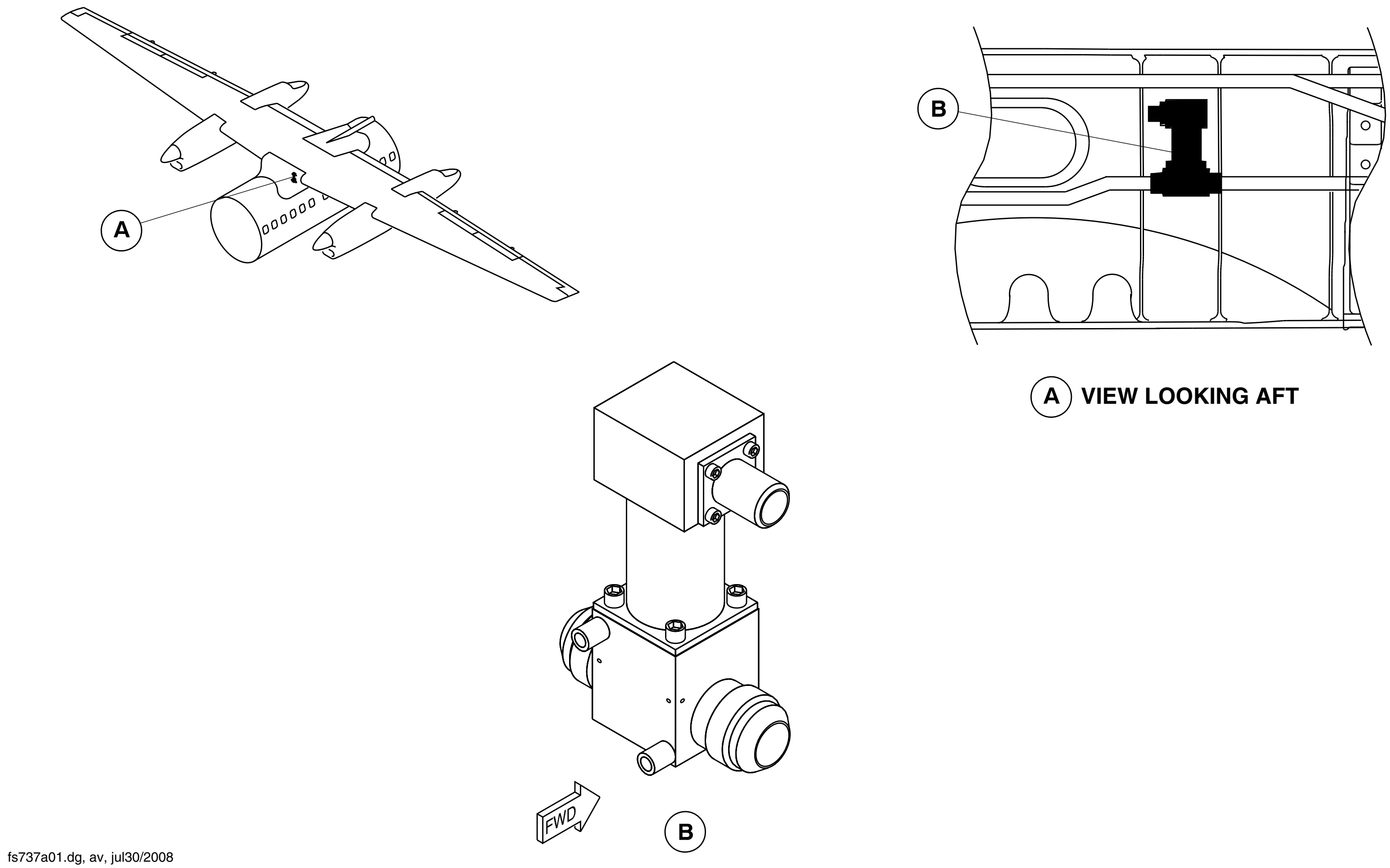


LEGEND

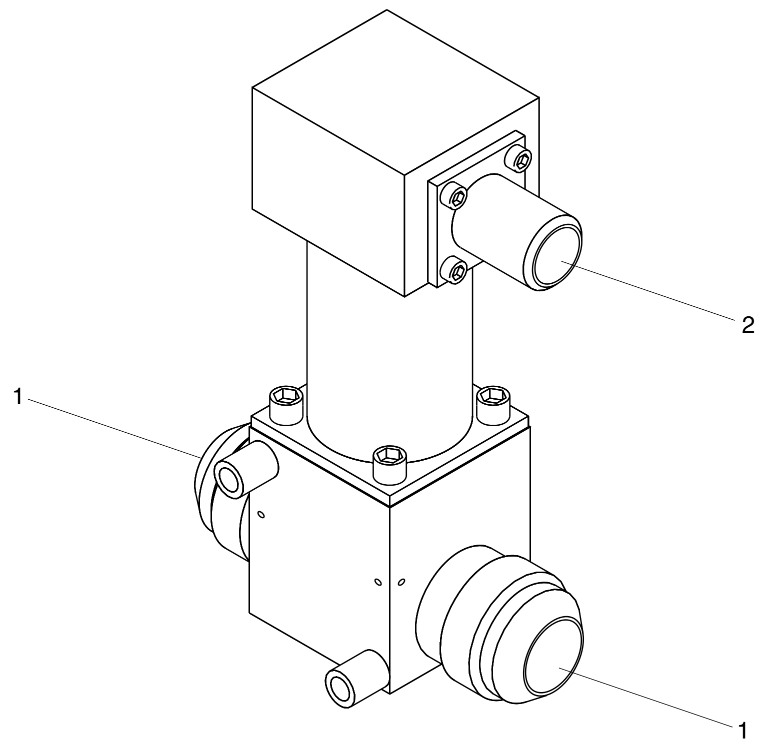
1. Pressure Regulating Valve (PRV).
2. Check Valve (CV).

fs447a01.cgm

PRESSURE REGULATING AND RELIEF VALVE
Figure 8



Isolation Valve Locator
Figure 9

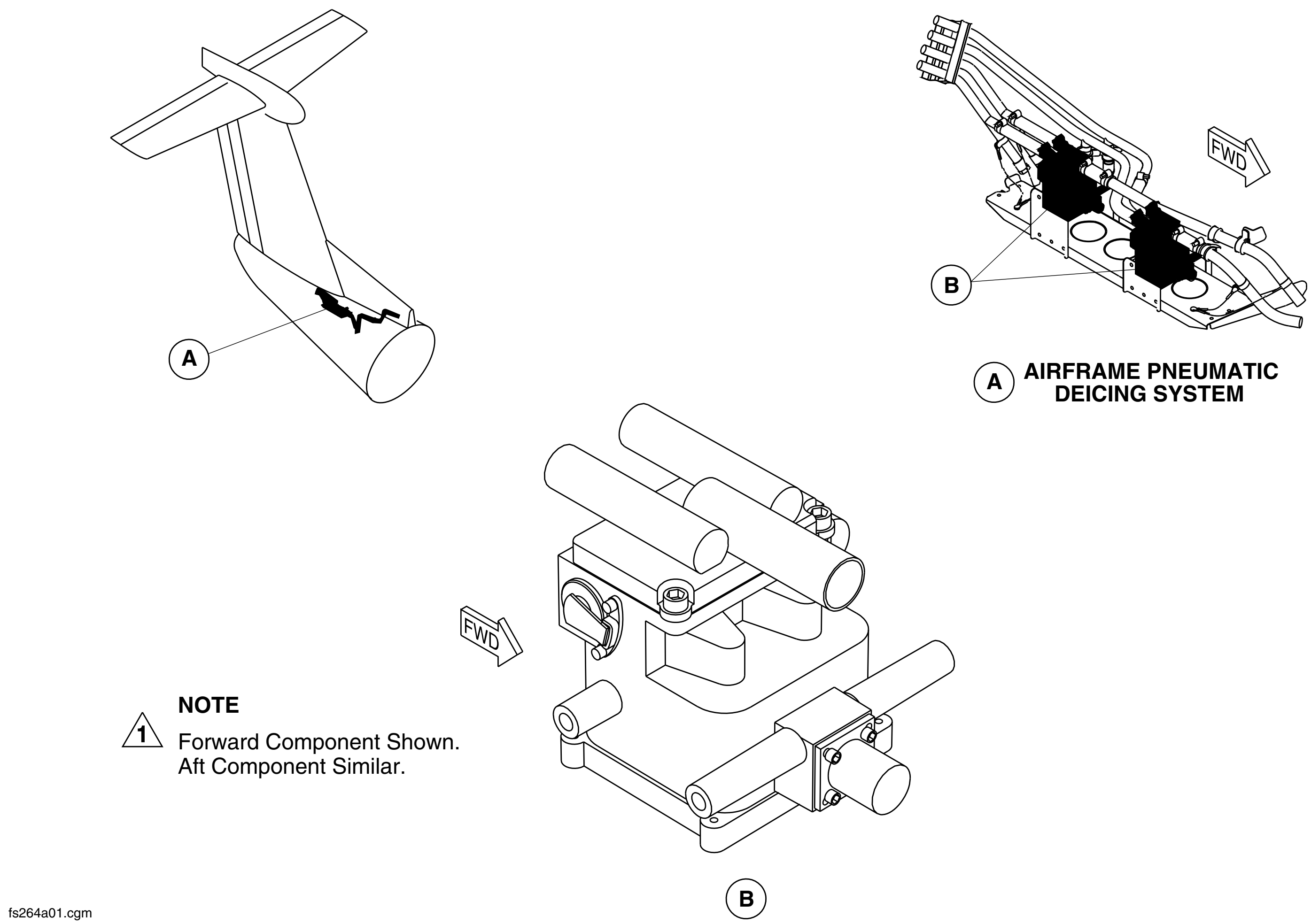


LEGEND

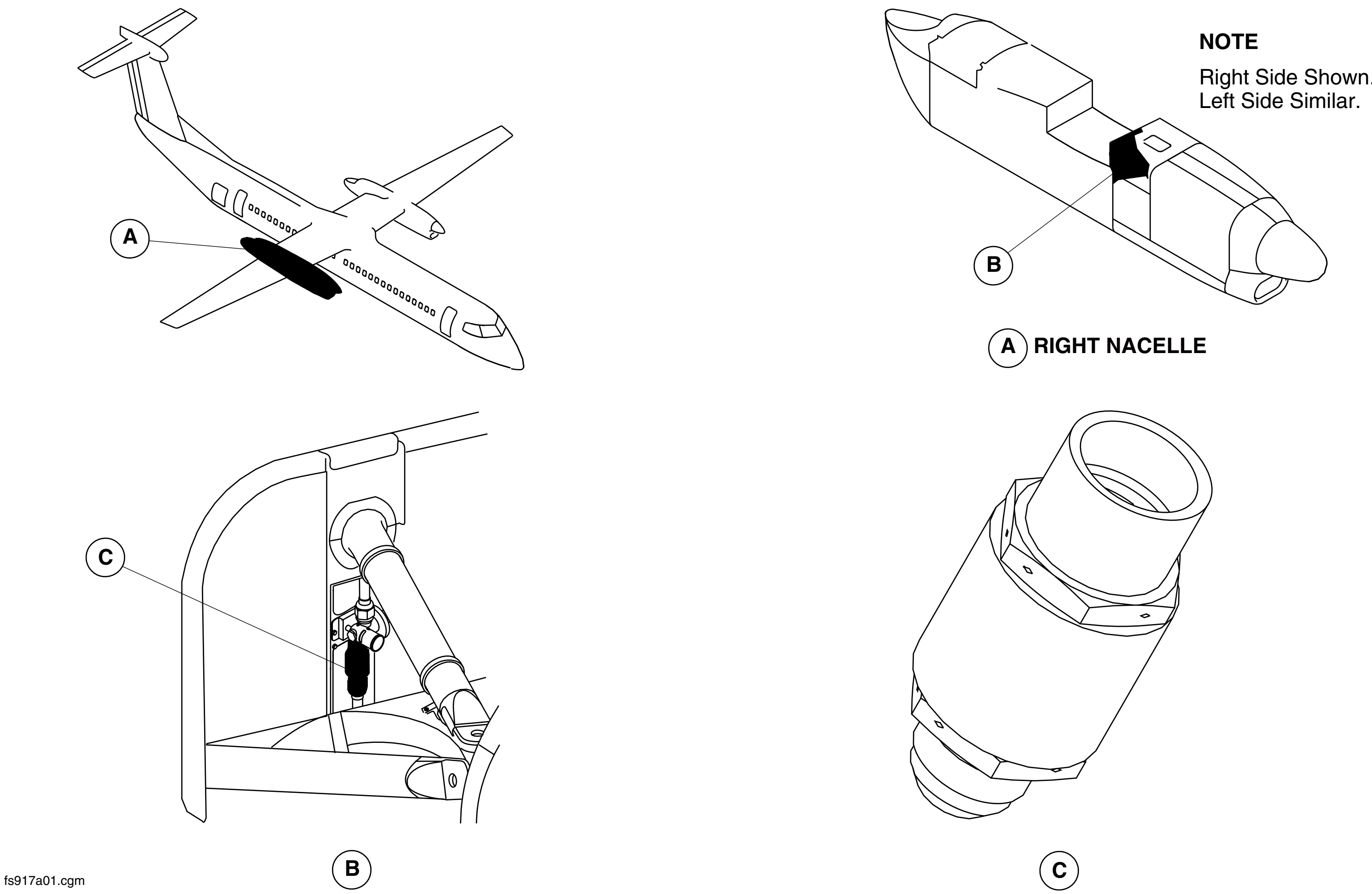
1. Ports.
2. Connector.

fs738a01.cgm

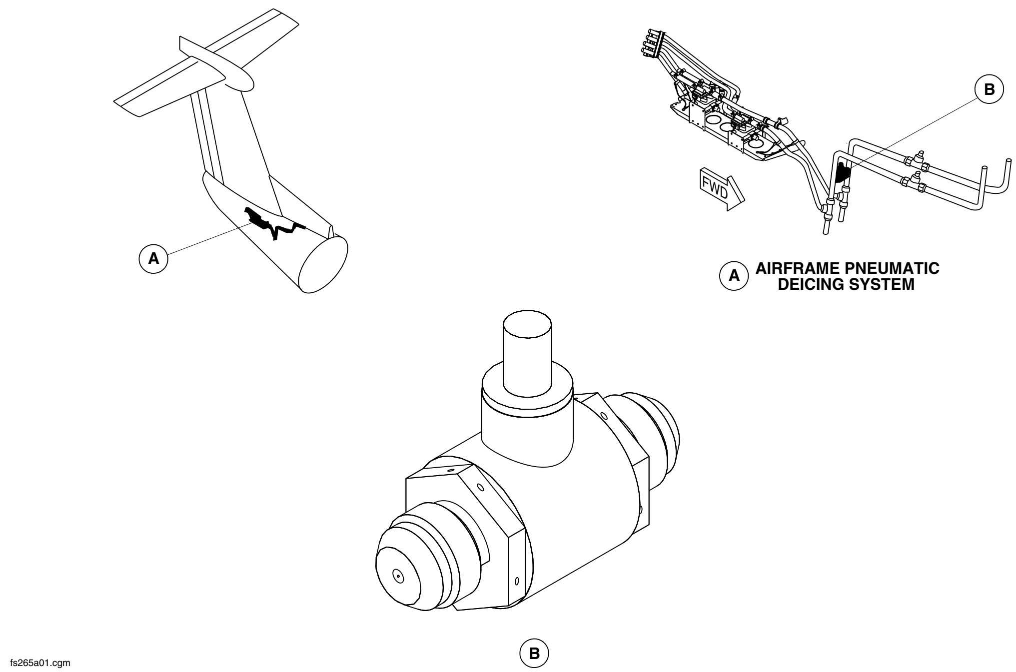
ISOLATION SHUT OFF VALVE
Figure 10



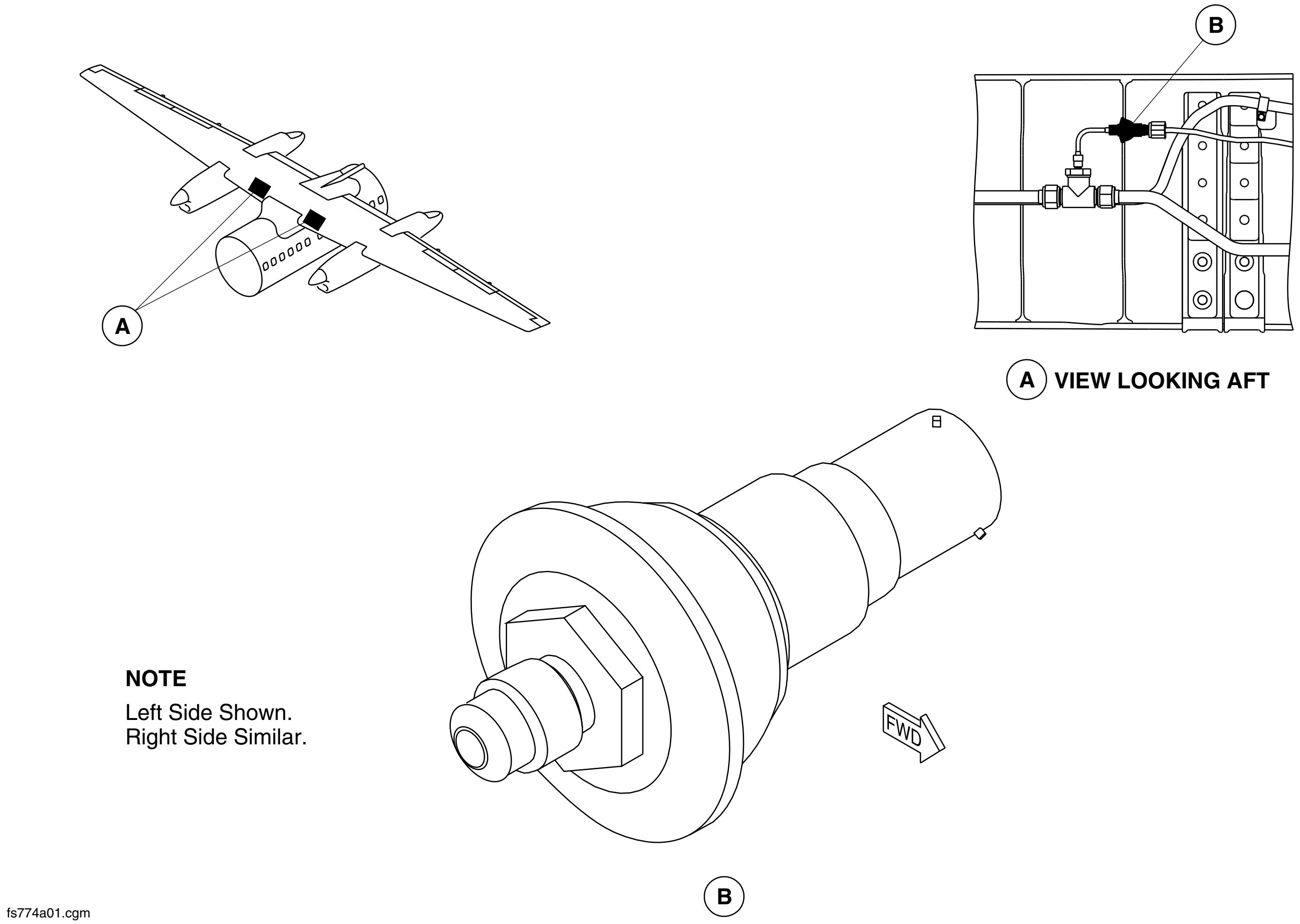
DUAL DISTRIBUTING VALVE LOCATION
Figure 11



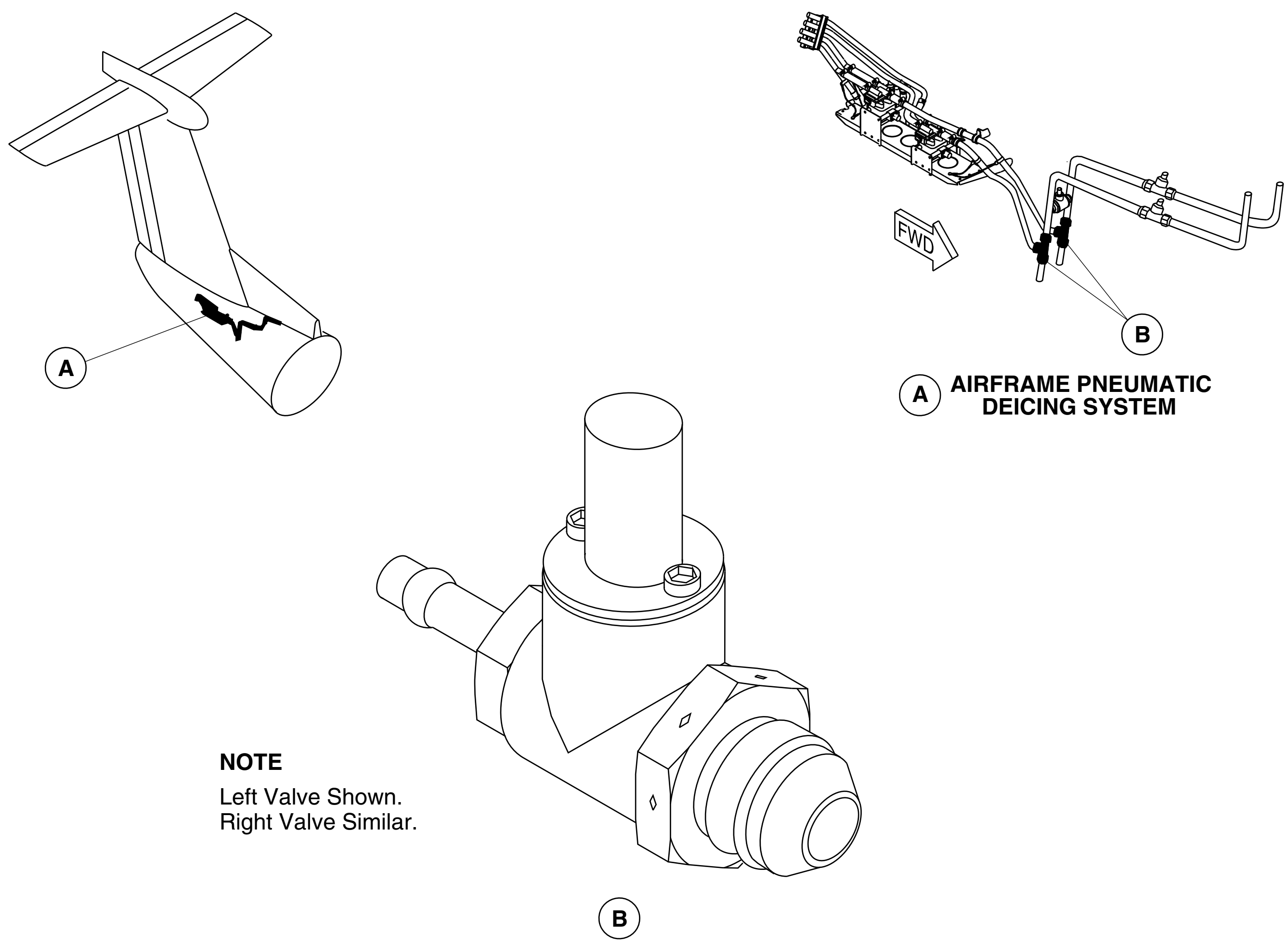
NON−HEATED CHECK VALVE LOCATION
Figure 12



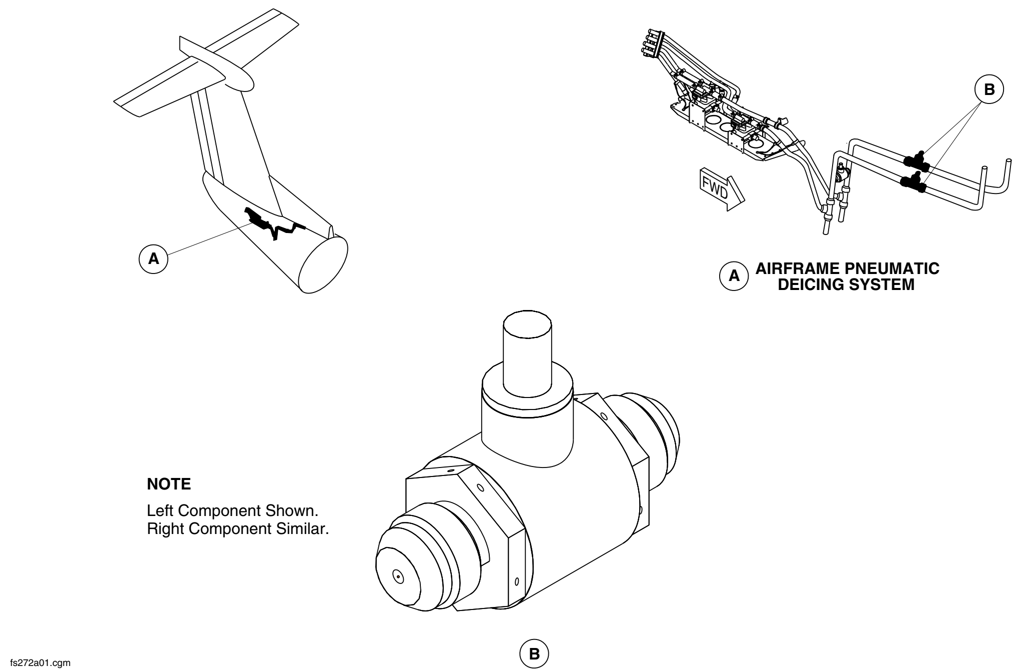
RESTRICTOR LOCATION
Figure 13



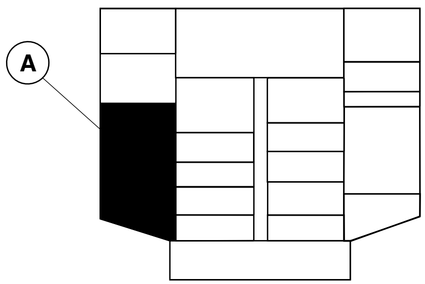
LOW PRESSURE WARNING SWITCH LOCATION
Figure 14



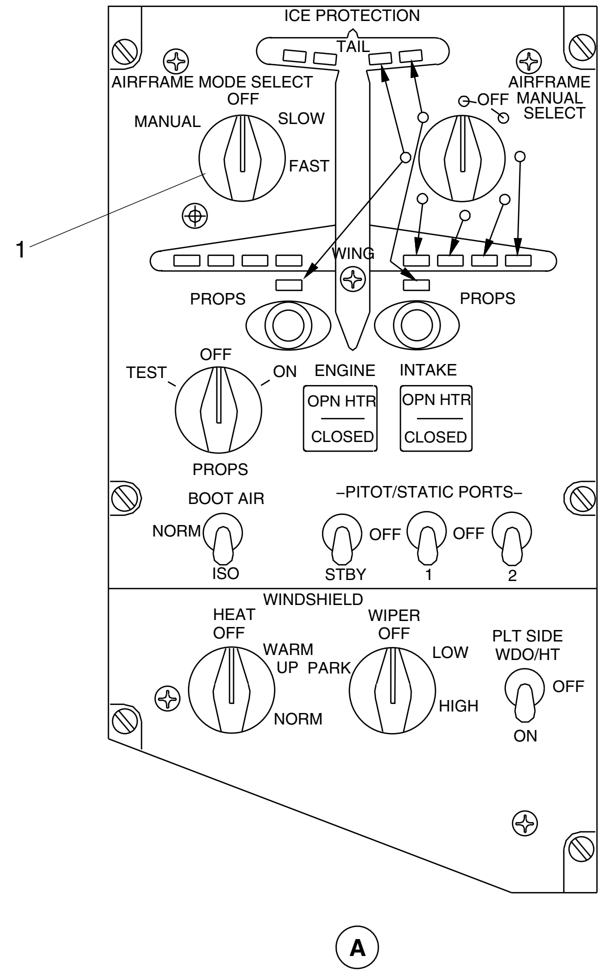
AUTOMATIC DRAIN VALVE LOCATION
Figure 15



