Carpatair

DE-ICING / ANTI-ICING MANUAL KRP-DAM

03rd Edition
Revision 3

Internal approval

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STATEMENT OF INITIAL APPROVAL

This manual complies with Romanian Civil Aviation Regulations Edition 02/2010. The content of this manual has been verified and it is subject of internal approval.

Nr. 25334
No.

SCRISOARE DE APROBARE
LETTER OF APPROVAL

Întrucât sunt îndeplinite cerințele Regulamentului (UE) nr. 965/2012 al Comisiei de stabilire a cerințelor tehnice și a procedurilor administrative referitoare la operațiunile aeriene,
Taking into account the fact that the requirements of Commission Regulation (EU) No. 965/2012 laying down technical requirements and administrative procedures related to air operations are satisfied,

Autoritatea Aeronautică Civilă Română aprobă:
Romanian Civil Aeronautical Authority approves:

1. procedura dezvoltată în Manualul de Operaţiuni - Partea A, capitolul 0.2.3, Ediţia 4/10.12.2018, care descrie modalitatea prin care CARPATAIR S.A. poate efectua schimbări fără aprobarea prealabilă a Autorităţii Aeronautice Civile Române.
   The procedure developed in Operations Manual - part A, Chapter 0.2.3, 4th Issue/10.12.2018, describing how CARPATAIR.

2. următoarele documente care fac parte din sistemul de manual de operațiuni al CARPATAIR S.A.:
   The following documents from operations manual system of CARPATAIR S.A.:

   - Partea A - Generalități/fundamente, Ediţia 4/10.12.2018, inclusiv Revizia 08/10.08.2021, împreună cu următoarele manuale asociate:
     - Manualul de proceduri pentru siguranța cabinei Ediția 3, Revizia 12/03.01.2019;
     - Manualul de degivrare/antigivrare Ediția 03, Revizia 03/22.10.2021;
     - Manualul de Monitorizare a Conformării CMM - scrisoare de aprobare specifică;
     - Manualul de Management al Siguranței - scrisoare de aprobare specifică;

     Part A – General/Basic 4th Issue/10.12.2018, up to Revision 08/10.08.2021, with the following associated manuals:
     - *Cabin Safety and Procedures Manual, 3rd Edition, Revision 12/03.01.2019;*
     - *De-Icing/Anti-Icing Manual 3rd Edition, Revision 03/22.10.2021;*
     - *Compliance Monitoring Manual– specific letter of approval;*
     - *Safety Management System Manual – specific letter of approval.*

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- Partea B – Aspecte legate de utilizarea aeronavei de tip F100, Ediţia 04/03.01.2019, inclusiv Revizia 01/25.04.2019;
  - Manualul echipamentului minim – scrisoare de aprobare specifică;

  Part B – Operating matters applicable to aircraft type F100, 4th Issue/03.01.2019, up to 1st Revision/25.04.2019;
  - *Minimum Equipment List – specific letter of approval;*

- Partea C – Instrucțiuni și informații privind rutele și aerodromurile, Ediţia 03/28.10.2014, inclusiv Revizia 02/15.08.2019;
  Part C – Route/role/area and aerodrome/operating site instructions and information, 3rd Issue/28.10.2014, up to Revision 02/15.08.2019;

- Partea D - Pregătire, Ediţia 04/28.10.2014, inclusiv Revizia 11/01.12.2020;
  Part D – Training, 4th Issue/28.10.2014, up to Revision 11/01.12.2020.

Orice schimbare care necesită aprobare prealabilă va fi transmisă la Autoritatea Aeronautică Civilă Română pentru analiză, aprobare şi amendarea documentului martor în termenele menţionate în Manualul de Operaţiuni - Partea A, capitolul 0.2.3, Ediţia 4/10.12.2018 al CARPATAIR S.A.
Any change requiring prior approval will be forwarded to Romanian Civil Aeronautical Authority for the analysis, approval and amendment of the master document within the time specified in Operations Manual - part A, Chapter 0.2.3, 4th Issue/10.12.2019 of CARPATAIR S.A..

În cazul în care se constată faptul că orice schimbare care nu necesită aprobarea prealabilă nu se conformează cu cerințele aplicabile, Autoritatea Aeronautică Civilă Română va solicita retragerea acesteia și restabilirea conformării.
If it is found that any change that does not require prior approval does not comply with the applicable requirements, Romanian Civil Aeronautical Authority will require its withdrawal and reestablishment of compliance.

(E-signed)

Director General

Nicolae STOICA

Record of Revisions

No.	3rd Edition. Revision Date	Inserted by
0	01 October 2018	AND BMI
1	25 October 2019	AND BMI
2	25 October 2020	BMI
3	22 October 2021	BMI
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DISTRIBUTION OF DOCUMENTATION / REVISION

HOLDER (ground department)

DC
ACCOUNTABLE MANAGER
NP FLIGHT OPERATIONS
COMPLIENCE MONITORING DIRECTOR
RCAA
SAFETY DIRECTOR
FSO
NP CONTINUING AIRWORTHINESS
NP GROUND OPERATIONS
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REVISION LETTER

Revision No. 3

Explanation:

… Exchange
ADD Add
DEL Delete

Action	Chapter	Title	Page	Date
…		**Record of Revisions**	1	22.10.2021
…		Revision Letter	1	22.10.2021
…		Table of Contents	1	22.10.2021
…		List of Effective Pages	1-6	22.10.2021
…		Section 2 APPLICATION GUIDELINES AND HOLDOVER TIMES TABLES	57	22.10.2021
…		2.1. FAA Holdover Time Guidelines for Winter 2021-2022	58-66	22.10.2021
…		2.3. Procedure Requiring Special Training and Authorization	67-71	22.10.2021
ADD		Section 4 DE-ICING / ANTI-ICING PROCEDURES FOR AIRBUS 319	91-114	22.10.2021

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List of Effective Pages

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Revisions Letter	1	3	22 October 2021
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	2	0	01 October 2018
1.2. Effectiveness	3	0	01 October 2018
1.3. Duties and Responsibilities	4	0	01 October 2018
	5	0	01 October 2018
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	9	1	25 October 2019
	10	1	25 October 2019
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SECTION 1

1.1 INTRODUCTION

This manual has been developed for all airline staff, handling agents, inspecting companies, etc., whoever is involved in the De-/Anti-Icing process of Carpatair aircraft. It represents the minimum requirements for De-/Anti-Icing of airplanes with fluids on ground.

The requirements of this publication are mandatory for all individuals who are involved in the handling of Carpatair aircraft, as long as no other regulations are issued by any other authority/ manufacturer, which overrule them.

A. In operation of Carpatair aircraft, a pilot shall not take off in an aircraft that has:

(a) frost, snow, slush or ice on any windshield or power plant installation or on airspeed, altimeter, rate of climb or flight altitude systems;

(b) snow, slush or ice on the wings or stabilizers or control surfaces, or any frost on stabilizers or control surfaces or on the upper surfaces of wings.

This standard represents the "Clean Aircraft Concept". Aircraft performance certification is based upon an aircraft having an uncontaminated or clean structure. For this reason, a contamination check of the aircraft surfaces must be performed prior to departure.

All critical and treated surfaces have to be clean from any contamination:

- Wings, tail and control surfaces, except frost on lower wing
- Pitot and static system, all other type of inlets and outlets especially engine inlets
- Fuselage, landing gear and landing gear area

Clean Aircraft Concept:
A commander shall not commence a flight unless the external surfaces are clean of any deposit which might adversely affect the performance and controllability of the aeroplane except permitted in the Airplane Flight Manual.

International standards have been approved and published to give correct operations during ground de-icing conditions. Brief descriptions of those standards are given below:

- ISO 11075 – minimum requirements for ISO type I fluid
- ISO 11076 – procedures and methods related to aircraft de/anti-icing
- ISO 11077 – minimum requirements for movable equipment used for aircraft de-icing
- ISO 11078 – minimum requirements for ISO type II anti-icing fluid
- SAE 6286B – Aircraft Ground De-icing/Anti-icing Training and Qualification Program
- SAE AS6285D – Aircraft Ground De-icing/Anti-Icing Processes
- FAA Holdover Time(HOT) Guidelines Winter 2021-2022
- FAA N8900 “Revised FAA-Approved De-icing Program Updates, Winter 2021-2022
- Aircraft Maintenance Manuals
- Fokker 10 Task 12-31-660-833-A
- AMM Airbus 319 Task 12-31-12-660-002-A-De-icing of the Aircraft in Power-Off Condition
- AMM Airbus 319 Task 12-31-11-660-001-A-Cold Weather Maintenance–Anti-Icing Protection
- AMM Airbus 319 Task 12-31-12-660-007-A- De-Icing of the Aircraft after a Landing with Snow on the Runway

Documents listed above have been used for preparation of this manual.

Exposure to weather conditions can cause accumulation of frost, snow, slush or ice on aircraft surfaces and components. Such deposits can seriously affect performance, control and stability of the aircraft and can cause mechanical damage. Such deposits also increase the aircraft weight. Clear ice can form on the upper surface of the wings when cold soaked fuel is in the wing fuel thanks and the

aircraft has been exposed to high humidity, rain, drizzle or fog, even when the ambient temperatures are well above the freezing point.

Snow or ice in engine nacelles, on fan blades, inlet guide vanes or ingested into the engines, can result in engine vibrations and engine stall, causing partial or total loss of engine thrust. Frozen deposits on the wings or landing gears can become loose and can cause serious damage to tail mounted engines or even total loss of engine thrust.

Contamination on wing leading edges and on wing upper surfaces disturb the airflow over the wings and cause decreased lift, increased drag, and a reduced stall margin.

If frozen deposits are present, other than those considered in the relevant manuals, the airworthiness of the aircraft may be invalid and no attempt should be made to fly the aircraft until it has been restored to the clean configuration.

B. This procedure provides the general minimum requirements for de-icing and anti-icing of aircraft on ground with fluids. The procedure is based on ISO and SAE standards.
However, aircraft ice inspections (contamination checks), clear ice inspections, and inspections after de-icing/anti-icing must be performed in accordance with the appropriate aircraft maintenance manual.

This procedure does not specify requirements for particular aircraft model types, and it does not overrule the specific requirements in the appropriate aircraft maintenance manuals or operation manuals. In case of conflict, the aircraft maintenance manual or operation manuals shall take precedence over this procedure.

