SUPPLEMENT S003 ICE PROTECTION SYSTEM FOR FLIGHT INTO KNOWN ICING

AFMS-S003

Doc No.: 9.01.01-S003

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01
GENERAL

01-01 General Information

Description

1 INTRODUCTION

This Supplement to the AFM contains all necessary information to operate the ice protection system of the DA 50 C in known icing conditions.

The DA 50 C can be equipped with an optional ice protection system in accordance with the Optional Design Change Advisory OÄM 50-011. It distributes a thin film of ice protection fluid on the wings, vertical stabilizer, horizontal stabilizer, and windscreen. This prevents the formation and accumulation of ice.

An additional electric ice protection system is installed on the propeller, the pitot and stall warning system.

NOTE

The ice protection system is not a “de-icing” system in the usual sense. It can remove only small accumulations of ice. Its main purpose is to prevent the accretion of ice (anti-icing).

WARNING

KNOWN ICING CONDITIONS ARE DEFINED BY CS 25/14 CFR PART 25, APPENDIX C. THESE CONDITIONS DO NOT INCLUDE, NOR WERE TESTS CONDUCTED IN, ALL ICING CONDITIONS THAT MAY BE ENCOUNTERED (E.G., FREEZING RAIN, FREEZING DRIZZLE, MIXED PHASE ICING CONDITIONS, OR CONDITIONS DEFINED AS SEVERE). FLIGHT IN THESE CONDITIONS MUST BE AVOIDED. SOME ICING CONDITIONS NOT DEFINED IN CS 25/14 CFR PART 25 HAVE THE POTENTIAL OF PRODUCING HAZARDOUS ICE ACCUMULATIONS, WHICH (1) EXCEED THE CAPABILITIES OF THE AIRPLANE'S ICE PROTECTIONS EQUIPMENT, AND/OR (2) CREATE UNACCEPTABLE AIRPLANE PERFORMANCE. INADVERTENT OPERATION IN THESE CONDITIONS MAY BE DETECTED IF ICE FORMS ON THE SIDE AREAS OF THE DOOR WINDOWS. IF THESE CONDITIONS ARE ENCOUNTERED, THE PILOT SHOULD TAKE IMMEDIATE ACTION TO SELECT HIGH/MAX FLOW RATE AND LEAVE THESE CONDITIONS BY CHANGING ALTITUDE, TURNING BACK, OR EVEN CONTINUING ON THE SAME COURSE IF CLEAR AIR IS KNOWN TO BE IMMEDIATELY AHEAD.

01-02 Definitions and Abbreviations

Description

1 DEFINITIONS AND ABBREVIATIONS

Airspeeds

KTAS	TAS in knots.

Meteorological Terms

De-ice or De-icing:	The periodic shedding or removal of ice accumulations from a surface, by destroying the bond between the ice and the protection surface.
Freezing Drizzle:	Drizzle is precipitation on the ground or aloft in the form of liquid water drops that have diameters less than 0.5 mm, and greater than 0.05 mm (50 µm to 500 µm, 0.002 in to 0.02 in). Freezing drizzle is drizzle in liquid form that exists in air temperatures less than 0 °C (32 °F), i.e. supercooled water, and freezes upon contact with objects on the surface or airborne.
Freezing Rain:	Rain is precipitation on the ground or aloft in the form of liquid water drops which have diameters greater than 0.5 mm (0.02 in). Freezing rain is rain in liquid form that exists at air temperatures less than 0 °C (32 °F), i.e. supercooled water, and freezes upon contact with objects on the surface or airborne.
FIKI:	Flight into known icing.
Ice Crystals:	Any one of a number of macroscopic, crystalline forms in which ice appears. Examples are hail and snow.
Icing Conditions:	An icing condition is defined as the presence of visible moisture in any form at or below an indicated outside air temperature (OAT) of +5 °C (41 °F).
LWC:	Liquid water content. The total mass of water contained in liquid drops within a unit volume of air.
Mixed Phase Icing Conditions:	A homogeneous mixture of supercooled water drops and ice crystals existing within the same cloud environment.
Supercooled Water:	Liquid water at a temperature below the freezing point of 0 °C (32 °F).

Flight Performance and Flight Planning

Continuous Operation:	Typical continuous operations in icing conditions are holding and cruise.

Miscellaneous

CS 25/14 CFR Part 25, Appendix C:	Certification icing condition standard for approving ice protection provisions on airplanes. The conditions are specified in terms of

	altitude, temperature, LWC, representative droplet size, and cloud horizontal extent.
ICTS:	Ice contaminated tailplane stall.
FPD:	Freezing point depressant.
Protected Surface:	A surface containing ice protection, typically located at the surface's leading edge.
TKS:	Tecalemit-Kilfrost-Sheepbridge Stokes.
USP:	Underspeed Protection System

02
OPERATING LIMITATIONS

02-01 Airspeed Limitations

Description

1 AIRSPEED

WARNING

IF MINIMUM ICING SPEED CANNOT BE MAINTAINED, 02-07 - METEOROLOGICAL CONDITIONS OUTSIDE THE APPROVED ICING CONDITIONS - DESCRIPTION APPLIES.

NOTE

Typical continuous operations in icing conditions are holding and cruise.

Airspeed	KIAS or KTAS	Remarks
Minimum airspeed for continuous operation in icing conditions.	94 KIAS	Flaps UP
	79 KIAS	Flaps T/O
Maximum airspeed for continuous operation in icing conditions.	152 KIAS 172 KTAS	Flaps UP
	123 KIAS	Flaps T/O

Table 1 Airspeed Limitations

02-02 Limitation Placards

Description

1 LIMITATION PLACARDS

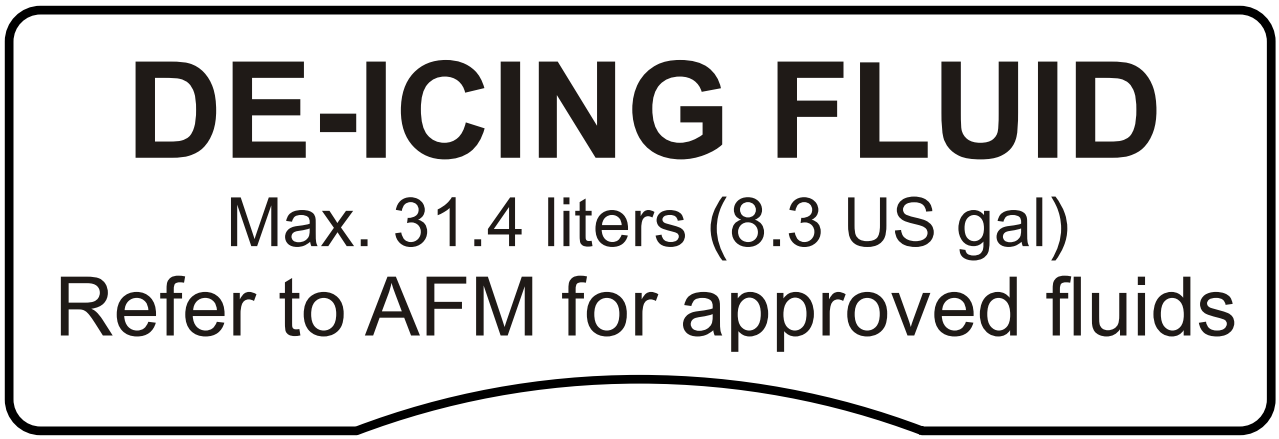

Figure 1 - Ice Protection Fluid

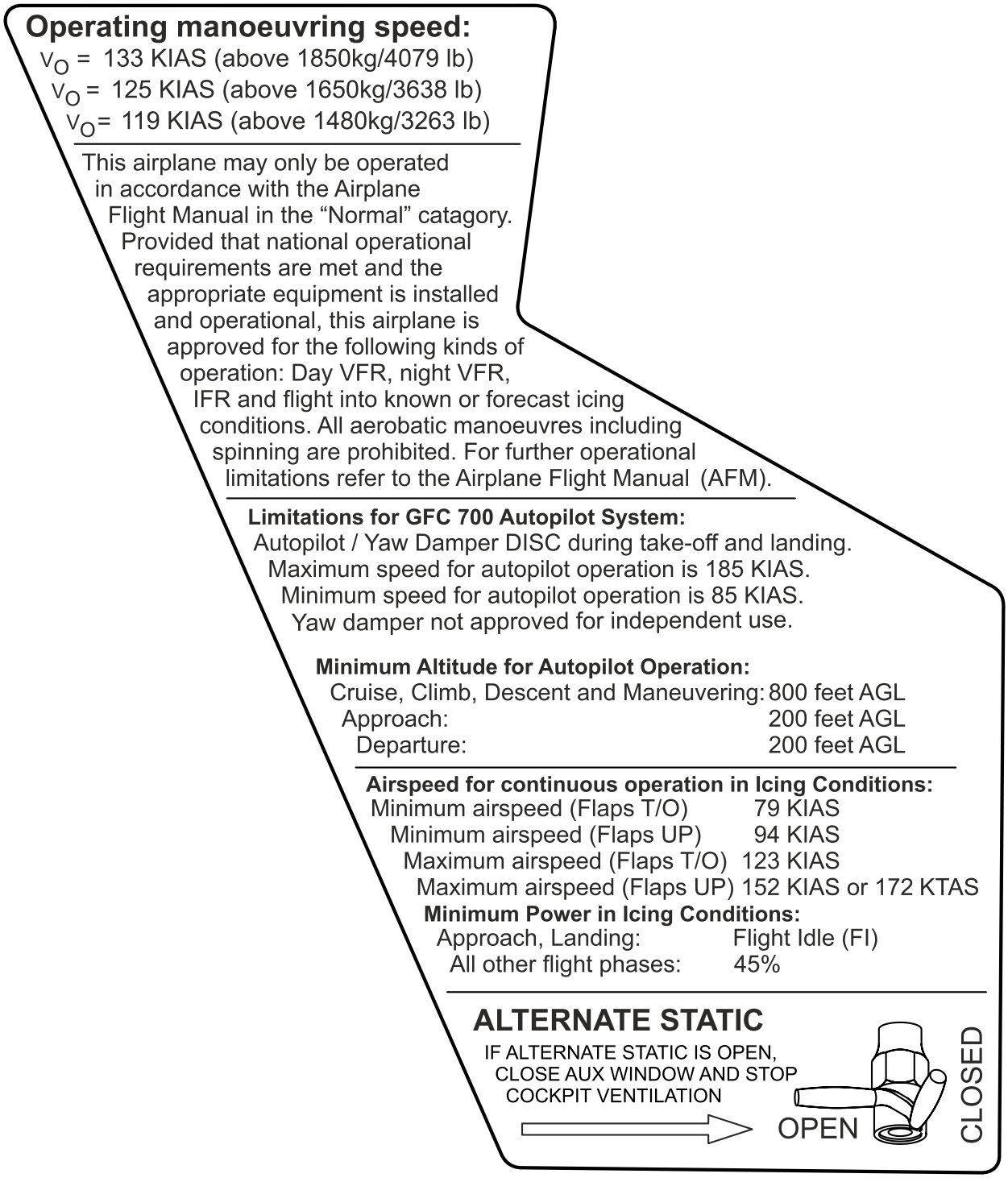

Figure 2 - Ice Protection System Speeds

02-03 Kinds of Operation

Description

1 KINDS OF OPERATIONS

Provided that national operational requirements are met, the following kinds of operation are approved:

- Flights into known or forecast icing conditions.