HEATED CHECK VALVE LOCATION
Figure 16



OVERHEAD CONSOLE

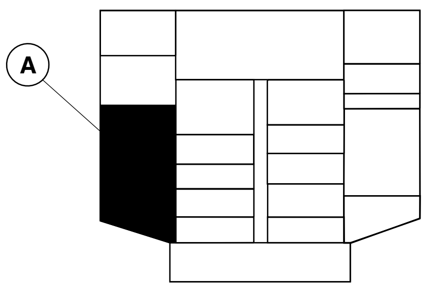


LEGEND

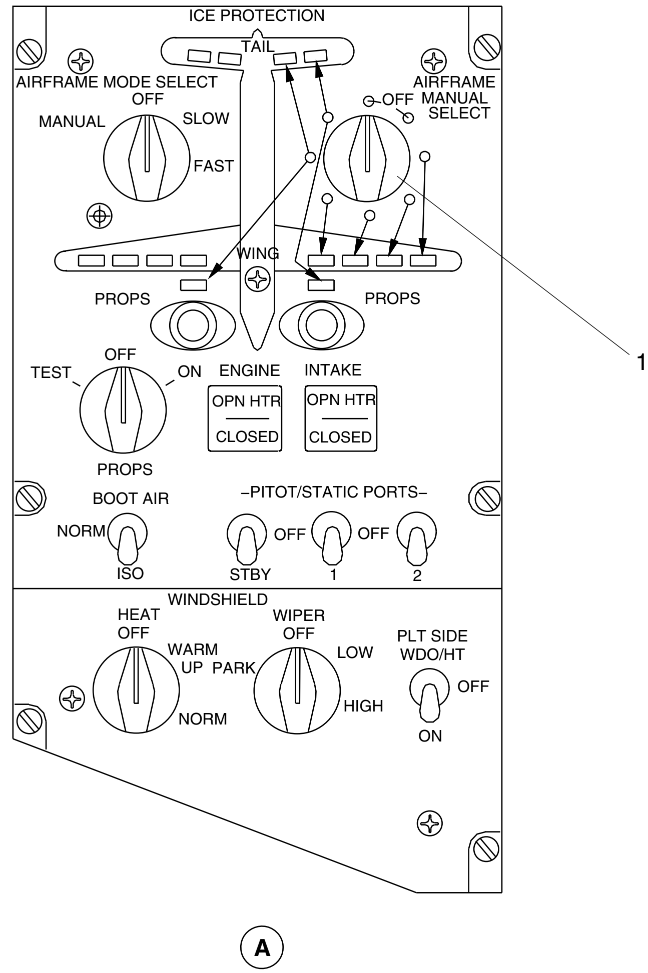
1. Airframe Auto Selector.

fs909a01.cgm

AIRFRAME AUTO SELECTOR LOCATION
Figure 17



OVERHEAD CONSOLE

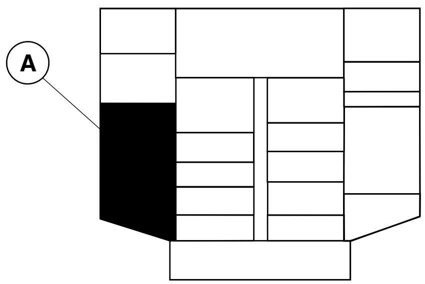


LEGEND

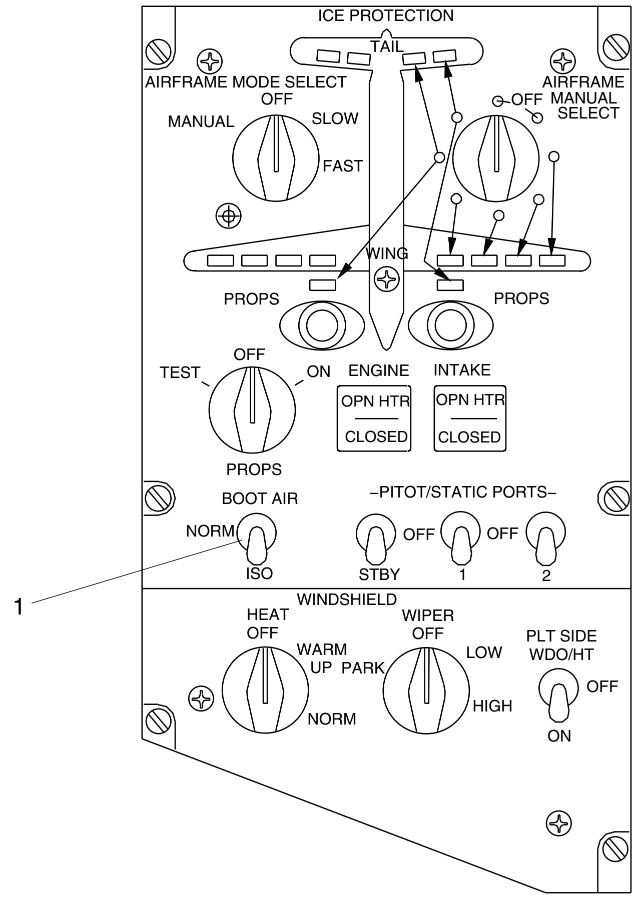
1. Airframe Manual Selector.

fs913a01.cgm

AIRFRAME MANUAL SELECTOR LOCATION
Figure 18



OVERHEAD CONSOLE



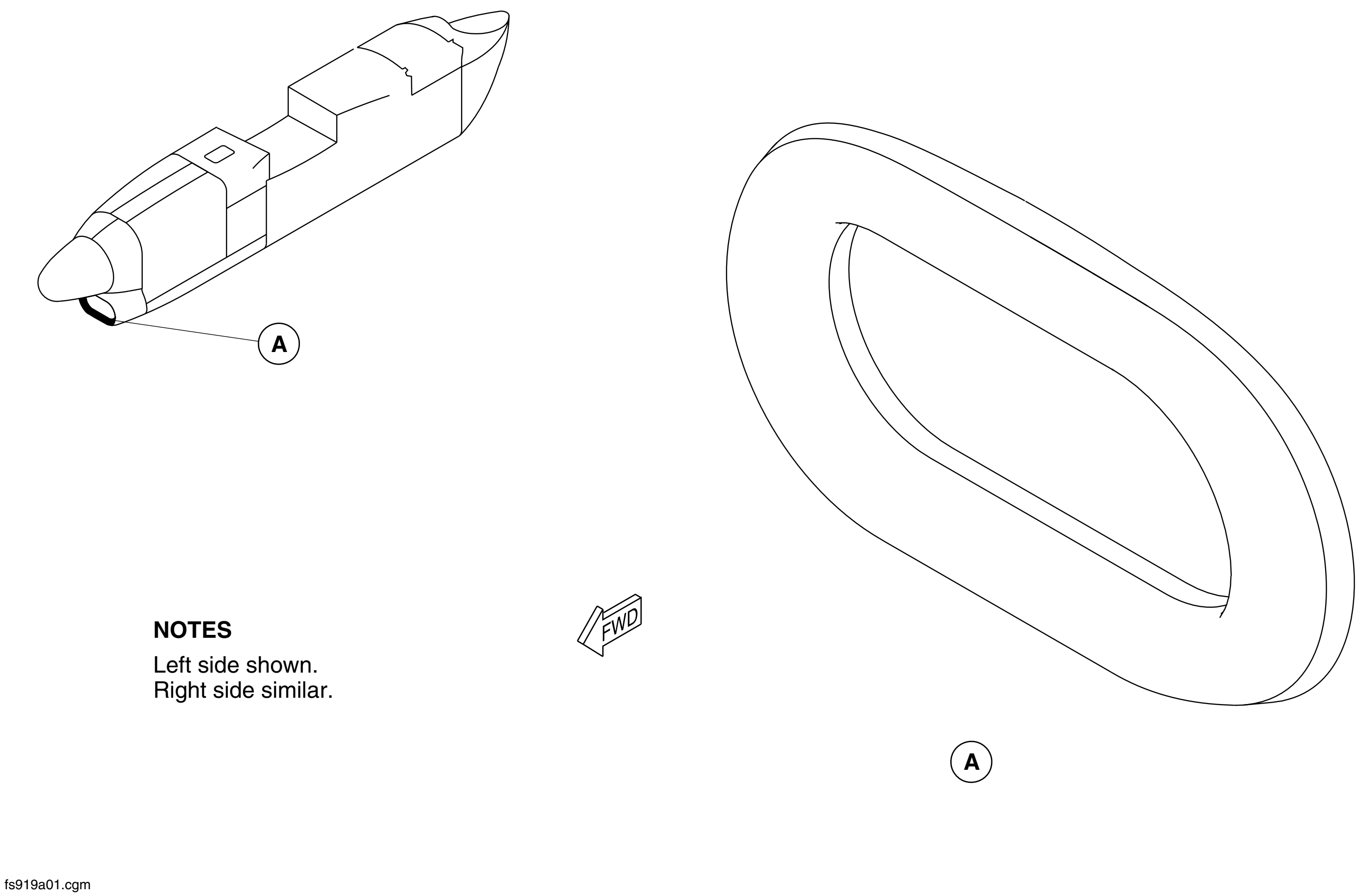
A

LEGEND

1. Boot Air Isolate Switch.

fs911a01.cgm

BOOT AIR SWITCH LOCATION
Figure 19



NOTES
Left side shown.
Right side similar.

NACELLE DE–ICE BOOTS
Figure 20

**ON A/C ALL

30–21–00–001

ENGINE AIR INTAKE ANTI–ICING

Introduction

The engine intake anti–icing system has two electrically heated engine adapters, one per engine, to prevent ice build–up on the engine air inlets.

General Description

The engine intake adapters are located on each engine inlet front case. The engine adapter heater has two 1000 W heating elements (one main and one spare). Each heater has an individual power and ground connection. Each heated adapter is controlled from the ENGINE INTAKE switchlights on the ICE PROTECTION panel. The heating elements are embedded in epoxy fiberglass and installed on the inner surface of the intake adapter. The heaters are insulated using stayfoam polyurethane and are sealed with polysulfide.

The engine intake anti–icing system contains the components that follow:

– Thermostats, Air Intake Heater (30–21–01)
– Switches, Heater–Engine Intake (30–21–06)
– Relays, Control–Intake Heater (30–21–11).

Detailed Description

Refer to Figure 1.

Power is supplied to the heater through a relay when all of the conditions that follow are met:

– Temperature measured by a thermostat in the fuselage is below +60 °F (+15.6 °C)
– Related engine oil pressure switch is closed
– ENGINE INTAKE switchlight has been pushed
– 115 Vac power is available.

When the heaters are powered, the HTR lights on the ENGINE INTAKE switchlights on the ICE PROTECTION control panel come on.

The Timer and Monitor Unit (TMU) monitors current intensity to the heater. If an abnormal current flow into the main heater (below 1.0 A or above 12 ±0.5 A) is sensed, the TMU activates a relay to switch to the spare heater.

Refer to Figure 2.

When the ENGINE INTAKE switchlight is pushed, the bypass doors of the related engine opens to evacuate ice pieces shed from nacelle inlet components. The OPN or CLOSED lights shows the position of the related bypass doors.

Refer to Figure 3.

If both heating elements in the engine adapter heater fail, the related ENG ADPT HEAT 1 or ENG ADPT HEAT 2 caution light on the Caution and Warning panel comes on. If failure of the main heating circuit is sensed by the TMU, it is posted on the IRPS page of the

Central Diagnostic System (CDS) as follows for maintenance purposes:

- L ENG ADPT HEATER 1 FAIL
- R ENG ADPT HEATER 1 FAIL.

The left ENGINE INTAKE switchlight is electrically powered by the 28 Vdc left secondary bus bar and the right switchlight by the 28 Vdc right secondary bus bar.

The left engine adapter heater is energized by the 115 Vac B phase left variable frequency bus bar, and the right heater by the 115 Vac B phase right variable frequency bus bar. Protection is through 10A circuit breakers labeled INTK LIP HTR ENG 1 (left) and INTK LIP HTR ENG 2 (right).

Thermostats, Air Intake Heater

Refer to Figure 4.

There are two thermostats, one for each adaptor, located on a plate attached to the skin below the pilot's seat between stingers 31P and 32P at X–54.00

On aircraft with ModSum 4–126402 OR SB84–30–10 incorporated, there are two thermostats, one for each adaptor, located on the skin between the stingers 26P and 27P at X–54.00.

Transfer tape is used to bond the thermostats to the inside surface of the fuselage skin.

The thermostat is a thermal and mechanical switch which is energized closed when the Outside Air Temperature (OAT) is 60 ±4 °F (15 ±2 °C) and opens when the Outside Air Temperature (OAT) is 2 to 5 °F (1 to 3 °C) above 60 ±4 °F (15 ±2 °C).

Switches, Heater–Engine Intake

Refer to Figure 2.

The engine intake adapter heater circuits are activated by the pilot through the selection of the ENGINE INTAKE switchlights on the ICE PROTECTION control panel. Each circuit is selected separately through the respective switchlights. The left and right systems operate independently, therefore, depending on thermostat tolerance and sensing of fuselage temperature, the lights may not come on exactly at the same time while still operating within the acceptable system tolerance.

Relays, Control–Intake Heater

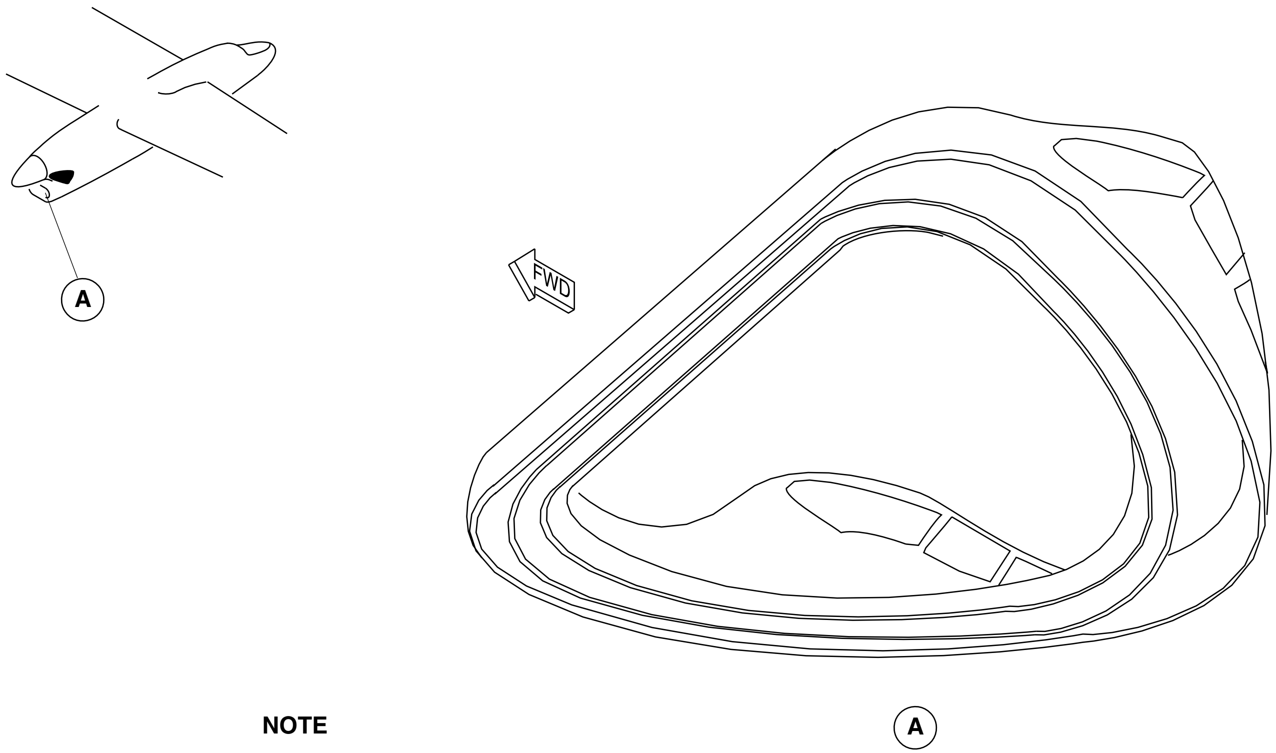
Refer to Figure 5.

The TMU monitors the current in the main circuit of the heater. The TMU detects a current below 1 A or above 12 ±0.5 A, a fault message is sent to the TMU for maintenance purposes. The TMU also automatically activates the heater selection relay to the spare heater circuit.

Training Information Points

Prior to the removal of the heated engine intake adapter, make sure the related circuit breaker is open.

The metallic case of the engine intake adapter is not repairable. The heater incorporated within the assembly can be removed and replaced by the manufacturer.



NOTE

Left Side Shown.
Right Side Similar.

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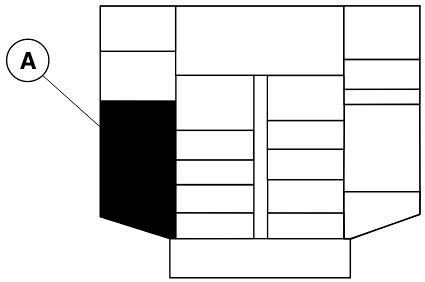
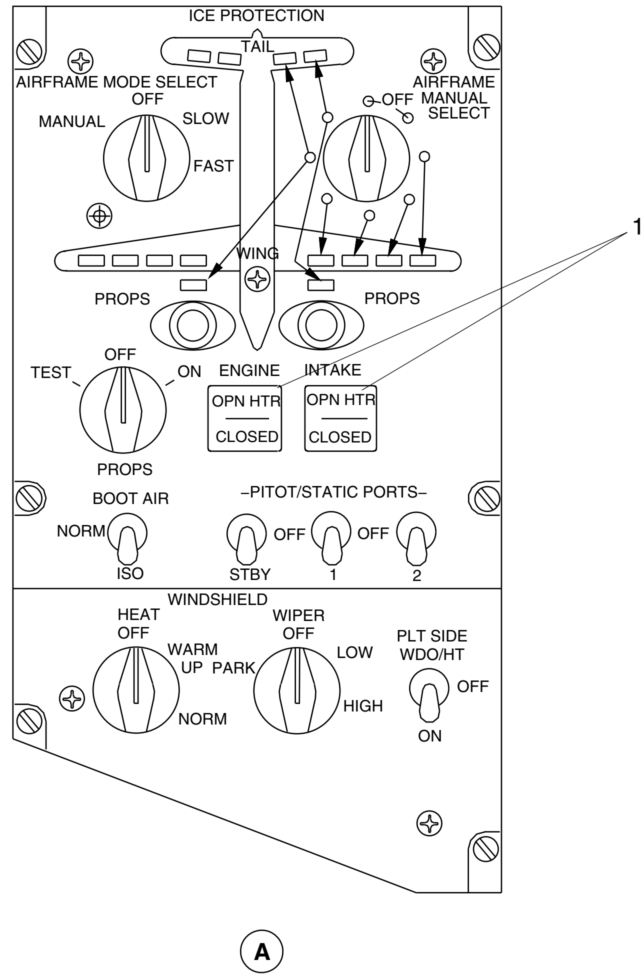
ENGINE INTAKE HEATER LOCATION
Figure 1



OVERHEAD CONSOLE

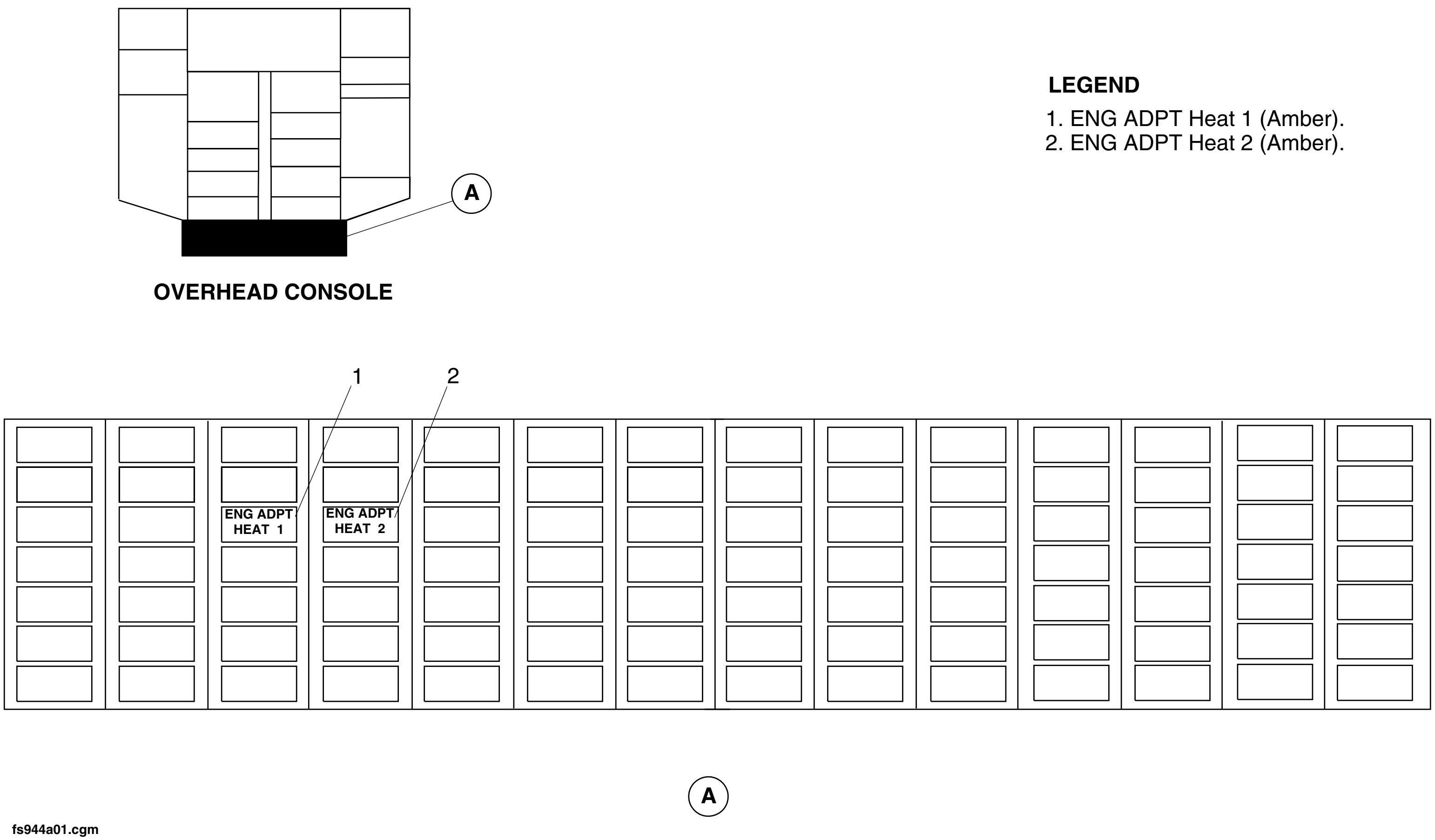


LEGEND

1. Engine Intake Bypass Switchlights.

fs912a01.cgm

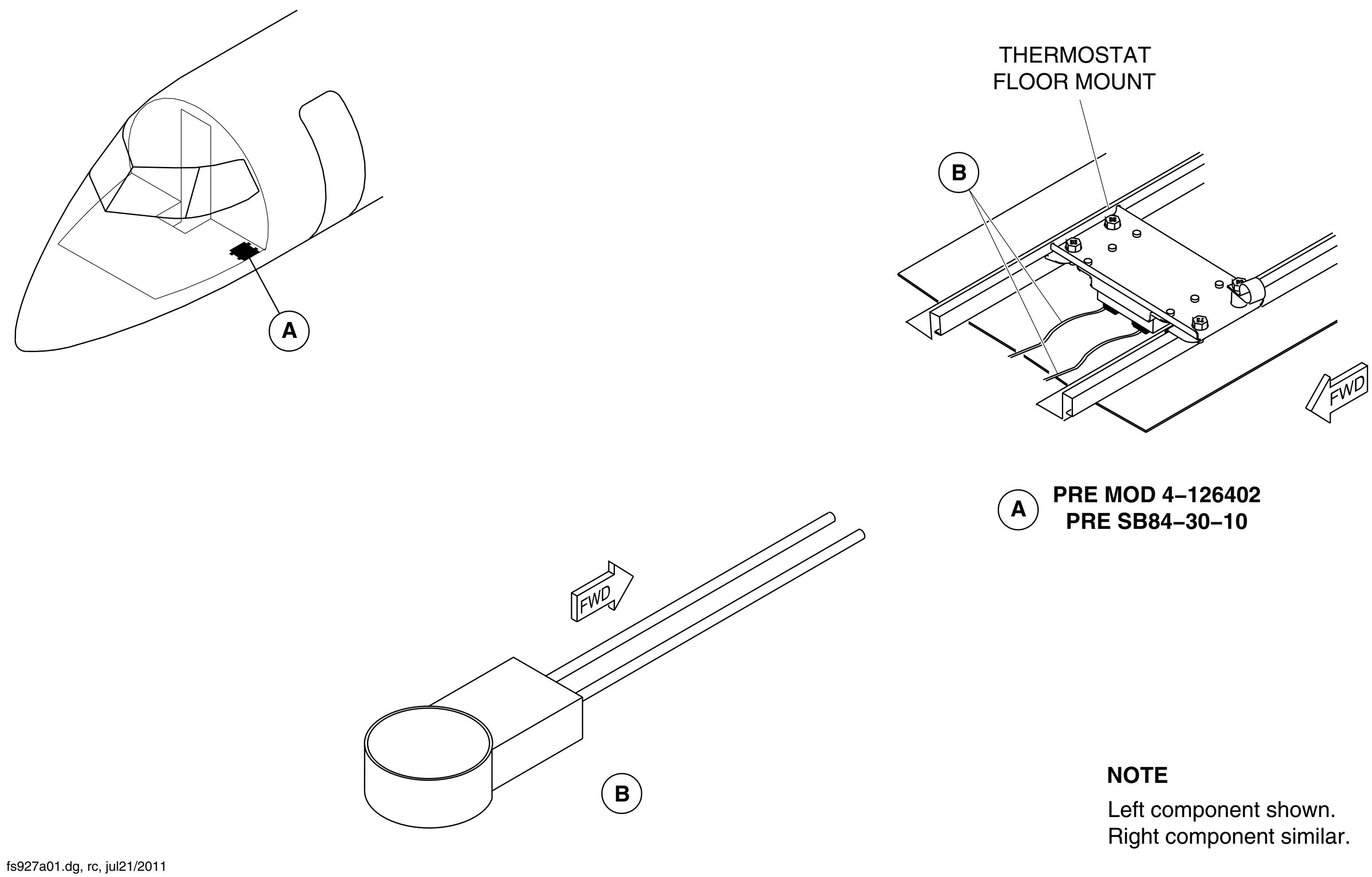
ENGINE INTAKE BYPASS SWITCHLIGHT LOCATION
Figure 2



LEGEND

1. ENG ADPT Heat 1 (Amber).
2. ENG ADPT Heat 2 (Amber).

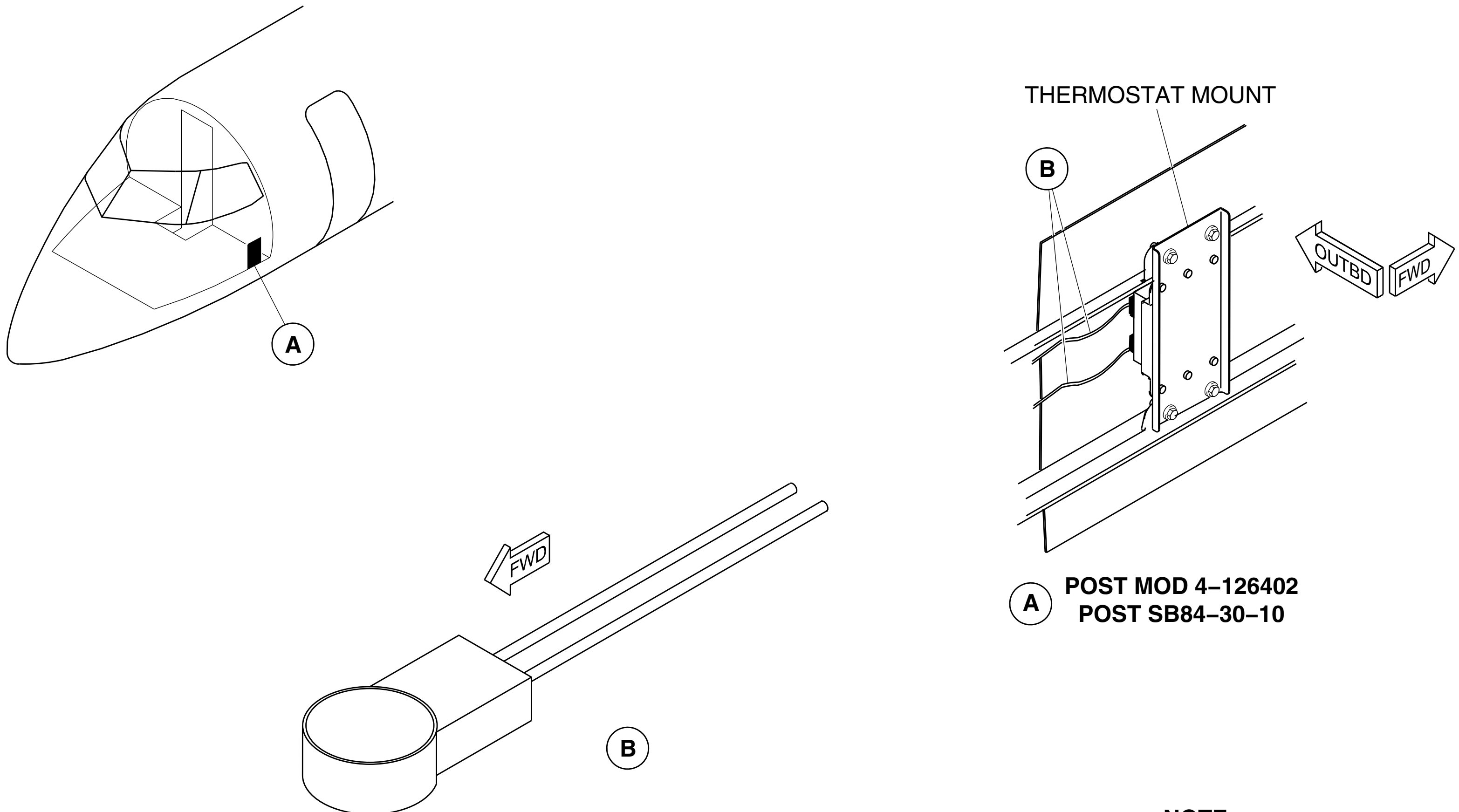
ENGINE ADAPTER CAUTION LIGHTS
Figure 3



NOTE

Left component shown.
Right component similar.