C. De-icing by mechanical means, hot air or other alternate technology is not covered in this procedure. For this subject consult the appropriate aircraft maintenance manual. For aircraft de-icing with infrared technology, refer to SAE ARP 4737, section 6.2 for cautions and minimum requirements.
For aircraft de-icing with forced air technology, refer to SAE ARD 50102 for cautions and minimum requirements.

D. In several steps, this procedure refers to aircraft maintenance manuals. For aircraft of Carpatair, the relevant paragraphs of the aircraft maintenance manual are added to the DAM as Section 3.

E. The De-/Anti-Icing Manual (KRP-DAM 01) is subject to annual reviewing. However, should significant changes in procedures occur at shorter intervals, the Manual is revised accordingly, irrespective of the time interval passed from the last revision.

1.2. EFFECTIVENESS

The procedures comprised in this Manual are effective for all de-icing/anti-icing operations on ground performed on aircraft of Carpatair. However, the procedures do not cover inspection / check procedures in all details, and they do not cover cockpit procedures.

NOTE: The de-icing/anti-icing operations, related checks and quality assurance are covered by a contracted party (handling agents) which clearly assigns the duties and responsibilities (according to the existent contracts). It should be noted that the Post De-icing/Anti-icing Check is not performed by some handling companies; in such a case, a separate contract is needed for this check.

The responsibility to maintain de-icing/anti-icing manual is assigned to the person administering documentary matters at Ground Operations Department. In order to maintain this manual up-to-date, Maintenance Department and Flight Operations Department are obliged to make available any information and data which ensure the maintenance of up-to-date conditions.

1.3. DUTIES AND RESPONSIBILITIES

The authority to decide whether a de-icing/anti-icing treatment is necessary lies with the Commander.

The person responsible for the departure check shall check the aircraft for frost, snow, slush or ice, in accordance with the appropriate airframe manufacturer manuals, Operations Manual Part 8 and carrier requirements (see paragraph 1.6.).

The basket operator (de-icer, sprayer) is responsible for the performance and the control of the de-icing/anti-icing treatment.

The authorised person (handling/contracted agent) who releases the aircraft is responsible for reporting the performed treatment, including verification and reporting of the Anti-icing Code, to the Commander (for hangar releases special procedures may be required). The person who reports the Anti-icing Code to the Commander must be sure that the Post De-icing/Anti-icing Check has been performed.

The responsibility for accepting the aircraft with the performed de-icing/anti-icing treatment lies with the Commander.

Commander

The decision regarding de-ice and anti-ice treatment is usually made by ground personnel. If any doubts exist, the captain and ground crew should discuss the need together. The captain must take into account the different factors affecting the requirements for treatment.

The pilot-in-command should make his judgement based on the existing weather forecast, the actual or expected contamination, take-off time, taxi time, and holdover time.

The commander is responsible for the decision to perform **de-/anti-icing**.

The commander informs the service provider about the procedures (1-step or 2-step) to be used and about all surfaces to be treated with anti-icing fluid.

The commander decides about the mixture ratio for **anti-icing**. He has to make sure that the relevant surfaces remain free of frost, ice, slush and snow until take-off and will assume responsibility for the anti-icing condition of the aircraft before take-off.

The commander may only accept the airplane after receiving the anti-icing code including time of the beginning of the treatment from the staff who is responsible for the inspection after de-/anti-icing. He must enter the Anti-icing Code into the Technical Log Book (TLB) or equivalent.

The commander shall not commence take-off unless the external surfaces are clear of any deposit which might adversely affect the performance and/or controllability of the aeroplane except as permitted in the Airplane Flight Manual.

Final decision. The Commander has the final decision. His evaluation will override the judgments of ground staff and may include additional instructions. However, if ground personnel report contamination (for example clear ice etc.) on aircraft surfaces, this contamination must be removed before take-off.

If the runway is not free of snow, ice, slush or frost, the PIC may perform one additional cycle of landing gear up/down. It has been proven that the deposits remaining in the landing gear bay are removed after one additional cycle.

Recent research showed that when thickened aircraft anti-icing fluid came in contact with minimal amounts of runway de-icing fluids, anti-icing protection provided by the aircraft anti-icing fluid could be diminished. The separation of the thickening agents in this fluid consequently reduce holdover time.

This can occur when fluids from the runway are splashed onto the wing by the nose gear wheels or from the use of engine thrust reversers at landing prior to when the aircraft is anti-iced using a one-step process as protection for the next flight. Additional tests also showed that when using a two-step de/anti-icing process, the application of the first step cleans off the contamination from the runway de-icing fluid so that the anti-ice protection provided with the second step is not affected by the runway de-icing fluids. Therefore, it is recommended that de/anti-icing applications be performed using a two-step process.

Service Provider

- Shall have aircraft de-icing/anti-icing procedures, including a quality control program
- Maintain vehicles/ equipment, fluids, training and procedures in accordance with this manual and the relevant specifications
- Shall use suitable de-icing/anti-icing equipment
- Shall use only certified fluids
- Shall have qualified staff to co-ordinate and supervise the de-icing/anti-icing treatments

The staff responsible for inspection after de-/anti-icing or supervision has to ensure that the de-/anti-icing has been done in accordance with this procedure, that all relevant surfaces are free of snow, ice, slush and frost at dispatch and has to report the anti-icing code including time of the beginning of the treatment to the commander.

The provider has to support audits performed either by Carpatair or by its nominees.

- Shall have documentation of all de-icing/anti-icing treatments
- Shall have personnel safety arrangements and environmental arrangements
- Shall have a protocol for communications with cockpit crew for both gate and remote locations (if applicable)

Performance tasks

Provider of De-icing/ Anti-icing Services (Performance) needs to:

- Maintain vehicles/ equipment, fluids, training and procedures in accordance with this manual and the relevant specifications
- Ensure that the fluid quality is within the limits determined by the fluid manufacturer.
- Assume responsibility for the correct and complete and in time accomplishment of the De-icing/ Anti-icing of the aircraft.
- Make sure that the personnel performing the De-icing/ Anti-icing operation works in accordance with the requirements detailed in this manual.
- Observe the relevant freezing point, the lowest operational use temperature, and aircraft limitations of the fluid.
- Make sure that Carpatair has full access to the provider’s fluid quality records and training program and records.

Post De-icing/ Anti-icing Check

Staff performing Post De/Anti-Icing needs to:

- Make sure that the aircraft has been de-iced/ anti-iced in accordance with the requirements detailed in this manual.
- Make sure that the surfaces mentioned in Section 3 are free of frost, slush, ice, and snow in accordance with the 'Clean Aircraft Concept' before they report the Anti-icing Code to the Commander.

- Report the Anti-icing Code to the Commander. This confirms the correct and complete accomplishment of the De-icing/ Anti-icing of the aircraft and transfers the responsibility for the condition of the aircraft before take-off to the Commander.
- Make sure that Carpatair has full access to their training program and records.

Inspection Staff – Supervision

The inspection staff (or supervision) is responsible for the **post de-/anti-icing check** and the **clean wing check**. The post de-/anti-icing check has to be performed by an aircraft-engineer or the service provider. The clean wing check has to be performed either by an aircraft-engineer or by special trained ground staff.

This check may also be performed by the commander (if neither an engineer nor licensed ground staff is available).

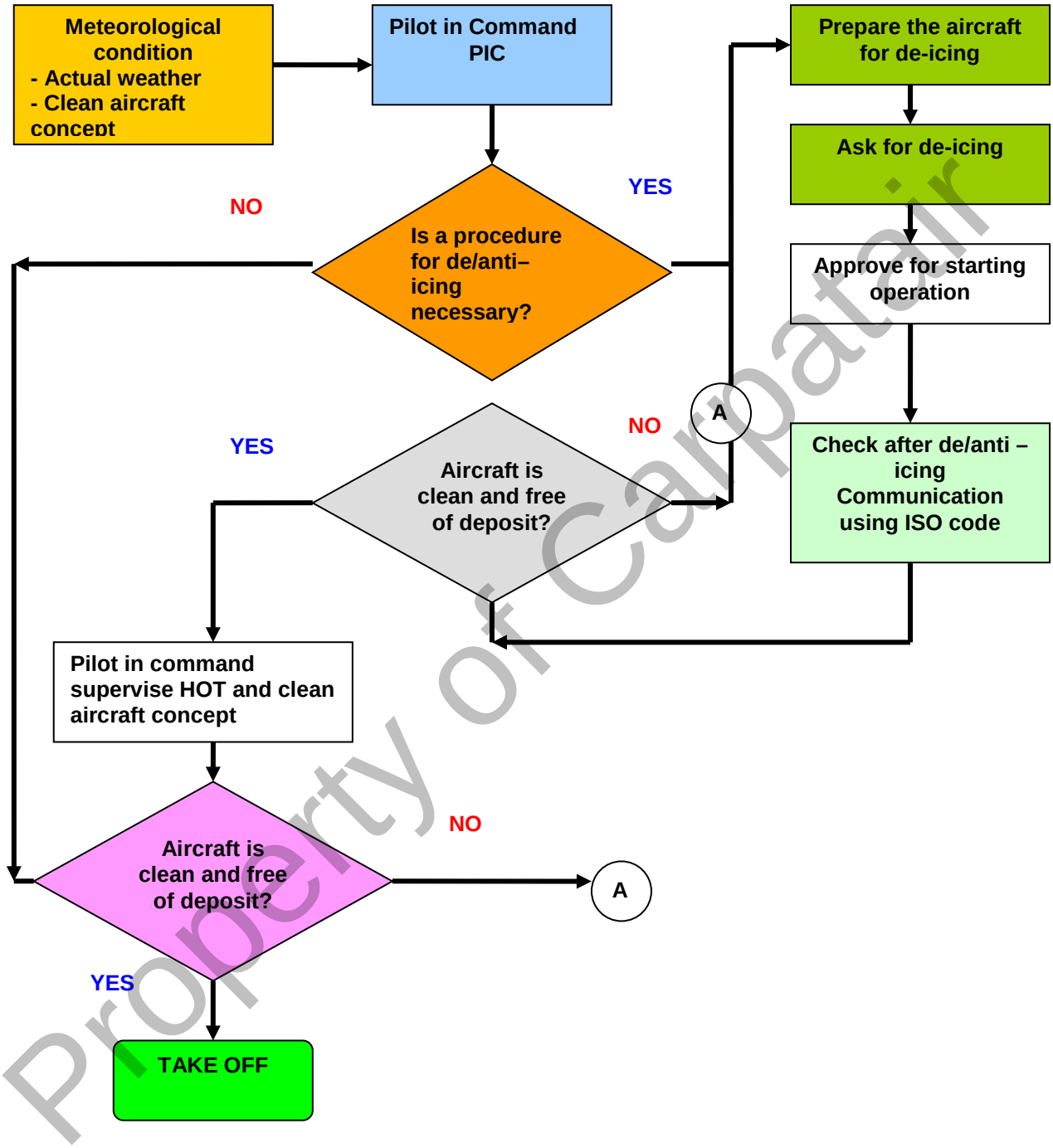
Employers are obligated to:

a) Investigate, record and report accidents, occupational diseases or other hazardous occurrences affecting employees;

b) Telephone or telex the safety officer within 24 hours where the occurrence results in: death, disabling injury to two or more, loss of body member or loss of usefulness, permanent impairment of body function, explosion, or damage to elevating device or freefall of the elevating device;

c) Provide written report immediately to the safety officer where the occurrence resulted in: disabling injury, electric shock, and/or oxygen deficient atmosphere, implementation of emergency procedures or fire or explosion.