02-04 Autopilot Limitations

Description

1 AUTOPILOT

Use of the autopilot is prohibited when any ice is observed forming aft of the protected surfaces of the wing, or when unusual lateral trim requirements, or autopilot trim warnings are encountered.

NOTE

The autopilot may mask tactile cues that indicate adverse changes in handling characteristics; therefore, the pilot should consider not using the autopilot when any ice is visible on the airplane, or periodically disconnect the autopilot and check for free movement of all controls (elevator, aileron, and rudder).

Use of autopilot coupled go-around is prohibited during ice encounter and after icing encounter. USP operation has not been tested during or after icing encounter.

02-05 Operation in Icing Conditions

Description

1 OPERATION IN ICING CONDITIONS

1 General

The DA 50 C is approved for flight into known or forecast icing conditions as defined by CS 25/14 CFR Part 25, Appendix C “Continuous Maximum and Intermittent Icing Envelope”, only if the ice protection system is installed and is serviceable.

In icing conditions, the airplane must be operated and its ice protection systems used as described in the operating procedures sections of this manual. Where specific operational speeds and performance information have been established for such conditions, this information must be used.

2 Temperature Limitation

Minimum operation temperature for the ice protection system is -30 °C (-22 °F).

3 Take-Off

Take-off with ice or snow accumulation, or any frost on the airplane is prohibited.

4 Flight into Known or Forecast Icing Conditions

Setting flaps to the LDG position is prohibited:

- During flights in icing conditions
- With ice accumulations on any visible surfaces

Setting flap to LDG or T/O is prohibited in case of a failure of the ice protection system.

NOTE

The flaps and landing gear should only be extended and retracted for landing.

Minimum power in icing conditions: 45%

Minimum power in icing conditions during approach and landing: Flight Idle (FI)

5 Minimum Operational Equipment (Serviceable)

Flight into known or forecast icing conditions requires the following equipment to be installed and serviceable:

- Ice protection system installed in accordance with the Optional Design Change Advisory OÄM 50-011.

NOTE

The wing ice inspection lights must be operative prior to flight into known or forecast icing conditions at night. This supersedes any relief provided by the table given in AFM DA50-A-15-10-00-12A-040A-D.

02-06 Ice Protection Fluids for System Operation Description

1 ICE PROTECTION FLUIDS FOR SYSTEM OPERATION

1 Ice Protection Fluids

WARNING

THE APPROVED ICE PROTECTION FLUIDS ARE HARMFUL. THEY ARE GLYCOL BASED WITH DIFFERENT ADDITIVES. REFER TO THE MATERIAL SAFETY DATA SHEETS FOR PROPER HANDLING, WHICH ARE AVAILABLE FROM THE SUPPLIER OF THE ICE PROTECTION FLUID.

The ice protection fluid must conform to British Specification DTD 406B.

2 Minimum Ice Protection Fluid Quantity for Dispatch

The minimum ice protection fluid quantity for dispatch is 6.1 US gal (23 liter).

NOTE

This minimum allows more than 120 minutes of ice protection with NORM selected. The pilot must ensure adequate fluid quantity before each flight.

NOTE

The maximum tank capacity is 8.3 US gal (31.4 liter). The maximum usable tank capacity is 8.2 US gal (31.0 liter).

02-07 Meteorological Conditions Outside the Approved Icing Conditions

Description

1 METEOROLOGICAL CONDITIONS OUTSIDE THE APPROVED ICING CONDITIONS

1 Freezing Rain / Freezing Drizzle

Flight in meteorological conditions described as freezing rain or freezing drizzle, as determined by the following visual cues, is prohibited:

- Unusually extensive ice accreted on the airframe in areas not normally observed to collect ice.
- Accumulation of ice on the upper surface of the wing aft of the protected area.
- Ice formation on side window areas.
- Visible rain at temperatures below +5 °C (41 °F) OAT.
- Droplets that splash or splatter on impact at temperatures below +5 °C (41 °F) OAT.
- Performance losses larger than normally encountered in icing conditions.

If the airplane encounters conditions that are determined to contain freezing rain or freezing drizzle, the pilot must immediately exit the freezing rain or freezing drizzle conditions by changing altitude, turning back, or even continuing on the same course if clear air is known to be immediately ahead.

2 Mixed Phase Conditions

Mixed phase conditions exist when liquid water droplets and ice particles coexist in a region of a cloud. If the airplane encounters conditions that are determined to contain mixed phase / ice crystals, the pilot must immediately exit the conditions by changing altitude, turning back, or even continuing on the same course if clear air is known to be immediately ahead.

NOTE

The prohibition on flight in freezing rain, freezing drizzle or mixed phase conditions is not intended to prohibit purely inadvertent encounters with the specified meteorological conditions; however, pilots should make all reasonable efforts to avoid such encounters and must immediately exit the conditions if they are encountered.

03
EMERGENCY PROCEDURES

03-01 Certain Airspeeds in Emergencies

Description

1 CERTAIN AIRSPEEDS IN EMERGENCIES

If icing conditions do exist:

Event		KIAS
Airspeed for emergency landing with engine off	Flaps UP	96
	Flaps T/O	88

Table 1 Certain Airspeeds in Emergencies

03-02 Erroneous or Loss of Ice Protection Fluid Display

Emergency operation procedure

1 ERRONEOUS OR LOSS OF ICE PROTECTION FLUID DISPLAY

If the ice protection fluid quantity is known, the remaining system operating time can be estimated based on the durations given in 05-04 - Ice Protection System Operating Times and Fluid Consumption - Description.

A Icing conditions.....leave the icing area as soon as practicable

03-03 Complete Failure of the Electrical System

Emergency operation procedure

1 COMPLETE FAILURE OF THE ELECTRICAL SYSTEM

A Leave the icing area immediately (by changing altitude, turning back, even continuing on the same course if clear air is known to be immediately ahead).

B Proceed in accordance with the procedure given in AFM DA50-A-15-42-00-00A-141A-D.

NOTE

Switching the ESSENTIAL BUS switch ON removes electrical power from the ice protection system (including stall warning heat and propeller de-ice).

03-04 Failures of the Ice Protection System

Emergency operation procedure

1 FAILURE OF THE ICE PROTECTION SYSTEM

A failure of the ice protection system is any condition in which the system fails to remove ice from protected surfaces, including the propeller, and any system malfunction not covered in the abnormal operating procedures given in Chapter 3A of this supplement.

A AUTOPILOT.....hold control stick firmly and disengage

B Leave the icing area (by changing altitude, turning back, or even continuing on the same course if clear air is known to be immediately ahead).

WARNING

WITH AN INOPERATIVE ICE PROTECTION SYSTEM, SET POWER LEVER TO 90% OR MAX. 2300 RPM, AND LEAVE ICING CONDITIONS AS SOON AS POSSIBLE. IN HEAVY ICING CONDITIONS, IT MAY NOT BE POSSIBLE TO MAINTAIN ALTITUDE OR PROPER GLIDE PATH ON APPROACH; IN THIS CASE, IT IS IMPERATIVE THAT A SAFE AIRSPEED BE MAINTAINED. THE STALL WARNING SYSTEM MAY NOT FUNCTION, AND THERE MAY BE LITTLE OR NO PRE-STALL BUFFETING WITH HEAVY ICE LOADS ON THE WING LEADING EDGES.

C Airspeed.....maintain 94 KIAS to 152 KIAS or 172 KTAS until landing

Before landing

D FLAPS.....UP

E Final approach speed:

	up to 1600 kg (3527 lb)	**above 1600 kg (3527 lb) up to 1800 kg (3968 lb)**	**above 1800 kg (3968 lb)**
v_{ref} - Flaps UP	86 KIAS	92 KIAS	96 KIAS

Table 1 v_{ref} for Approach and Landing

03-05 Inadvertent Icing Encounter, Delayed Activation and Excessive Ice Accumulation

Emergency operation procedure

1 INADVERTENT ICING ENCOUNTER, DELAYED ACTIVATION AND EXCESSIVE ICE ACCUMULATION DUE TO OPERATION OUTSIDE APPROVED ICING CONDITIONS

A DE-ICE.....HIGH

B MAX.....press push button to maximize ice protection

NOTE

The MAX push button activates the maximum possible system flow rate for 120 seconds.

C PROP DEICE.....check ON

D PITOT/STALL HEAT.....check ON

E ICE LIGHT.....ON, as required

F Cabin heat & defrost.....ON

G WINDSHIELD.....press push button as required

If ice accretions are present on protected surfaces

H Continue with 03-04 - Failures of the Ice Protection System - Emergency operation procedure.

If the protected surfaces are free from ice accretions

I Ice protection fluid level.....check periodically

J DE-ICE.....NORM, HIGH or MAX as required. Monitor ice build-up.

03-06 Procedures for exiting the freezing rain/freezing drizzle environment

Emergency operation procedure

1 PROCEDURES FOR EXITING THE FREEZING RAIN/FREEZING DRIZZLE ENVIRONMENT

These procedures are applicable to all flight phases from take-off to landing. Monitor the outside air temperature. While ice may form in freezing drizzle or freezing rain at temperatures as cold as -18 °C (0 °F), increased vigilance is warranted at temperatures around freezing, if visible moisture is present. If the visual cues specified in 02-07 - Meteorological Conditions Outside the Approved Icing Conditions - Description for identifying possible freezing rain or freezing drizzle conditions are observed, accomplish the following:

A Exit the freezing rain or freezing drizzle icing conditions immediately, to avoid extended exposure to flight conditions outside of those for which the airplane has been certificated for operation. Asking for priority to leave the area is fully justified under these conditions.