THERMOSTAT LOCATION
Figure 4 (Sheet 1 of 2)



NOTE

Left component shown.
Right component similar.

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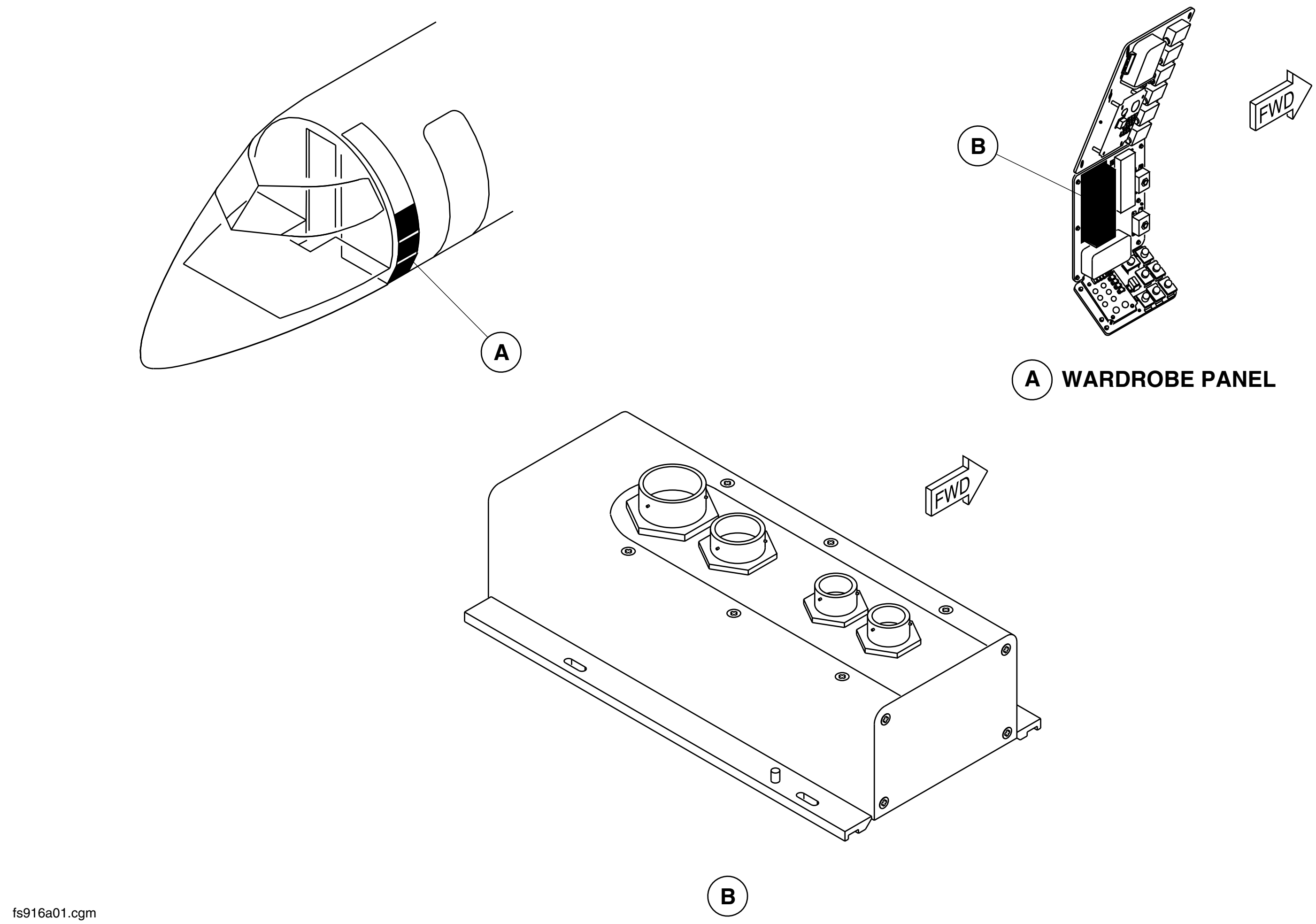
THERMOSTAT LOCATION
Figure 4 (Sheet 2 of 2)



RELAY PANEL LOCATION (TMU)
Figure 5

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30–30–00–001

PITOT AND STATIC ANTI–ICING SYSTEM

Introduction

Three pitot–static probes incorporate electrical heating elements to prevent icing which can cause incorrect pitot or static measurements.

General Description

Refer to Figures 1 , 2 , 3 and 4.

The Dash 8 Series 400 does not have dedicated pitot probes and static ports but uses three integrated pitot and static probes. The No. 1 probe is located below the pilot's windshield, the No. 2 probe is located below the copilot's windshield, and the No. 3 (standby) probe is located below the bottom aft corner of the copilot's side window.

The pitot and static anti–icing system includes the component that followings:

- Switches, Control (30–30–01).

Detailed Description

The Timer Monitor Unit (TMU) monitors the current of the pitot–static probe heaters. The Timer Monitor Unit (TMU) senses a defective pitot/static heater and sends the fault code to the Air Data Units (ADUs). Selection of pneumatic de–icing using the AIRFRAME MODE SELECT Switch or AIRFRAME MANUAL Switch is sent to each Stall Protection Module (SPM).

The No. 1 probe is directly connected to the number one Air Data Unit (ADU) only and does not supply inputs to any barometric indicators or instruments.

The Air Data Unit (ADU) converts the barometric pressures to digital data for use by various systems and for pilot display through the Primary Flight Display (PFD). The No. 2 probe is directly connected to the No. 2 Air Data Unit (ADU). Cross–side connections link the No. 1 and 2 static systems for static source error correction.

The No. 3 probe is connected only to the standby barometric altimeter and standby airspeed indicator on the engine instrument panel, and to the cabin pressure controller in the overhead console.

Each probe has an internal heater element for anti–ice protection. Pitot–static heat is routed through and monitored by the airframe Ice and Rain Protection System (IRPS) Timer Monitor Unit (TMU). The No. 1 and 2 probes are energized using 115 Vac from their related left and right variable frequency busses through 7.5 A circuit breakers labeled PITOT HEAT 1 and PITOT HEAT 2. The Standby Pitot–Static probe is energized from the 28 Vdc Right Essential Bus.

The Left and Right 115 Vac power supply is transmitted through the Ice and Rain Protection System (IRPS) Timer Monitor Unit (TMU) to the Left and Right Pitot–Static probe respectively. For nominal power supply within 98 Vac and 132 Vac, characteristics of consumption of probe heating will be (t = time, s = seconds, I = current, A = amperes):

- $t<5$ s, $I<6$ A
- $t<10$ s, $I<4$ A
- $t<20$ s, $I<2.6$ A
- continuous, $I<2.6$ A and $I>0.3$ A.

The Right Essential 28 Vdc electrcial power supply is transmitted through the Ice and Rain Protection System (IRPS) Timer Monitor Unit (TMU) to the Standby Pitot–Static probe. For nominal power supply, characteristics of consumption of probe heating will be (t = time, s = seconds, I = current, A = amperes):

- t<1 s, I<30 A
- t<5 s, I<25 A
- t<20 s, I<15 A
- continuous, I<15 A and I>1.5 A.

Refer to Figure 5.

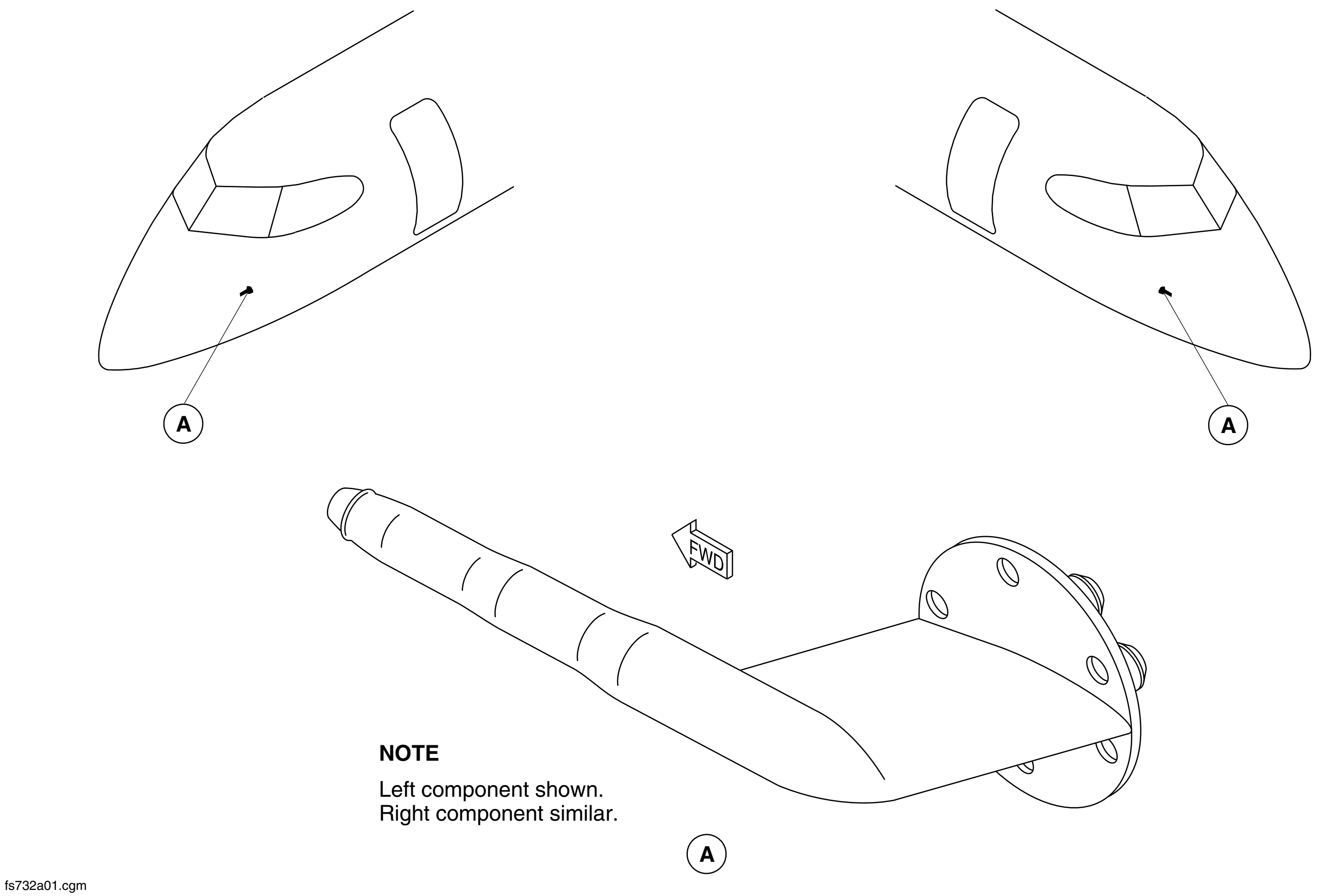
When the probe heater is selected on and the heater electrical current is out of specified limits, or if the heating is not activated, the Timer Monitor Unit (TMU) senses a defective heater and the respective PITOT HEAT 1, PITOT HEAT 2, or STBY PITOT caution light on the Caution and Warning Panel comes on. Fault codes are stored in the Timer Monitor Unit (TMU) for maintenance purposes. The maintenance messages associated with the fault codes are:

- PITOT 1 FAIL
- PITOT 2 FAIL
- PITOT STBY FAIL.

Switches, Control

Refer to Figure 6.

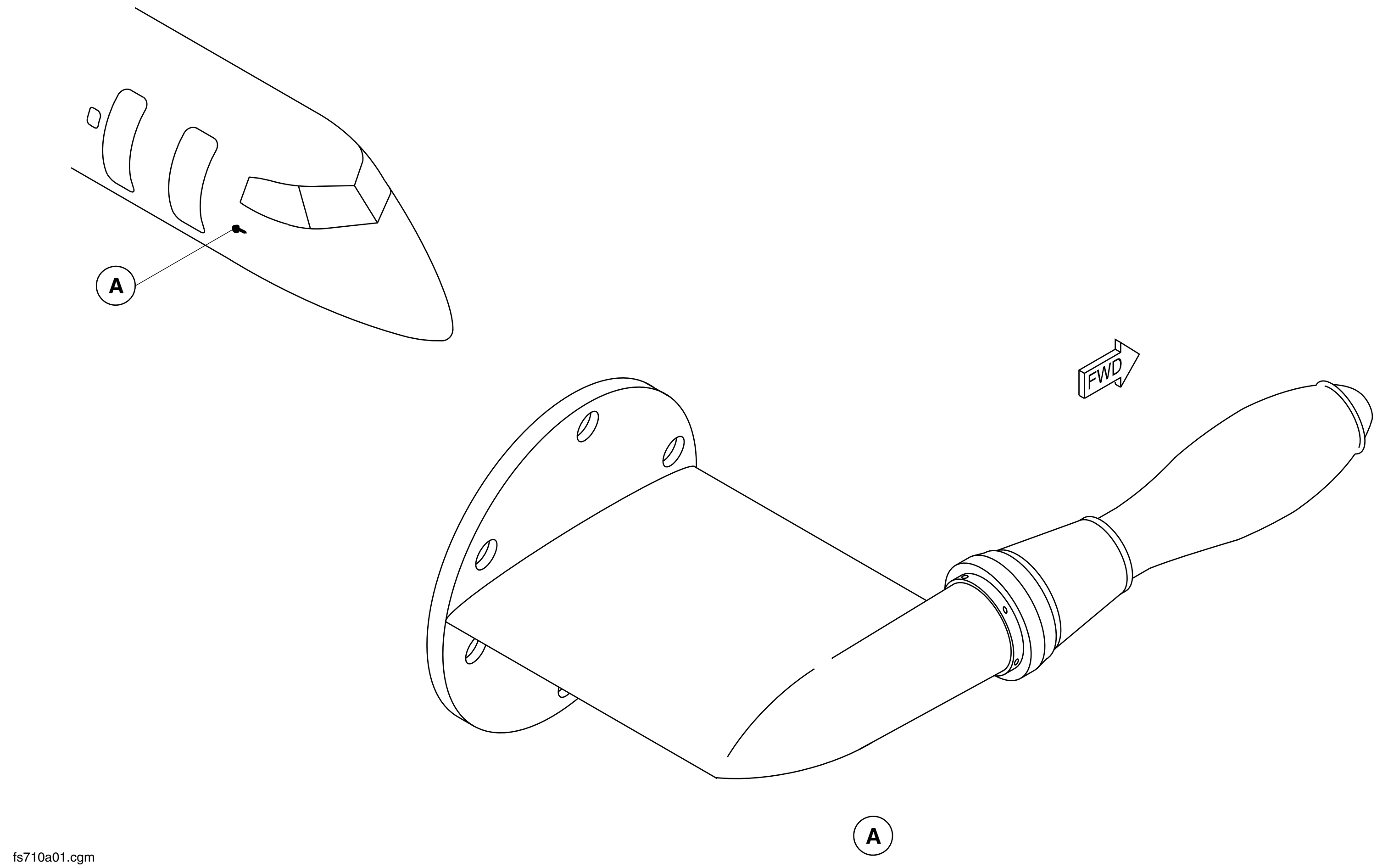
The pitot–static heaters are energized before take–off using three switches labeled PITOT/STATIC PORTS–STBY/1/2, on the overhead console (each probe having it’s own switch).



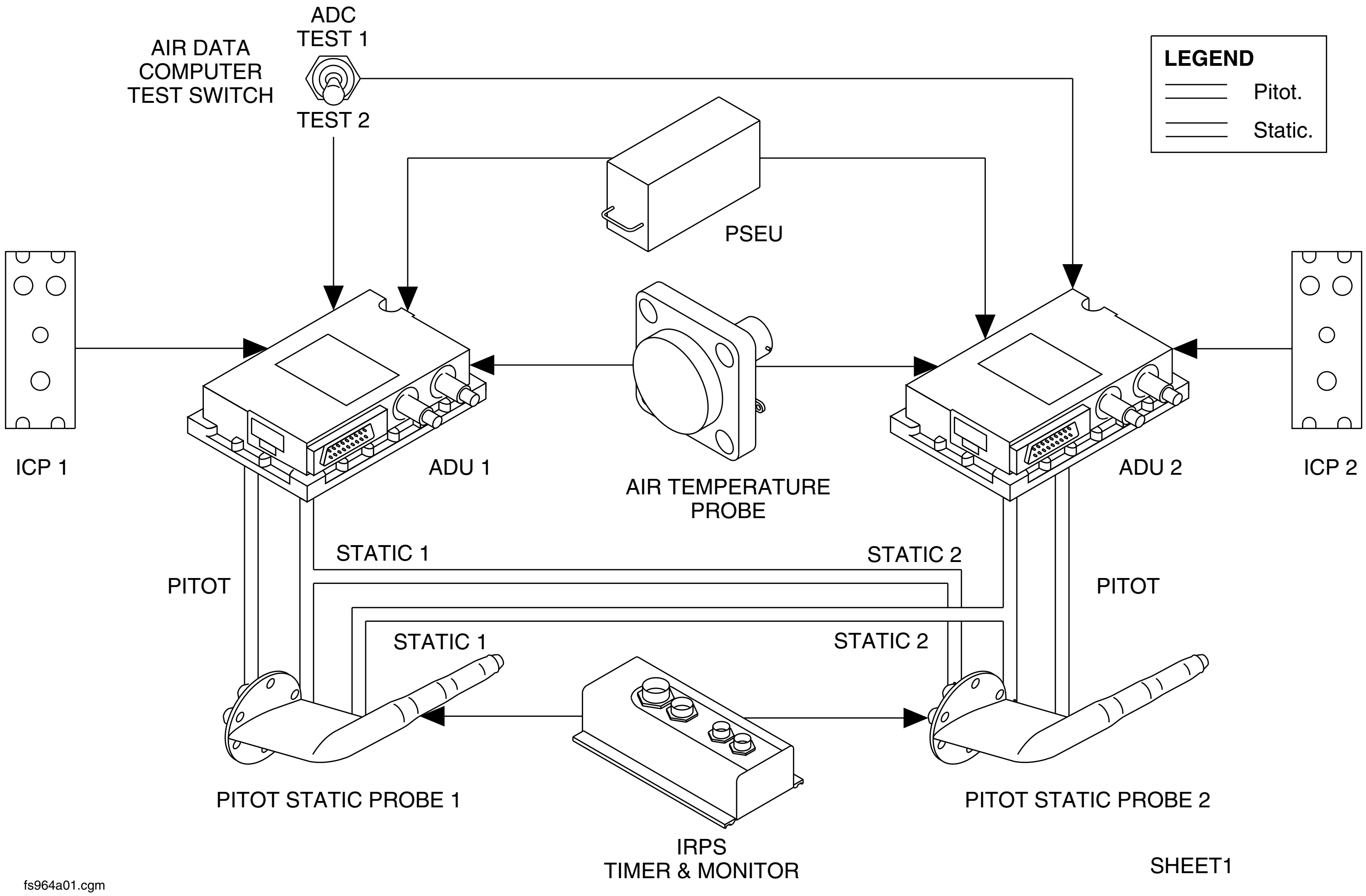
NOTE

Left component shown.
Right component similar.

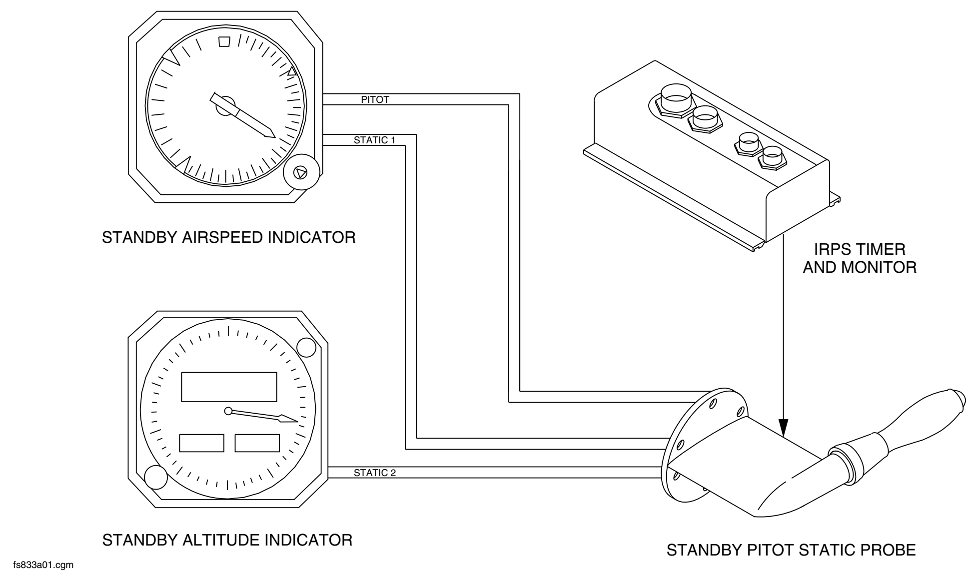
PRIMARY PITOT STATIC PROBE LOCATIONS
Figure 1



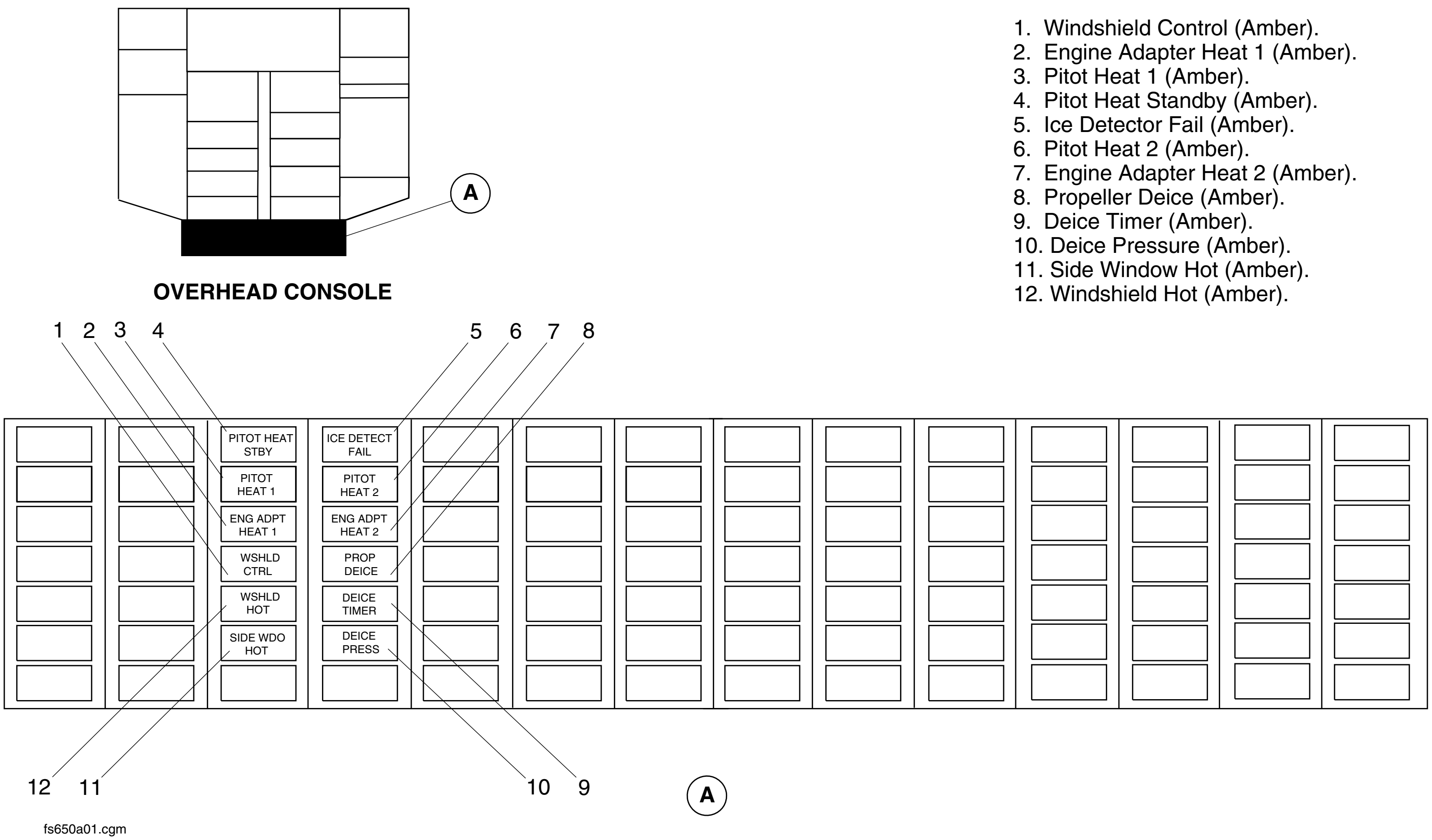
STANDBY PITOT STATIC PROBE LOCATION
Figure 2



PRIMARY PITOT STATIC PROBE BLOCK DIAGRAM
Figure 3



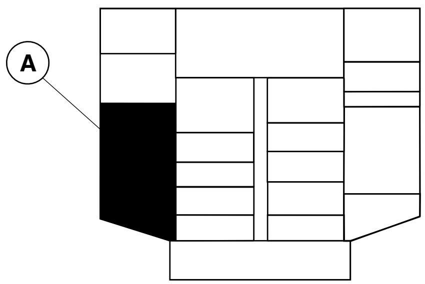
STANDBY PITOT STATIC PROBE BLOCK DIAGRAM
Figure 4

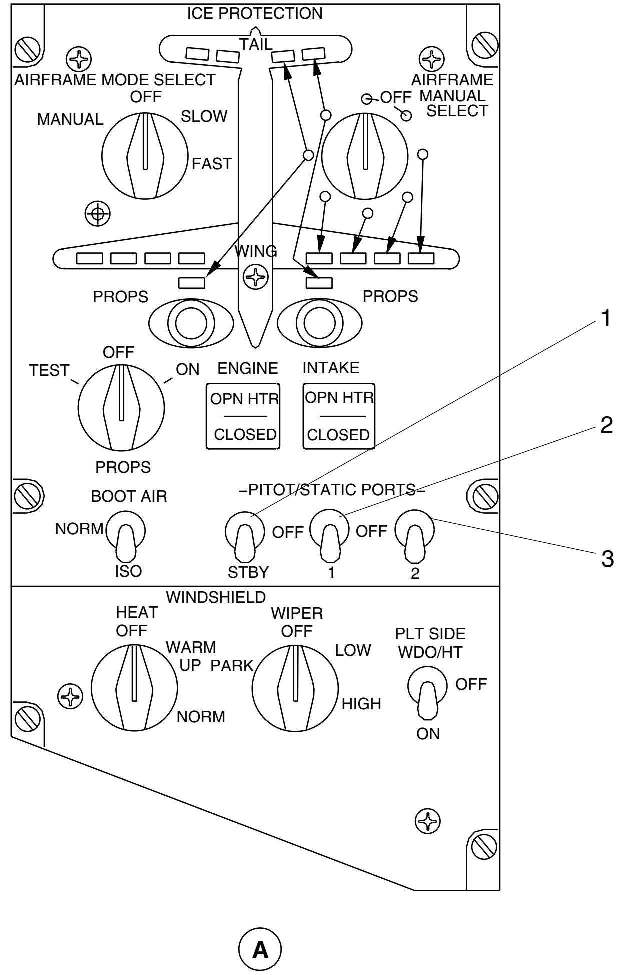


LEGEND

1. Windshield Control (Amber).
2. Engine Adapter Heat 1 (Amber).
3. Pitot Heat 1 (Amber).
4. Pitot Heat Standby (Amber).
5. Ice Detector Fail (Amber).
6. Pitot Heat 2 (Amber).
7. Engine Adapter Heat 2 (Amber).
8. Propeller Deice (Amber).
9. Deice Timer (Amber).
10. Deice Pressure (Amber).
11. Side Window Hot (Amber).
12. Windshield Hot (Amber).