Procedures for De-/Anti-Icing



1.4. DEFINITIONS

Cold weather conditions exist when the temperature falls below the freezing point. When the low temperature is accompanied by any form of moisture like rain, sleet, snow or even condensation, the cold weather conditions change into icing conditions.

Active frost: A condition when frost is forming. During active frost conditions, frost will form on an unprotected surface or re-form on a surface protected with de/anti-icing fluid where the holdover time has expired.
Frost forms whenever the exposed surface temperature cools below OAT to, or below, the frost point (not dew point). The mechanisms for cooling include:
1. radiation cooling; or
2. conductive cooling (due to cold soaked fuel).

Active frost occurs when aircraft surface temperature is:
- at or below 0 °C and
- at or below dew point.

Once formed, residual accreted frost may remain after the active frost phase if the exposed surface temperature remains below freezing.

Adhering to: Any contamination shall be considered as adhering to an aircraft critical surface.

Anti-icing: Precautionary procedure which provides protection against the formation of frost or ice and accumulation of snow or slush on treated surfaces of the aircraft for a limited period of time (holdover time).

Anti-icing fluids: Anti-icing fluids are
a. Mixture of water and Type I fluid;
b. Premix Type I fluid;
c. Type II fluid, Type III fluid, or Type IV fluid;
d. Mixture of water and Type II fluid, Type III fluid, or Type IV fluid.
NOTE: Fluids mentioned in (a) and (b) shall be heated to ensure a temperature of 60 °C minimum at the nozzle.

SAE Type II and IV fluids for anti-icing are normally applied unheated on clean aircraft surfaces but may be applied heated. SAE Type III fluids for anti-icing may be applied heated or unheated on clean aircraft surfaces.

Anti-icing code: This code is given to the flight crew/Pilot in Command that De-icing/anti-icing has been carried out and the details of the anti-icing treatment that was applied.

Anti-icing fluids are normally applied unheated on clean aircraft surfaces, but may be applied heated.

Check: An examination of an item against a relevant standard by a trained and qualified person.

Clear Ice: A coating of ice, generally clear and smooth, but with some air pockets. It is formed on exposed objects at or below or slightly above the freezing temperature by freezing of super cooled drizzle, droplets or raindrops.

Clear ice may form on the wings if the fuel temperature is below freezing point and the aircraft is subject to precipitation, even if the outside temperature is as high as 15 °C or more.

Cold soaked wings / cold-soak effect: The wings of aircraft are said to be "cold-soaked" when they contain very cold fuel as a result of having just landed after a flight at high altitude or from having been re-fuelled with very cold fuel. Whenever precipitation falls on a cold-soaked aircraft when on the

ground, clear icing may occur. Even in ambient temperatures between -2 °C and more than +15 °C, ice or frost can form in the presence of visible moisture or high humidity if the aircraft structure remains at 0 °C or below.
Clear ice is very difficult to detect visually and may break loose during or after takeoff. The following factors contribute to cold-soaking: temperature and quantity of fuel in fuel cells, type and location of fuel cells, length of time at high altitude flights, temperature of refueled fuel, and time since refueling.

Cold Soaking: Ice can form even when the outside air temperature (OAT) is well above 0 °C. An aircraft equipped with wing fuel tanks may have fuel that is at a sufficiently low temperature such that it lowers the wing skin temperature to below the freezing point of water. If an aircraft has been at a high altitude, where cold temperature prevails, for a period of time, the aircrafts' major structural components such as the wing, tail, and fuselage will assume the lower temperature, which will often be below the freezing point. This phenomenon is known as cold soaking. While on the ground, the cold soaked aircraft will cause ice to form when liquid water, either as condensation from the atmosphere or as rain, comes in contact with cold soaked surfaces.

Cold soaked clear ice: This is the formation of ice, normally in the area of the wing fuel tanks, caused by the cold soak effect. Clear ice is very difficult to be detected visually and may break loose during or after takeoff, and poses a hazard particularly to aircraft with rear fuselage mounted engines like F100.

Cold soaked fuel frost: This is the formation of frost, normally in the area of the wing fuel tanks, caused by the cold soak effect.

Cold soaked wing ice/frost: Water, visible moisture, or humidity forming ice or frost on the wing surface, when the temperature of the aircraft wing surface is at or below 0 °C.

Contamination: contamination in this document is understood as all forms of frozen or semi-frozen moisture such as frost, snow, ice or slush.

Contamination check: check of aircraft surfaces for contamination to establish the need for de-icing.

Critical surfaces: surfaces of the aircraft which shall be completely free of ice, snow, slush or frost prior to take off. The critical surfaces include the wings, leading edges, horizontal and vertical stabilizers, ailerons, rudder(s), elevators, spoilers, slats, flaps, fuselage, engine nacelles and inlets. The critical surfaces shall be determined by the aircraft manufacturer; refer to aircraft maintenance manual.

De-icing: Procedure by which frost, ice, snow or slush is removed from an aircraft in order to provide uncontaminated surfaces.

De-icing/anti-icing: is a combination of or referring to both of the procedures for de-icing and anti-icing. It can be performed in one or two steps.

De-icing service provider: Company responsible for the aircraft De-icing/anti-icing operations on an airfield.

De-icing fluid: De-icing fluids are
a. Heated water;
b. Heated mixture of water and Type I fluid;
c. Heated premix Type I fluid;
d. Heated Type II, Type III, or Type IV fluid;
e. Heated mixture of water and Type II, Type III, or Type IV fluid.

- NOTE: Unheated fluids are ineffective to deice
- De-icing fluid is normally applied heated in order to assure maximum efficiency.

Dew Point and Frost Point
The dew point is the temperature at a given pressure to which air must be cooled to cause saturation. The dew point can occur below or above 0°C.

The frost point is the temperature, at or below 0°C, at which moisture in the air will undergo deposition as a layer of frost on an exposed surface. The frost point occurs between the OAT and dew point.

METAR does not report frost point, however it does report dew point. The frost point is higher (warmer) than the dew point for a given humidity in the air. The frost point and the dew point are the same at 0ºC; at a dew point of -40ºC, the frost point is 3.2ºC warmer (-36.8ºC).

FP: freezing point.

Freezing conditions: Conditions in which the outside air temperature (OAT) is below 6 °C and either the difference between dew point temperature and OAT is less than 3 °C or visible moisture in any form (such as fog with horizontal visibility below 1, 5 km, drizzle, rain, snow, sleet, rain and snow mixed, ice crystals) is present, or standing water, slush, ice or snow is present on the runway.

Freezing drizzle: Fairly uniform precipitation composed exclusively of fine drops (diameter less than 0.5 mm (0.02 in)) very close together which freezes upon impact with the ground or other exposed objects.

Freezing fog: A suspension of numerous tiny water droplets which freezes upon impact with ground or other exposed objects, generally reducing the horizontal visibility at the earth's surface to less than 1km (5/8 mile).

Freezing precipitation: Freezing rain or freezing drizzle.

Frost/Hoar Frost: Ice crystals that form from ice saturated air at temperatures below 0 °C by direct sublimation on the ground or other exposed objects.

Hail: Precipitation of small balls or pieces of ice with a diameter ranging from 5 to >50 mm (0.2 to >2.0 inch) falling either separately or agglomerated.

High Speed Test: The High Speed Aerodynamic test establishes the aerodynamic flow off requirements for fluids used to deice or anti-ice large transport jet aircraft with rotation speeds generally exceeding 100 to 110 knots and with ground acceleration to lift of times exceeding 23 seconds.

Some slow take off speed aircraft manufacturers have allowed the use of fluids designed for high-speed aircraft on their models. There are often changes required to take off procedures, to take off configuration or to both. The aircraft manufacturer must be consulted.

Holdover time: Estimated time for which an anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the protected surfaces of an aircraft.

Ice pellets/small hail: Precipitation of transparent (grains of ice), or translucent (small hail) pellets of ice, which are spherical or irregular, and which have a diameter of 5 mm (0.2 inch) or less. The pellets of ice usually bounce when hitting hard ground.

Light freezing rain: Precipitation of liquid water particles which freezes upon impact with the ground or other exposed objects, either in the form of drops of more than 0.5 mm (0.02 in) or smaller drops which, in contrast to drizzle, are widely separated. Measured intensity of liquid water particles is up to 2.5 mm or 25 grams/dm_2/hour (0.10 inch/hour) with a maximum of 0.25 mm (0.01 inch) in 6 minutes.

Local Frost Prevention in Cold Soaked Wing Areas: Procedure to prevent local frost formation on critical wing tank areas under certain specific conditions. See paragraph 1.8.F.

Low Speed Test: The Low Speed Aerodynamic test establishes the aerodynamic flow off requirements for fluids used to deice or anti-ice slower aircraft whose take off rotation speeds generally exceed 60 knots and with ground acceleration to rotation time exceeding 16 seconds.

Lowest on-wing viscosity (LOWV): lowest viscosity of a deicing/anti-icing fluid for which the applicable holdover time table can still be used.