B Activate the ice protection system (DE-ICE, PROP DEICE, PITOT/STALL HEAT, and WINDSHIELD if necessary) if not already active.

C Check that the DE-ICE system is set to HIGH. Activate the DE-ICE system in MAX mode if ice accumulates on or aft of protected surfaces.

D Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.

E Do not engage the autopilot. The autopilot may mask unusual control system forces.

F If the autopilot is engaged, hold the control stick firmly, and disengage the autopilot.

G Periodically move all controls gently to check for and prevent frozen (stuck) control surfaces.

H If an unusual roll response or uncommanded control movement is observed, reduce the angle of attack by increasing airspeed or rolling wings level (if in a turn), and apply additional power, if needed.

I Avoid extending flaps during prolonged operation in icing conditions. Operation with flaps extended can result in a reduced wing angle of attack, with ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.

J If the flaps are extended, do not retract them until the airframe is clear of ice.

K Report these weather conditions to air traffic control.

03-07 Insufficient Engine Power in Icing Conditions

Special operation

1 INSUFFICIENT ENGINE POWER IN ICING CONDITIONS

Engine power is less than expected during icing encounter due to blocked intercooler.

A COWL FLAP.....open

B ALTERNATE AIR.....check open

C Leave icing conditions immediately. (by changing altitude, turning back, or even continuing on the same course if clear air is known to be immediately ahead).

If engine power is insufficient to continue the flight

D Be prepared for an emergency landing. Proceed in accordance with main AFM 03-40 Emergency Landing with Engine Off.

03A
ABNORMAL OPERATING PROCEDURES

03A-01 Airplane related G1000 Caution Messages

Emergency operation procedure

1 CREW ALERT SYSTEM (CAS) CAUTION MESSAGES

CAS Message	Cause	Corrective Action
ALTN 1 FAIL ALTN 2 FAIL	Engine alternator 1 or 2 has failed.	See 03A-02 - ALTN 1 or 2 FAIL - Special operation.
DEIC PRES LO	De-icing pressure is low.	See 03A-03 - DEIC PRES LO - Special operation.
DEIC PRES HI	De-icing pressure is high.	See 03A-04 - DEIC PRES HI - Special operation.
DEIC LVL LO	Ice protection fluid level is low.	See 03A-05 - DEIC LVL LO - Special operation.
PROP DE-ICE FAIL	Failure of electro thermal propeller de-ice.	See 03A-06 - PROP DE-ICE FAIL - Special operation.

03A-02 ALTN 1 or 2 FAIL

Special operation

1 ALTERNATOR 1 OR 2 FAILURE

ALTN 1 FAIL

ALTN 2 FAIL

Engine alternator 1 or 2 has failed.

A Icing conditions.....leave the icing area as soon as practicable

B Proceed in accordance with the procedure given in AFM DA50-A-15-52-04-01A-161A-D or DA50-A-15-52-04-02A-161A-D.

03A-03 DEIC PRES LO

Special operation

1 DEIC PRES LO

DEIC PRES LO

De-icing pressure is low.

A DE-ICE.....HIGH

If DEIC PRES LO indication does not extinguish on the G1000 NXi

B PUMP1/PUMP2.....select other main pump

NOTE

Activate the WINDSHIELD pump to prime the alternate main pump if necessary.

If DEIC PRES LO indication still does not extinguish on the G1000 NXi

C ALTERNATE switch on de-ice panel.....open guard, toggle switch

If DEIC PRES LO indication still does not extinguish on the G1000 NXi

D Proceed with 03-04 - Failures of the Ice Protection System - Emergency operation procedure.

If DEIC PRES LO indication extinguishes on the G1000 NXi and normal operation is achieved

WARNING

IF AT AMBIENT TEMPERATURE ABOVE 10 °C (50 °F) AND BELOW 20 °C (68 °F) DEIC PRES LO WARNING APPEARS IN HIGH MODE, SWITCH TO MAX MODE TO CANCEL THE WARNING.

ABOVE 20 °C (68 °F) AMBIENT TEMPERATURE, WARNING CANCELLATION MAY NOT BE POSSIBLE.

E Ice protection system.....monitor operation

Ice protection fluid flow in ALTERNATE similar to HIGH mode.

F Ice protection fluid level.....check periodically

03A-04 DEIC PRES HI

Special operation

1 DEIC PRES HI

DEIC PRES HI

De-icing pressure is high.

NOTE

Reduced system performance may occur. Unscheduled maintenance is required.

A Icing conditions.....leave the icing area as soon as practicable.

B Proceed with 03-04 - Failures of the Ice Protection System - Emergency operation procedure.

03A-05 DEIC LVL LO

Special operation

1 DEICE LVL LO

DEICE LVL LO

Ice protection fluid level is low.

Maximum remaining system operating times after first annunciation of the DEICE LVL LO caution message:

NORM mode	40 min.
HIGH mode	20 min.

03A-06 PROP DE-ICE FAIL

Special operation

1 PROP DE-ICE FAIL

PROP DE-ICE FAIL

Propeller heat has failed.

NOTE

Reduced system performance may occur. Unscheduled maintenance is required.

NOTE

With a failure of the propeller de-ice system, increased vibrations may occur. In that case, set power lever to 90% or MAX: 2300 RPM to aid de-icing of the propeller and leave the icing conditions as soon as possible

A Icing conditions.....leave the icing area as soon as possible

03A-07 Failure of Indication Lights

Special operation

1 FAILURE OF THE INDICATION LIGHTS

The indication lights (MAX, NORM, HIGH) on the de-ice panel are only used to indicate the selected operating mode. Failure to illuminate does not indicate a malfunction of the system.

A Continue flight.

B Unscheduled maintenance is required.

03A-08 Failure of Windshield DE-ICE

Special operation

1 FAILURE OF THE WINDSHIELD DE-ICE

A failure of the windshield de-ice is any condition in which the system fails to remove ice from the windshield.

A Continue flight viewing through the unobstructed areas on the side of the door windows. Open the emergency window if necessary.

B Use DEFROST to clear light ice formation.

C Leave the icing area as soon as possible.

03A-09 Failure in Flap Operating System

Special operation

1 FAILURES IN FLAP OPERATING SYSTEM

Failure in Position Indication or Function

A FLAPS position.....check visually

B FLAPS switch.....re-check flap positions

Modified Approach Procedure Depending on the Available Flap Setting

NOTE

Refer to the Landing Distance DA50-A-15-62-09-01A-040A-D, or DA50-A-15-62-09-02A-040A-D, or DA50-A-15-62-09-03A-040A-D, and increase the distances by 30%.

Before landing, with ice accretion on any visible surfaces, or if icing conditions do exist

	up to 1600 kg (3527 lb)	**above 1600 kg (3527 lb) up to 1800 kg (3968 lb)**	**above 1800 kg (3968 lb)**
v_{ref} - Flaps UP	86 KIAS	92 KIAS	96 KIAS

Table 1 v_{ref} for Approach and Landing

Land at a flat approach angle, use power lever to control airplane speed and rate of descent.

04
NORMAL OPERATING PROCEDURES

04-01 Normal Operating Procedures

Description

1 NORMAL OPERATING PROCEDURES

WARNING

IF ICE IS OBSERVED FORMING AFT OF THE PROTECTED SURFACES OF THE WING, OR IF UNUSUAL LATERAL TRIM REQUIREMENTS, OR IF AUTOPILOT TRIM WARNINGS ARE ENCOUNTERED, DO THE FOLLOWING:

- **REDUCE THE ANGLE OF ATTACK BY INCREASING SPEED AS MUCH AS THE AIRPLANE CONFIGURATION AND WEATHER ALLOW, WITHOUT EXCEEDING THE DESIGN MANEUVERING SPEED.**
- **IF THE AUTOPILOT IS ENGAGED, HOLD THE CONTROL STICK FIRMLY AND DISENGAGE THE AUTOPILOT. DO NOT RE-ENGAGE THE AUTOPILOT UNTIL THE AIRFRAME IS CLEAR OF ICE.**
- **LEAVE THE ICING AREA IMMEDIATELY BY CHANGING ALTITUDE, TURNING BACK, OR EVEN CONTINUING ON THE SAME COURSE IF CLEAR AIR IS KNOWN TO BE IMMEDIATELY AHEAD.**
- **IF THE FLAPS ARE EXTENDED, DO NOT RETRACT THEM UNTIL THE AIRFRAME IS CLEAR OF ICE.**

WARNING

FLIGHT IN FREEZING RAIN, FREEZING DRIZZLE, OR MIXED PHASE ICING CONDITIONS (SUPERCOOLED WATER AND ICE CRYSTALS) MAY RESULT IN HAZARDOUS ICE BUILD-UP ON PROTECTED SURFACES EXCEEDING THE CAPABILITY OF THE ICE PROTECTION SYSTEM, OR MAY RESULT IN ICE FORMING AFT OF THE PROTECTED SURFACES. THIS ICE MAY NOT BE SHED USING THE ICE PROTECTION SYSTEMS, AND IT MAY SERIOUSLY DEGRADE THE PERFORMANCE AND CONTROLLABILITY OF THE AIRPLANE.

WARNING

THE AUTOPILOT WILL NOT MAINTAIN AIRSPEED WITH ICE ON THE AIRPLANE. MONITOR SPEED CLOSELY.

CAUTION

DO NOT DELAY ACTIVATION OF THE ICE PROTECTION SYSTEM, IF ICING CONDITIONS ARE ENCOUNTERED. THE SYSTEM MUST BE ACTIVATED PRIOR TO ACCUMULATION OF ICE ON PROTECTED SURFACES.

1 Identification of Icing Conditions

The following indication shall be used to identify icing conditions:

Visible moisture at or below an indicated outside air temperature of +5 °C (41 °F).

2 Identification of Freezing Rain/Freezing Drizzle Icing Conditions

The following shall be used to identify freezing rain/freezing drizzle icing conditions:

A. Unusually extensive ice accreted on the airframe in areas not normally observed to collect ice.

B. Accumulation of ice on the upper surface of the wing, aft of the protected area.

C. Ice accretion on the side window areas.

3 Identification of Possible Freezing Rain/Freezing Drizzle Conditions

The following may be used to identify possible freezing rain/freezing drizzle conditions:

A. Visible rain at temperatures below +5 °C (41 °F) outside air temperature (OAT).

B. Droplets that splash or splatter on impact at temperatures below +5 °C (41 °F) OAT.

C. Performance losses larger than normally encountered in icing conditions. It is possible to experience severe ice accretions not visible to the flight crew, such as wing lower surface accretion or propeller blade accretion.