PITOT STATIC CAUTION LIGHTS LOCATION
Figure 5





LEGEND

1. Standby Pitot/Static Probe Switch.
2. No. 1 Pitot/Static Probe Switch.
3. No. 2 Pitot/Static Probe Switch.

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PITOT AND STATIC PROBE SWITCH
Figure 6

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30–40–00–001

WINDSHIELD AND WINDOWS ICE AND RAIN PROTECTION

Introduction

The windshield anti–icing system prevents ice formation on the windshields and the pilot's side window.

The windshield wiper system removes rain water to obtain an adequate zone of vision through the pilot's and copilot's windshields. The wipers are able to remove any amount of rain which may fall on the windshields during taxiing, taking off, landing and at airspeeds up to 200 kt (370.6 km/h).

General Description

Refer to Figures 1 and 2.

The windshield anti–icing system includes one windshield heater, two temperature sensors, seven relays and two Anti–Ice Controllers (AICs). Both windshields and the pilot's side window have electronically controlled heater elements laminated into the panels to keep the windows at a predetermined temperature to prevent icing and misting.

The pilot's and copilot's windshield wiper systems are symmetrical but completely independent from each other. Each system has a two speed, dc motor fitted to a mechanical converter which drives a wiper arm and blade. A single rotary switch, located on the WINDSHIELD wiper control panel in the overhead console, operates both motor/converters.

The Windshield And Windows Ice And Rain Protection has the components that follow:

- Controllers, Anti–Icing (30–41–01)
- Selector, Windshield Heat (30–41–06)
- Switch, Pilot Side Window (30–41–11)
- Relays, Control (30–41–16).
- Windshield Wiper System (30–42–00)
- Assembly, Motor (30–42–01)
- Arm, Wiper (30–42–06)
- Blade, Wiper (30–42–11)
- Selector, Control–Wiper (30–42–16)

Detailed Description Windshield Anti–Icing System (30–41–00)

The windshield anti–icing system prevents ice formation on both windshields and the pilot's side window. The windows are electrothermally anti–iced.

The windshield anti–icing system includes the components that follow:

- One (1) windshield heater
- Two (2) temperature sensors
- Seven (7) relays
- Two (2) Anti–Ice Controllers (AIC).

Refer to Figures 3 and 4.

The windshield anti–icing system is controlled by an overhead switch labelled HEAT located on the WINDSHIELD wiper control panel. The pilot's side window anti–icing is controlled using a two–position toggle switch labelled PLT SIDE WDO/HT also located on the WINDSHIELD wiper control panel.

Refer to Figure 5.

The windshield and pilot's side window heaters are controlled by the Anti–Ice Controller (AIC). If either AIC fails, the WSHLD CTRL caution light will come on. If the HEAT selector is in the OFF position the WSHLD CTRL caution light is prevented from coming on. Failure messages are recorded in the Timer and Monitor Unit (TMU) for maintenance purposes. Two maintenance messages related to the failures are RIGHT WSHLD CTRL FAIL and LEFT WSHLD CTRL FAIL.

The AIC sends signals to operate the related windshield heater relay. The 115 VAC C phase left bus supplies power for the pilot's windshield in the NORM mode. It also supplies power to both windshields in the WARM UP mode. The 115 VAC C phase right bus supplies power for the copilot's windshield in the NORM mode. The 115 VAC A phase right bus supplies power for the pilot's side window.

The pilot's windshield, copilot's windshield, and pilot's side window anti–ice controllers are electrically powered by 28 VDC from the Left and Right Secondary Buses. The pilot's windshield controller is protected by a 1 Ampere circuit breaker labelled PLT WS/HT CONT. The copilot's windshield and pilot's side window controllers are protected by a 1 A circuit breaker labelled COPLT WS PLT WDO HT CONT.

Controllers, Anti–icing (30–41–01)

Refer to Figure 6.

Two Anti–Ice Controllers (AICs) control heater operation to prevent ice accumulating on the windshields and the pilot's side window. The AICs activate the heaters using relays. The relays are used to isolate the AICs from the high current flow required for heating. When the windshield control is in the OFF position, the deactivation relay is controlled using the overheat temperature sensor. The activation relay stays open regardless of the normal temperature sensor information. In the WARM–UP or NORM modes, the Anti–Ice Controller (AIC) uses the normal temperature sensor information to control the activation relay and the overheat temperature sensor to control the deactivation relay. The left AIC is powered by the 28 VDC left secondary bus. The right AIC is powered by the 28 VDC right secondary bus.

The Anti–Ice Controllers (AICs) are installed in the midsection of the wardrobe on the Electrical Equipment Panel (zone 225).

Selector, Windshield Heat (30–41–06)

Refer to Figure 4.

The windshield mode selector labelled WINDSHIELD HEAT OFF/WARM UP/NORM on the WINDSHIELD panel operates the pilot and copilot windshield heaters.

The WARM UP mode prevents thermal shocks to the windshield. To avoid this damage, the warm up relay decreases the electrical power supply to the windshield heaters by 50%. This is achieved when the WARM UP mode activates the warm–up relay which places both windshields in a serial connection. When the WARM UP mode is selected, each Anti–Ice Controller (AIC) uses the normal temperature sensor information to activate its related windshield heater. Power for the serial connection is taken from the pilot windshield power supply. In the OFF and NORM modes, the windshields are connected in parallel.

When the NORM mode is selected, both windshields are heated with full electrical power. When the NORM mode is selected, the WARM UP relay is deactivated and switches from a serial connection to an independent connection on the related bus.

Refer to Figure 5.

An overheat condition of the pilot's or copilot's windshield is shown by the WSHLD HOT caution light coming on.

Switch, Pilot Side Window (30–41–11)

Refer to Figure 4.

The side window toggle switch labelled PLT SIDE WDO/HT on the WINDSHIELD wiper control panel operates the pilot's side window heater.

When ON is selected, the right Anti–Ice Controller (AIC) energizes the side window relay, which supplies the pilot's side window heater with 115 VAC phase A power.

Refer to Figure 5.

An overheat condition for the pilot side window is shown by the SIDE WDO HOT caution light coming on.

Relays, Control (30–41–16)

Control of the heaters is done by temperature sensors installed in the windshields and the pilot's side window.

Refer to Figure 7.

When the pilot's or copilot's windshield temperature is less than 93 ±6 °F (34 ±2 °C) or the pilot's side window temperature is less than 86 ±11 °F (30 ±2 °C), the related Anti–Ice Controller (AIC) activates the related activation relay that supplies 115 VAC to the heater.

When the windshield temperature is above 108 ±6 °F (42 ±3 °C) or the pilot side window temperature is above 101 ±7 °F (38 ±4 °C), the AIC deactivates the deactivation relay which opens the circuit and shuts off the power to the heater. The overheat relays fail (unpowered) in the open position to prevent overheat.

In the event the normal heating control fails, the AIC uses the overheat temperature sensor to control the heater. In an overheat condition (temperature above 140 ±5 °F (60 ±3 °C) for windshield or above 126 ±4 °F (52 ±2 °C) for the pilot's side window), the AIC deactivates both relays and shuts off the heating. On aircraft without SB 84–24–12 incorporated, the overheat indication of the AIC for windshields activates above 126 ±4 °F (52 ±2 °C).

Training Information Points

Use caution when doing window heater and control tests, as the windshield and side windows become hot very quickly when they are heated.

Prior to the removal of a faulty Anti–Ice Controller (AIC), the appropriate circuit breaker (CB) must be pulled. Care must be taken not to remove the working Anti–Ice Controller (AIC), as they are identical and located in close proximity to one another.

Windshield Wiper System (30–42–00)

The pilot's and copilot's windshield wiper systems are symmetrical but completely independent from each other. Each system has a two speed, dc motor fitted to a mechanical converter which drives a wiper arm and blade. A single rotary switch, located on the WINDSHIELD wiper control panel in the overhead console, operates both motor/converters.

The two motor/converter units are installed in front of the forward pressure bulkhead. The motor/converters are independent from each other and operate the wiper arms for the pilot's and copilot's windshields. They are supplied with electrical power from the L and R SECONDARY buses. This configuration ensures that in the event of failure of either unit, the remaining unit will supply an unobstructed forward view for one pilot.

Refer to Figures 3 and 4.

The rotary WIPER switch on the WINDSHIELD wiper control panel operates the motor/converter units. The switch has the positions that follow:

- PARK
- OFF
- LOW
- HIGH.

With the WIPER switch set to LOW, the two field windings in each motor are connected in series by the related switch section contacts and the motors rotate at a low speed. With the WIPER switch set to HIGH, the two field winding in each motor are connected in parallel by the related switch section contacts and the motors rotate at a high speed. With the WIPER switch set to OFF from the HIGH or LOW position, electrical power is removed from the motor field windings and the wiper blades stop anywhere in their cycle.

The wiper blades are placed into a parked position when the WIPER switch is set to the momentary PARK position. When the WIPER switch is held in the PARK position, the motor field windings are connected in series and the motors rotate at a slow speed. When the wiper arm reaches the parked position, the park switches are mechanically closed, shorting out the armatures and stopping the motors in the parked position. The WIPER switch is then released and returns to the OFF position, removing power to the motor circuits.

Refer to Figures 8 and 9.

Ice detectors, illuminated by lights in the flight compartment, give a visual indication of the formation of ice on the windshield wipers. The W/S WIPER ICE DETECT LIGHT switches, located on the pilot's and copilot's side consoles, operate the ice detector lights in the flight compartment.

The wiper arm, with the wiper blade, is installed on the converter output shaft adjusting sleeve with a washer, nut and cotter pin. The wipers are designed to park off the windshield when not in use.

Assembly, Motor (30–42–01)

Refer to Figures 10 and 11.

Two motor/converter assemblies are located forward of the front pressure bulkhead, one on each side of the aircraft centreline.

Each motor/converter assembly includes the components that follow:

- DC motor with two field windings

– Park switch

– Converter gearbox.

The converter gearbox changes the rotary motion of the motor to an oscillating motion at the wiper blade arm.

The left windshield wiper system is powered from the L SECONDARY bus through a 10 A circuit breaker (S7) labeled PLT W/S WIPER. The right windshield wiper system is powered from the R SECONDARY bus through a 10 A circuit breaker (A6) labeled COPLT W/S WIPER. The motors are also protected by a permanent grounding contact to the aircraft structure. The assembly has radio noise filters to suppress interference.

Arm, Wiper (30–42–06)

Refer to Figures 12 and 13.

The wiper arm (and wiper blade) is installed on the converter output shaft adjusting sleeve with a washer, nut and cotter pin. A bolt, washer, nut and cotter pin secure the adjusting sleeve in the hub arm.

The wiper arm is attached to the hub and includes a tension spring. A trigger and detente within the arm facilitates removal and installation of the arm and blade assembly by keeping the blade away from the windshield. An ice detector spigot is riveted to the wiper arm attachment and is illuminated by lights located in and controlled from the flight compartment.

Blade, Wiper (30–42–11)

Refer to Figure 13.

The wiper blade is attached to the arm with a nut, washers, and cotter pin.

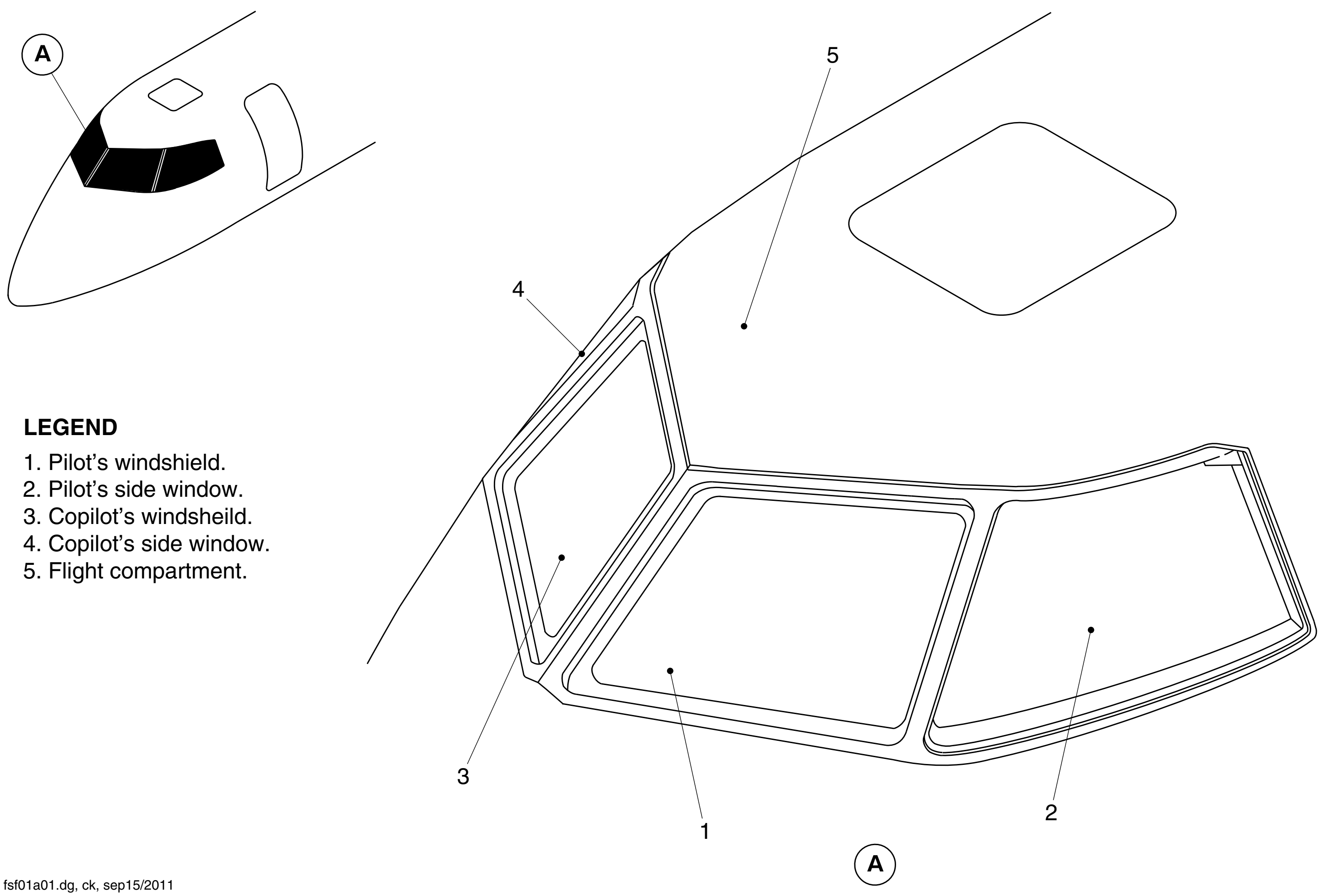
Selector, Control–Wiper (30–42–16)

Refer to Figure 4.

Both the pilot's and copilot's wipers are controlled by a single rotary switch labeled WIPER, located on the WINDSHIELD wiper control panel of the overhead console with positions labeled PARK, OFF, LOW, HIGH. The PARK position is momentarily spring–loaded to OFF.

Selection of LOW or HIGH activates both wipers at the appropriate speed. Selection for LOW or HIGH to OFF stops the blades at their existing position. When the switch is held at the spring–loaded PARK position, the blades start to operate at low speed until they reach the bottom of their travel, where they will automatically stop at the park position.

The WIPER control selector is electrically powered from the L SECONDARY bus through a 1 A circuit breaker (R7) labeled PLT WS/HT CONT. The selector is also powered from the R SECONDARY bus through a 1 A circuit breaker (B6) labeled COPLT WS PLT WDO HT.



LEGEND

1. Pilot's windshield.
2. Pilot's side window.
3. Copilot's windsheild.
4. Copilot's side window.
5. Flight compartment.

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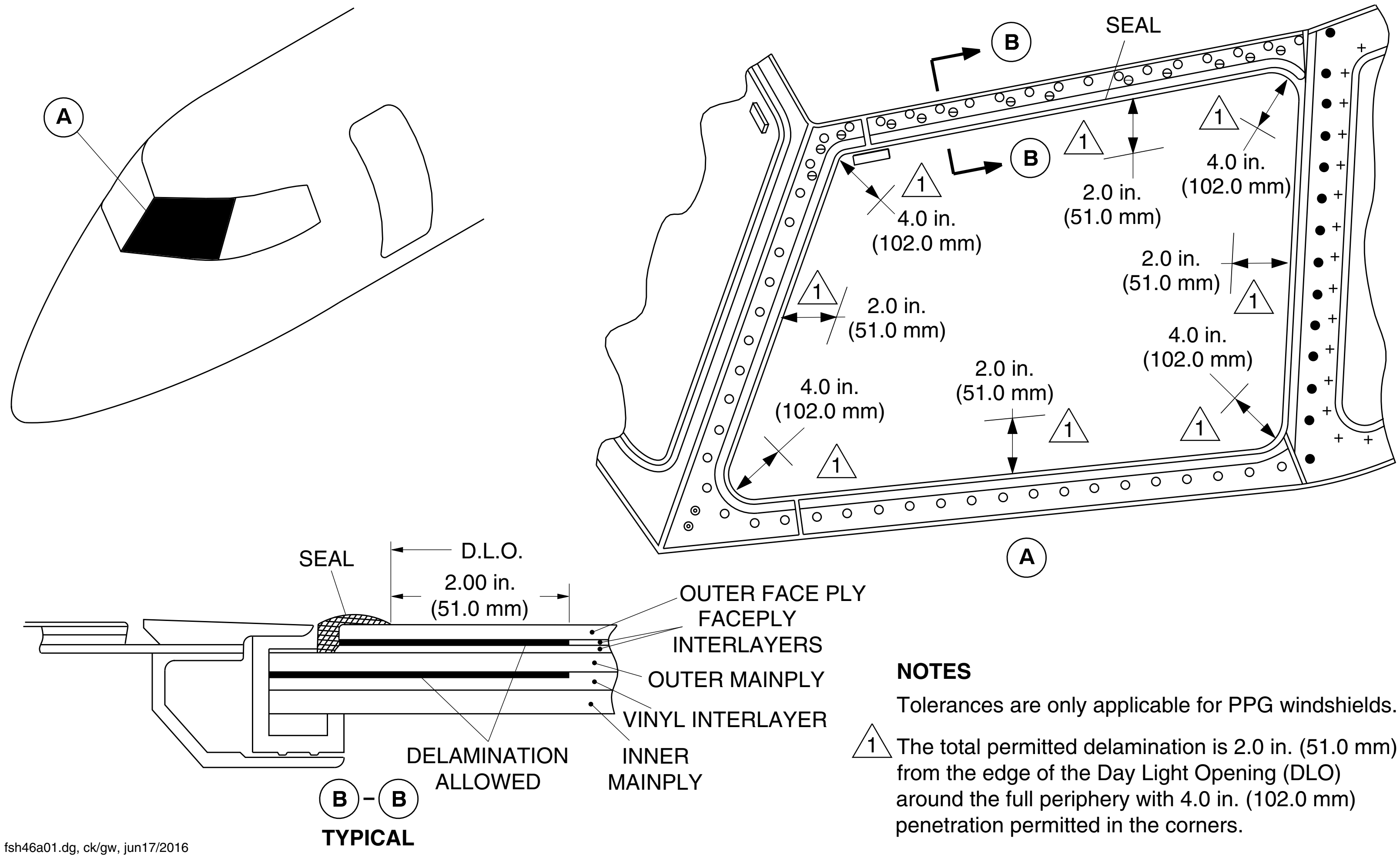
Flight Compartment Windows
Figure 1

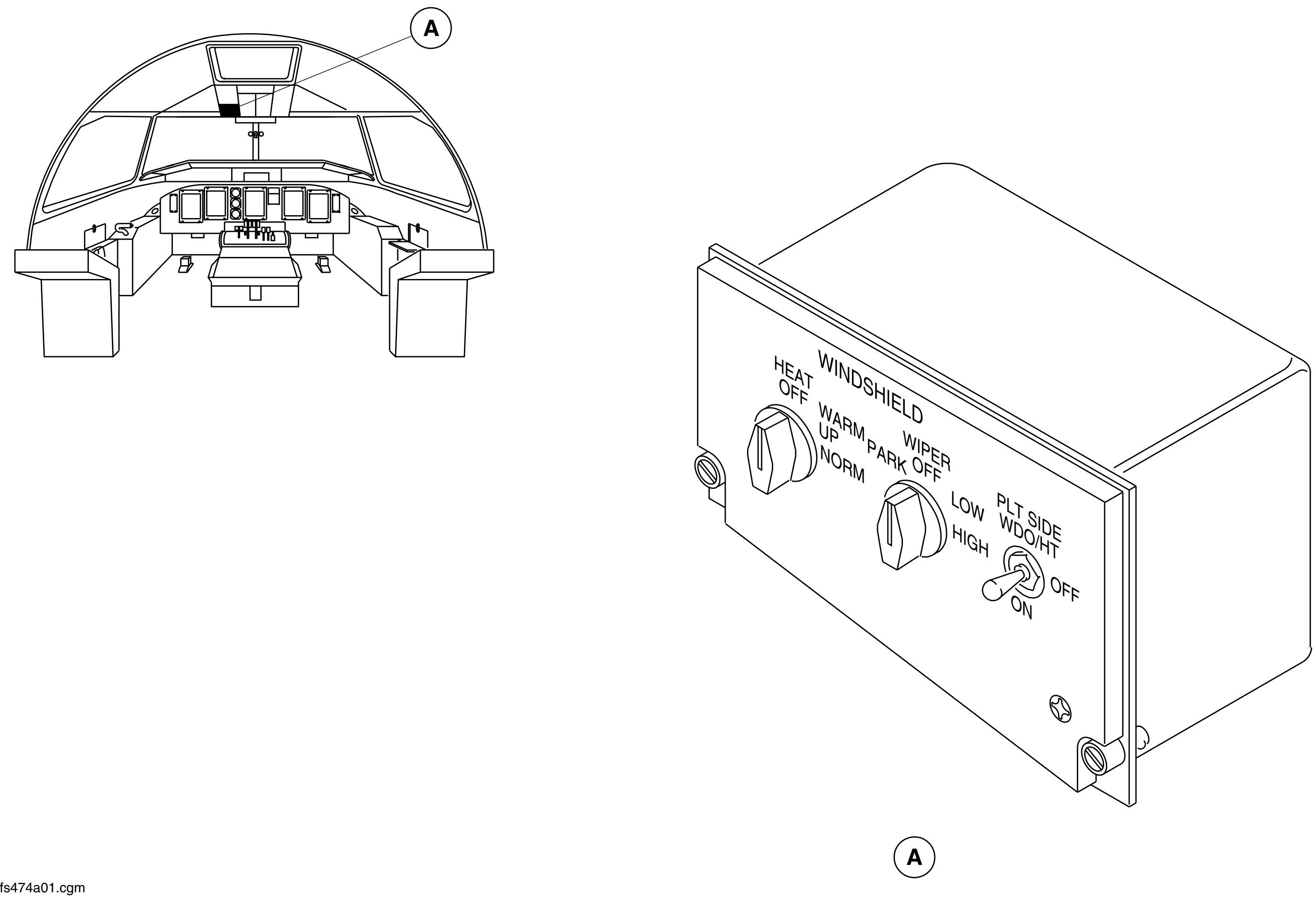


NOTES

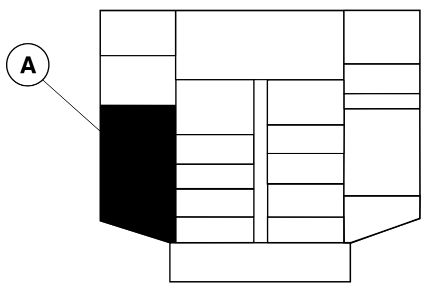
Tolerances are only applicable for PPG windshields.

1 The total permitted delamination is 2.0 in. (51.0 mm) from the edge of the Day Light Opening (DLO) around the full periphery with 4.0 in. (102.0 mm) penetration permitted in the corners.