Lowest Operational Use Temperature (LOUT): The higher (warmer) of:
The lowest temperature at which the fluid meets the aerodynamic acceptance test (according to AS5900) for a given type (high speed or low speed) of aircraft, or,

- The freezing point of the fluid plus the buffer of 10 °C for Type I fluid and 7 °C for Type II, III, or IV fluids.
  For applicable values, refer to the fluid manufacturer's documentation.

Heavy freezing rain: Precipitation of liquid water particles which freezes upon impact with the ground or other exposed objects. Heavy freezing rain can seem to fall in sheets and individual drops may not be identifiable. Heavy freezing rain has a measured intensity of more than 0.30in/h.

Moderate freezing rain: Precipitation of liquid water particles which freezes upon impact with the ground or other exposed objects. Moderate freezing rain can seem to fall in sheets and individual drops may not be identifiable. Heavy freezing rain has a measured intensity of between 0.10 to 0.30in/h.

Negative buffer: A negative buffer exists when the freezing point of a De-icing fluid is above the OAT

Proximity sensor: A proximity sensor is a safety feature on some models of De-icing equipment, that upon activation disengages relevant systems, preventing equipment movement and damage from occurring due to physical contact between equipment components (e.g., spray nozzle, forced air nozzle, operator basket, etc.,) and aircraft surfaces. As a safety mechanism, the proximity sensor is designed to prevent damage from occurring to aircraft surfaces, normally while the equipment chassis is in a stationary position (not maneuvering). Where equipped, the type of sensor used may vary by design, and may activate either by physical contact (e.g., a proximity switch with contact mechanism), or by non-physical activation (e.g., infrared, radar, etc.).

Refractive index: Refractive index is the comparative speed of light in different transparent media. The difference in this speed leads to refraction (bending of the light) which can be used to measure the composition of the media. In the case of water and glycol mixture, this refraction can be used to accurately determine the percentage of glycol in the water.

Qualified staff: Trained staff who have passed theoretical and practical training tests and have been certified for performing this type of job, see AS6286A training and qualification program.

Refractometer: An optical instrument designed to measure the refractive index of water soluble fluids.

Residue/Gel: A buildup of dried out thickened fluids typically found in aerodynamically quiet areas of the aircraft.

Just as an aircraft has a specific operating envelope within which it is approved to be operated, de/anti-icing fluids are also tested and qualified for operation within a specific temperature envelope. The qualification of de/anti-icing fluids, also called freezing point depressants (FPD), is a complex and thorough process, which evaluates a multitude of fluid properties and characteristics. The one of particular interest in this case is the lowest operational use temperature (LOUT). The LOUT is fluid concentration specific. The fluid concentration may change if the fluid is subjected to sustained heating.

The LOUT for a given fluid is the higher of:

- The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type, or
- The actual freezing point of the fluid plus its freezing point buffer of 10°C, for a Type I fluid, and 7°C for a Type II or IV fluid.

NOTE: Manufacturers state that a fluid must not be used when the outside air temperature or skin temperature is below the LOUT of the fluid.
An example of establishing an LOUT:
A Type I fluid that has met the aerodynamics acceptance test down to -45°C.
The reported freezing point of the fluid (as measured by the de-icing Operator) is -43°C. The OAT is -39°C.
Can this fluid be used to de-ice the aircraft under these conditions?
Answer:
The LOUT for a given fluid is the higher of:
The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type, in this case -45°C; or
The actual freezing point of the fluid plus a freezing point buffer of 10°C, in this case -43°C + 10°C = -33°C.
The LOUT is -33°C and since the OAT is -39°C, this fluid as is, can't be used.

Moderate and heavy freezing rain: Precipitation of liquid water particles which freezes upon impact with the ground or other exposed objects, either in the form of drops of more than 0.5 mm (0.02 inch) or smaller drops which, in contrast to drizzle, are widely separated. Measured intensity of liquid water particles is more than 2.5 mm/hour (0.10 inch/hour) or 25 grams/dm^2/hour.

OAT: Outside air temperature.

One-step de-icing/anti-icing: is performed with an anti-icing fluid. The heated fluid used to deice the aircraft remains on aircraft surfaces to provide limited anti-icing capability. For details see paragraph 1.8.B. (1).

Post de-icing/anti-icing check: A visual check after de-icing/anti-icing treatment covering all critical parts of the aircraft and performed from points offering sufficient visibility of these parts (e.g. from the de-icer itself or another elevated piece of equipment) to ensure that these parts are free from any frost, ice, snow, or slush.

Preflight Contamination Check: A check performed by ground crew to determine if the aircraft requires de-icing and/or anti-icing, or if anti-icing has failed and the aircraft needs re-treatment. Pre-takeoff is not used because this can be confused with the pilot pre-takeoff checks. Maintenance or on-aircraft activity up to the pilot handover is generally termed preflight, activity after pilot handover is normally performed by flight crew and generally termed pre-takeoff.

Pre-Take off Check: A check performed by the Commander prior to take off to assess whether the applied holdover time is still appropriate. For details, see paragraph 1.12.A.

Pre-Take off Contamination Check: A check of the critical surfaces for contamination. For details see paragraph 1.12.B.

Radiation Cooling
Radiation cooling will generally occur during clear sky (i.e. SKC, high FEW or high SCT), low wind (i.e. less than 10 knots), and low light (i.e. shade, at night or in low angle / obscured sun) conditions. These conditions will cause the exposed surface temperature to cool below the OAT. Once the exposed surface temperature cools to the frost point or below, active frost occurs.

Certain surface finishes and material compositions may be more susceptible to radiation cooling, and as a result, different areas of an aircraft may begin to accrete frost at different times. Radiation cooling

can cause an exposed surface to cool several degrees below the OAT, therefore frost can form on an exposed surface at an OAT several degrees above 0°C.
Depending on conditions, time to frost formation may range from minutes to hours. As a result, a surface that appears free of frost during an early inspection may become contaminated later. When

conditions are favourable for active frost formation, a direct inspection of critical surfaces conducted as close as possible to the departure time is recommended.

Rain or high humidity on cold soaked wing: Water forming ice or frost on the wing surface, when the temperature of the aircraft wing surface is at or below 0 °C.

Rain and snow, mixed: Precipitation in the form of a mixture of rain and snow. For operation in light rain and snow treat as light freezing rain.

Rime ice: small frozen water droplets, spherical opaque/milky granular appearance looking similar to frost in a freezer. Typically rime ice has low adhesion to the surface and its surrounding rime ice particles.

Representative surfaces: Aircraft surfaces may be identified which the flight crew can readily observe to determine whether or not ice, frost, slush or snow is accumulating or forming on that surface.

Slush: Snow or ice that has been reduced to a soft watery mixture by rain, warm temperature and/or chemical treatment.

Snow: Precipitation of ice crystals, most of which are branched, star-shaped, or mixed with un-branched crystals. At temperatures higher than -5 °C, the crystals are generally agglomerated into snowflakes.

Snow grains: Precipitation of very small white and opaque particles of ice that are fairly flat or elongated with a diameter of less than 1 mm (0.04 in.). When snow grains hit hard ground, they do not bounce or shatter.

Snow pellets: Precipitation of white and opaque grains of ice. These grains are spherical or sometimes conical; their diameter is about 2-5 mm (0.08-0.2 in.). Snow pellets are brittle, easily crushed; they bounce and break on hard ground.

Two step de-icing/anti-icing: Consists of two distinct steps. See under “De-icing/anti-icing”, and for details see paragraph 1.8.B. (2).

Storage tank: A vessel for holding fluid that can be fixed, or mobile; includes rolling tanks (ISO tanks), totes, trailers, or drums.

Tactile check: A tactile check requires a person to touch specific aircraft surfaces. Tactile checks, under certain circumstances, may be the only way of confirming the critical surfaces of an aircraft are not contaminated. For some aircraft, tactile checks are mandatory as part of the De-icing/anti-icing check process to ensure the critical surfaces are free of frozen contaminants.

1.5. FLUIDS

Generalities

There are two principal classes of anti-ice fluids known as unthickened and thickened fluids. More commonly, they are called TYPE ONE and TYPE TWO or TYPE FOUR fluids.
Type one fluid is most commonly used for de-icing. When it is used for anti-icing, you must remember that it has only a very limited holdover time.
Type two and type four fluids are used mainly for anti-icing purposes and they have a longer hold over time than type one fluid.
The fluids are not classified as harmful. They might slightly irritate eyes and skin. Inhaling of the spray or fumes should be avoided.

Different factors can affect the holdover time. Heavy precipitation will cause the anti-icing fluid to be diluted with water quickly and the fluid freezing temperature will rise accordingly. You should remember that the water content of the snow is the most important factor. Wet snow dilutes the fluid faster than dry snow.

When the outside air temperature or the aircraft surface temperature falls, the margin to the freezing temperature gets smaller thus decreasing the holdover time. Remember that in some cases the aircraft skin temperature may be considerably lower than the outside air temperature. Type two and type four fluid viscosity decreases with increasing speed and the fluid will run off the wing during the take off if the speed is high enough. For this reason, the use of type two fluid in 100 percent concentration or 75 % mixture is limited to aircraft with the rotation speed higher than 85 knots. For type four, the rotation speed must be above 100 knots.
High winds or even jet blasts will reduce thickness of the anti-ice fluid layer or blow it off the wing.

A. Types of Fluids

Type I Type II Type IV

(1) ISO / SAE Type I Fluids
(Reference: ISO 11075; AMS 1424)

Un-thickened fluid whose viscosity is shear independent. Contains a minimum of 80 % by weight of glycols. The freezing point of the type I fluid mixture used for either one-step de-icing/anti-icing or as a second step in the two-step operation shall be at least 10 °C below the outside temperature. The fluid must have demonstrated acceptable aerodynamic performance. Increasing the concentration of fluid in the fluid/water mix does not provide any extension in holdover time.
Type I fluids give a rather limited holdover time and in precipitation conditions they are preferably used for de-icing only.
Since the viscosity of Type One fluid is lower than that of type two or type four fluids, it will form only a thin film over the wing surface. Precipitation, such as snow, sleet, rain or any other form of moisture will dilute the applied fluid. When more and more water is mixed with it, the freezing temperature of the fluid rises. Finally, type one fluid contains so much water that it will freeze.