NOTE

Procedures for exiting freezing rain/freezing drizzle conditions are given in 03-06 - Procedures for exiting the freezing rain/freezing drizzle environment - Emergency operation procedure.

4 Propeller Vibration

Asymetric ice shedding from the propeller blades may result in vibrations. Increasing the propeller RPM by increasing the power may help the shedding of the remaining ice. As not all icing conditions are predictable, the propeller vibration may not cease in all cases.

5 Holding in icing conditions

Holding in icing conditions for longer than 45 minutes may reduce margins and could result in inadequate handling and control characteristics.

04-02 Airspeeds for Normal Operation

Description

1 AIRSPEEDS FOR NORMAL OPERATING PROCEDURES

With ice accumulation on the unprotected surfaces of the airplane or if icing conditions do exist:

Flight Mass	**up to 1600 kg (3527 lb)**	**above 1600 kg (3527 lb) up to 1800 kg (3968 lb)**	**above 1800 kg (3968 lb)**
Airspeed for cruise climb (Flaps UP)	96 KIAS		
Approach speed for normal landing (Flaps UP)	86 KIAS	92 KIAS	96 KIAS
Approach speed for normal landing (Flaps T/O)	80 KIAS	84 KIAS	88 KIAS
Minimum speed during go-around (Flaps T/O)	80 KIAS	84 KIAS	88 KIAS

Table 1 Airspeeds

04-03 Pre-Flight Inspection - Cabin Check

Pre-operation procedure

1 PRE-FLIGHT INSPECTION - CABIN CHECK

Ice Protection System

CAUTION

IT IS EXTREMELY IMPORTANT TO VISUALLY INSPECT EACH TKS PANEL FOR PROPER FLUID DISTRIBUTION ACROSS THE ACTIVE AREA OF EACH PANEL PRIOR TO FLIGHT INTO KNOWN ICING.

A ELECT. MASTER.....ON

B ICE PROTECTION FLUID.....check quantity

C Doors.....closed

WARNING

ICE PROTECTION FLUIDS ARE HARMFUL. FOR PROPER HANDLING, REFER TO THE MATERIAL SAFETY DATA SHEETS, WHICH ARE AVAILABLE FROM THE SUPPLIER OF THE ICE PROTECTION FLUID.

D WINDSHIELD.....press push button

E Spraynozzles.....evidence of ice protection fluid

NOTE

If the system has been inoperative for a while, has been drained, or has run dry, trapped air - suspected in the feeder lines to the main pumps - can be removed from the feeder lines to the main pumps by activating the windshield pump several times.

NOTE

Do not operate the main pumps with an empty ice protection fluid tank. Operating the main system pumps with an empty ice protection fluid tank can cause a future system malfunction. To reestablish full system function, special maintenance action is required.

NOTE

The ANNUN-TEST mode activates the DEICE LVL LO caution immediately if the ice protection fluid quantity is low, and activates the DEIC PRES LO caution after 120 seconds.

F ANNUN-TEST.....ON

G DEIC PRES HI.....verify NOT ILLUMINATED

H DEICE LVL LO.....check, must be annunciated if ice protection fluid quantity is below 1.9 US gal (7 liter)

I Wait for minimum 120 seconds.

J DEIC PRES LO.....check, ILLUMINATED

K ANNUN-TEST.....OFF

L ALTERNATE.....ON

M Porous panels on wings.....Evidence of ice protection fluid

N ALTERNATE.....OFF

O PUMP 2.....select

P DE-ICE.....HIGH

Q Wait for minimum 120 seconds.

R DEIC PRES LO.....verify NOT ILLUMINATED refer to NOTE below

NOTE

The ice protection system is approved for operation with ice protection fluid that has a very temperature dependant viscosity characteristic. The viscosity decreases with rising temperature above 0 °C (32 °F) and passes through the porous membrane of the panels with less resistance. This decrease in pressure drop reduces the pressure in the panel reservoir, which may not be adequate to wet-out the entire panel active area if the preflight inspection is performed at warmer outside temperatures.

NOTE

If at ambient temperatures above 10 °C (50 °F) and below 20 °C (68 °F) DEIC PRES LO warning appears in HIGH mode, switch to MAX mode to cancel the warning. Above 20 °C (68 °F) ambient temperature, warning cancellation may not be possible.

S PUMP 1.....select

T Wait for minimum 120 seconds.

U ICE LIGHT.....ON

V Ice lights.....visual inspection, check

W DEIC PRES HI.....verify NOT ILLUMINATED

X DEIC PRES LO.....verify NOT ILLUMINATED refer to NOTE above

Y DE-ICE.....OFF

Z ICE LIGHT.....OFF

AA ELECT. MASTER.....OFF

04-04 Pre-Flight Inspection - Walk Around Check

Pre-operation procedure

1 PRE-FLIGHT INSPECTION - WALK AROUND CHECK, VISUAL INSPECTION

Ice protection system

CAUTION

IT IS EXTREMELY IMPORTANT TO VISUALLY INSPECT EACH TKS PANEL FOR PROPER FLUID DISTRIBUTION ACROSS THE ACTIVE AREA OF EACH PANEL PRIOR TO FLIGHT INTO KNOWN ICING.

A Ice protection fluid tank.....check quantity through filler cap

B Filler cap.....secure

C Spraynozzles.....visually check, no holes blocked

D Porous panels on wings.....visually check no damage, and no holes blocked, evidence of ice protection fluid along entire porous panel active area

NOTE

If required, activate DE-ICE on MAX until fluid is evident along entire porous panel active area.

E Porous panels on horizontal & vertical tail.....visually check no damage, and no holes blocked, evidence of ice protection fluid along entire porous panel active area

F Propeller heating pads.....visually check no damage

G Wing, tail, propeller, windshield.....verify free from ice

04-05 Before Taxiing

Pre-operation procedure

1 BEFORE TAXIING

A PROP DEICE.....ON

B Wait for 120 seconds.

C PROP DE-ICE FAIL.....verify OFF

D PROP DEICE.....OFF

04-06 Taxiing

Pre-operation procedure

1 TAXIING

NOTE

Ice protection fluid will remain on the windshield for a while after operating windshield de-ice. For an unobstructed view, do not operate the windshield de-ice during taxi.

04-07 After Take-Off

Normal operation procedure

1 AFTER TAKE-OFF

Activate the ice protection system sufficiently in advance of entry in icing conditions.

A DE-ICE.....NORM

B PROP DEICE.....ON

C PITOT/STALL HEAT.....ON

D ICE LIGHT.....ON, as required

E Cabin heat & defrost.....ON

04-08 Climb

Normal operation procedure

1 CLIMB

Before entering icing conditions, or if icing conditions do exist

A DE-ICE.....NORM, monitor ice build-up
HIGH if ice accretes on protected areas
MAX if ice accretes on protected areas in HIGH mode.

NOTE

The MAX push button activates the maximum possible system flow rate for 120 seconds.

B PROP DEICE.....ON

C PITOT/STALL HEAT.....check ON

If ice accretes in MAX mode

D Proceed with 03-05 - Inadvertent Icing Encounter, Delayed Activation and Excessive Ice Accumulation - Emergency operation procedure.

While in icing conditions

E Airspeed.....maintain 94 KIAS (Flaps UP)

F PROP DEICE.....check ON

G PITOT/STALL HEAT.....check ON

H ICE LIGHT.....ON, as required

I Cabin heat & defrost.....check ON

J WINDSHIELD.....press push button, as required

WARNING

WHEN DISCONNECTING THE AUTOPILOT WITH ICE ACCRETIONS ON THE AIRPLANE, THE PILOT SHOULD BE ALERT FOR OUT-OF-TRIM FORCES. PILOT CONTROL STICK INPUT SHOULD BE APPLIED AS REQUIRED TO PREVENT POTENTIAL UNDESIRED FLIGHT PATH DEVIATIONS.

K Ice protection fluid level.....check periodically

NOTE

Ice shedding from the propeller may result in elevated vibration. These vibrations stop, once ice is shedded from all propeller blades equally. Increasing the propeller RPM can assist in ice shedding.

NOTE

The autopilot may be used in icing conditions. However, every 10-15 minutes, the autopilot should be disconnected to detect any out-of-trim conditions caused by ice build-up on unprotected surfaces. If significant out-of-trim conditions are detected, the autopilot must remain off for the remainder of the icing encounter so that the pilot may monitor for additional force build-up.

After leaving icing conditions

L DE-ICE.....OFF

M PITOT/STALL HEAT.....OFF, as required

N PROP DEICE.....OFF, as required

O ICE LIGHT.....OFF, as required

P Cabin heat & defrost.....OFF, as required

04-09 Cruise

Normal operation procedure

1 CRUISE

Before entering icing conditions, or if icing conditions do exist

A DE-ICE.....NORM, monitor ice build-up
HIGH if ice accretes on protected areas
MAX if ice accretes on protected areas in HIGH mode.

B PROP DEICE.....ON

C PITOT/STALL HEAT.....check ON

If ice accretes on protected surfaces in MAX mode

D Proceed with 03-04 - Failures of the Ice Protection System - Emergency operation procedure.

While in icing conditions

E PROP DEICE.....check ON

F PITOT/STALL HEAT.....check ON

G ICE LIGHT.....ON, as required

H Cabin heat & defrost.....check ON

I WINDSHIELD.....press push button, as required

J Ice protection fluid level.....check periodically

K POWER lever.....minimum 45%

WARNING

WHEN DISCONNECTING THE AUTOPILOT WITH ICE ACCRETIONS ON THE AIRPLANE, THE PILOT SHOULD BE ALERT FOR OUT-OF-TRIM FORCES. PILOT CONTROL STICK INPUT SHOULD BE APPLIED AS REQUIRED TO PREVENT POTENTIAL UNDESIRED FLIGHT PATH DEVIATIONS.

NOTE

Ice shedding from the propeller may result in elevated vibration. These vibrations stop, once ice is shedded from all propeller blades equally. Increasing the propeller RPM can assist in ice shedding.

NOTE

The autopilot may be used in icing conditions. However, every 10-15 minutes, the autopilot should be disconnected to detect any out-of-trim conditions caused by ice build-up on unprotected surfaces. If significant out-of-trim conditions are detected, the autopilot must remain off for the remainder of the icing encounter so that the pilot may monitor for additional force build-up.