Pilot's Windshield Cross–Section
Figure 2

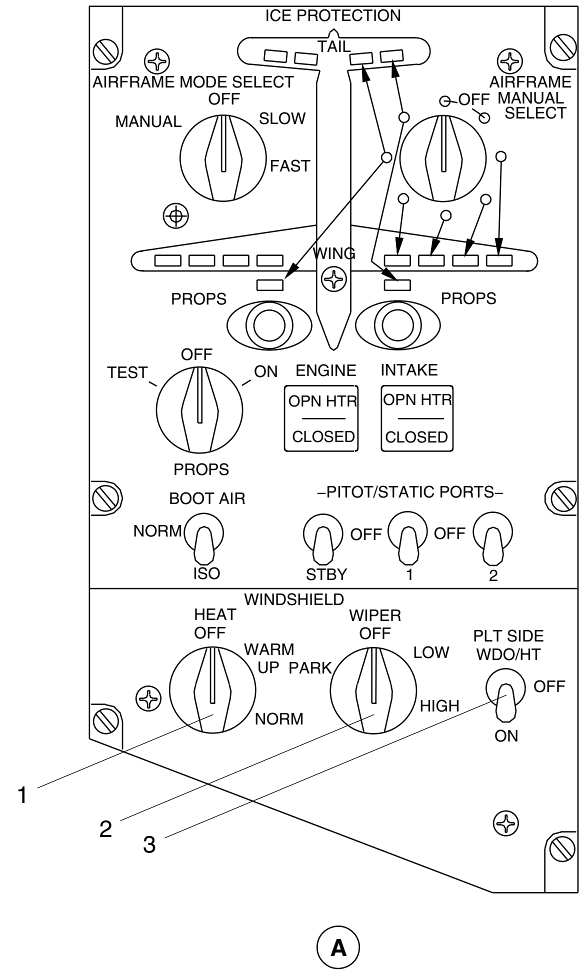


WINDSHIELD CONTROL PANEL LOCATOR
Figure 3



LEGEND

1. Windshield Heat Switch.
2. Windshield Wiper Switch.
3. Pilot Side Window Heat Switch.



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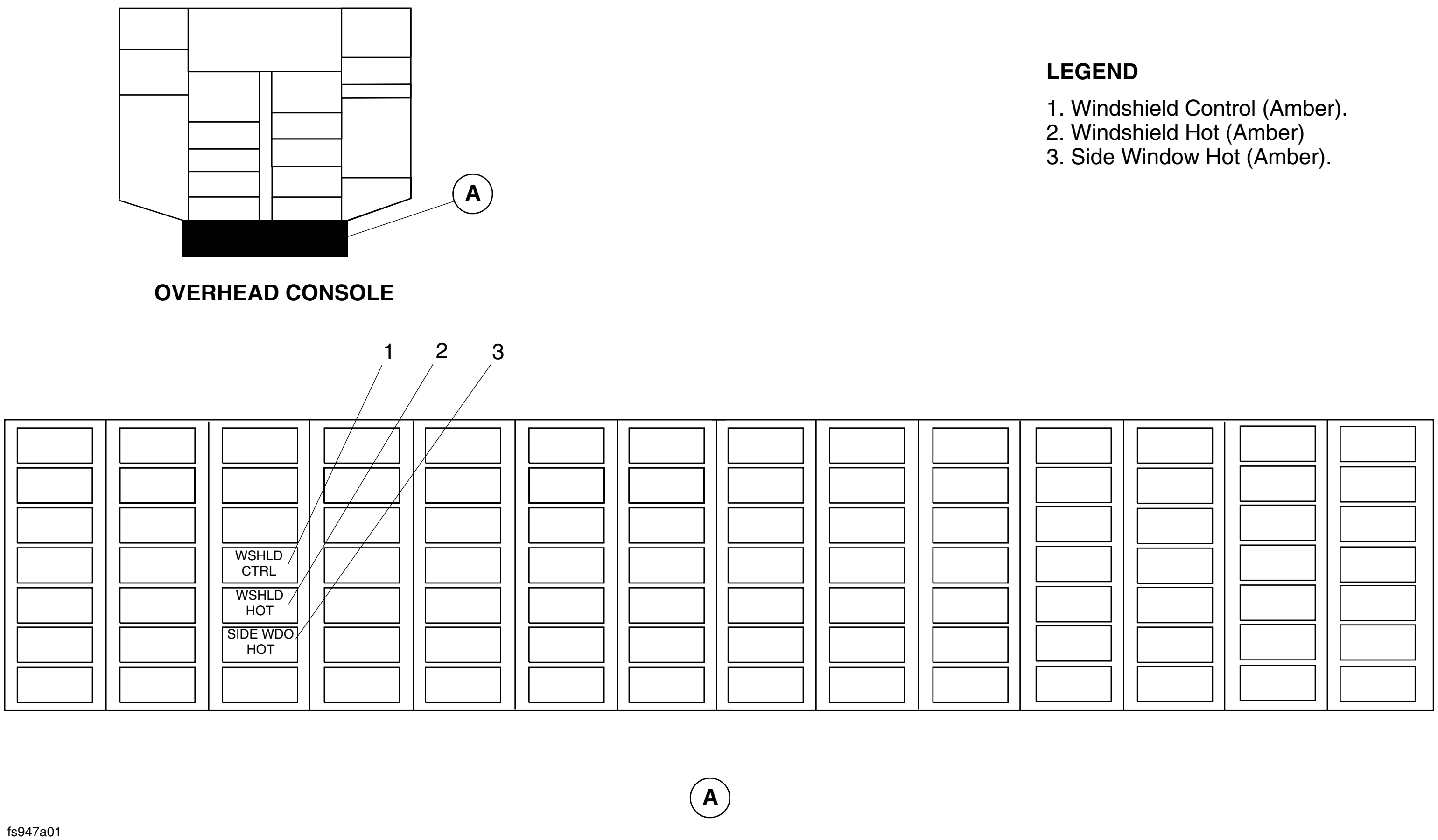
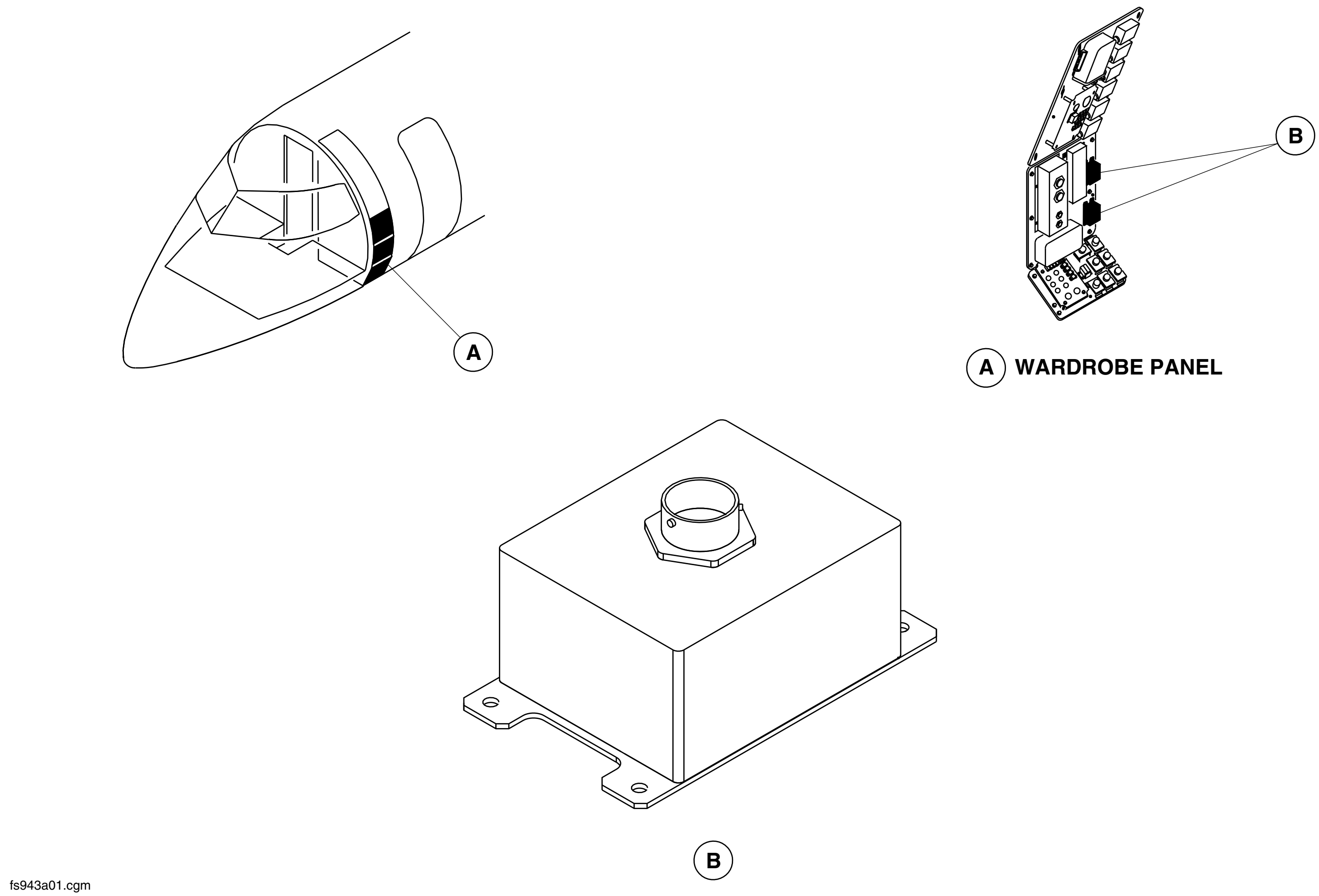
WINDSHIELD CONTROL PANEL
Figure 4



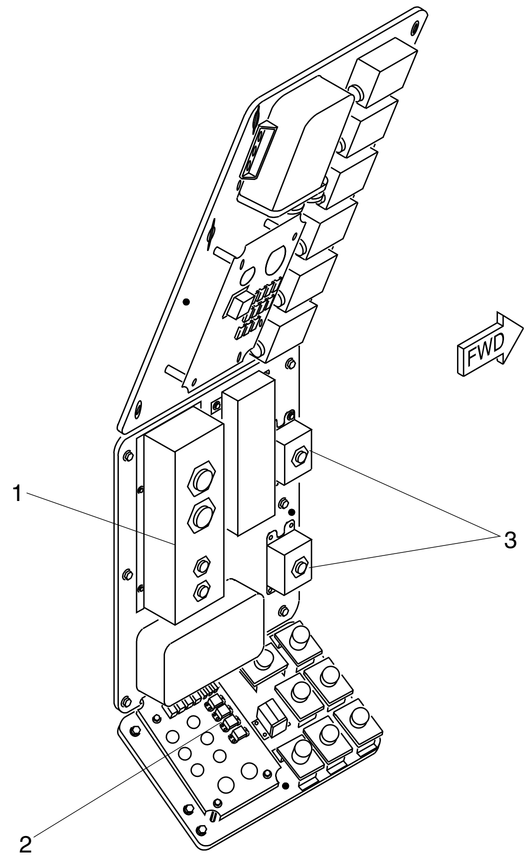
LEGEND

1. Windshield Control (Amber).
2. Windshield Hot (Amber)
3. Side Window Hot (Amber).

WINDSHIELD CONTROL AND OVERHEAT CAUTION LIGHTS
Figure 5



ANTI–ICE CONTROLLER LOCATION
Figure 6



LEGEND

1. TMU.
2. Relay Panel.
3. AIC.

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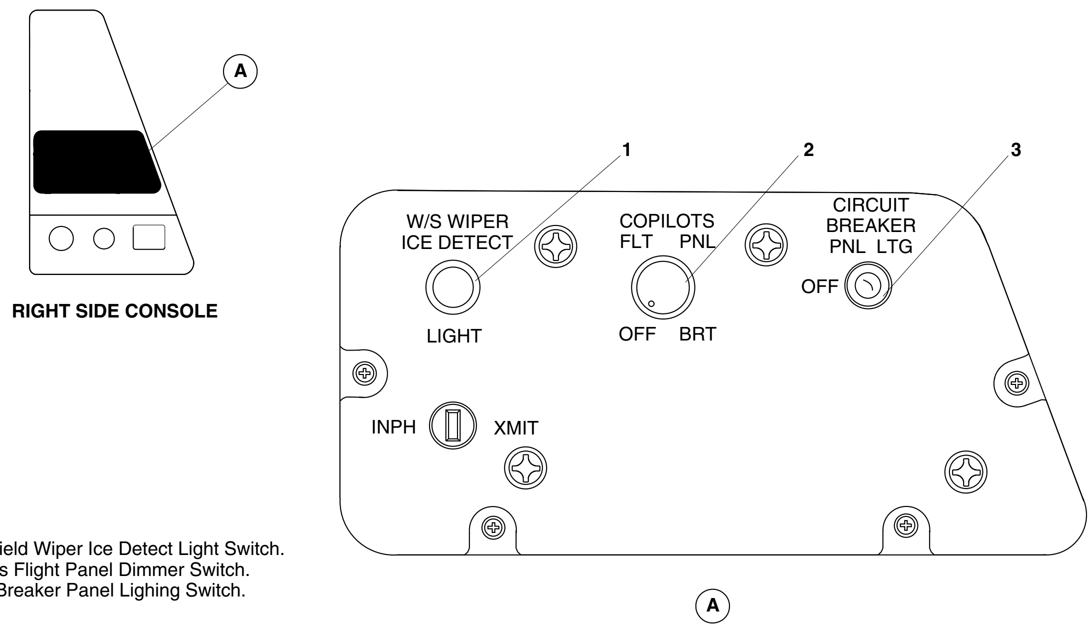
RELAY PANEL LOCATION
Figure 7



LEGEND

1. Windshield Wiper Ice Detect Light Switch.
2. Copilot's Flight Panel Dimmer Switch.
3. Circuit Breaker Panel Lighing Switch.

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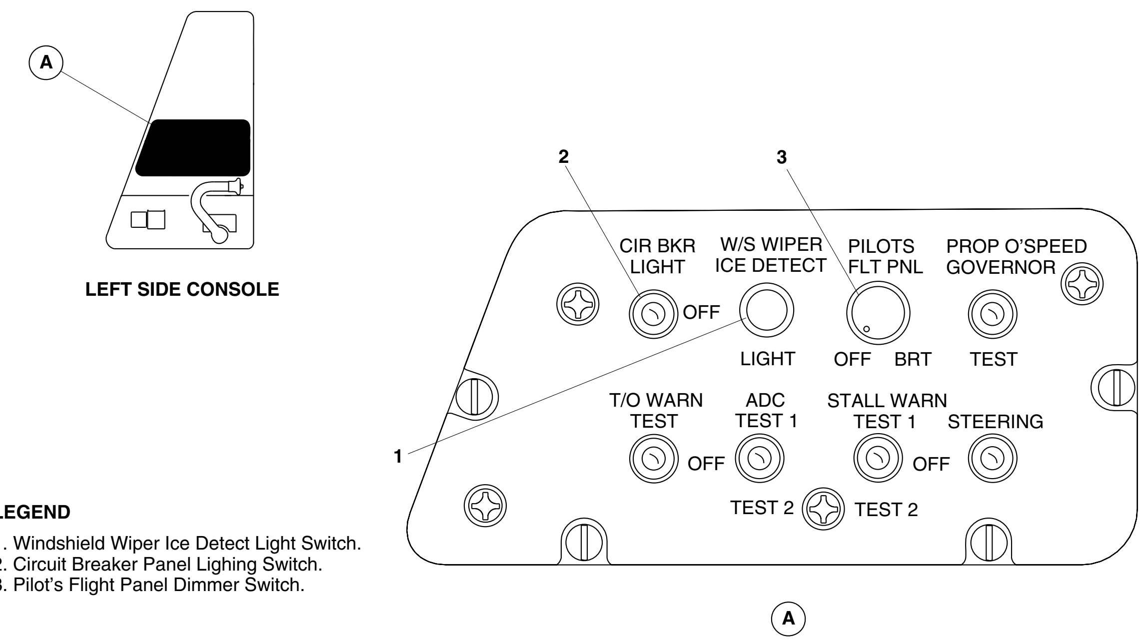
COPILOT SIDE CONSOLE PANEL DETAIL
Figure 8



LEGEND

1. Windshield Wiper Ice Detect Light Switch.
2. Circuit Breaker Panel Lighing Switch.
3. Pilot's Flight Panel Dimmer Switch.

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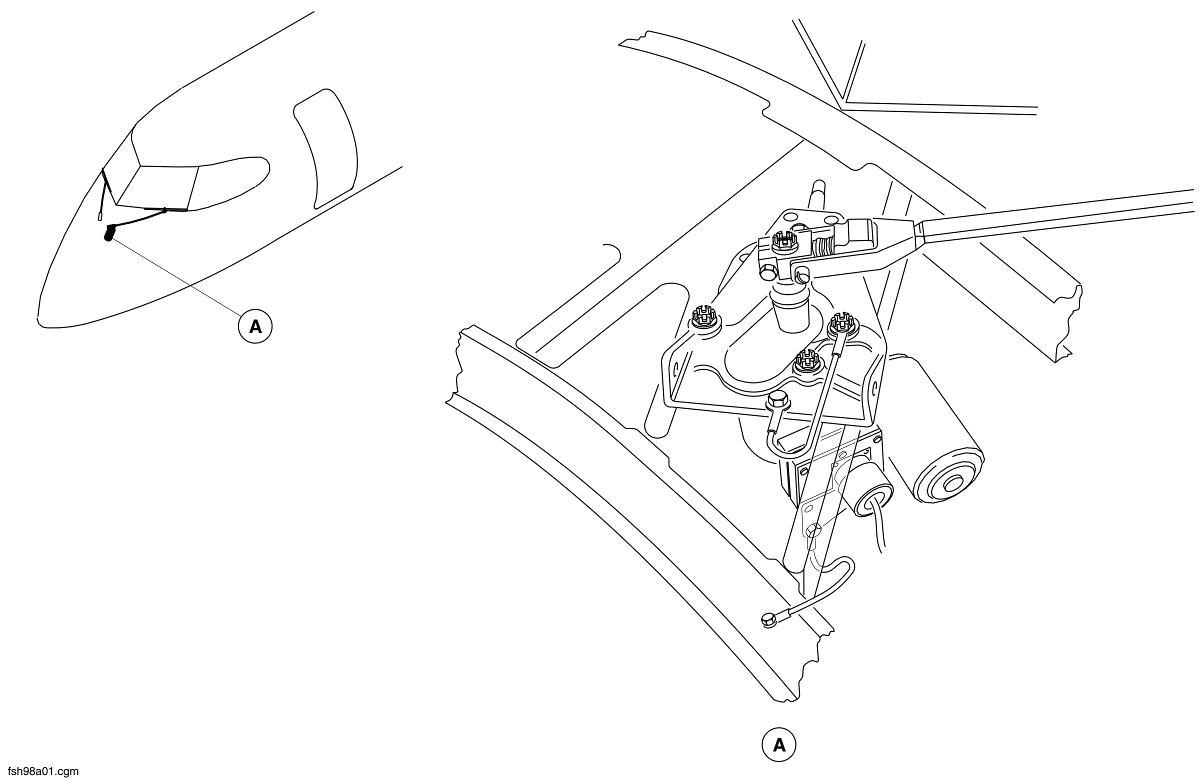
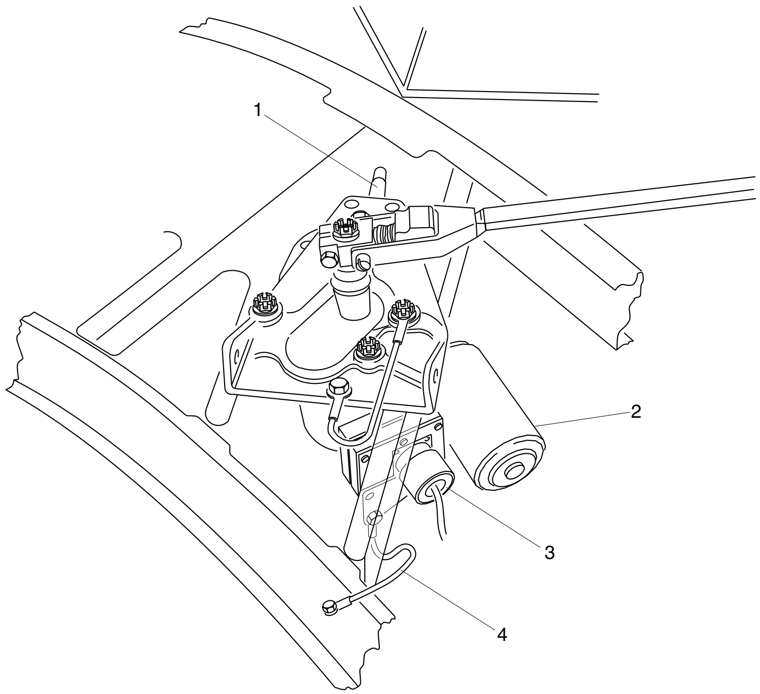
PILOT SIDE CONSOLE PANEL DETAIL
Figure 9



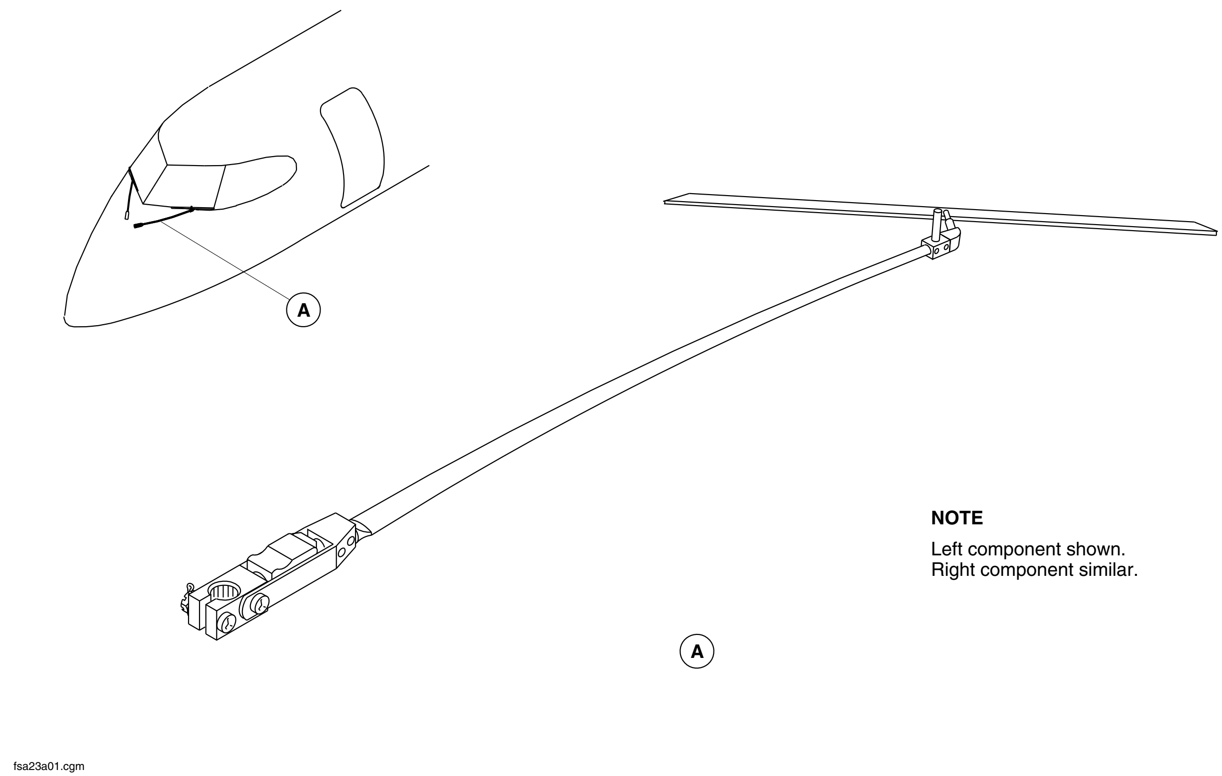
WINDSHIELD WIPER MOTOR ASSEMBLY LOCATOR
Figure 10



LEGEND

1. Spigot.
2. Motor Assembly.
3. Electrical Connector.
4. Ground Wire.

WINDSHIELD WIPER MOTOR ASSEMBLY DETAIL
Figure 11



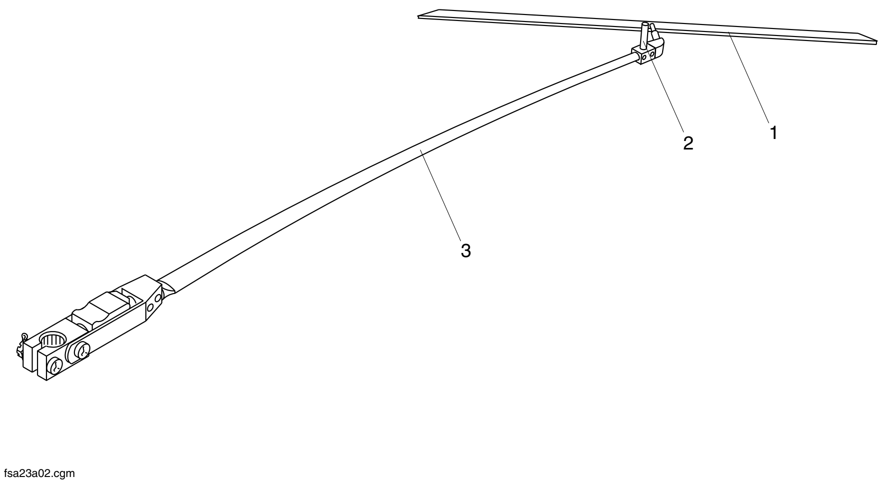
NOTE

Left component shown.
Right component similar.

WINDSHIELD WIPER LOCATOR
Figure 12

LEGEND

1. Wiper Blade.
2. Ice Detector Spigot.
3. Wiper Arm.



WINDSHIELD WIPER DETAIL
Figure 13

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30–41–00–001

WINDSHIELD AND PILOT'S WINDOWS ANTI–ICING SYSTEM

Introduction

The Windshield Anti–Icing System prevents ice formation on the windshields and the pilot's side window.

General Description

The Windshield Anti–Icing System includes one windshield heater, two temperature sensors, seven relays and two Anti–Ice Controllers (AICs).

Both windshields and the pilot's side window have electronically controlled heater elements laminated into the panels to keep the windows at a predetermined temperature to prevent icing and misting.

The Windshield Anti–Icing System has the components that follow:

- Controllers, Anti–Icing (30–41–01)
- Selector, Windshield Heat (30–41–06)
- Switch, Pilot Side Window (30–41–11)
- Relays, Control (30–41–16).

Detailed Description

The windshield anti–icing system prevents ice formation on both windshields and the pilot's side window. The windows are electro–thermally anti–iced.

The windshield anti–icing system includes the components that follow:

- One (1) windshield heater
- Two (2) temperature sensors
- Seven (7) relays
- Two (2) Anti–Ice Controllers (AIC).

Refer to Figures 1 and 2.

The windshield anti–icing system is controlled by an overhead switch labelled HEAT located on the overhead WINDSHIELD panel. The pilot's side window anti–icing is controlled using a two–position toggle switch labelled PLT SIDE WDO/HT located on the overhead WINDSHIELD panel.

Refer to Figure 3.

The windshield and pilot's side window heaters are controlled by the Anti–Ice Controller (AIC). If either AIC fails, the WSHLD CTRL caution light will come on. If the HEAT selector is in the OFF position the WSHLD CTRL caution light is prevented from coming on. Failure messages are recorded in the Timer and Monitor Unit (TMU) for maintenance purposes. Two maintenance messages related to the failures are RIGHT WSHLD CTRL FAIL and LEFT WSHLD CTRL FAIL.

The AIC sends signals to operate the related windshield heater relay. The 115 Vac C phase left bus supplies power for the pilot's windshield in the NORM mode. It also supplies power to both windshields in the WARM UP mode. The 115 Vac C phase right bus supplies power for the copilot's windshield in the NORM mode. The 115 Vac A phase right bus supplies power for the pilot's side window.

The pilot's windshield, copilot's windshield, and pilot's side window are electrically powered by 28 Vdc from the Left and Right Secondary Buses. The pilot's windshield is protected by a 1 Ampere circuit breaker labelled PLT WS/HT CONT. The copilot's windshield and pilot's side window are protected by a 1 Ampere circuit breaker labelled COPLT WS PLT WDO HT CONT.

Controllers, Anti–icing

Refer to Figure 4.

Two Anti–Ice Controllers (AICs) control heater operation to prevent ice accumulating on the windshields and the pilot's side window. The AICs activate the heaters using relays. The relays are used to isolate the AICs from the high current flow required for heating. When the windshield control is in the OFF position, the deactivation relay is controlled using the Overheat Temperature Sensor. The activation relay stays open regardless of the Normal Temperature Sensor information. In the WARM–UP or NORM modes, the Anti–Ice Controller (AIC) uses the Normal Temperature Sensor information to control the activation relay and the Overheat Temperature Sensor to control the deactivation relay. The left AIC is powered by the 28 Vdc left secondary bus. The right AIC is powered by the 28 Vdc right secondary bus.

The Anti–Ice Controllers (AICs) are installed in the mid–section of the wardrobe on the Electrical Equipment Panel (zone 225).

Selector Windshield Heat

Refer to Figure 2.

The Windshield Mode Selector labelled WINDSHIELD HEAT OFF/WARM UP/NORM on the WINDSHIELD panel operates the pilot and copilot windshield heaters.

The WARM UP mode prevents thermal shocks to the windshield. To avoid this damage, the warm up relay decreases the electrical power supply to the windshield heaters by 50%. This is achieved when the WARM UP mode activates the warm–up relay which places both windshields in a serial connection. When the WARM UP mode is selected, each Anti–Ice Controller (AIC) uses the normal temperature sensor information to activate its related windshield heater. Power for the serial connection is taken from the pilot windshield power supply. In the OFF and NORM modes, the windshields are connected in parallel.

When the NORM mode is selected, both windshields are heated with full electrical power. When the NORM mode is selected, the WARM UP relay is deactivated and switches from a serial connection to an independent connection on the related bus.

Refer to Figure 3.

An overheat condition of the pilot's or copilot's windshield is shown by the WSHLD HOT caution light coming on.

Switch, Pilot Side Window

Refer to Figure 2.

The side window toggle switch labelled PLT SIDE on the WINDSHIELD panel operates the pilot's side window heater.

When ON is selected, the right Anti–Ice Controller (AIC) energizes the side window relay, which supplies the pilot's side window heater with 115 Vac phase A power.

Refer to Figure 3.

An overheat condition for the pilot side window is shown by the SIDE WDO HOT caution light coming on.

Relays, Control

Control of the heaters is done by temperature sensors installed in the windshields and the pilot's side window.

Refer to Figure 5.

When the pilot's or copilot's windshield temperature is less than 93 ±6 °F (34 ±2 °C) or the pilot's side window temperature is less than 86 ±11 °F (30 ±2 °C), the related Anti–Ice Controller (AIC) activates the related activation relay that supplies 115 Vac to the heater.