(2) ISO / SAE Type II and SAE Type IV Fluids
(Reference: ISO 11078; AMS 1428)

Thickened fluid with a non-Newtonian flow behaviour. Contains a minimum of 50% by weight of glycols. Type II and type IV fluids have normally a lower temperature application limit of -25°C. The application limit may be lower, provided a 7°C buffer is maintained between the freezing point of the neat fluid and outside air temperature. In no case shall this temperature be lower than the Lowest Operational Use Temperature as demonstrated in an aerodynamic acceptance test. The fluid must have demonstrated acceptable aerodynamic performance.
Type II and type IV fluids have a higher viscosity; their layer over the wing is thicker. Thus, the layer has higher volume and it can absorb more water before the freezing point reaches the outside temperature. Due to these phenomena, type two and type four fluids can prevent the aircraft from freezing longer than type one fluids. In other words, type two and type four fluids have longer holdover time than type one fluids.
As a general rule, the use of type II and type IV fluids in fluid/water proportions of 100/0 or 75/25 is not authorized on aircraft with a rotation speed of 85 knots or less. The application of a thickened de-icing/anti-icing fluid shall be in accordance with the requirements of the airframe/engine manufacturer.

Specifically, the fluid type and fluid/water mixture must be in line with airframe/engine manufacturer's requirements.

Type IV fluids are normally dyed green, but some type IV fluids are also available in a clear version.

(3) Type III Fluids

The type III fluids have properties between type II and type IV fluids and have a hold over time longer than type two fluids. **The so-called type III fluids are not covered in this procedure and must not be used on Carpatair aircraft.** These fluids would meet aerodynamic performance requirements applicable to aircraft with low rotation speed or short takeoff run, and may not be applied on Fokker 100 aircraft.

B. Approved Fluids

(1) Qualification Requirements
In order to use a fluid for de-icing or anti-icing of aircraft, at least one of the following requirements must be met:

(a) The product shall be listed as approved material in the airframe manufacturer's aircraft maintenance manual of the affected aircraft type.

(b) The product shall be qualified in accordance with the latest revision of following documents:
- ISO 11075 for type I fluids
- ISO 11078 for type II fluids
- AMS 1424 for SAE type I fluids
- AMS 1428 for SAE type II and type IV fluids

WARNING: Fluid manufacturers and airframe manufacturers may issue limitations for use of specific fluids on certain aircraft types and/or for certain dilutions of specific fluids. The appropriate airframe/engine manufacturer's manual and fluid manufacturer's information must be consulted.

(2) Qualified Products
The type I, type II and type IV products have been qualified in accordance with ISO/SAE requirements and are approved for de-icing/anti-icing of aircraft of Carpatair.
Before unlisted fluids are used for de-icing/anti-icing of aircraft, approval must be obtained from Carpatair.

C. Fluid Handling

(1) General

The requirements of fluid manufacturers will be considered for storage and handling of fluids.

(2) Fluid Handling / Personnel Safety Precautions

De-icing and Anti-icing fluid is a chemical product with environmental impact. During fluid handling, avoid any unnecessary spillage and comply with local environmental and health laws and the manufacturer's safety data sheet (MSDS). Different products shall not be mixed without additional qualification test.
Slippery conditions can exist on the ground or equipment following the de-icing/anti-icing procedure. Caution should be exercised, particularly under low humidity or non-precipitation weather conditions.

Extreme caution shall be exercised while walking or stepping on icy or wet aircraft surfaces or in areas on the ground where de-icing/anti-icing fluids have accumulated. Personnel walking on the wing shall use a safety harness.
(a) Avoid fluid direct contact with skin. The fluids are generally not absorbed through the skin, but repeated or prolonged exposure to the fluids of the skin must be avoided as they may dissolve the natural skin oil, causing dehydration and a cooling effect on the skin.
(b) Wetted clothes shall be removed as soon as possible. Affected skin shall be washed with water and soap and may then be treated and protected using suitable creams.
(c) Avoid fluid contact with the eyes. Eyes are moderately irritated by these fluids. If fluid enters the eyes, they shall be washed thoroughly with clean, running water.
Because of the low vapour pressure of the glycols, the vapour does not present any noticeable hazard. However, unnecessary exposure to spraying mists must be avoided.

(3) Storage/Pumping

Storage should be done in special tanks dedicated to the storage of de/anti-icing fluids. Tanks and transfer systems dedicated to the storage of de-icing/anti-icing fluids shall be used to avoid contamination with other fluids
Tanks and systems shall be of a material of construction compatible with the de/anti-icing fluid, as specified by fluid manufacturer (for example: plastic), not exposed to the sun. Care should be taken to avoid using dissimilar metals in contact with each other, as galvanic couples may form and degrade thickened fluids. Tank corrosion can cause severe degradation of type II fluids. Therefore, corrosion resistant steel tanks are recommended. Mild steel tanks are only acceptable when coated with a suitable lining to prevent corrosion. The lining must be resistant to heated glycol/water mixtures for fluid storage in heated condition.
All storage tanks have to be clearly labelled to avoid contamination.
Tanks should be inspected annually for corrosion and/or contamination.Annual visual examination of all tanks must be performed. Stainless steel (or acid-proof) tanks must be visually examined annually, but more in-depth checks and tests, such as Non-Destructive Testing (NDT), may not be necessary on an annual basis. The testing periods should be conducted according to the container manufacturer recommendations or standards set for the deicing operation.

(4) Heating

De-icing/anti-icing fluids shall be heated according to the fluid manufacturer’s guidelines, and the heated fluids shall be checked periodically.

- For Type I fluids, water loss may cause undesirable aerodynamic effects.
- For Type II / IV fluids thermal exposure and/or water loss may cause degradation making them not usable.

Avoid unnecessary heating of fluid in vehicle tanks. Prolonged or repeated heating of fluids (directly or indirectly) may result in loss of water or oxidation which can lead to the performance degradation of the fluid, and may cause viscosity degradation in Type II and IV fluids leading to shorter holdover times.

Following situations or a combination of them can accelerate the fluid performance degradation:
• Low fluid usage (turnover);

• Trucks being in standby mode with heating system on for extended periods of time;
• High temperatures in the fluid tanks;
• High temperatures in water tanks which are in direct contact with the fluid tanks (no insulation between tanks).

Type II and IV are normally only required to be heated when used for deicing of for “spot” or local anti-icing on cold-soaked areas of the aircraft. When used for anti-icing they are normally applied cold, either on de-iced surfaces or to prevent the formation of ice.

1.6. AIRCRAFT ICE INSPECTION (Contamination Check, Check for Need to De-ice)

The flight crew will perform the Pre Flight Contamination Check.
Under certain circumstances it may be delegated to a suitably qualified person. The pilot in command is ultimately responsible for determining the need to de-/anti-ice.

During conditions conducive to aircraft icing on the ground, an aircraft shall not be dispatched for departure unless it has been given a check by the Commander. This check shall cover all critical parts of the aircraft and be performed from points offering sufficient visibility of these parts (e.g. from the de-icing vehicle itself or any other suitable piece of equipment). To ensure that there is no clear ice on suspect areas, it may be necessary to make a physical check (e.g. by touch). Any contamination found shall be removed by a de-icing treatment followed by an anti-icing treatment if required.

NOTE: Account must be taken of the wing skin temperature versus OAT, as this may affect the need to carry out aircraft de-icing/anti-icing and the performance of de-icing/anti-icing fluids.

The Wing Temperature check

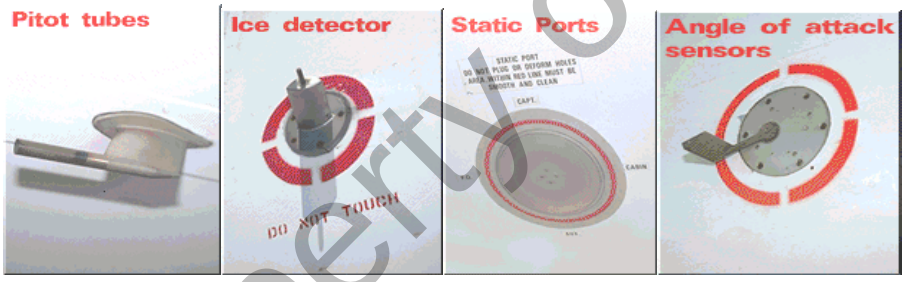
Clear ice normally builds up at low wing temperatures and when large quantities of cold fuel remain in wing tanks during the turnaround/transit and any subsequent refuelling is insufficient to cause a significant increase in fuel temperature.
Significant deposits of clear ice can form on the top and underside of wing fuel tanks. Aircraft are most vulnerable to this type of ice build-up when one or more of the following conditions exist:
a) wing temperatures remain well below 0°C during the turnaround/transit;
b) ambient temperatures between -2°C and +15°C are experienced;
c) ambient humidity is high and/or precipitation occurs while the aircraft is on the ground.

For this reason, on board each Carpatair aircraft there is an infrared thermometer which can be used to measure the wing temperature.
The indicated temperature can be used for calculations.

The lowest wing temperature is usually at the point located below the middle of the collector tank as you can see in the below picture. The infrared thermometer must be kept perpendicular under the wing surface and the “trigger” must be pressed and hold for 3-4 seconds to heave a stable indication.

The inspection for the need for de-icing/anti-icing must be done in accordance with the appropriate airframe / engine manufacturers manuals and with additional requirements which may have been released by Carpatair. The critical aircraft surfaces shall be free of frost, snow, slush, ice contamination as per following requirements:

During walk-around, at the nose section you should pay special attention to the areas around the pitot tubes.



Snow on the nose cone can suddenly reduce visibility when drifting rearwards to the windshields during the take-off run. Check the static ports. Even a thin contamination layer around them can cause turbulent flow and false readings in the pitot-static system.

Check also the ice detector probes and the angle of attack sensors.

Wings, Tails, and Control Surfaces

Wings, tails, and control surfaces shall be free of frost, snow, slush, or ice unless the aircraft manufacturer and state regulatory authority permits that a coating of frost may be present on wing lower surfaces in areas cold soaked by fuel between forward and aft spars; and/or on upper wing surfaces within defined areas, in accordance with the aircraft manufacturer's published documentation.
In the tail section, the horizontal stabilizer and the elevator upper and lower surfaces should be checked, as well as the cavities between the control surfaces to ensure that they are free from contamination. The vertical stabilizer and the rudder should be checked in a similar manner
At wing area, you should look for any ice formation on the wing leading edges and on wing and flight control surfaces. Also check the slots and gaps between the surfaces, flap leading edges, flight control hinge points, shrouds, fairings and seals.