L Airspeed.....maintain 94 KIAS to 152 KIAS or 172 KTAS

After leaving icing conditions

M DE-ICE.....OFF

N PITOT/STALL HEAT.....OFF, as required

O PROP DEICE.....OFF, as required

P ICE LIGHT.....OFF, as required

Q Cabin heat & defrost.....OFF, as required

04-10 Descent

Normal operation procedure

1 DESCENT

Before entering icing conditions, or if icing conditions do exist

A DE-ICE.....NORM, monitor ice build-up
HIGH if ice accretes on protected areas
MAX if ice accretes on protected areas in HIGH mode.

B PROP DEICE.....ON

C PITOT/STALL HEAT.....check ON

If ice accretes on protected surfaces in MAX mode

D Proceed with 03-04 - Failures of the Ice Protection System - Emergency operation procedure.

While in icing conditions

E PROP DEICE.....check ON

F PITOT/STALL HEAT.....check ON

G ICE LIGHT.....ON, as required

H Cabin heat & defrost.....check ON

I WINDSHIELD.....press push button, as required

NOTE

Ice protection fluid will remain on the windshield for a period after operating windshield de-ice. Stop operating the windshield de-ice 30 seconds before landing for an unobstructed view.

J POWER lever.....minimum 45%

04-11 Approach and Landing

Normal operation procedure

1 APPROACH AND LANDING

Before entering icing conditions, or if icing conditions do exist

A DE-ICE.....NORM, monitor ice build-up
HIGH if ice accretes on protected areas
MAX if ice accretes on protected areas in HIGH mode.

B PROP DEICE.....ON

C PITOT/STALL HEAT.....check ON

If ice accretes on protected surfaces in MAX mode

D Proceed with 03-04 - Failures of the Ice Protection System - Emergency operation procedure.

While in icing conditions

E PROP DEICE.....check ON

F PITOT/STALL HEAT.....check ON

G ICE LIGHT.....ON, as required

H Cabin heat & defrost.....check ON

I WINDSHIELD.....press push button, as required

NOTE

Ice protection fluid will remain on the windshield for a period after operating windshield de-ice. Stop operating the windshield de-ice 30 seconds before landing for an unobstructed view.

J POWER lever.....as required, minimum Flight Idle (FI)

K Airspeed

	up to 1600 kg (3527 lb)	**above 1600 kg (3527 lb) up to 1800 kg (3968 lb)**	**above 1800 kg (3968 lb)**
v_{ref} - Flaps UP	86 KIAS	92 KIAS	96 KIAS
v_{ref} - Flaps T/O	80 KIAS	84 KIAS	88 KIAS

Table 1 v_{ref} for Approach and Landing

L FLAPS.....UP or T/O, as required

04-12 Go Around

Normal operation procedure

1 GO AROUND

CAUTION

THE STALL WARNING SCHEDULE MAY BE REVERTED TO THE NON ICING SCHEDULE DURING A BALKED LANDING WITH POSSIBLE GROUND CONTACT OF THE WHEELS FOLLOWING A FLIGHT IN ICING CONDITIONS. TO ENSURE PROPER MARGINS FOR STALL WARNING IN THIS CASE, THE PILOT SHALL ACTIVATE THE AIRFRAME ICE PROTECTION SYSTEM FOR A SHORT TIME DURING GO AROUND WHEN IT IS ENSURED ALL WHEELS HAVE NO GROUND CONTACT.

04-13 After Landing

Post-operation procedure

1 AFTER LANDING

A	DE-ICE	OFF
B	PROP DEICE	OFF
C	PITOT/STALL HEAT	OFF
D	ICE LIGHT	OFF

04-14 Exit Airplane

Post-operation procedure

1 EXIT AIRPLANE

CAUTION

WHEN THE ICE PROTECTION SYSTEM HAS BEEN ENABLED IN FLIGHT, THE WALKWAYS ON THE INNER WINGS MAY BE SLIPPERY.

04-15 Parking

Post-operation procedure

1 PARKING

NOTE

When the ice protection system has been enabled in flight, special care must be taken when touching the airframe structure or doors, as they may be partially contaminated with ice protection fluid.

Clean the ice protection fluid from the porous panels. Refer to 08-01 - General - Description for appropriate procedures.

WARNING

ICE PROTECTION FLUIDS ARE HARMFUL. FOR PROPER HANDLING, REFER TO THE MATERIAL SAFETY DATA SHEETS, WHICH ARE AVAILABLE FROM THE SUPPLIER OF THE ICE PROTECTION FLUID.

05
PERFORMANCE

05-01 Performance data

Description

1 PERFORMANCE

Airplane performance and stall speeds in clear air are unchanged with the installation of the ice protection system.

Significant climb and cruise performance degradation, range reduction, buffet, and stalling speed increase must be expected if ice accumulates on the airframe.

Ice accretions on the protected surfaces can cause noticeable performance losses beyond those stated in this section.

05-02 Use Of Performance Tables and Diagrams

Description

1 PERFORMANCE TABLES AND DIAGRAMS

The performance data in this supplement is valid for ice accumulation on unprotected surfaces in the maximum continuous icing conditions defined by CS 25/14 CFR Part 25, Appendix C.

NOTE

Known icing conditions are defined by CS 25/14 CFR Part 25, Appendix C. These conditions do not include, nor were tests conducted in all icing conditions that may be encountered (e.g. supercooled clouds, freezing rain, freezing drizzle, mixed phase icing conditions, or conditions defined as severe). Flight in these conditions must be avoided. Some icing conditions not defined in CS 25/14 CFR part 25 have the potential of producing hazardous ice accumulations, which (1) exceed the capabilities of the airplane's ice protection equipment, and/or (2) create unacceptable airplane performance.

05-03 Stalling Speeds

Description

1 Stalling Speeds

Stalling Speed at Various Flight Masses.

Airspeeds, most forward CG, Flight Idle (FI):

1600 kg (3527 lb)		Bank Angle							
		0°		30°		45°		60°	
Gear	Flaps	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
UP	UP	65	65	70	70	78	77	94	92
DOWN	TO	62	60	66	64	73	71	87	85

Table 1 Stalling Speeds - 1600 kg (3527 lb)

1800 kg (3968 lb)		Bank Angle							
		0°		30°		45°		60°	
Gear	Flaps	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
UP	UP	69	69	75	74	83	82	100	98
DOWN	TO	65	63	69	68	77	75	91	89

Table 2 Stalling Speeds - 1800 kg (3968 lb)

1999 kg (4407 lb)		Bank Angle							
		0°		30°		45°		60°	
Gear	Flaps	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
UP	UP	73	72	78	77	87	86	104	102
DOWN	TO	68	66	73	71	80	78	96	93

Table 3 Stalling Speeds - 1999 kg (4407 lb)

NOTE

KIAS values may not be accurate at stall.

05-04 Ice Protection System Operating Times and Fluid Consumption Description

1 SYSTEM OPERATING TIMES AND FLUID CONSUMPTION

The maximum system fluid consumption and operation times with the maximum usable quantity of ice protection fluid is:

NORM mode: max. 3 US gal/h (11.3 L/h): 2 hrs. 44 min.

HIGH mode: max. 6 US gal/h (22.6 L/h): 1 hr. 22 min.

The ice protection fluid consumption per activation is:

MAX mode:	0.4 US gal (1.5 L)
WINDSHIELD:	1.5 fl. oz. (40 mL)

05-05 Climb Performance - Cruise Climb 1999

Description

Cruise Climb - 1999 kg / 4407 lb					
Flaps:	**UP**		**Power:**	**90%, max. 2300 RPM**	
v_Y:	**94 KIAS**		**Gear:**	**retracted**	
Press. Alt. [ft] / [m]	**Rate of Climb [ft/min]**				
	Outside Air Temperature - [°C] / [°F]				**ISA**
	-20 / -4	**-10 / 14**	**0 / 32**	**5 / 41**	
SL	460	450	440	430	---
2000 610	440	430	410	410	---
4000 1219	410	400	390	380	---
6000 1829	390	370	360	350	352
8000 2438	360	340	320	320	326
10000 3048	300	280	260	260	273
12000 3658	220	210	190	180	203
14000 4267	130	110	90	80	115
16000 4877	0	-20	-40	-50	-7
18000 5486	-160	-190	-210	-210	-161
20000 6096	-330	-360	-370	-370	-322

Table 1 Cruise Climb - 1999 kg (4407 lb)

05-06 Climb Performance - Cruise Climb 1800

Description

Cruise Climb - 1800 kg / 3968 lb					
Flaps:	**UP**		**Power:**	**90%, max. 2300 RPM**	
v_Y:	**94 KIAS**		**Gear:**	**retracted**	
Press. Alt. [ft] / [m]	**Rate of Climb [ft/min]**				
	Outside Air Temperature - [°C] / [°F]				**ISA**
	-20 / -4	**-10 / 14**	**0 / 32**	**5 / 41**	
SL	550	540	530	530	---
2000 610	530	520	510	500	---
4000 1219	510	490	480	470	---
6000 1829	480	470	450	440	445
8000 2438	450	430	420	410	417
10000 3048	390	370	350	340	361
12000 3658	310	290	270	260	286
14000 4267	210	190	160	150	191
16000 4877	70	40	20	10	60
18000 5486	-110	-130	-160	-160	-108
20000 6096	-290	-320	-330	-330	-283

Table 1 Cruise Climb - 1800 kg (3968 lb)

05-07 Climb Performance - Cruise Climb 1600

Description

Cruise Climb - 1600 kg / 3527 lb					
Flaps:	**UP**		**Power:**	**90%, max. 2300 RPM**	
v_Y:	**94 KIAS**		**Gear:**	**retracted**	
Press. Alt. [ft] / [m]	**Rate of Climb [ft/min]**				
	Outside Air Temperature - [°C] / [°F]				**ISA**
	-20 / -4	**-10 / 14**	**0 / 32**	**5 / 41**	
SL	670	660	640	640	---
2000 610	640	630	620	610	---
4000 1219	620	600	590	580	---
6000 1829	590	570	560	550	552
8000 2438	560	540	520	510	523
10000 3048	490	470	450	440	463
12000 3658	410	380	360	350	382
14000 4267	290	270	250	240	277
16000 4877	140	120	100	80	133
18000 5486	-50	-80	-100	-110	-51
20000 6096	-250	-280	-300	-300	-243

Table 1 Cruise Climb - 1600 kg (3527 lb)

05-08 Cruise Performance

Description

Cruise Performance						
Press Alt. [ft] / [m]	Pwr [%]	FF [gph]	KTAS			
			ISA-10	ISA	ISA+10	ISA+20
2000 610	90	15.3	124	---	---	---
	75	12.4	115	---	---	---
	60	10.1	103	---	---	---
4000 1219	90	15.3	126	---	---	---
	75	12.4	117	---	---	---
	60	10.1	105	---	---	---
6000 1829	90	15.3	129	130	---	---
	75	12.4	119	120	---	---
	60	10.1	106	107	---	---
8000 2438	90	15.3	131	132	---	---
	75	12.4	121	122	---	---
	60	10.1	108	109	---	---
10000 3048	90	15.9	133	135	---	---
	75	12.4	123	124	---	---
	60	10.2	109	110	---	---
12000 3658	86	14.7	133	134	136	---
	75	12.4	125	126	127	---
	60	10.3	111	112	112	---
14000 4267	82	14.3	132	134	135	---
	75	12.8	127	128	129	---
	60	10.4	112	113	114	---

Table 1 Cruise Performance

05-09 Landing Distances

Description

1 LANDING DISTANCES

With ice accumulation on the unprotected surfaces of the airplane, or if icing conditions do exist:

Power Lever	Flight Idle (FI)
Flaps	T/O

Use the abnormal flap position information from the main part of the AFM.