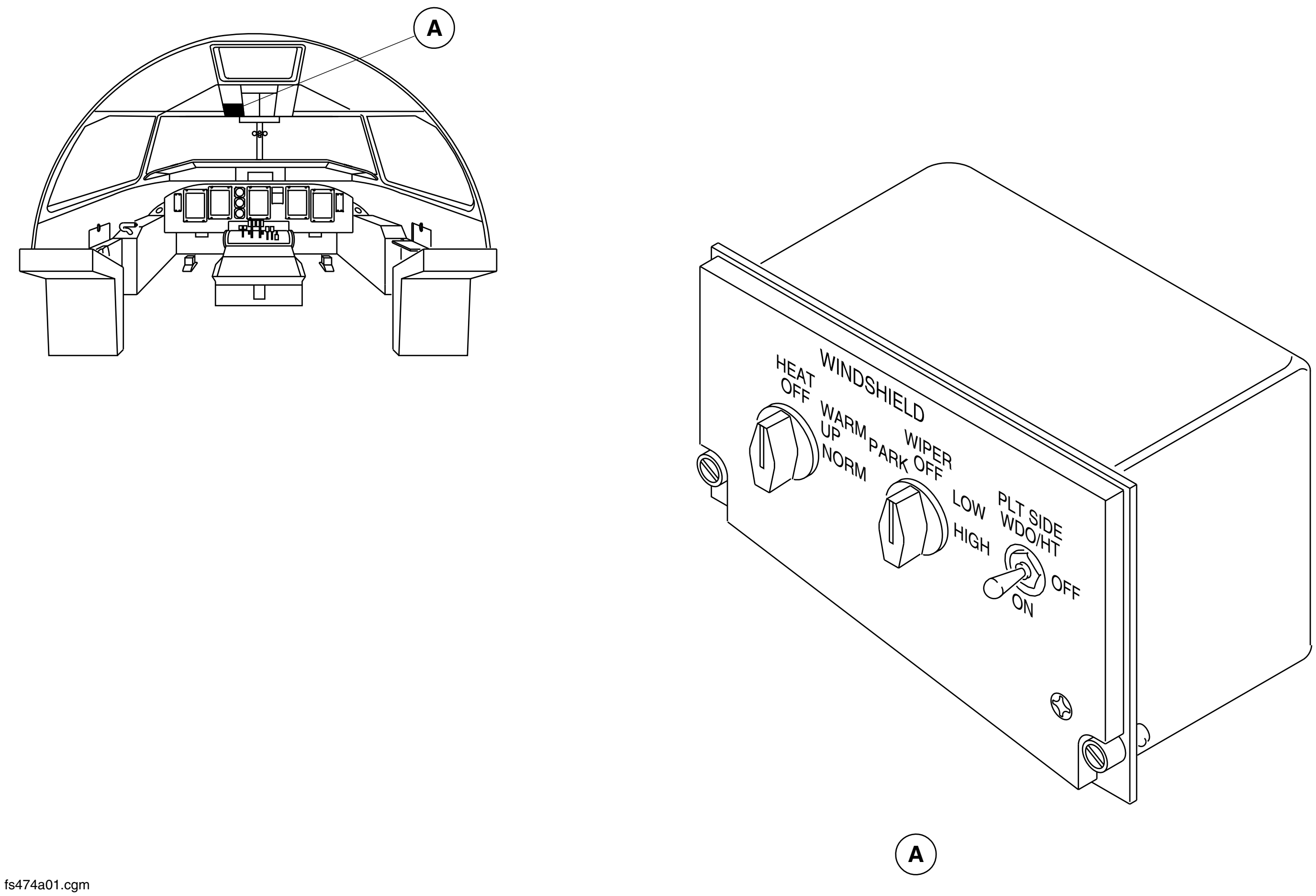
When the windshield temperature is above 108 ±6 °F (42 ±3 °C) or the pilot side window temperature is above 101 ±7 °F (38 ±4 °C), the AIC deactivates the deactivation relay which opens the circuit and shuts off the power to the heater. The overheat relays fail (unpowered) in the open position to prevent overheat.

In the event the normal heating control fails, the AIC uses the overheat temperature sensor to control the heater. In an overheat (temperature above 122 ±6 °F (50 ±3 °C) for windshield or above 126 ±6 °F (52 ±3 °C) for the pilot's side window), the AIC deactivates both relays and shuts off the heating.

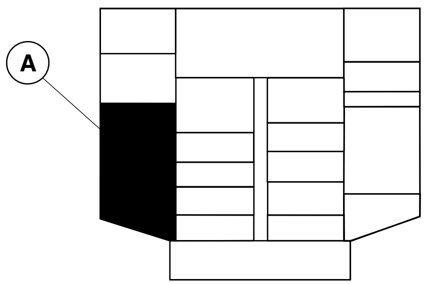
Training Information Points

Use caution when doing window heater and control tests, as the windshield and side windows become hot very quickly when they are heated.

Prior to the removal of a faulty Anti–Ice Controller (AIC), the appropriate circuit breaker (CB) must be pulled. Care must be taken not to remove the working Anti–Ice Controller (AIC), as they are identical and located in close proximity to one another.



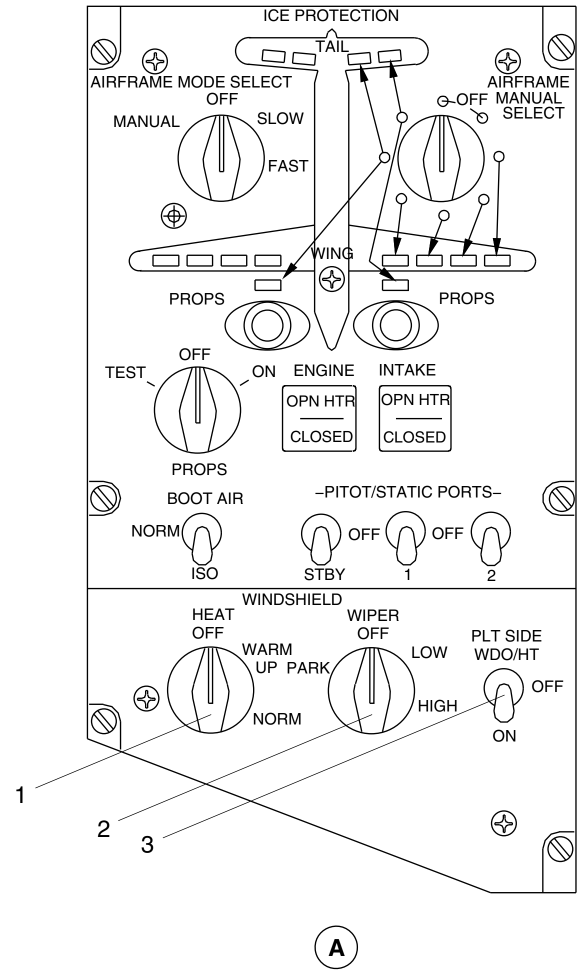
WINDSHIELD CONTROL PANEL LOCATION
Figure 1



OVERHEAD CONSOLE

LEGEND

1. Windshield Heat Switch.
2. Windshield Wiper Switch.
3. Pilot Side Window Heat Switch.



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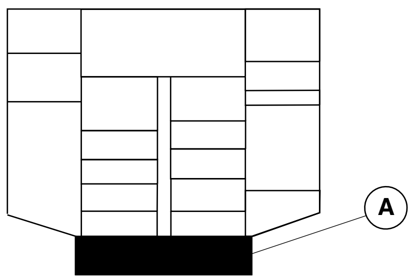
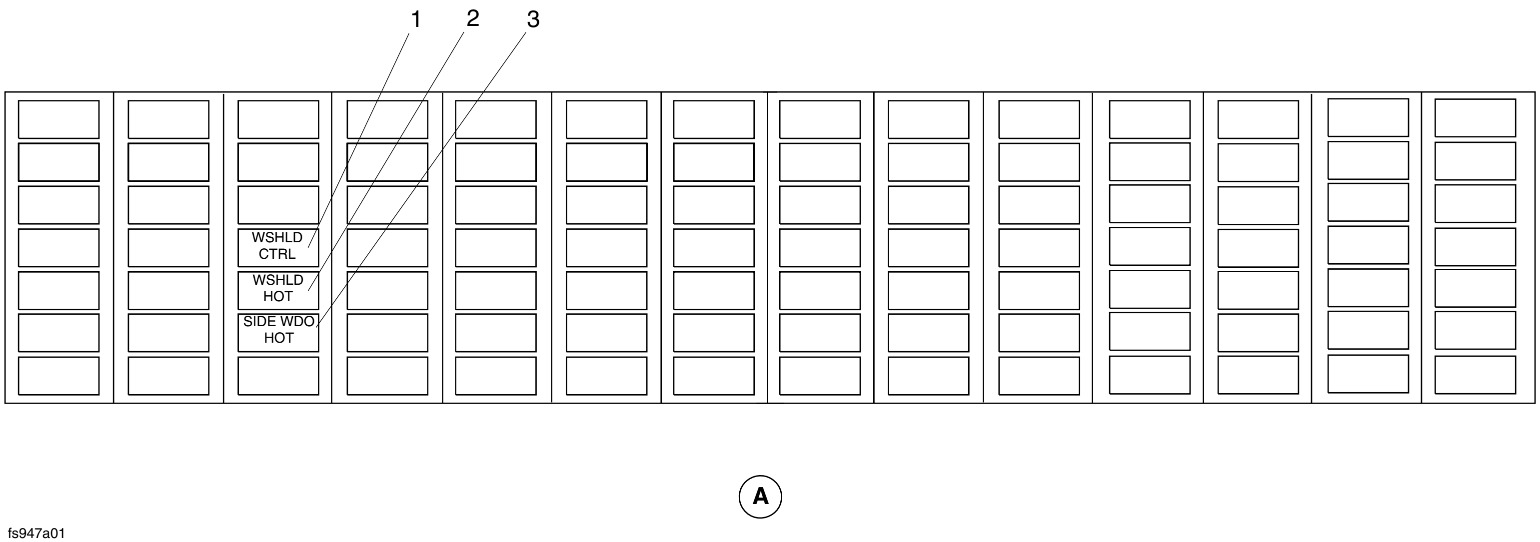
WINDSHIELD CONTROL PANEL
Figure 2



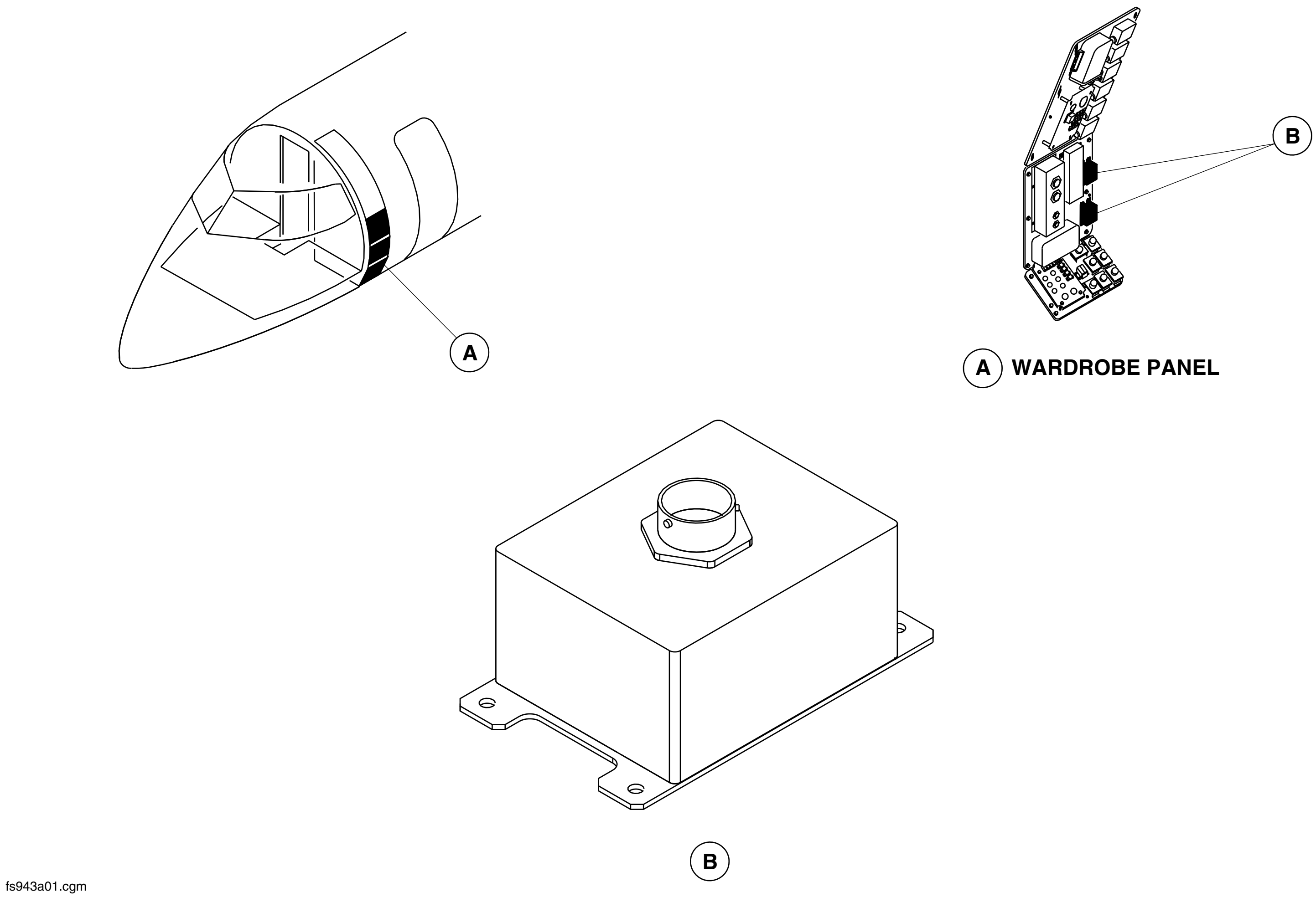
OVERHEAD CONSOLE

LEGEND

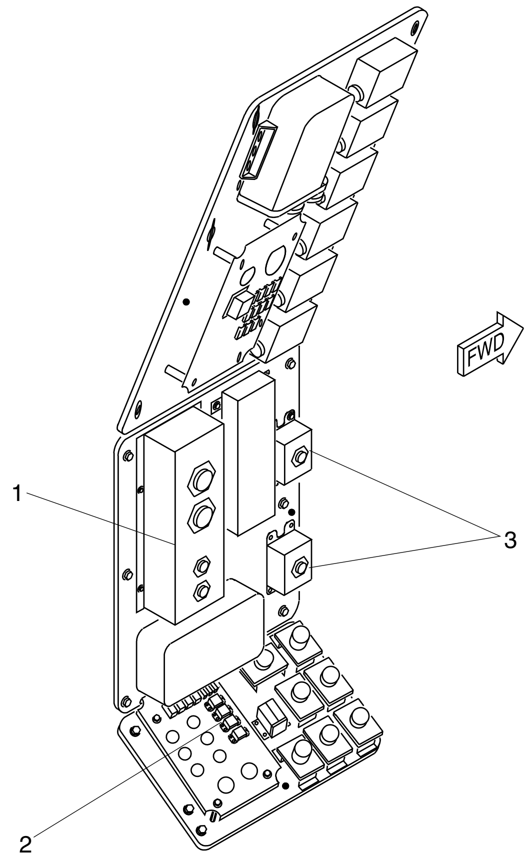
1. Windshield Control (Amber).
2. Windshield Hot (Amber)
3. Side Window Hot (Amber).



WINDSHIELD CONTROL AND OVERHEAT CAUTION LIGHTS
Figure 3



ANTI–ICE CONTROLLER LOCATION
Figure 4



LEGEND

1. TMU.
2. Relay Panel.
3. AIC.

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RELAY PANEL LOCATION
Figure 5

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WINDSHIELD WIPER SYSTEM

Introduction

The windshield wiper system removes rain water to obtain an adequate zone of vision through the pilot's and copilot's windshields. The wipers are able to remove any amount of rain which may fall on the windshields during taxiing, taking off, landing and at airspeeds up to 200 kt (370.6 km/h).

General Description

The pilot's and copilot's windshield wiper systems are symmetrical but completely independent from each other. Each system has a two speed, DC motor fitted to a mechanical converter which drives a wiper arm and blade. A single rotary switch, located on the WINDSHIELD wiper control panel in the overhead console, operates both motor/converters.

The windshield wiper system has the components that follow:

- Assembly, Motor (30–42–01)
- Arm, Wiper (30–42–06)
- Blade, Wiper (30–42–11)
- Selector, Control–Wiper (30–42–16).

Detailed Description

The two motor/converter units are installed in front of the forward pressure bulkhead. The motor/converters are independent from each other and operate the wiper arms for the pilot's and copilot's windshields. They are supplied with electrical power from the L and R SECONDARY buses. This configuration ensures that in the event of failure of either unit, the remaining unit will supply an unobstructed forward view for one pilot.

Refer to Figures 1 and 2.

The rotary WIPER switch on the WINDSHIELD wiper control panel operates the motor/converter units. The switch has the positions that follow:

- PARK
- OFF
- LOW
- HIGH.

With the WIPER switch set to LOW, the two field windings in each motor are connected in series by the related switch section contacts and the motors rotate at a low speed. With the WIPER switch set to HIGH, the two field winding in each motor are connected in parallel by the associated switch section contacts and the motors rotate at a high speed. With the WIPER switch set to OFF from the HIGH or LOW position, electrical power is removed from the motor field windings and the wiper blades stop anywhere in their cycle.

The wiper blades are placed into a parked position when the WIPER switch is set to the momentary PARK position. When the WIPER switch is held in the PARK position, the motor field windings are connected in series and the motors rotate at a slow speed. When the wiper arm reaches the parked position, the park switches are mechanically closed, shorting out the armatures and stopping the motors in the parked position. The WIPER switch is then released and returns to the OFF position, removing power to the motor circuits.

Refer to Figure 3.

The ALTERNATE PILOT WIPER switch on the pilot's side console, operates the pilot's motor convertor unit through the K1 relay.

When the ALTERNATE PILOT WIPER switch is pushed ON, the K1 relay is energized. The energized contacts of K1 relay supply 28 V dc electrical power to the pilot's windshield wiper motor convertor. The energized contacts of the K1 relay also connect the two field windings of the pilot's windshield wiper motor in the parallel. This causes the motor to turn with the high–speed which operates the pilot's wiper at the high–speed mode. When you push the ALTERNATE PILOT WIPER switch to OFF (usual position), the electrical power is removed from the motor and the wiper blades stop immediately in their position.

The ALTERNATE PILOT WIPER switch has priority over the WIPER switch. When you set the WIPER switch to LOW and push the ALTERNATE PILOT WIPER switch to the ON position:

– The pilot's wiper will operate at a high speed
– The copilot's wiper will operate at a low speed.

Refer to Figures 4 and 5.

Ice detectors, illuminated by lights in the flight compartment, give a visual indication of the formation of ice on the windshield wipers. The W/S WIPER ICE DETECT LIGHT switches, located on the pilot's and copilot's side consoles, operate the ice detector lights in the flight compartment.

The wiper arm, with the wiper blade, is installed on the converter output shaft adjusting sleeve with a washer, nut and cotter pin. The wipers are designed to park off the windshield when not in use.

Assembly, Motor (30–42–01)

Refer to Figures 6 and 7.

Two motor/converter assemblies are located forward of the front pressure bulkhead, one on each side of the aircraft centreline.

Each motor/converter assembly includes the components that follow:

– DC motor with two field windings
– Park switch
– Converter gearbox.

The converter gearbox changes the rotary motion of the motor to an oscillating motion at the wiper blade arm.

The left windshield wiper system is powered from the L SECONDARY bus through a 10 A circuit breaker (S7) labeled PLT W/S WIPER. The right windshield wiper system is powered from the R SECONDARY bus through a 10 A circuit breaker (A6) labeled COPLT W/S WIPER. The motors are also protected by a permanent grounding contact to the aircraft structure. The assembly has radio noise filters to suppress interference.

Arm, Wiper (30–42–06)

Refer to Figures 8 and 9.

The wiper arm (and wiper blade) is installed on the converter output shaft adjusting sleeve with a washer, nut and cotter pin. A bolt, washer, nut and cotter pin secure the adjusting sleeve in the hub arm.

The wiper arm is attached to the hub and includes a tension spring. A trigger and detent within the arm facilitates removal and installation of the arm and blade assembly by keeping the blade away from the windshield. An ice detector spigot is riveted to the wiper arm attachment and is illuminated by lights located in and controlled from the flight compartment.

Blade, Wiper (30–42–11)

Refer to Figure 9.

The wiper blade is attached to the arm with a nut, washers, and cotter pin.

Selector, Control–Wiper (30–42–16)

Refer to Figures 2 and 3.

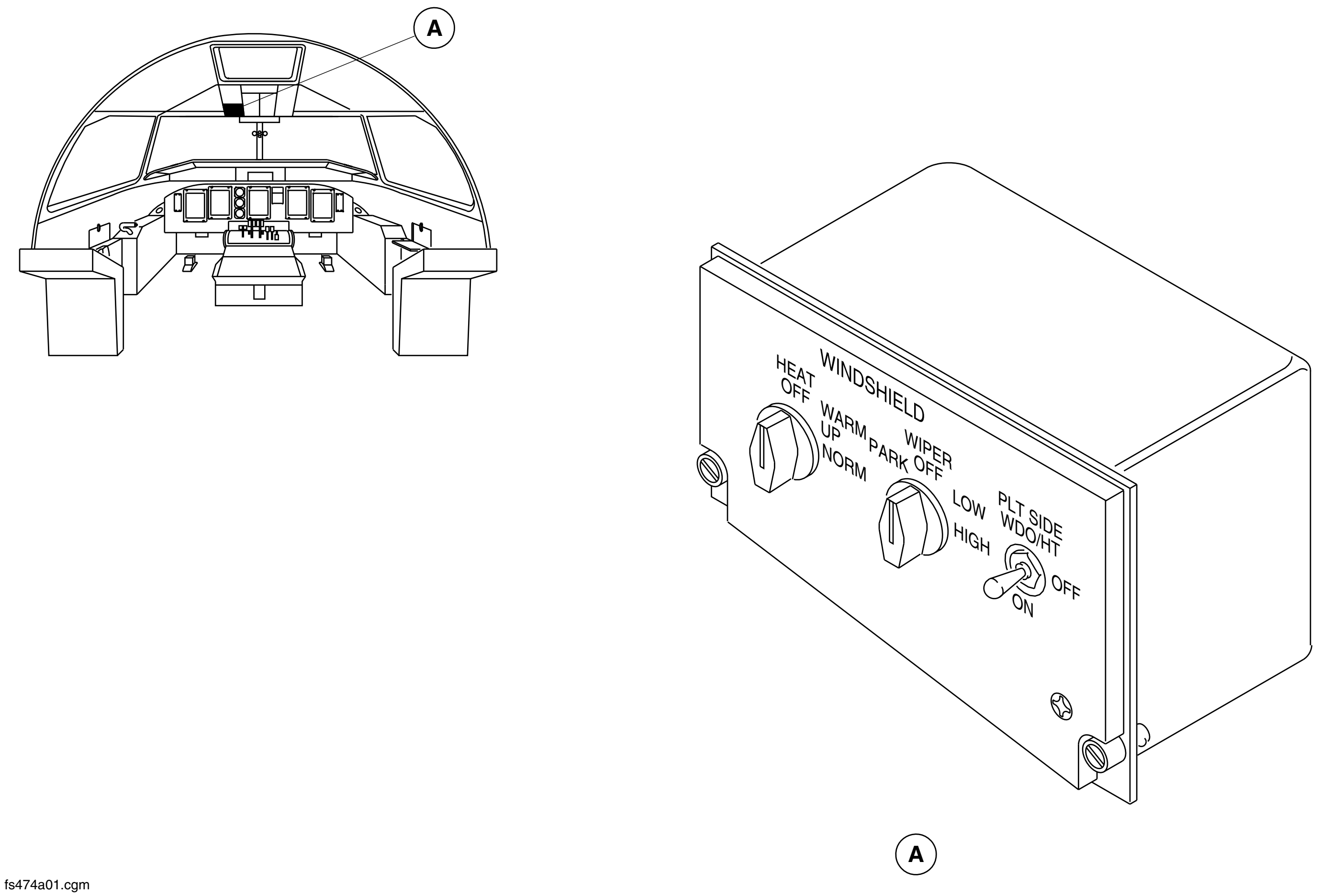
Both the pilot's and copilot's wipers are controlled by a single rotary switch labeled WIPER, located on the WINDSHIELD wiper control panel of the overhead console with positions labeled PARK, OFF, LOW, HIGH. The PARK position is momentarily spring–loaded to OFF.

The pilot's wiper can also be controlled by a single push–button switch labelled ALTERNATE PILOT WIPER located on the pilot side panel. It will activate the pilot's side windshield wiper in case of failure of normal wiper control.

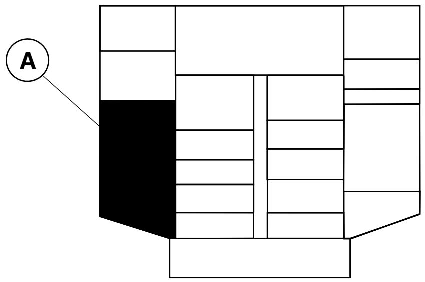
Selection of LOW or HIGH activates both wipers at the appropriate speed. Selection for LOW or HIGH to OFF stops the blades at their existing position. When the switch is held at the spring–loaded PARK position, the blades start to operate at low speed until they reach the bottom of their travel, where they will automatically stop at the park position.

The WIPER control selector is electrically powered from the L SECONDARY bus through a 1 A circuit breaker (R7) labeled PLT WS/HT CONT. The selector is also powered from the R SECONDARY bus through a 1A circuit breaker (B6) labeled COPLT WS PLT WDO HT.

The ALTERNATE PILOT WIPER switch is electrically powered from the L SECONDARY bus through a 10 A circuit breaker (S7) labelled PLT WS WIPER.