If relatively warm fuel has been uplifted during a ground stop, it may cause snow to melt and run into the slots between flight controls and then freeze there. If flaps have been left extended after landing in heavy icing conditions, an inspection shall be made before moving these surfaces. You might need to de-ice the slots before retraction. Ice on these areas can cause severe damage to flaps and hinge structure if they are retracted before clearing the ice.

The most critical areas for clear ice formation are the wing root, the areas in contact with fuel tanks, and the areas near and above the landing gear. Remember that clear ice may be covered by snow, slush or even by anti-icing fluid.

The wing upper surface ice is very difficult to detect, especially if viewed only from one angle. Ladders or steps shall be used to aid the check. In some aircraft types, this check is critical and it should be made by hand and repeated after de-icing has been done. Take off with a certain amount of frost on the wing lower surface is allowed in some aircraft types according to the flight manual. For Fokker 100 a layer of approximately 3 millimetres or 0.125 inches is acceptable. The frost must be taken into consideration when calculating the aircraft take-off performance.
In adverse conditions, the frost accumulation will continue until the take off and the thickness may exceed the allowable limits.

Landing Gear and Landing Gear Doors

Landing gear and landing gear doors shall be unobstructed and free of frost, snow, slush, or ice. Do not spray De-icing/anti-icing fluids directly onto wiring harnesses and electrical components (receptacles, junction boxes, etc.,) brakes, wheels, exhausts, or thrust reversers.

The landing gear shall be specially checked after operation in slush covered areas. During take-off, ball slush will detach from the landing gear and may damage the wing and flap lower surfaces or it may be ingested into the rear mounted engines. If contamination occurs on the ground, brake disk freezing may also occur. Make sure, when the aircraft starts moving, that the wheels rotate freely.

Engines

Engine inlets (including the leading edge), exhaust, cooling intakes, control system probes, and ports shall be free of frost, snow, slush, or ice. Engine fan blades, propellers (as appropriate), and spinner cones shall be free of frost, snow, slush, or ice, and shall be free to rotate.

Air Conditioning Inlets and Outlets

Air inlets, outlets, pressure-release valves, and outflow valves shall be free of frost, snow, slush, or ice, and shall be unobstructed.
The air intake as well as the pressure probes, the guide vanes and the compressor blades must be checked to ensure that they are free of ice and snow.
The free rotation of the low-pressure rotor must be checked either visually or manually to ensure that it has not frozen to the inlet cowling.

The air intake as well as the pressure probes, the guide vanes and the compressor blades must be checked to ensure that they are free of ice and snow.
The free rotation of the low-pressure rotor must be checked either visually or manually to ensure that it has not frozen to the inlet cowling.

In the tail section, the horizontal stabilizer and the elevator upper and lower surfaces should be checked, as well as the cavities between the control surfaces to ensure that they are free from contamination. The vertical stabilizer and the rudder should be checked in a similar manner.

Fuselage

The fuselage shall be free of ice, slush, and snow. In accordance with the aircraft manufacturer's documentation, frost may be present on the fuselage for take-off within specified amounts provided that no other forms of contamination are present, and inlets, outlets, and other devices (as identified by the aircraft manufacturer) are free of contamination. No snow or ice is allowed on the fuselage during take-off. This is especially important to prevent ingestion into the rear mounted engines.

If the aircraft is covered with packed snow or ice, the hydraulic system must not be pressurized until the surfaces are checked for free movement. Otherwise, the flight controls might be damaged.
After the walk around check, you will decide what actions to take.

If the aircraft surfaces are contaminated, de-icing is required. If conditions are favourable for further accumulation, the aircraft must also be anti-iced to give protection against snow, ice or frost formation

Flight Deck Windows and Nose or Radome Area

Any significant deposits of frost, snow, slush, or ice on the windscreens or on areas forward of the windscreens shall be removed prior to departure. Heated flight deck windows will not normally require De-icing.

If the aircraft is covered with packed snow or ice, the hydraulic system must not be pressurized until the surfaces are checked for free movement. Otherwise, the flight controls might be damaged.
After the walk around check, you will decide what actions to take.
If the aircraft surfaces are contaminated, de-icing is required. If conditions are favourable for further accumulation, the aircraft must also be anti-iced to give protection against snow, ice or frost formation.

Any forward area from which fluid may flow back onto windscreens during taxi or subsequent takeoff shall be free of fluid prior to departure.

If SAE Type II or IV fluid has been used previously, all traces of the fluid on flight deck windows shall be removed prior to departure, with particular attention paid to windows fitted with wipers. Thickened-fluid (SAE Type II or IV) can be removed by using a diluted Type I mixture, water (where it has been determined that refreezing will not occur), a manual method (ensuring that windscreen heat is turned off), or another cleaner as approved by the aircraft manufacturer.

NOTE: During falling precipitation, heated windows may cause liquid runoff to freeze near sensors, requiring De-icing.

Dried Thickened Fluid Residues When the Aircraft Has Not Been Flown After Anti-Icing

Dried thickened-fluid (SAE Type II or IV) residues can occur when surfaces have been deiced/anti-iced but the aircraft has not imminently been flown and has not been subject to precipitation. The fluid may then have dried on the surfaces. In such situations, the aircraft must be checked for dried residues from thickened fluids and cleaned as necessary.

Tactile Check

A tactile (Hands-On) check requires a person to touch specific aircraft surfaces. Tactile checks, under certain circumstances, may be the only way of confirming the critical surfaces of an aircraft are, or not contaminated. For some aircraft, tactile checks are mandatory as part of the De-icing/anti-icing check process to ensure the critical surfaces are free of frozen contaminants.

1.7. PREPARATION OF AIRCRAFT FOR DE-ICING /ANTI-ICING

A. The preparation of the aircraft for de-icing/anti-icing must be done in accordance with the affected aircraft maintenance manual and with special requirements which may have been released by the Carpatair.

Before starting the treatment, all control surfaces must be positioned so that no water, melting snow or ice can flow into the control surface cavities.
All doors should be closed.
Engines are normally shut down. If the engines are running, you must follow the procedures laid down by the engine manufacturer.

B. During de-icing and anti-icing, the moveable surfaces must be in a position as specified by the aircraft manufacturer. Therefore, before starting the de-icing/anti-icing treatment, the cockpit crew must be informed accordingly in order to allow proper positioning of the controls.

NOTE: De-icing/anti-icing operation must not be started without authorisation from the cockpit crew.

C. Before de-icing/anti-icing starts, all doors and windows shall be closed to prevent contamination of galley floor areas with slippery de-icing fluids, and upholstery from becoming soiled.

NOTE: Before doors are closed, all snow and ice must be removed from the surrounding area. The appropriate aircraft maintenance manual may provide more detailed instruction for snow and ice removal/prevention in door areas.

1.8. PROCEDURES FOR DE-ICING /ANTI-ICING

A. General

Contamination from the aircraft can be removed by mechanical methods, by pneumatic methods or through the use of heated fluids. Some aircraft parts may be de-iced with hot air only.
Ice, frost and other types of contamination are removed with heated fluids. In de-icing treatment, aircraft surfaces are sprayed with heated, diluted type one or type two or type four fluids under high pressure. The heat will melt snow and frozen deposits.
De-icing and anti-icing can be done in one or two steps depending on the weather conditions and the required holdover time. One-step de-icing and anti-icing is carried out with heated fluid water mixture that has a low enough freezing point. The fluid used to de-ice the aircraft remains on aircraft surfaces to provide limited anti-ice capability.

Two-step de-icing and anti-icing consists of two different steps. The first step is de-icing which is followed by the second step, anti-icing. The two-step procedure should be used in adverse weather conditions and it provides maximum possible anti-ice capability.

Carpatair should preferably avoid the use of Type I fluids that could negatively affect the hold-over time provided by the anti-icing fluid in a two-step de-icing operation. During two-steps de-icing operations, if the use of such Type I fluid cannot be avoided, consider mitigating measures to counteract the potential effect on holdover time reduction described above.
These mitigating measures could be: special care when washing-off the Type I fluid in the second step (anti-icing) and performing a pre-take-off contamination check.

If there is thick ice or heavy frozen deposits on a wing, the heat will break the bond between the ice and aircraft skin and a hydraulic force of the fluid spray will then flush the residue off the wing and finally the anti-icing fluid will prevent refreezing of the treated surfaces.
Glycol used in this de-icing process lowers the freezing point of sprayed fluid so that the water in the fluid does not refreeze after application. The dilution ratio of type one fluid and water is normally between 40 to 70 percent.
During the de-icing process, contamination is removed from all parts of the aircraft. This includes the fuselage as well as the wings and the tail section.

Manual De-Icing

Reducing the amount of de-icing fluid used can have a positive impact on both the cost and the environmental. Manual methods of snow removal should be used whenever possible, as long as safety is not compromised. There are a wide variety of devices available to assist in the removal of frozen contaminants from aircraft. Factors such as temperature, amount of contamination, wind conditions, and contaminant location must be taken into account when choosing the method.
Under extremely low temperatures, the use of glycol based fluids is limited (refer to the fluid manufacturers' specifications for details). In these circumstances, manual methods may be the only option.
Some of the more common devices are:
a) Brooms
b) Brushes
c) Ropes
d) Scrapers

NOTE**:** Extreme care must be taken anytime manual methods are used to protect the highly sensitive and often fragile sensors and navigation antennas. Also very vulnerable to damage are: pitot tubes, static ports, angle of attack sensors, and vortex generators. When sweeping or "pulling" contamination off an aircraft, care must be taken to use motions which pull contamination away from any openings, in order to avoid forcing the contamination into any openings on the wings or stabilizers.