06
MASS AND BALANCE / EQUIPMENT

06-01 Moment Arms

Description

1 Moment Arms

Item	Lever Arm	
	[m]	[in]
Ice protection fluid tank	3.945	155.3

Table 1 Moment Arms

The mass (weight) of the ice protection fluid is obtained as follows:

- Multiply the fluid quantity in liters by 1.1 to obtain kilograms (kg), or
- Multiply the fluid quantity in US gallons by 9.2 to obtain pounds (lb), or
- Multiply the fluid quantity in US gallons by 4.16 to obtain kilograms (kg)

07
DESCRIPTION OF THE AIRPLANE AND ITS SYSTEMS

07-01 Engine Indicating

Description

1 ENGINE INSTRUMENTS

On the Garmin G1000 NXi MFD the ice protection fluid level indication is displayed on the engine page. Indication markings indicate (from left to right) 1/4, 1/2, 3/4 and full of the maximum fluid quantity of 8.3 US gal (31.4 liter).

Display when pushing the ENGINE softkey refer to Figure 1.

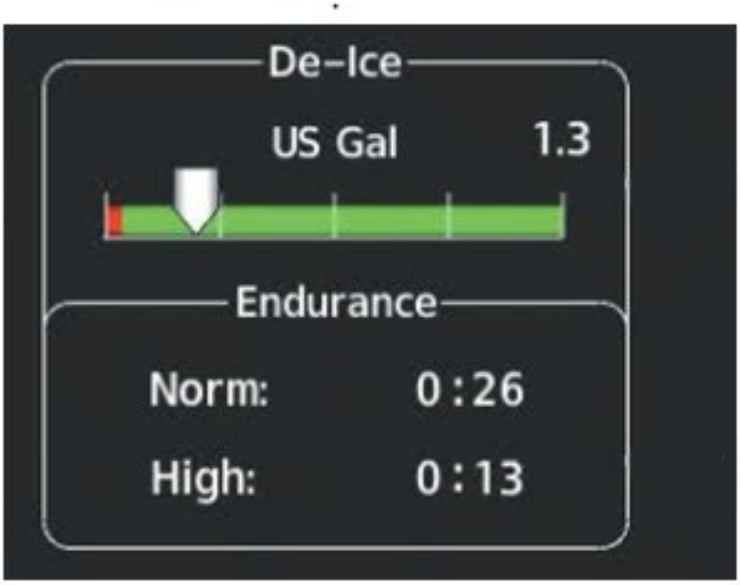

Figure 1 - Ice Protection Fluid Level Indication

07-02 Ice Protection System

Description

1 Ice Protection System Caution Alerts

CAS Message	Cause
DEIC PRES LO	System pressure upstream of the porous panels on the horizontal, vertical tail or RH wing is too low.
DEIC PRES HI	System pressure upstream of the ice protection fluid filter is too high.
DEIC LVL LO	Ice protection fluid level in the tank is below 1.85 US gal (7 liter)
PROP DE-ICE FAIL	Failure of electrothermal propeller de-ice.

Table 1 Ice Protection System Caution Alerts

07-03 Airframe and Windshield Ice Protection System

Description

1 AIRFRAME AND WINDSHIELD ICE PROTECTION SYSTEM

The ice protection system is electrically operated. It is supplied with power via the DE-ICE circuit breaker. The airframe and windshield IPS is fluid based and a so called Tecalemit-Kilfrost-Sheepbridge Stokes (TKS) system whereby a fluid acts as a freezing point depressant (FPD).

1 Airframe Ice Protection System

The fluid is distributed via a tubing system to each part of the aircraft structure (fuselage, wing, tail) necessary to be protected by preventing ice accretion during flight in FIKI condition. The core of the system are porous panels located on the leading edge of protected surfaces that are used to distribute the fluid to the skin of each surface. The fluid mixes with the accreting ice or freezing water decreasing the freezing point and therefore preventing formation and accretion of ice.

2 Windshield Ice Protection System

The windshield ice protection system consists of two spray nozzles that, on demand, spray fluid to the lower portions of the windshield. The fluid soaks into potential ice on the windshield and depresses the freezing point so the ice becomes liquid and is removed by aerodynamic forces.

2 System Overview

For the overview of the mechanical systems refer to Figure 2, for the overview of the electrical system refer to Figure 3.

Both systems draw fluid from a common tank.

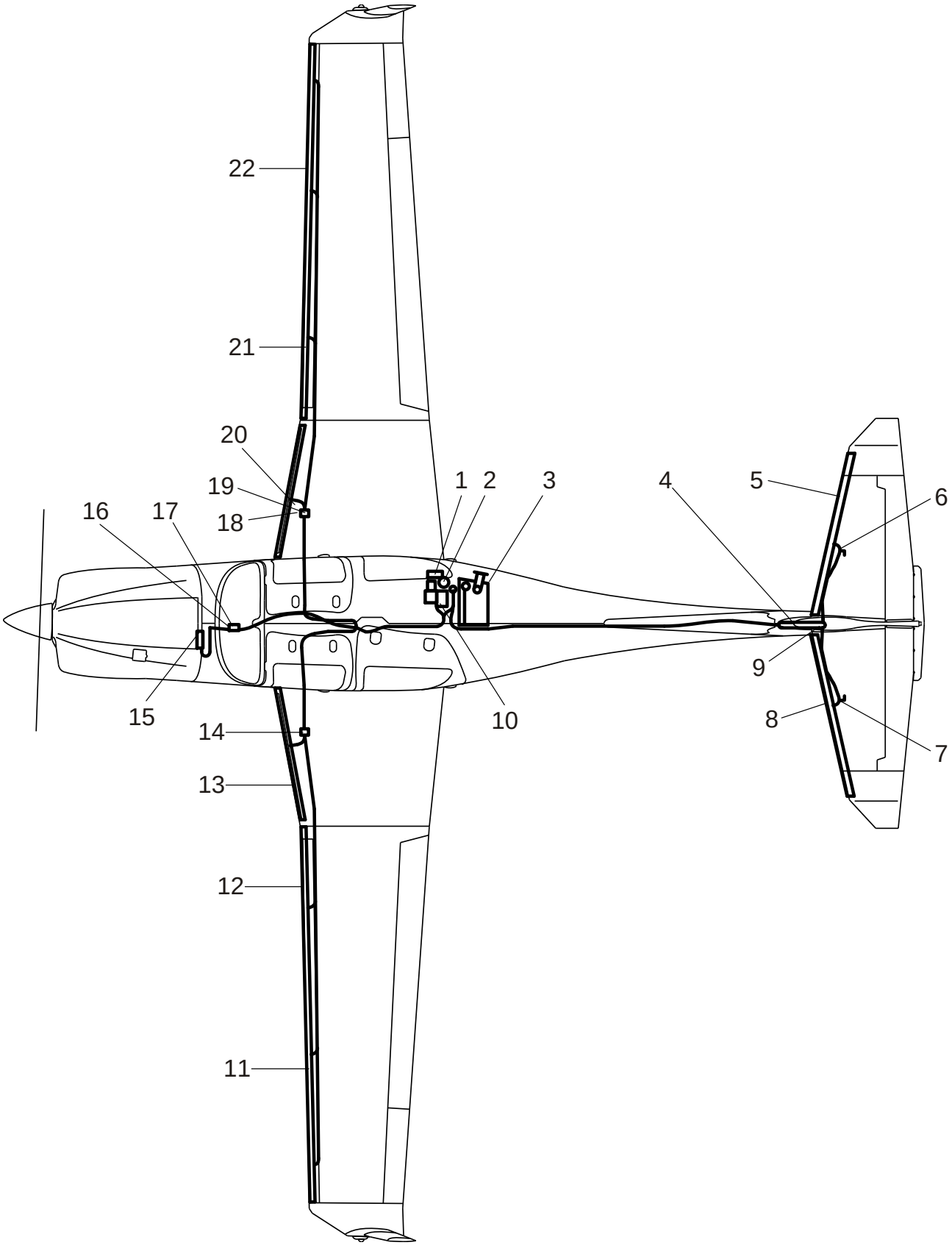

Figure 2 - Ice Protection System - Mechanical System Overview

Legend

[1, Fig.2]	HP Switch
[2, Fig.2]	Filter
[3, Fig.2]	TKS Fluid Tank
[4, Fig.2]	Vertical Tail Porous Panel
[5, Fig.2]	Horizontal Tail Porous Panel, RH
[6, Fig.2]	LP Switch, Horizontal Tail RH
[7, Fig.2]	LP Switch, Horizontal Tail LH
[8, Fig.2]	Horizontal Tail Porous Panel, LH
[9, Fig.2]	Tail Bracket Assy (LP Switch Vertical Tail and Proportioning Unit Empennage)
[10, Fig.2]	Metering Pumps
[11, Fig.2]	Porous Panel, Outboard Wing, LH
[12, Fig.2]	Porous Panel, Mid Wing, LH
[13, Fig.2]	Porous Panel, Center Wing, LH
[14, Fig.2]	Proportioning Unit, LH
[15, Fig.2]	Spray Nozzles
[16, Fig.2]	Windshield Pump
[17, Fig.2]	Solenoid Valve
[18, Fig.2]	LP Switch, Center Wing, RH
[19, Fig.2]	Proportioning Unit, RH
[20, Fig.2]	Porous Panel, Center Wing RH
[21, Fig.2]	Porous Panel, Mid Wing, RH
[22, Fig.2]	Porous Panel, Outboard Wing, RH