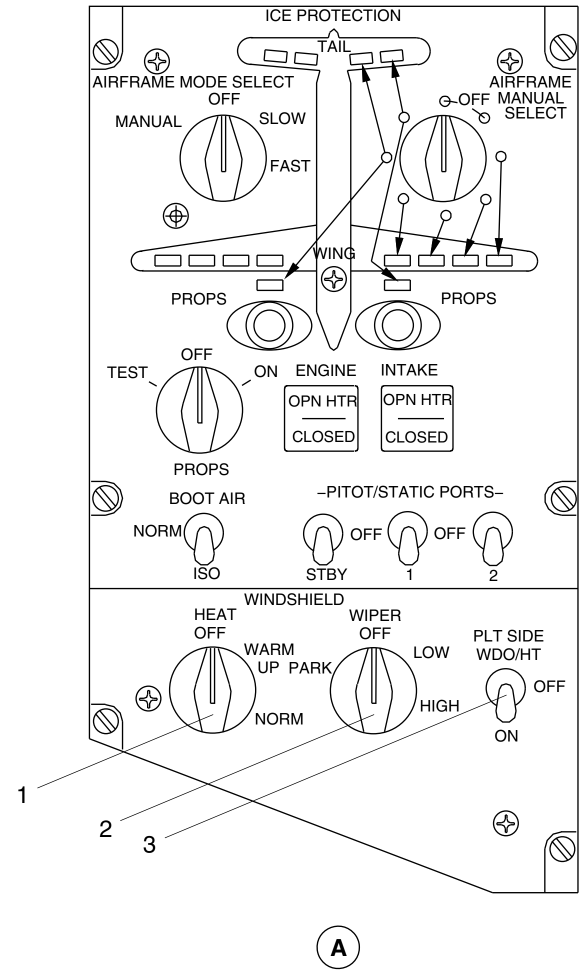
WINDSHIELD WIPER CONTROL PANEL LOCATOR
Figure 1



OVERHEAD CONSOLE

LEGEND

1. Windshield Heat Switch.
2. Windshield Wiper Switch.
3. Pilot Side Window Heat Switch.



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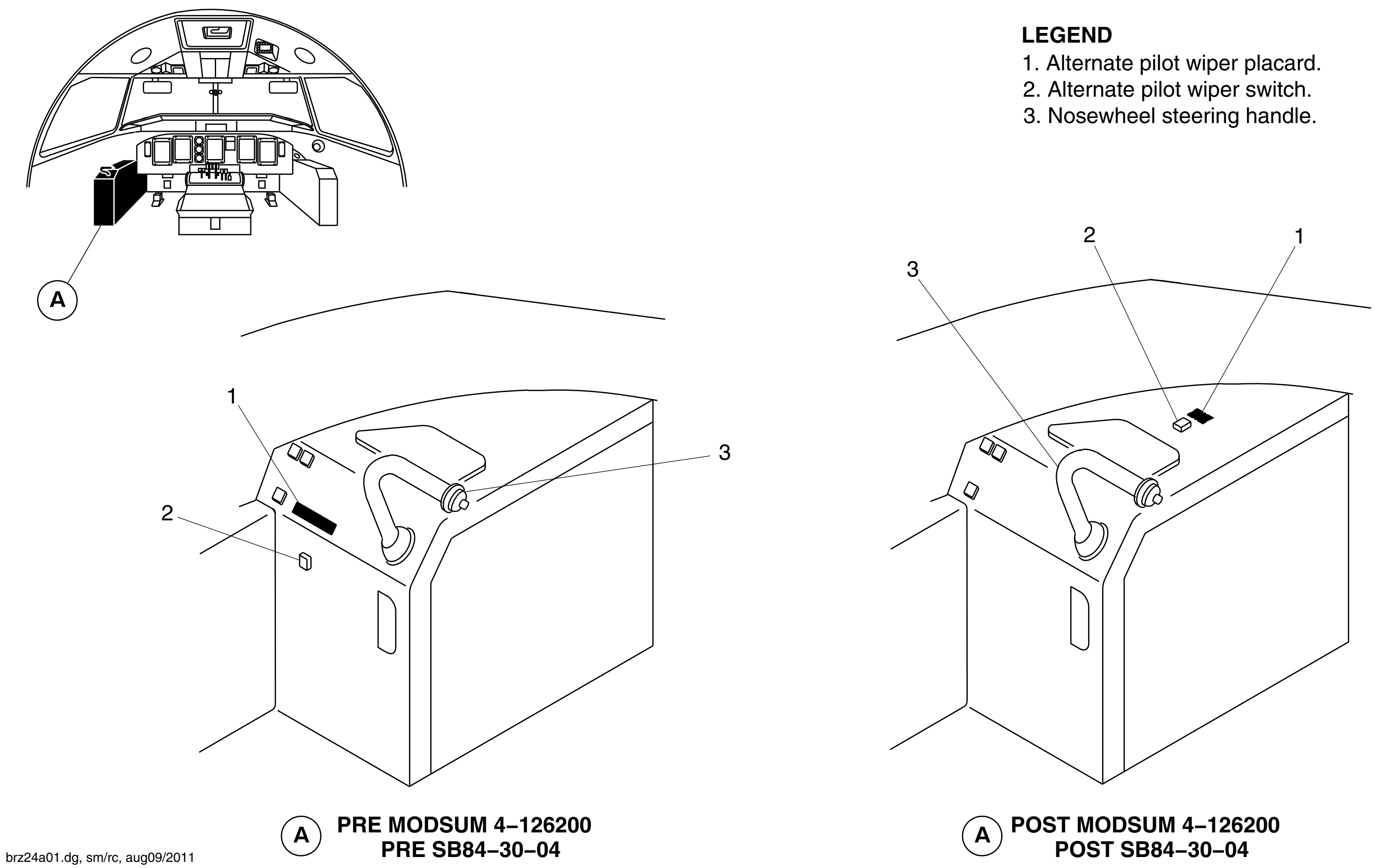
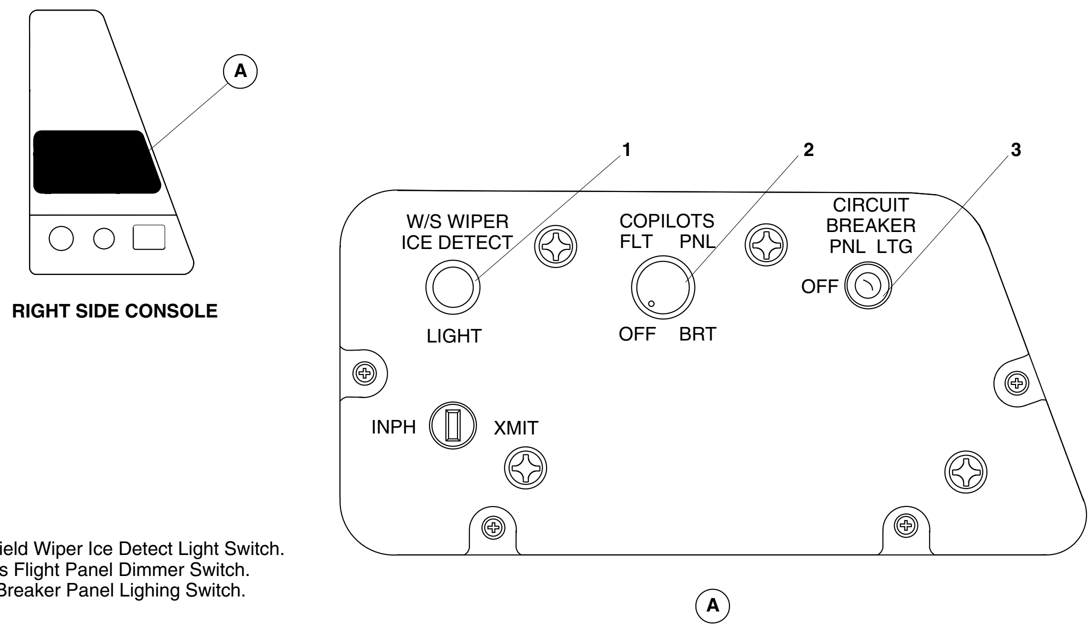
WINDSHIELD WIPERS AND HEATER SWITCHES DETAIL
Figure 2

LEGEND
1. Alternate pilot wiper placard.
2. Alternate pilot wiper switch.
3. Nosewheel steering handle.



Alternate Pilot Wiper Switch Detail
Figure 3



LEGEND

1. Windshield Wiper Ice Detect Light Switch.
2. Copilot's Flight Panel Dimmer Switch.
3. Circuit Breaker Panel Lighing Switch.

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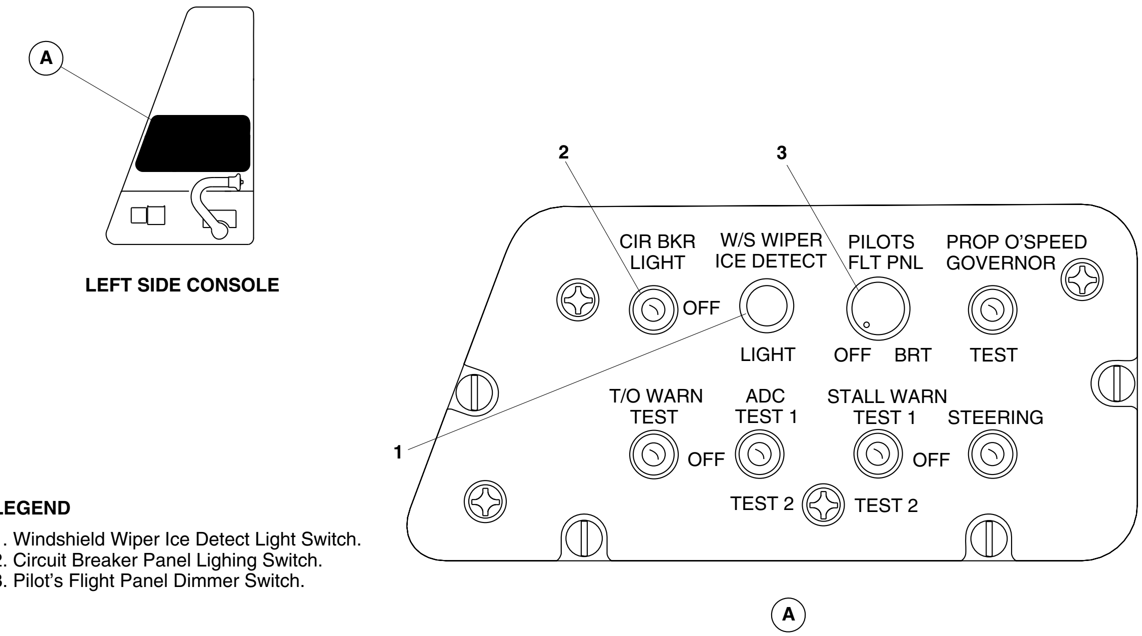
COPILOT SIDE CONSOLE PANEL DETAIL
Figure 4



LEGEND

1. Windshield Wiper Ice Detect Light Switch.
2. Circuit Breaker Panel Lighing Switch.
3. Pilot's Flight Panel Dimmer Switch.

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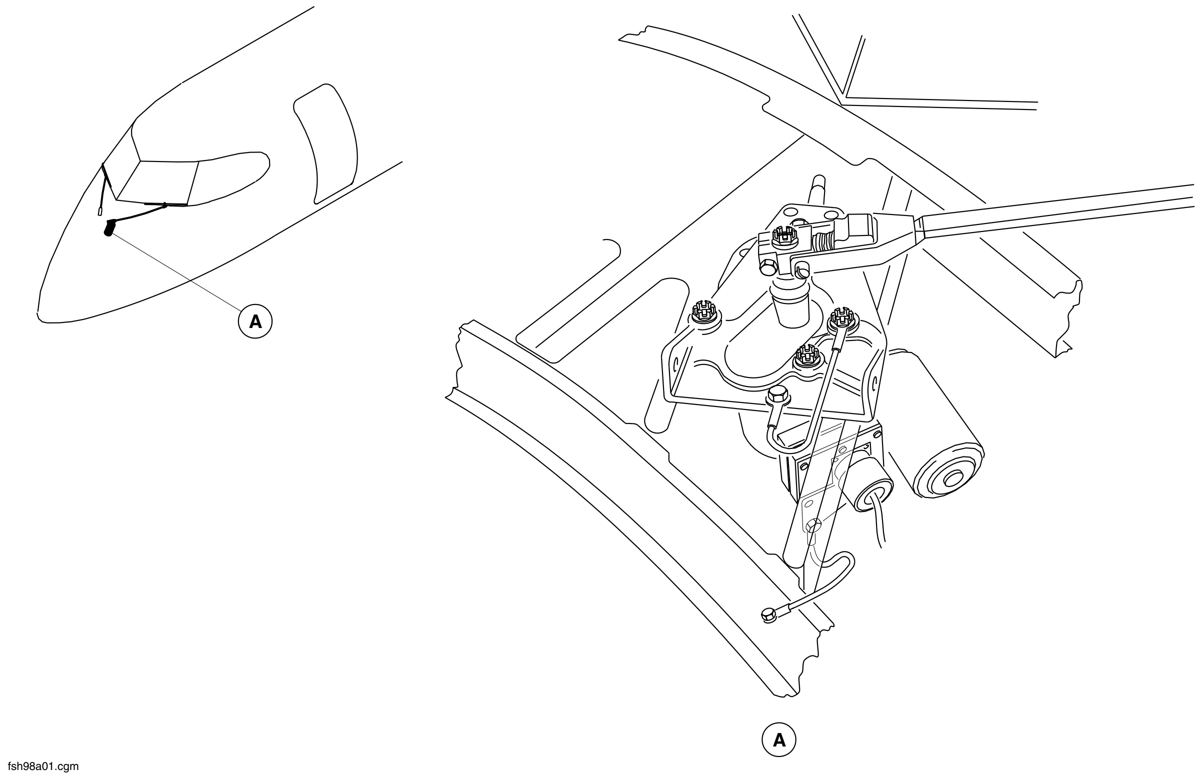
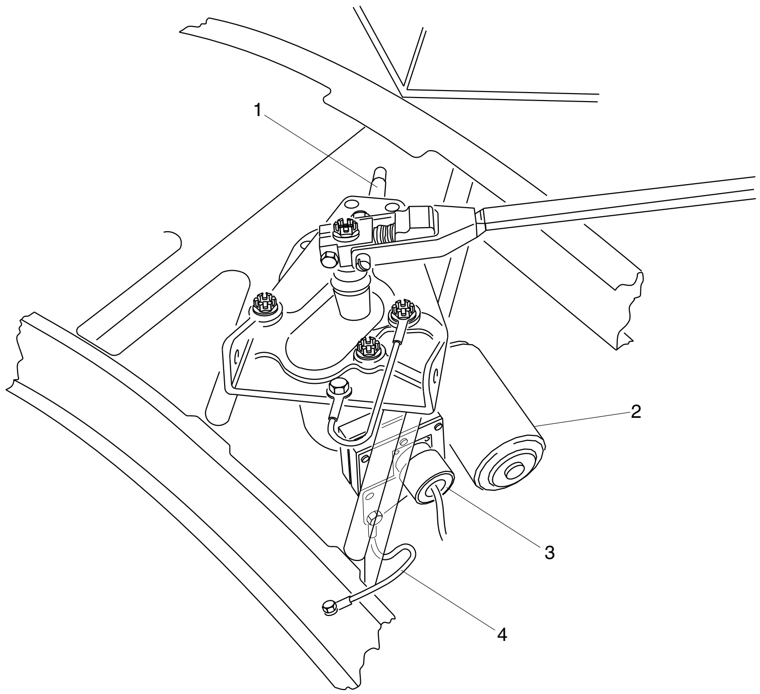
PILOT SIDE CONSOLE PANEL DETAIL
Figure 5



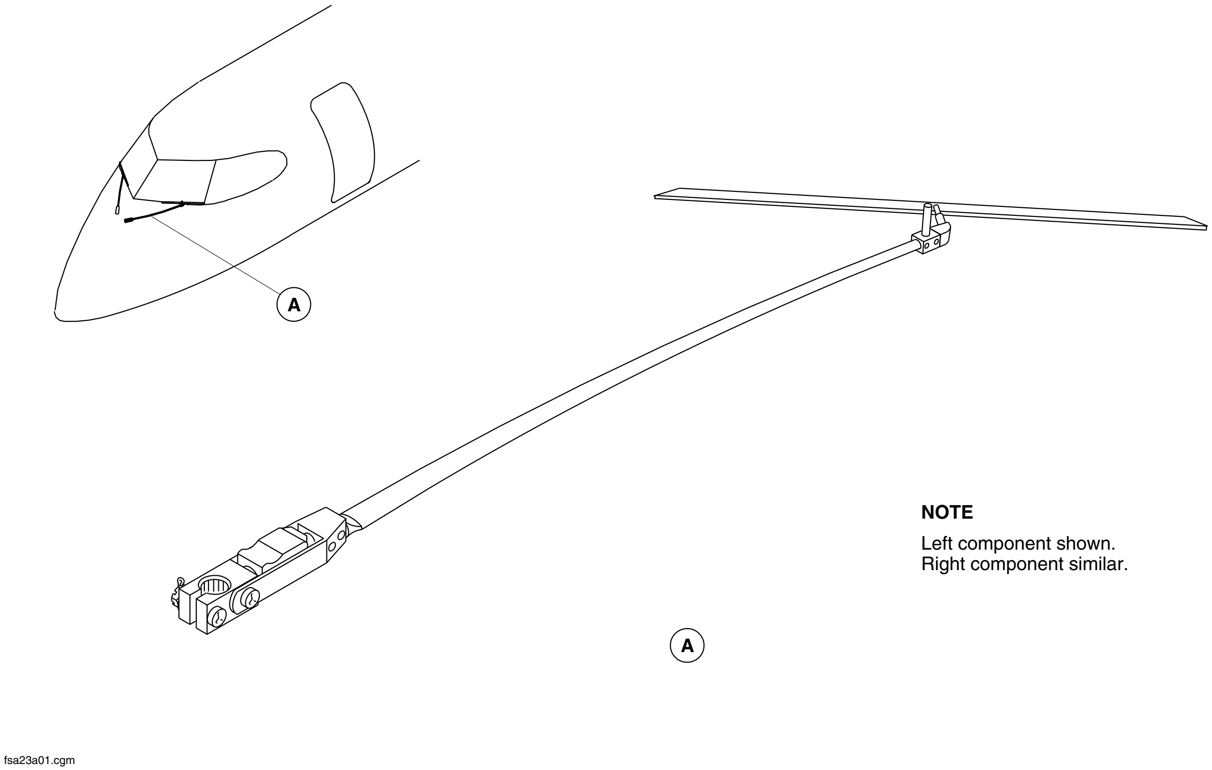
WINDSHIELD WIPER MOTOR ASSEMBLY LOCATOR
Figure 6



LEGEND

1. Spigot.
2. Motor Assembly.
3. Electrical Connector.
4. Ground Wire.

WINDSHIELD WIPER MOTOR ASSEMBLY DETAIL
Figure 7



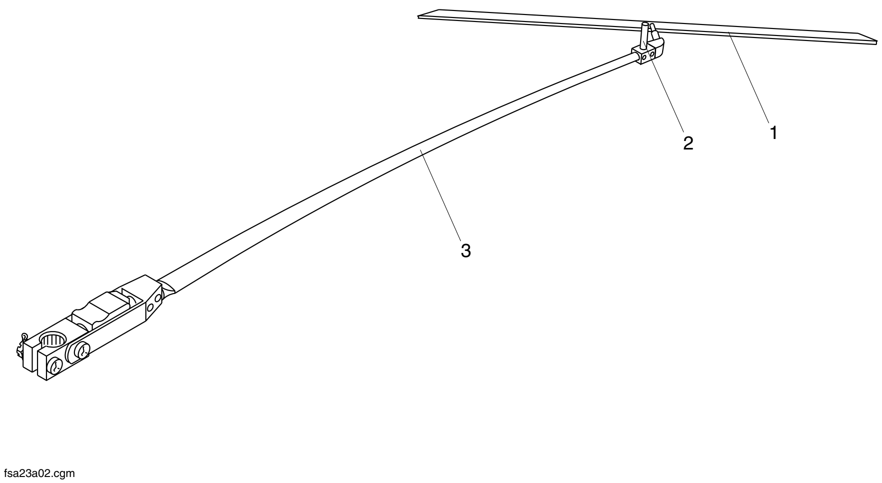
NOTE

Left component shown.
Right component similar.

WINDSHIELD WIPER LOCATOR
Figure 8

LEGEND

1. Wiper Blade.
2. Ice Detector Spigot.
3. Wiper Arm.



WINDSHIELD WIPER DETAIL
Figure 9

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30–61–00–001

PROPELLER DE–ICING

Introduction

The Propeller is built with an integral electro–thermal de–icing system embodied in the leading of each propeller blade. The heating cycle alternates between the propellers to shed ice build up during each cycle.

General Description

Ice detection is not available for the propeller de–icing system, therefore to avoid excessive build–up of ice, the pilot must select propeller heat ON when flying through known icing conditions. When heat is selected ON, all six blades on one propeller are heated at one time, then the propeller on the other side is heated.

The propeller de–icing system has the components that follow:

- Assembly, Bracket – De–icing Brush Block (30–61–01)
- Control, De–icing Timer Monitor (30–61–06)
- Switch, Control–Propeller Heater (30–61–11).

Detailed Description

The propeller de–icing system monitors the propeller speed (Np) and Total Air Temperature (TAT).

Sliprings transfer the blade heater power across the rotating/static interface using the brushes of the brush block. Three slip rings are installed into an insulating ring contained within an aluminum housing. The housing is attached to the spinner back plate by a series of bolts on the outer diameter. The rings have a cross–section of 10 mm wide by 5 mm thick, with 3 mm of the thickness allowed for wear and refacing. Also attached to the outer diameter of the housing are seven steel targets used to generate the electrical pulses for the control system pulse probe.

The propeller de–icing is powered through the circuit breaker labeled PROP DEICE on the 115 VAC variable frequency bus. The dc control power is applied to the left and right Timer Monitor Control Units (TMCUs) through the two 3 A circuit breakers labeled PROP DEICE CONT and PROP DEICE CONT 2 from the left and right 28 VDC secondary buses respectively.

On the aircraft with SB84–30–07 OR ModSum 4–126268 incorporated, the circuit breakers PROP DEICE CONT and PROP DEICE CONT 2 are connected to the left and right 28 VDC essential buses respectively.

Assembly, Bracket–De–icing Brush Block

Refer to Figures 1 and 2.

The brush block contains the spring loaded brushes that transfers de–icing power from the airframe to the rotating propeller using slip rings.

The block is a molded composite material with external and internal covers and contains the parts that follow:

- Receptacle for the connection of the airframe harness.

- Six brushes arranged with two brushes per slip ring position, brush size 8 mm wide by 18 mm long with a length of 20 mm, and a maximum allowable length for wear of 11 mm.
- Three terminal studs for connection of the incoming three phase power wiring from the receptacle, and also the connection for the two brush leads per slip ring position.
- Six brush/spring cavities.
- Two brush/spring retaining covers.
- A terminal housing cover.

The de–icing power brush block and the pulse probe that is used in the control system are attached to a bracket. The brush block is attached to the bracket at three positions.

Control, De–icing Timer Monitor

Refer to Figure 3.

The TMCU distributes electrical heating power to the propellers to give a correct of five ice shedding timer cycles under different TAT conditions. It also monitors the propeller heaters for open or short circuits.

There are two identical TMCUs, one for each propeller.

Power is supplied to the heater in a cyclic sequence by the TMCU with the 'on' time set, which weakens the ice bond and allows the lower centrifugal forces to displace the ice. The 'off' period time allows a small layer of ice to build up and give a mass that can be shed during the on cycle.

There are cooling fins on two sides of the box to dissipate the heat generated within the unit on the inner surfaces. The TMCU is cooled by air convection, conduction and radiation. The location of the TMCU in the aircraft does not allow it to be cooled by forced air.

The TMCUs are connected to the aircraft systems and propeller by two connectors, installed on the top of the unit. The ac power connector has the connections that follow:

- To the aircraft ac bus through the isolator contactor
- To the propeller blade heaters using the brushes and slip rings

The other connector, connects all the system switches and indicators to the Integrated Flight Cabinet (IFC) through an ARINC 429 data bus, to receive and transmit data.

The TMCU contains discrete solid state power switches for cycling power from a three phase variable frequency 115 VAC supply to de–ice elements installed on the propeller blades. For safety reasons, an aircraft–mounted isolation contactor is placed between the three phase power supply from the TMCU and propeller when de–icing is not demanded or if there is a potentially damaging failure. The TMCU controls the operation of the contactor. The contactor coil is wired such that it can only be enabled when the propeller heater control switch is in the ON or TEST position.

The TMCU activates the propeller blade heaters when the conditions that follow are met:

- TAT must be at or below 41 °F (5 °C).
- Propeller is rotating (Np) greater than 400 rpm.
- Propeller Heater Control Switch must be ON.

The power switches are controlled by the TMCU in response to air temperature data received on an ARINC 429 DITS (Digital Information Travel System) bus. The TAT and propeller speed (Np) conditions are transmitted to the TMCU microprocessor by the ARINC 429 data bus from the Integrated Flight Cabinet (IFC). When the propeller heater control switch is selected ON a discrete Pilot De−ice Demand (PDD) signal passes into a buffer circuit for interfacing to the processor.

When all conditions are met for the activation of the de−icing system, the processor calculates the system ON and OFF timing cycles from a “lookup table”, which are dependant upon TAT data temperature bands. Default cycle timing will be provided in the event of an ARINC bus failure or data integrity error.

The processor then sends a signal to the isolator contactor coil through a contactor drive circuit to close the ac supply contactor and make ac power available to the TMCU. After approximately 30 msec the processor sends a signal to the solid state switches (Silicon Controlled Rectifiers−SCR) firing control circuit to turn the solid state switches (SCRs) ON and OFF and supply power to the blade heaters. This output signal will be used as an input to the other TMCU on the aircraft to give synchronization of the two TMCUs to prevent both heaters from cycling ON at the same time. During the on cycle, the left or right propeller indicator on the ICE PROTECTION control panel comes on for the duration of the ON cycle.

Circuit breakers are placed between the aircraft generator and the isolation contactor to isolate the aircraft electrical power supply if there is a severe short−circuit failure. These circuit breakers automatically open when their rated current is exceeded and must be manually reset.

A watchdog timer circuit makes sure that the microprocessor operates within designed specifications through all dc power conditions. If a refresh signal is not received in a pre−set timing window (i.e. 50 to 100 msec), the watchdog timer circuit resets the microprocessor. If the microprocessor does not start normal behaviour, it is switched off by the watchdog circuit.

The TMCU performs continuous passive fault monitoring of the propeller de−ice system. An active pilot−initiated test mode is available to support pre−flight functional test. Nominal blade heater resistance is measured during a manually initiated calibration sequence and recorded in Non−Volatile Memory (NVM). The calibration procedure is activated using a push−button switch located on the top face of the unit. A Light Emitting Diode (LED), also installed on the top face, comes on to indicate that the calibration has been completed successfully. These two functions are also provided by a remote switch and indicator installed on the aircraft maintenance panel. The calibration data will be used during the passive fault monitoring and pre−flight functional test to monitor the blade heater elements. A fault indicator output discrete signal indicates when a system fault is sensed by the TMCU. The isolation contactor drive signal is disabled by the TMCU when a fault which limits continued safe operation of the system is sensed. All detected faults will be recorded in NVM. Faults are indicated in the flight compartment with the illumination of the MASTER CAUTION indicator on the glareshield panel and the PROP DEICE caution light on the overhead Caution and Warning Panel (one indicator for both propellers).

English language fault messages are transmitted by the TMCU on an ARINC 429 DITS bus upon request from the Centralized Diagnostic System (CDS) as indicated by activation of a discrete input signal when the propeller is rotating below 400 rpm.

The heater mat is attached into a rebate along the leading edge of the blade on the inboard section below the radius, where centrifugal force at cruise Np is too low to shed ice at the critical thickness.

The heater mat is made of layers of Neoprene rubber enclosing a resistant wire element. The inner rubber layer is flame retardant to give protection to the heater and blade.

The TMCU is an anodized aluminum box measuring 7.25 x 5.75 x 5 in. (184 x 146 x 127 mm) maximum dimensions, and weighs 6.4 lb (2.9 kg).

It is installed onto the aircraft structure by 4 bolts through the base plate. These attachment points are also the unit bonding points to the airframe. One foot of the TMCU is Alocromed to achieve the electrical bonding requirements between the case and the aircraft frame.

The TMCUs are located adjacent to each under the aircraft cabin floor at station X375.

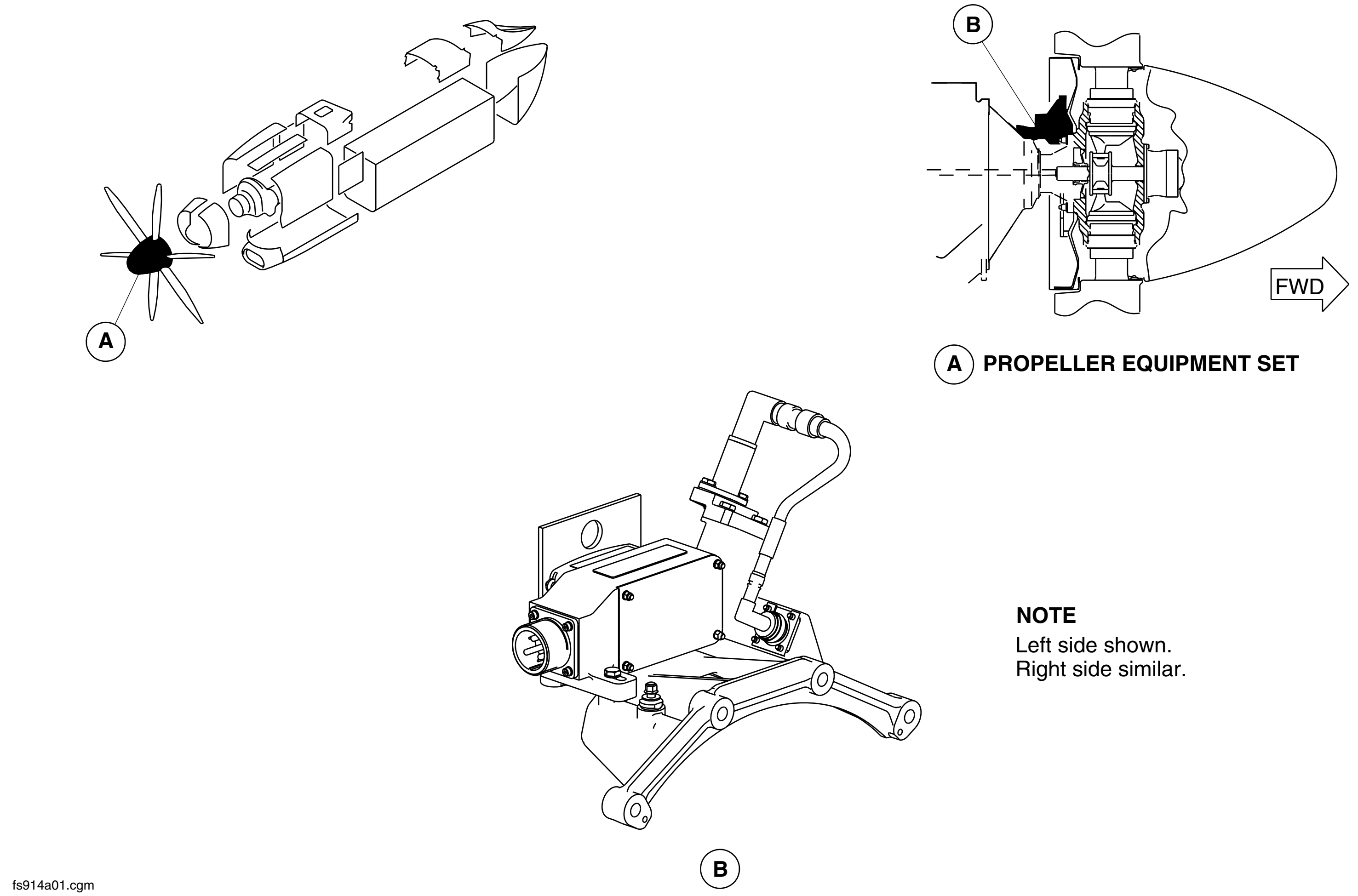
<u>Switch, Control–Propeller Heater</u>

Refer to Figures 4 and 5.