Brooms

The most commonly used and most readily available manual tool is the broom. Although a common household broom could be used, a larger, sturdier commercial variety is usually chosen. Care must be taken to ensure the bristles are sturdy enough to be effective, yet not so stiff as to do damage to the skin of the aircraft. The broom that is to be used to sweep the snow should not be used to break the ice or to sweep floors and other surfaces.
Using the wing broom to remove contamination does not always mean that the wing surface is clean and safe for flight. Every time a broom is used to remove contamination, a tactile inspection must be performed.
Brooms are very useful in cleaning windows and other sensitive where the application of hot liquid is best avoided or prohibited.
Extra attention should be paid to safety, especially when combined with the tendency to stretch the reach with a broom. If a ladder or other such device is used, personnel must be certain that it is safe to use. Slippery surfaces can make climbing dangerous.
Personnel have attempted to sweep snow from wing and tail surfaces while standing on these surfaces. This is an extremely unsafe practice with a very high risk of a slip and fall accident. As well, many surfaces are not stressed to support the weight of a person.
Using the wing broom to remove contamination does always mean that the wing surface is clean and safe for flight. Every time a broom is used to remove contamination a tactile inspection shall be done. If any contamination is found adhering to a critical surface, it shall be removed prior to flight.
The following points should be considered when using a broom to clean frozen contaminants from the critical surfaces of an aircraft:
a) Ensure the flight crew and/or maintenance personnel conducting aircraft checks are aware that contamination removal is being conducted and advise them when the removal procedures are complete;
b) Ensure that control surfaces are in the “neutral” position (all leading edge devices, flaps and spoilers are retracted, unless they are deployed for an operational reason);
c) Ensure the horizontal stabilizer is in the full nose down position;
d) For safety reasons, sweep from the bucket of a de-icing vehicle or use the wing inspection ladder;
e) Sweep from leading edge of the wing to the tailing edge. Generally try not to push contamination from the trailing edge towards the leading edge, otherwise this may push frozen contamination into cracks and crevasses and cause flight control difficulties later;
f) Generally, sweep contamination from wing tip to wing root;
g) Sweep contamination away from flight controls, hinges points and bay areas; and
h) If all of the contamination cannot be removed when working from the leading edge, because the broom is not long enough, then remove the remaining contamination by dragging it off the trailing edge. Ensure that the handle of the broom does not come in contact with the wing flap or any other surface of the wing because damage may result.

Removal of contamination with hand tools (brooms, brushes, ropes, etc.) is especially recommended when thick layers of snow are covering the airplane, so that de-/anti-icing fluid can be properly applied. It is also recommended for the removal of loose (snow, slush, etc.) and light fixed (frost, etc.) contamination from the fuselage (ropes), the wings and stabilizer with brooms and brushes. Special attention should be taken to avoid scratches and other damages.

Special safety equipment is required. Complete manual de-icing of airplane is not possible.

Hot Air De-Icing

Removal of contamination with hot air fan, especially for wheels, brakes, engine air intakes, static ports (be careful not to direct the airflow into the openings, orifice, etc. of the pitot-static system → **damage**) and fluid sensitive parts. It is also used to de-ice an airplane for the minimum taxiing requirements to a central/remote de-/anti-icing position.

Removal of loose (e.g. snow, slush, etc.) and light fixed (e.g. frost, etc.) contamination with regulated and heated air onto the effected surfaces.

Complete hot air de-icing of an airplane is not possible. Special safety precautions have to be taken, especially when using equipment (pressure of airflow up to 7 bar) for de-icing of tail mounted engines/air intake.

De-icing/Anti-icing with Fluids

These procedures specify the methods for de-icing and anti-icing of aircraft on the ground with fluids, in order to provide an aerodynamically clean aircraft.

When aircraft surfaces are contaminated by snow, frost, slush or ice, they shall be de-iced prior to dispatch. When freezing precipitation exists and there is a risk of contamination of the surface at the time of dispatch or take off, aircraft surfaces shall be anti-iced.

If both de-icing and anti-icing are required, the procedure may be performed in one or two steps. The selection of a one- or two-step process depends upon on actual weather conditions, available equipment, available fluids and the conditions of the aircraft (snow, ice, slush or frost covering aircraft surfaces).

When critical surfaces are free of snow, frost, slush and ice, but freezing precipitation is expected during the ground stop or during taxi, the surfaces shall be anti-iced as a precautionary measure.

Large quantities of snow can also be removed with other methods, e.g. with brooms/brushes, heated air, or with a cotton rope. For details and limitations, see the appropriate aircraft maintenance manual.

De-icing/anti-icing operations shall be coordinated with flight crew and local functions in due time. All efforts shall be made to maintain the traffic flow and to minimize delays after completion of de-icing/anti-icing.

Slippery conditions can exist on the ground or equipment following the de-icing/anti-icing procedure. Caution should be exercised, particularly under low humidity or non-precipitating weather conditions due to increased slipperiness.

Aircraft may be de-iced/anti-iced at a remote stand or area, which will normally be positioned between the terminal building and runway. Also in these situations the airframe manufacturer’s requirements must be fulfilled, and this document is also applicable. De-icing/ anti-icing near the departure runway provides the minimum interval between de-icing/anti-icing and take off.

Preventive de/anti-icing

In order to achieve an 'on time performance' after an aircraft night stop or during a longer transit ground time a Carpatair aircraft may receive early-de/anti-icing on condition following requirements are met:

- in frost conditions only
- no precipitation
- the station has a positive audit report regarding de-icing/anti-icing activities

WARNING**:** Preventive de/anti-icing may NOT be performed on aircraft equipped with non-hydraulic powered flight controls.

De/Anti-Icing in Active Frost Conditions

Frost reforming after removal is an indication of active frost. During active frost, anti-icing protection is required and operations should be conducted in accordance with holdover time guidelines and minimum fluid quantity and temperature application procedures therein. In active frost conditions, de-icing alone is insufficient, therefore, once the frost has been removed, a preventive anti-icing coating is enquired.

Spray Pressure

During the de-icing process, it is a combination of temperature and fluid velocity that dictates the efficiency with which the frozen contaminants are dislodged from the aircraft's surfaces. This is most effectively accomplished with a nozzle spray angle of approximately 45 degrees. Contaminants not removed from the surfaces by the initial impact of the fluid are melted off, or debonded, by virtue of the thermal energy contained in the heated de-icing fluid.
Excess pressure can result in fluid velocities out of the nozzle that can cause impact damage to aircraft components. The aircraft manufacturer should be consulted to ensure that any proposed de-icing procedures will not damage the aircraft and render it unsafe for flight.
When applying anti-icing (AAF) fluids to the aircraft surfaces, only correct pumping equipment must be used to avoid shearing the fluid and thereby destroying the fluid's HOT capacity. The fluid manufacturer should be contacted to determine what methods should be employed in the application of their fluids.

B. One-Step and Two-Step Procedures

(1) One Step De-icing/Anti-icing

The one-step de-icing/anti-icing is performed with a heated anti-icing fluid. The fluid used to de-ice the aircraft remains on aircraft surfaces to provide limited anti-ice capability. The correct fluid and concentration shall be chosen with regard to desired holdover time, outside and wing temperature and weather conditions; see Section 2

CAUTION: Wing skin temperature may differ and, in some cases, be lower than OAT a stronger mix can be used under these conditions.

CAUTION: The application of type II or IV fluid, especially when used in a one step process, may cause residues to collect in aerodynamically quiet areas, cavities and gaps. Dried residues may rehydrate and freeze following a period of high humidity and/or rain conditions. This may impede flight control systems. These residues may require removal. Consult the aircraft manufacturer with regard to inspection methods and frequency, related maintenance requirements and aircraft washing recommendations.

NOTE: The one-step de-icing/anti-icing procedure with a thickened anti-icing fluid (type II or type IV) is not recommended for a treatment of wings and empennage of aircraft with unpowered flight controls. A two-step procedure should always be performed on such aircraft, whereby hot water or a mix of hot water and type I fluid should be used for the first step.

NOTE: When holdover time is critical, a two-step procedure should always be considered, using undiluted fluid for the second step.

(2) Two Step De-icing/Anti-icing

The first step is performed with a heated de-icing/anti-icing fluid. The correct fluid shall be chosen with regard to ambient temperature and shall provide protection of the treated surfaces until the second step is performed.

NOTE: A sufficient amount of fluid shall be applied to remove any frozen contamination completely. Also, with its limited cleaning effect, the first step should help to avoid excessive build-up of residues from previous de-icing/anti-icing treatments with thickened fluids.
NOTE: On wings and empennage of aircraft with unpowered flight controls, hot water or a mix of hot water and type I fluid should be used for the first step.

After de-icing, the second step is performed with a separate over-spray on clean surfaces with an anti-icing fluid, which may be applied unheated if a thickened fluid (type II / type IV) is used. The second

step must be performed before the fluid applied in the first step starts to freeze, typically within three minutes after the first step. If necessary, the second step shall be performed area by area.
When treating composite surfaces, freezing may happen quickly.
When applying the second step fluid, use a spraying technique which completely covers the first step fluid (for example using the method described in 1.8.D. (4)) and provides a sufficient amount of second step fluid.

The correct fluid concentration for the second step shall be chosen with regard to desired holdover time, outside and wing temperature and weather conditions; see Section 2

CAUTION: Wing skin temperature may be lower than OAT. A stronger mix can be used under these conditions.
When refreezing occurs following the initial treatment, both first and second step must be repeated.

CAUTION: When a type II fluid is applied in the second step of a two-step procedure and a type I fluid has been applied in the first step, severe anti-icing performance degradation results if the two different fluids are not compatible. This kind of two-step procedure may only be performed if the combination of fluids is approved by the manufacturer of the type II or IV fluid.

CAUTION: The application of Type II or IV fluid, especially when used in a one-step process or in the first step of a two-step process, may cause fluid to collect in aerodynamically quiet areas, cavities, and gaps, which can dry out and leave dried residues. Dried residues may rehydrate and freeze following a period of high humidity and/or rain conditions. This may impede flight control systems. These dried residues may require removal.
The use of hot water or heated mixture of Type I fluid/water for the first step of a two-step De-icing/anti-icing process will minimize the formation of dried residues.

NOTE: Anti-icing of the lower side of the wings and/or horizontal stabilizer and elevator is normally not foreseen. However, if these surfaces must be de-iced, the quantity of the De-icing fluid must be low enough to prevent refreezing.
With regard to holdover time provided by the applied fluid, the objective is that it is equal to or greater than the estimated time from the start of anti-icing to the start of takeoff based on existing weather conditions.
Aircraft shall be treated symmetrically, that is, left hand and right hand side shall receive the same and complete treatment, even when only one side of the aircraft needs treatment. Anti-icing treatments shall always cover the entire wing, the entire vertical stabilizer/rudder and horizontal stabilizer/elevator on both sides of the aircraft.
WARNING: The aircraft is considered UNSAFE if this requirement is not met.