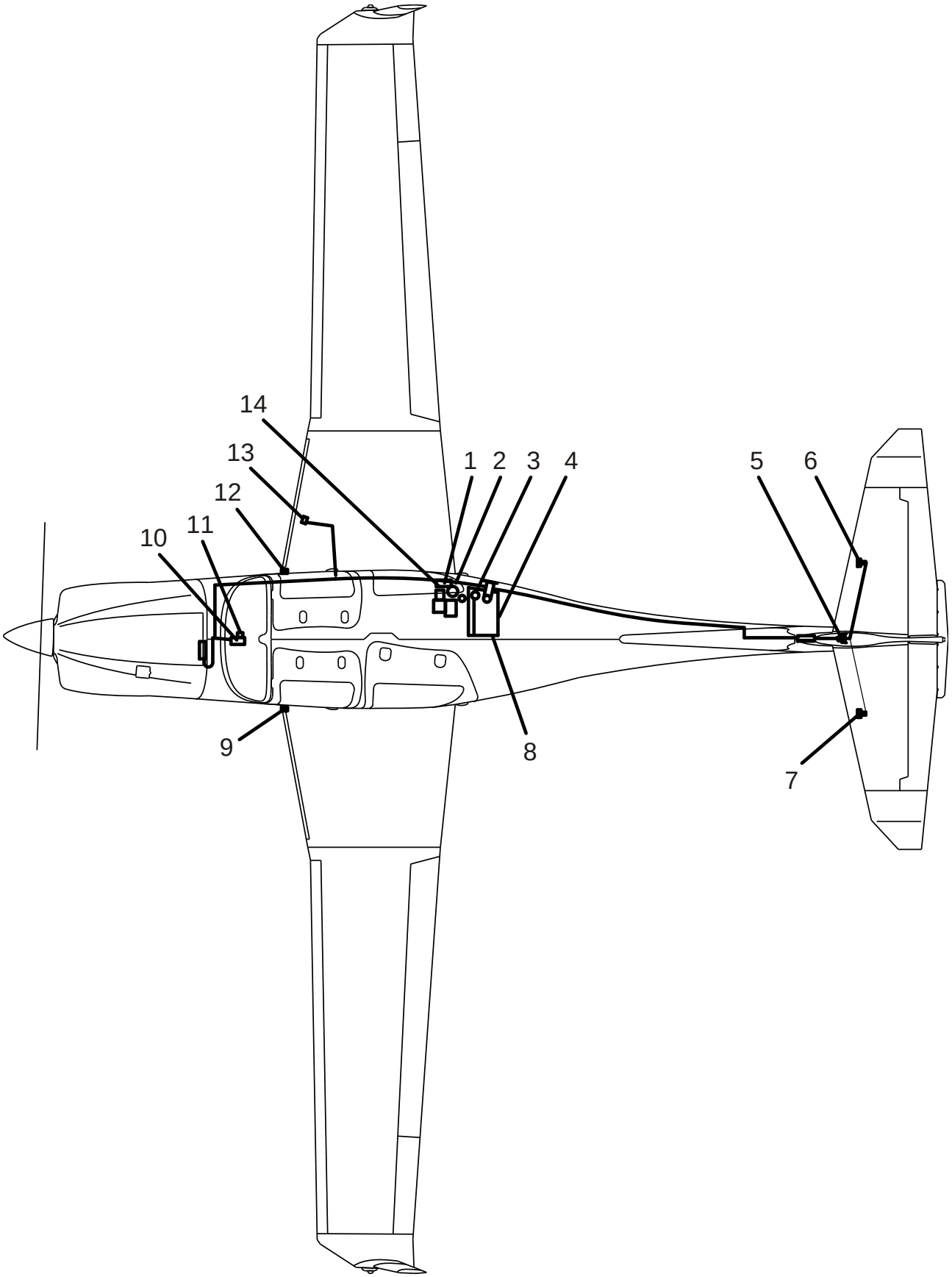

Figure 3 - Ice Protection System - Electrical System Overview

Legend

[1, Fig.3]	Control Box
[2, Fig.3]	Metering Pumps
[3, Fig.3]	Fluid Level Gauge
[4, Fig.3]	TKS Fluid Tank
[5, Fig.3]	Tail Bracket Assy (LP Switch Vertical Tail)
[6, Fig.3]	LP Switch, Horizontal Tail, RH
[7, Fig.3]	LP Switch, Horizontal Tail, LH
[8, Fig.3]	Low Fluid Level Switch
[9, Fig.3]	Ice Light, LH
[10, Fig.3]	Windshield Pump
[11, Fig.3]	Solenoid Valve
[12, Fig.3]	Ice Light, RH
[13, Fig.3]	LP Switch, Center Wing, RH
[14, Fig.3]	HP Switch

2.1 Airframe Ice Protection System - Main Components

The airframe ice protection system consists of the following main components:

- Ice protection fluid tank with an integrated filler neck, which has an inlet strainer. The tank has a maximum capacity of 8.3 US gal (31.4 liters), a useable volume of 8.2 US gal (31 liters) and is located within the aircraft fuselage in a designated compartment behind the rear seats.
  The ice protection fluid is glycol-based. It has an approx. mass density of 9.2 lb/US gal (4.16 kg/US gal / 1.1 kg/liter). A fluid level gauge provides data for ice protection fluid level indication on the G1000 NXi System.
  An independent low level sensor in the tank provides indication of low fluid level (below 1.85 US gal / 7 liter).
- Two main pumps, installed under a cover next to the ice protection fluid tank. The pumps take ice protection fluid from the tank and feed it to the airframe ice protection system (see below).
  - In the NORM mode both main pumps run simultaneously and are cycled on and off by the control box.
  - In the HIGH mode only the selected main pump runs continuously.
  - In the MAX mode both pumps run simultaneously and continuously for a duration of two minutes. The operation of the ice protection system is described below.
- One high pressure switch, installed between the metering pumps and the filter to identify high pressure conditions upstream the filter. Refer to 07-02 - Ice Protection System - Description.
- The ice protection fluid filter, installed next to the main pumps. The active main pump feeds the ice protection fluid through the filter to the proportioning units. The filters prevent the proportioning units from contamination.
- Proportioning units for wing panels (in the LH and RH center wing) and for the empennage (in the upper vertical tail). The proportioning units regulate the flow of ice protection fluid to the porous panels by means of capillaries.
- Four low pressure sensors which detect malfunctions of the system. Refer to 07-02 - Ice Protection System - Description.
- Porous Titanium panels are fitted to the leading edge of the wings, the vertical tail, and the horizontal tail. Each panel contains a porous membrane and a cavity along the porous front plate (active area) that serves as a reservoir. The porous panels weep the fluid at a low rate through fine holes.

2.2 Windshield Ice Protection System - Main Components

The windshield ice protection system consists of:

- One windshield de-icing pump with solenoid valve, installed in the middle tunnel between the pilot and co-pilot seat under an inspection lid on the LH side. The windshield de-icing pump supplies the fluid to spray nozzles.
- Two de-icing fluid spray nozzles for the windshield.

2.3 Electrical Systems of Airframe and Windshield Ice Protection System - Main Components

The electrical system of the airframe and windshield IPS consists of:

- An ice protection control box which is mounted next to the main pumps. The ice protection control box contains all necessary relays to operate and cycle the pumps.

- A de-ice panel, mounted on the LH side of the instrument panel, enables the complete control of the whole ice protection system.
- Two ice lights, one for each wing, are installed in the LH and RH doors to enable the pilot to identify icing conditions and to monitor adequate system performance on the wings in low lighting conditions.

3 Operation of the Airframe and Windshield Ice Protection System

The TKS airframe IPS is operated as anti ice system and must be activated if the aircraft is operated in visual moisture at an OAT lower than +5°C.

NOTE

The ice schedule of the stall warning system is automatically activated by the first activation of the airframe ice protection system if the wheels are off ground. Refer to paragraph 5 for a detailed description of the stall warning icing schedule.

The airframe ice protection system operation is designed for three different modes to be used depending on the severity of the icing conditions. The Normal, High and Max mode described below.

Operation and choice of system mode is done through four toggle switches and two push buttons located on the ice protection control unit in the LH section of the instrument panel. Refer to Figure 4.

The current operating mode is indicated by the following indication lights:

NORM	lower white light only
HIGH	center amber light only
MAX	both (top and center) amber lights