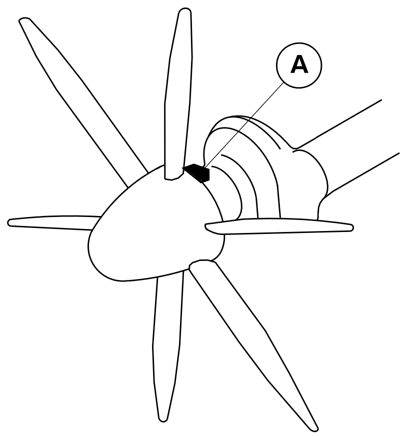
A rotary switch labeled PROP–TEST/OFF/ON, located in the flight compartment on the overhead panel, controls the power to the heater.

In the TEST position, the propellers are cycled through one time for a period of seven seconds each. The test cannot be initialized again for 30 seconds to complete the OFF cycle. The propeller speed (Np) must be greater than 400 rpm for the test function to operate.

Two advisory lights, one for each propeller, are located on the ICE PROTECTION control panel and indicate propeller heater function to the flight crew.

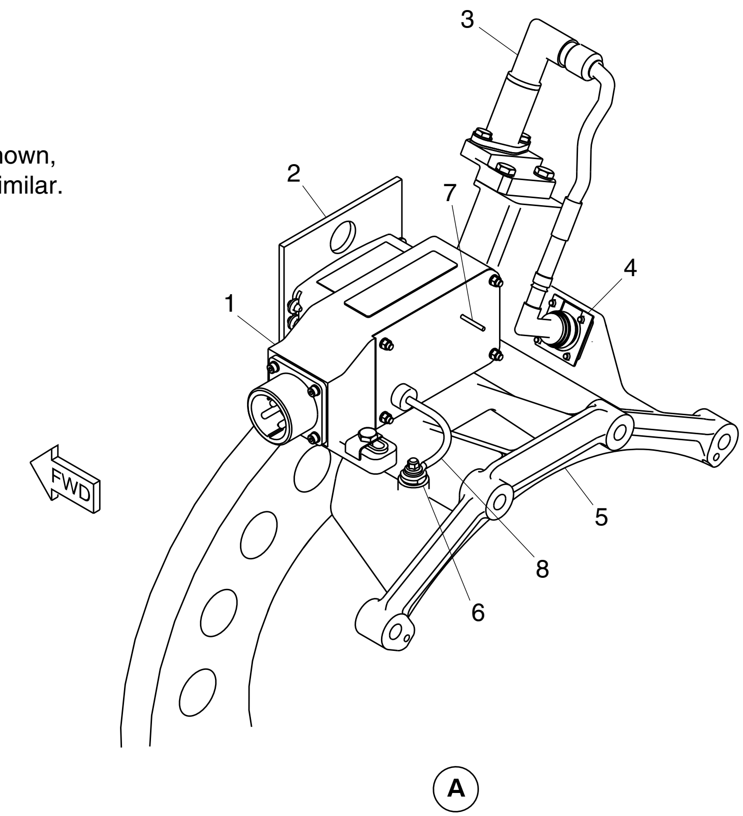


BRUSH BLOCK ASSEMBLY UNIT LOCATION
Figure 1



NOTE

Left side shown,
right side similar.



LEGEND

1. Brush block unit.
2. Brush retaining assembly.
3. Dual pulse probe assembly.
4. Dual pulse probe assembly receptacle (J22).
5. Brush block bracket sub–assembly.
6. Aircraft bonding point.
7. Brush wear indicator.
8. Bonding lead.

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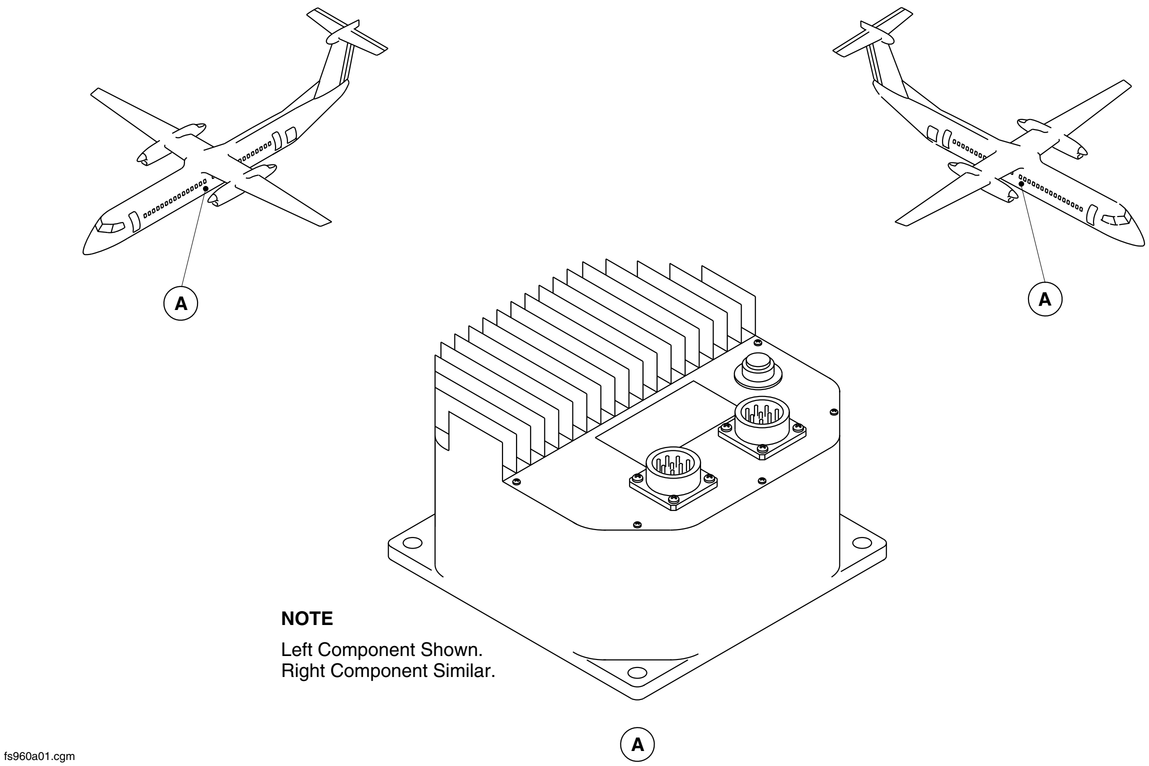
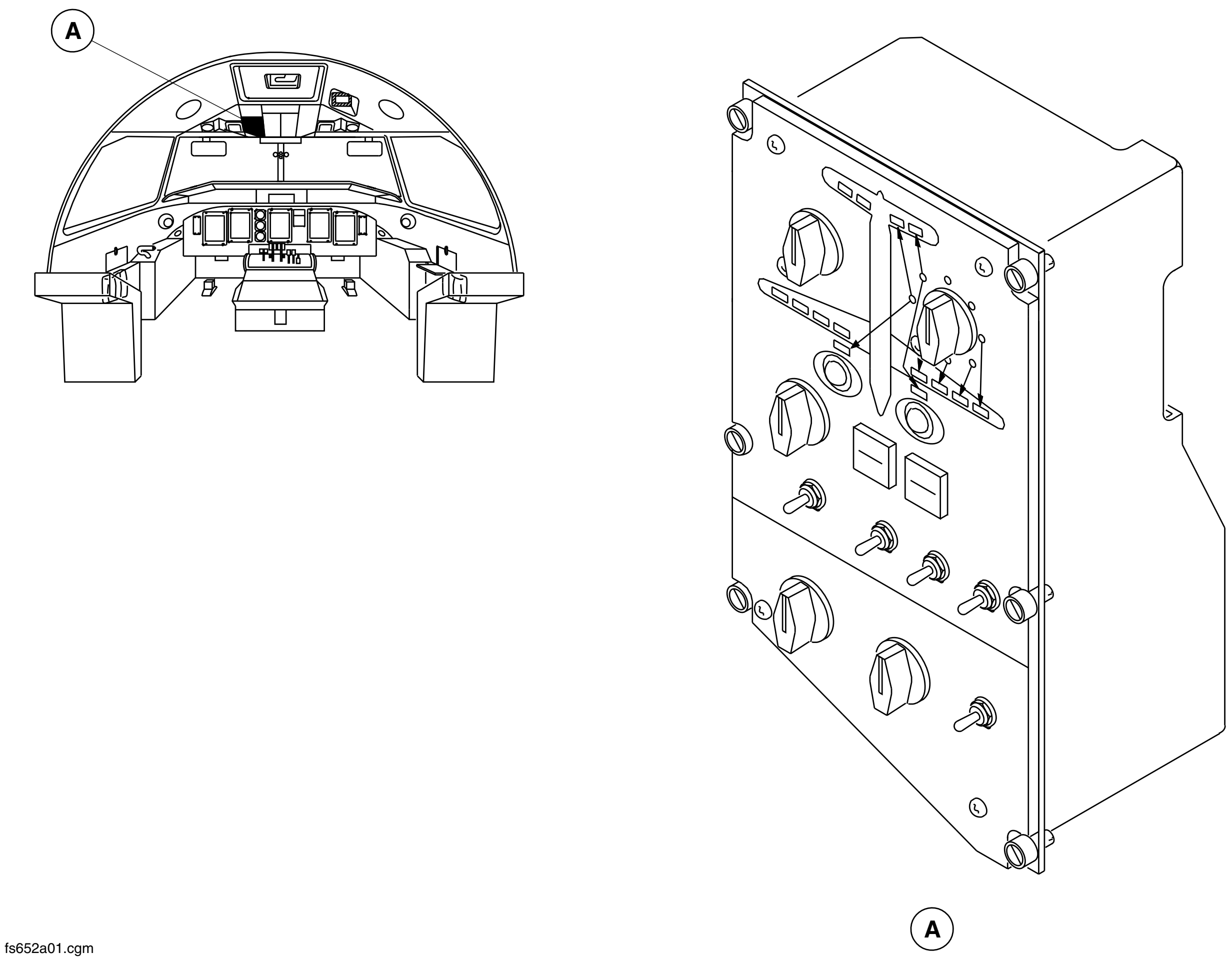
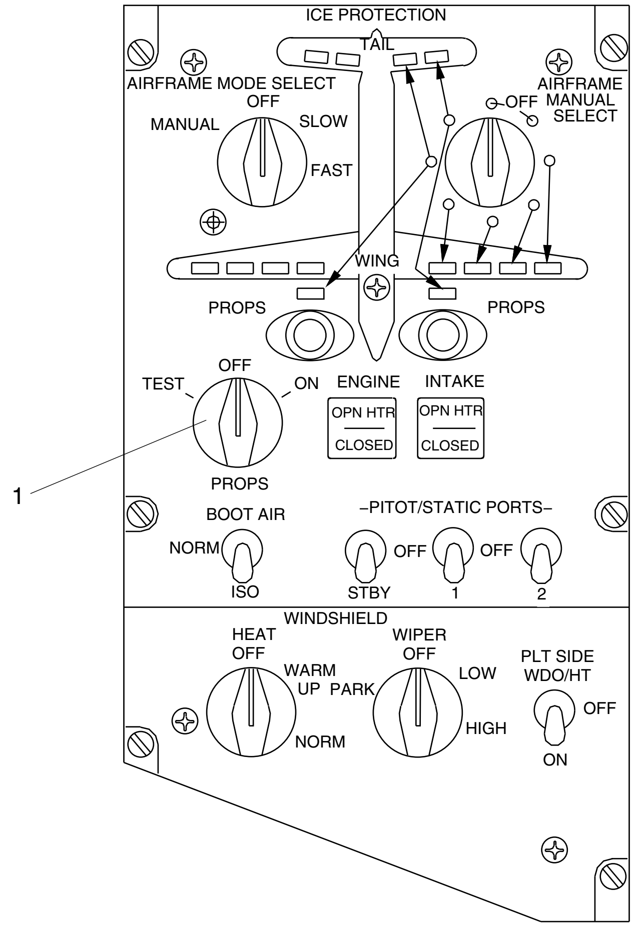
Brush Block Assembly Unit
Figure 2



TIMER MONITOR CONTROL UNIT LOCATION
Figure 3



IRPS CONTROL PANEL LOCATION
Figure 4



LEGEND

1. Prop Heater Switch.

PROPELLER HEATER SWITCH
Figure 5

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30–80–00–001

ICE DETECTION SYSTEM

Introduction

The Ice Detection System (IDS) provides early detection and indication of aircraft icing conditions.

General Description

The IDS has no flight compartment control. The system automatically operates when the 115 V ac power is available. When ice accumulation is sensed, the message ICE DETECTED comes into view on the Engine Display (ED).

The IDS uses two Ice Detector Probes (IDPs) that are installed on the left and right side of the front fuselage.

The Integrated Flight Cabinets (IFCs) interface with the Electronic Instrument System (EIS) to generate the ICE DETECTED advisory message.

The IDS has the component that follows:

- Probe, Ice Detector (30–80–01).

Detailed Description

IDPs indicate a signal condition that ice is accumulating on the aircraft. The signal condition provides an ICE DETECTED message on the ED.

The ice sensor operates on a piezoelectric principle within the IDP. It continuously vibrates at its natural resonant frequency and when ice accumulates on the ice sensor, the frequency of vibration increases due to an increase in rigidity. Water or liquid contaminants increase the diaphragm mass without increasing its stiffness, causing the natural frequency to drop. The frequency change is electronically converted to supply the electrical signal that causes the ice condition indication on the ED page of the Engine Systems Integrated Display (ESID).

Refer to Figure 1.

If the REF SPEEDS switch is selected to OFF and when one of the IDP detects ice, an ICE DETECTED message flashes in amber (yellow) in normal video on the ED just below the SAT indication.

If the REF SPEEDS switch is selected to INCR after one of the IDP initially detects ice, then the ICE DETECTED message will change to reverse white video for 5 s.

If the REF SPEEDS switch is selected to INCR and one of the IDP detects ice after 5 s, then the ICE DETECTED message will display steady white.

If the REF SPEEDS switch is selected to INCR, it will display an INCR REF SPEED message in white below the ICE DETECTED message. This confirms that the Stall Protection System (SPS) is modified for icing conditions.

If both IDP fails, then ICE DETECT FAIL caution light will come ON. Failure of only one probe will not cause the caution light to come ON, as the system is redundant.

Only one advisory message is shown when ice is sensed by one or both IDPs. The message will also flash until the propeller de–ice control switch is selected to ON. Discrete information comes from either sensor through Input/Output Processor (IOP1 or IOP2). The ICE DETECTED message is out of view when no ice is detected.

The signal supplied by the ice sensor is read by a signal conditioner, which compares the frequency to the “Ice Detection Threshold Level Frequency” stored in memory. If the signal from the sensor exceeds the “Ice Threshold Level”, there is an “ICE” output of the Ice Detector. It causes the heater circuit of the IDP to de–ice the sensor. The sensor is then ready for a new ice detection cycle. The ICE DETECTED message will remain in view for a minimum of 60 ±5 seconds.

Each IDP interfaces with the systems that follow:

- Caution and Warning Panel
- IFC
- Timer Monitor Unit (TMU).

The left and right IDPs are directly powered from the related 115 V ac variable frequency left bus and 115 V ac variable frequency right bus, through 5 A circuit breakers labeled L ICE DET and R ICE DET.

Probe, Ice Detector

Refer to Figure 2.

Two IDPs are located, one on each side of the forward fuselage. Each IDP is attached to the skin from the outside using six bolts.

The system advises the flight crew of icing conditions when ice accumulation is greater than 0.02 in. (0.5 mm) on one of the probes. This deices the probe so that it can detect the ice again.

The electro–thermal de–icing heater dissipates 300 W when supplied with 115 V ac. The de–icing heater can de–ice the entire probe and all parts exposed to the airflow in less than 15 seconds. In cases of very severe icing conditions, when the entire probe is not completely de–iced after 45 ±4 seconds, the heater cycles off and on. If the sensor temperature exceeds 60 ±5 °C (140 ±9 °F) the de–icing heater stops, and will be started again when the temperature is below the overheat threshold. This protects the sensor’s internal parts from damage due to overheating.

Refer to Figure 3.

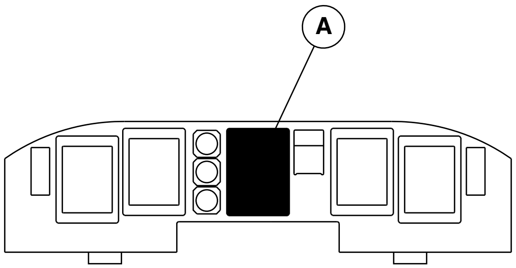
Failure of both IDPs is shown by the ICE DETECT FAIL caution light on the caution and warning panel. If one of the probes fails, the caution light will not come on, as the system is redundant.

Failure of one IDP is reported to the TMU. The TMU stores the failure as a maintenance message that will be displayed on the ESID when the Centralized Diagnostic System (CDS) is interrogated. The displayed message is “L ICE DETECTOR FAIL” or “R ICE DETECTOR FAIL” for the related left or right IDP failure.

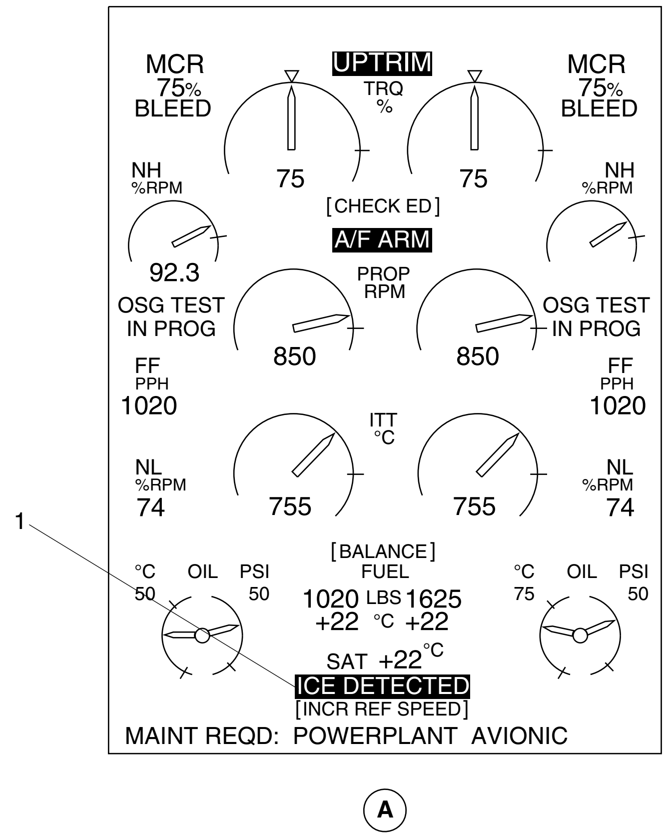
Training Information Points

Open the L ICE DET or R ICE DET circuit breaker on the 115 V ac variable frequency bus prior to the removal of the IDPs. Probes must be handled with care.

Maintenance personnel should wear protective gloves when pressing the diaphragm on the ice detectors, as they quickly become very hot.



MAIN INSTRUMENT PANEL



LEGEND

1. Ice Detected Indicator.

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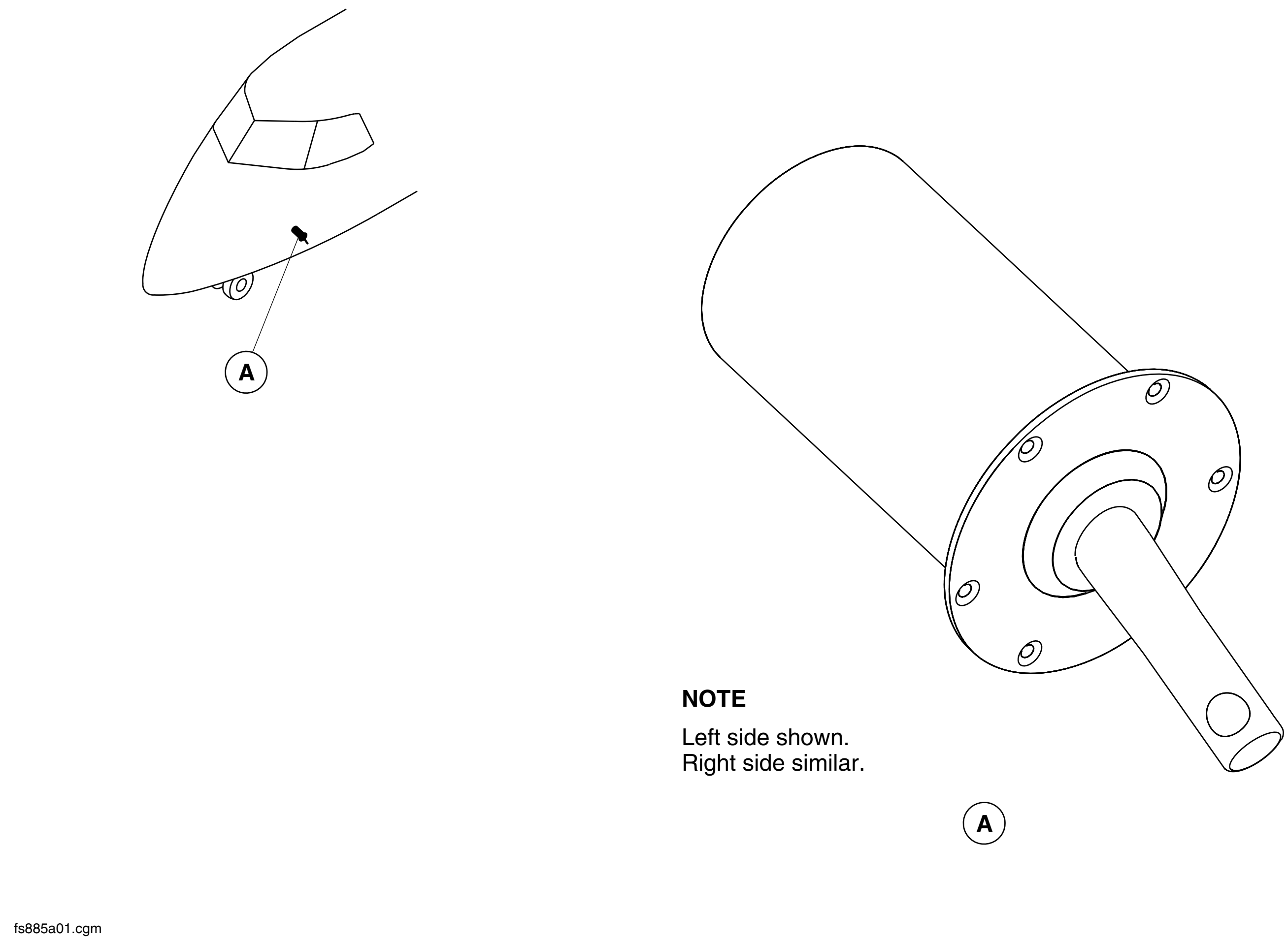
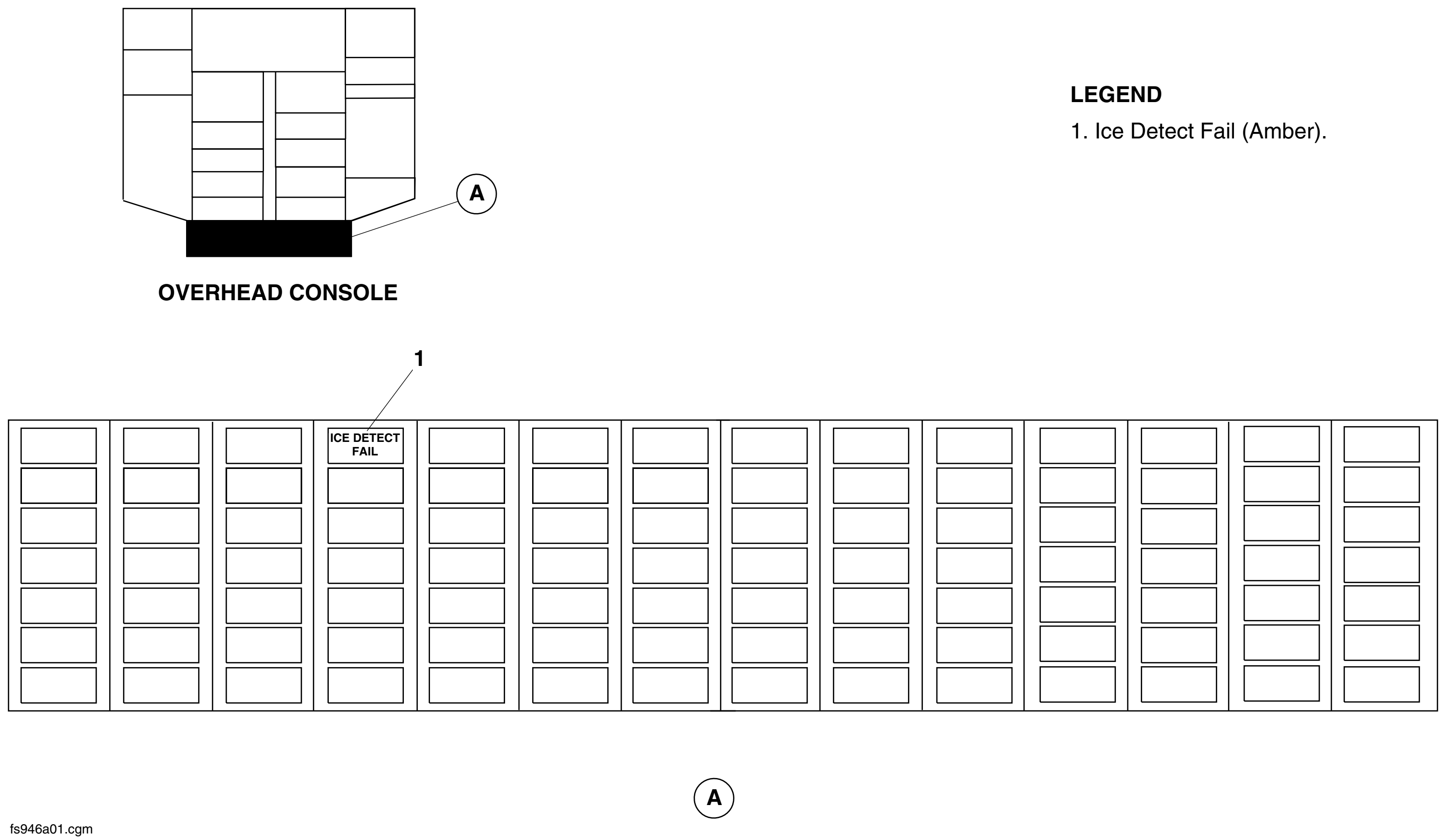
ESID ICE DETECTED INDICATOR
Figure 1



ICE DETECTOR PROBE LOCATIONS
Figure 2



LEGEND

1. Ice Detect Fail (Amber).

ICE DETECT FAIL CAUTION LIGHT
Figure 3