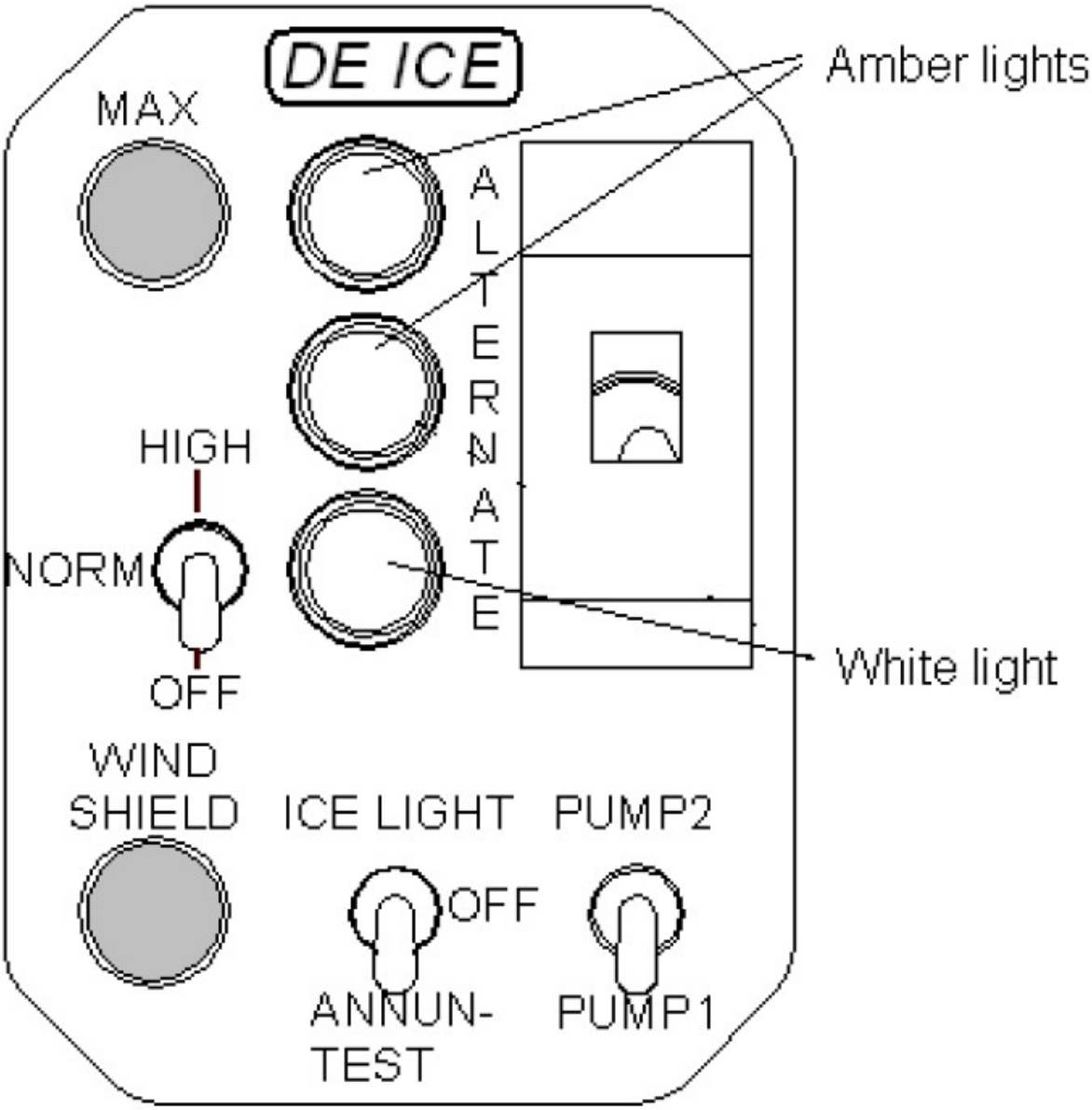

Figure 4 - Ice Protection Control Unit

3.1 OFF/NORM/HIGH Switch

The OFF/NORM/HIGH activates the airframe ice protection system and allows choice of the two constant system modes as described below.

- Down position: Airframe IPS OFF.
- Center position: The NORMAL mode is cycled 30 seconds active, 90 seconds inactive with both pumps in use resulting in 50% average design flowrate. The mode is to be used for the often encountered, but not very severe continuous maximum icing conditions. The NORMAL mode is selected when icing conditions (visible moisture and OAT < 5°C) are encountered and prior to ice formation. Maximum system fluid consumption is 3 US gal/h (11.3 liter/h). Conservative maximum system operating time is 2 hrs. 44 min.
- The HIGH mode is a constant mode with one (voted) metering pump active providing a constant flow rate. This mode is also called the “design mode” or 100% mode being reference for all design flow and pressure calculations. This mode is designed to cover all continuous maximum and most of the intermittent maximum icing conditions as defined by FAR 25 Appendix C, and is selected when icing conditions are more demanding. Maximum system fluid consumption is 6 US gal (22.6 liter/h). Conservative maximum system operating time is 1 hrs. 22 min.

3.2 MAX Push Button

The upper push button activates the MAX mode of the airframe ice protection system when the system is presently in the HIGH mode.

The MAX mode can be activated for 120 seconds having both metering pumps active providing a 200% design flowrate. This mode is used in case the HIGH mode is not sufficient for complete anti ice as are severe intermittent max encounters. Additionally, the MAX mode provides limited de-ice capabilities in case of delayed activation or conditions outside the envelope. Each activation consumes 0.4 US gal (1.5 liter).

3.3 PUMP1/PUMP2 Switch

A switch on the RH lower side of the IPS control panel selects one of the two main pumps if HIGH Mode is active.

3.4 ALTERNATE Switch

The ALTERNATE switch connects the main pump no. 2 directly to the ESSENTIAL BUS. Thus, in case of a total power loss of the main bus in icing conditions, operation of the ice protection system similar to the HIGH mode is possible.

3.5 ANNUN-TEST/OFF/ICE LIGHT

This switch activates the ice-lights or the annunciation test procedure. Refer to 04-03 - Pre-Flight Inspection - Cabin Check - Pre-operation procedure.

4 Replenishing

Refer to 02-06 - Ice Protection Fluids for System Operation - Description for approved ice protection fluids.

NOTE

The ice protection fluid must be considered for the mass and balance calculations. Refer to 06-01 - Moment Arms - Description.

Ice protection fluid is replenished through the filler which is located on the right hand side of the fuselage. The tank has a maximum capacity of 8.3 US gal (31.4 liter) and a usable capacity of 8.2 US gal (31 liter).

5 Stall Warning Ice Scheduling

Icing of aerodynamic surfaces can lead to an increase of the stall speed. Ice on unprotected surfaces might remain even after exit of the icing conditions.

To guarantee proper margin of the audible stall warning during a flight in, or following icing conditions, the stall warning automatically switches to an icing schedule upon activation of the airframe ice protection system (TKS). Due to possible residual ice accumulations on unprotected surfaces, the stall warning is latched in the icing schedule for the remainder of the flight, also after deactivation of the airframe ice protection system (TKS).

After deactivation of the airframe ice protection system, the icing schedule is reverted to the non-icing schedule, only when the wheels have contact with the ground (Weight on Wheels).

CAUTION

THE STALL WARNING SCHEDULE MAY BE REVERTED TO THE NON ICING SCHEDULE DURING A BALKED LANDING WITH POSSIBLE GROUND CONTACT OF THE WHEELS FOLLOWING A FLIGHT IN ICING CONDITIONS. TO ENSURE PROPER MARGINS FOR STALL WARNING IN THIS CASE, THE PILOT SHALL ACTIVATE THE AIRFRAME ICE PROTECTION SYSTEM FOR A SHORT TIME DURING GO AROUND WHEN IT IS ENSURED ALL WHEELS HAVE NO GROUND CONTACT.

07-04 Propeller Ice Protection System

Description

1 Propeller Ice Protection System

The electric propeller ice protection system functions on the principle of electric heating de-ice boots on the inner sections of the propeller. The heated pads increase the surface temperature of the propeller and reduce adhesion of ice, thus ice accumulating on the propeller blades when operating in icing conditions is periodically shedded due to centrifugal forces.

The ice protection system of the propeller is activated via an ON/OFF switch in the cockpit which supplies power from Alternator 2 bus to the timer box and a relay if the engine is running. Based on the outside air temperature the relay bypasses the timer box at temperatures below -10 °C (14 °F). The timed mode is required to prevent electric boots from overheating during ground use or at high OATs.

The power is transferred via electric brushes located on the mounting bracket at the front of the engine to a slip ring which is connected to the electrothermal de-icer boot on each propeller blade.

The current supplied to the brushes is measured and triggers the CAS message PROP DE-ICE FAIL of the Garmin 1000 NXi in case of low amperage. Refer to 07-02 - Ice Protection System - Description.

2 Propeller Ice Protection System - Main Components

The propeller ice protection system consists of the following main components:

- an electric timer box including an electric bypass
- a brush block assembly
- a slip ring assembly
- 3 propeller electrothermal de-icers with tapered heating distribution

3 Operation of the Propeller Ice Protection System

The propeller ice protection system must be activated if the aircraft is operated in visible moisture at or below an indicated outside air temperature of +5°C (41 °F).

The propeller ice protection system of the propeller is activated via the PROP DE-ICE switch in the cockpit which supplies power from Alternator 2 bus to the timer box and a relay if the engine is running. The switch is located on the lower left side of the I-panel.

Activation of the propeller de-ice is indicated by the Garmin G1000 NXi via the annunciation PROP DE-ICE ON.

08
AIRPLANE HANDLING, CARE AND MAINTENANCE

08-01 General

Description

1 AIRPLANE HANDLING, CARE, AND MAINTENANCE

The porous panels can be cleaned with soap and water using a clean, lint-free cloth. Isopropyl alcohol, ethyl alcohol, or methylated spirit may be used to remove oil or grease. Furthermore, approved ice protection fluids, AVGAS, and jet fuel are permitted for use on the panels. For further information, refer to Airplane Maintenance Manual Chapter 30.

WARNING

ICE PROTECTION FLUIDS ARE HARMFUL. FOR PROPER HANDLING, REFER TO THE MATERIAL SAFETY DATA SHEETS, WHICH ARE AVAILABLE FROM THE SUPPLIER OF THE ICE PROTECTION FLUID.

CAUTION

DO NOT APPLY POLISH OR WAX TO THE PANELS. CERTAIN SOLVENTS, PARTICULARLY METHYL ETHYL KETONE (MEK), ACETONE, LACQUER THINNER, AND OTHER TYPES OF THINNERS AND SOLVENTS DAMAGE THE INNER MEMBRANE OF THE PANELS. MASK ACTIVE AREA OF PANELS WITH A LOW TACK TAPE WHEN USING SOLVENTS, OR PAINTING THE AIRPLANE IN THE PROXIMITY OF THE PANELS, OR WHEN THE AIRPLANE IS STORED IN A DUSTY ENVIRONMENT.

NOTE

The ice protection system should be checked for excessive ice protection fluid leaks after each use. Due to the dihedral, small amounts of ice protection fluid can exit from the inner wing panels over a period of several days. Contamination precautions must be taken if the airplane is stored in a hangar.

08-02 Prolonged Out of Service or Ice Protection System Run Dry

Description

1 PROLONGED OUT OF SERVICE OR ICE PROTECTION SYSTEM RUN DRY

To avoid the need to reprime the system, and to provide a quick response when returned to service, maintain at least 0.5 US gal (2 liters) in the tank. To ensure that all system components are filled with fluid, operate the system at least once a month. If necessary, operate the pumps until all air is purged from components and pipelines.

1 Priming of the Main Pumps

The main pumps may not be self priming, and are primed, when required, by the operation of the windshield pump. The windshield pump will prime main pump 1 or 2.

08-03 Replenishment of the Ice Protection Fluid Tank

Description

1 REPLENISHMENT OF THE ICE PROTECTION FLUID TANK

For approved ice protection fluids, refer to 02-06 - Ice Protection Fluids for System Operation - Description. The ice protection fluid tank is located within the aircraft fuselage in a designated compartment behind the rear seats. The tank is connected to an external filler cap, mounted flush on the right hand side of the fuselage above the tank installation.

Always clean the filler of the fluid tank before replenishing. Secure the filler cap immediately after replenishment.