C. De-Icing

(1) General

De-icing fluids are applied close to the skin of the aeroplane to minimize heat loss. The spraying distance should be as close to the skin of the aircraft as possible. Normally the distance is between 3 to 10 meters.

Spraying starts with the fuselage, which is sprayed from the nose section along the top centreline and then downwards to the sides.
The wings and the horizontal stabilizer are sprayed from tip to root and from the leading edge to the trailing edge in order to wash the residue off the wing.
Spraying the vertical surfaces starts from the top and then works downwards.

Some precautions should be considered during de-icing. The high-pressure spray must not be directed at the cockpit and cabin windows as the window sealing is not designed for high pressure from outside. A direct flow towards them might cause the fluid leaking inside.

Spraying directly towards the pitot tubes, static ports, stall warning detectors and angle of attack vanes and various air inlets is also forbidden.

Avoid also spraying directly into control surface cavities and balance bays.

Keep the landing gear, wheel wells and engine intakes clear from de-icing fluids.
Snow from the engine air intake shall be brushed off and ice from the fan blades shall be melted with hot air.

It is recommended to use engine covers during ground icing conditions. Before they are installed, the engines must be cleared from ice and snow. The drain holes must be checked to be open in order to guarantee that water can run out freely.
The intake and exhaust covers should be removed as late as possible before engine start.
If ice has formed on propeller blades, it can be melted and they can then be dried with hot air.

The landing gear area must be cleared from ice, snow and slush that might prevent the normal retraction.
Removal can be accomplished by brushing or with a hot rich mixture of anti-icing fluid and water applied with low pressure.
Hot brakes must be cooled down before de-icing. If the aircraft is equipped with carbon fibre brakes, do not let any de-icing fluid to have contact with the brakes.
During de-icing, the APU may be running but no fluid containing glycol may be sprayed into the APU intake or exhaust openings.
Cockpit must be informed when de-icing starts so that the pilots can configure the air condition system. If the APU is running, its bleed valve must be switched to off. **If engines are running, the engine bleed valves must be closed. This is to prevent the fumes from entering the cabin via the air condition system.**
De-icing treatments shall be symmetrical, that is, left-hand and right-hand side of the aircraft shall receive the same treatment, even when only one side of the aircraft is contaminated.
Ant-icing treatment shall always cover the entire wing, the entire vertical stabilizer/rudder and horizontal stabilizer/elevator on both aircraft sides.

When the temperature is low and the snow on aircraft surfaces is dry, powdery additional methods may be used for snow removal.

Dry snow can be brushed off with a broom or blown off with dry cold air. After this, the surfaces have to be checked for any frozen contamination. If necessary, use de-icing fluids to remove any remaining contaminant.
Removing large amounts of snow by mechanical means before spraying always saves de-icing fluids thus reducing the cost of the treatment and minimizing the negative impact on the environment.

Ice, snow, slush and frost must be removed from aircraft surfaces prior to dispatch or prior to anti-icing. The following procedures shall be used for their removal.

CAUTION: These procedures do not overrule the airframe manufacturer's requirements for proper de-icing and anti-icing of a specific aircraft. Certain aircraft can require unique procedures to accommodate design differences; see manufacturer's instructions. In case of contradiction, the airframe manufacturer's instructions shall prevail.

For guidance regarding fluid limitations, see paragraph 1.9.
For maximum de-icing effect, fluids shall be applied close to the surface of the skin to minimize heat loss.

CAUTION: The fluid temperature at the spray nozzle must not exceed 85 °C.
The heat in the fluid effectively melts any frost, as well as light deposits of snow and ice.

Heavier accumulations require the heat to break the bond between the frozen deposits and the structure; the hydraulic force of the fluid spray is then used to flush off the residue. The de-icing fluid

will prevent refreezing for a period of time depending on aircraft skin and ambient temperature, fluid used mixture strength, and the weather. Ice, snow, slush or frost dilutes the de-icing/anti-icing fluid. Apply enough hot de-icing fluid to ensure that refreezing does not occur and that all contaminated fluid is driven off.

(2) Removal of Frost and light Ice

A nozzle setting giving a solid cone (fan) spray should be used. This ensures the largest droplet pattern available, thus retaining the maximum heat in the fluid. If the heated fluid is applied close to the aircraft skin, a minimal amount of fluid will be required to melt the deposit.

NOTE: A thin layer of frost is permitted on the upper half of the fuselage, provided that painted markings or letters are still visible.

NOTE: A thin layer of frost not exceeding 3 mm thickness is permitted on the wing lower surfaces within the wing tank areas. Operation with frost on wing surfaces other than in the lower surface fuel tank area is not permitted.

(3) Removal of Snow or Slush

A nozzle setting sufficient to flush off deposits and minimize foam production is recommended. Foam could be confused as snow.

The method chosen will depend on the equipment available and the depth and type of snow; i.e. light and dry or wet and heavy. In general, the heavier the deposits are the heavier the fluid flow that will be required to remove it effectively and efficiently from the aircraft surfaces. For light deposits of both wet and dry snow, similar procedures as for frost removal may be adopted. Wet snow is more difficult to remove than dry snow and unless deposits are relatively light, selection of high fluid flow will be more effective.

Under certain conditions, it will be possible to use the heat, combined with the hydraulic force of the fluid spray, to melt and subsequently flush off frozen deposits. A layer of snow can hide a sub-layer of clear ice. Therefore, snow removal is not a guarantee for a completely de-iced surface since the clear ice layer is difficult to see.
NOTE: Heavy accumulations of snow will always be difficult to remove from aircraft surfaces and vast quantities of fluid will be consumed. Serious consideration should be given to manual removal of deposits with long soft brooms before normal de-icing with fluids. In order to prevent the aircraft from tipping over to the tail, heavy accumulations of snow or ice shall always be removed from the tail first.

CAUTION: Prior to de-icing of wings, it must be determined whether or not ice exists under the snow.
CAUTION: When removing snow from the aircraft surfaces, do not damage antennas, sensors, pitot tubes, static dischargers, clear ice indicators or similar.

(4) Removal of Ice

Heated fluid shall be used to break the ice bond. The method makes use of the high thermal conductivity of the metal skin.

A stream of heated fluid is directed at close range onto one spot at an angle of less than 90 degrees, until the aircraft skin is just exposed. This aircraft skin will then transmit the heat laterally in all directions raising the temperature above the freezing point, thereby breaking the adhesion of the frozen mass to the aircraft surface. By repeating this procedure a number of times, the adhesion of a large area of frozen snow or glazed ice can be broken. The deposits can then be flushed off with either a low or high flow, depending on the amount of the deposit.

CAUTION: Non-metallic surfaces (e.g. composites) have a lower heat transfer than metallic surfaces. De-icing may take longer and more fluid may be needed.

(5) General De-icing Fluid application Strategy

For effective removal of snow and ice, the following techniques shall be adopted.

CAUTION: Certain aircraft require unique procedure(s) to accommodate design differences. The aircraft maintenance manual and the operator's documentation must be consulted for appropriate instructions.

CAUTION: Removal of snow, slush, frost and ice shall always be done by spraying in forward-to-aft direction to prevent movement of snow and ice into internal control areas or control surface hinge areas. Make sure that all controls and mechanisms are completely free from frozen deposits to prevent malfunction of flight controls.

Make sure that any frozen deposit is removed also in the trailing edge and flight control areas on large aircraft. Keep the distance to the nozzle small enough and adjust the nozzle setting to facilitate melting and complete removal of any frozen deposits.

WARNING: Spraying must generally be done in forward-to-aft direction to avoid penetration of an excessive amount of fluid into cavities and protected or shielded areas.

(a) Sequence of Treatment
Generally, the surfaces to be treated shall be sprayed from the highest point to the lowest, in order to use as little de-icing fluid as possible.

CAUTION: De-icing of higher surfaces must be completed before start of anti-icing of lower surfaces, in order to prevent dilution of anti-icing fluid with snow, slush or de-icing fluid with lower concentration. For instance vertical stabilizer must be treated before horizontal stabilizer; fuselage must be treated before wing.

(b) Wings, horizontal stabiliser, and elevators
Spray from the leading edge to the trailing edge. Do not spray from the rear. Start at the highest point of the surfaces and work to the lowest parts, i.e. on most aircraft start at the wing tip and work towards the wing root. NOTE: Refer to the Aircraft Manufacturer's Maintenance Manual for any deviation from this procedure.

(c) Fuselage
Spray along the top centre line and then outboard. Ensure that the fuselage is clear of ice and snow in accordance with aircraft manufacturer's manuals. Hoarfrost may be allowed.

(d) Vertical Surfaces
Start at the top and work down.
Wings / Tail plane
Spray from the tip inboard to the root from the highest point of the surface camber to the lowest. However, aircraft configurations can dictate a different procedure.

NOTE: The "clean wing concept" also applies to the horizontal stabilizer and elevator. However, there is no frost permitted on the lower side of the horizontal stabilizer.

CAUTION: Prior to removal of snow from the wings, it must be determined if ice exists under the snow.

CAUTION: De-icing/anti-icing fluid or water shall not be sprayed directly against trailing edges of wings and control surfaces.

(e) Engines / APU
Deposits of snow shall be removed mechanically from engine intakes prior to departure.
Any frozen deposits that have bonded to either the lower surface of the intake, the fan blades including the rear side, or propellers, shall be removed by hot air or other means specified in the applicable aircraft maintenance manual or recommended by the engine manufacturer.

CAUTION: Do NOT spray de-icing fluid into engine and APU intakes and exhausts.
De-icing/anti-icing fluid in engines can cause damage to the engines.
This is especially important for type II and type IV fluids. Remaining fluid must be removed before start of engine or APU.

(f) Landing Gear and Wheel Bays
De-icing with water only is not permitted.

The application of de-icing fluid in this area shall be kept to a minimum. Frozen deposits shall be removed with hot air. To prevent re-freezing, a light spray of type II / type IV de-icing/anti-icing fluid may be applied either by brushing on or with a compression sprayer (garden sprayer).

NOTE: Do not apply anti-icing fluid on the landing gear pistons. Anti-icing of the exposed chrome of landing gear pistons shall be made with hydraulic oil MIL-H-5606.

CAUTION: Do not spray de-icing fluid directly on landing gears, wheels or brakes, wiring harnesses and electrical components. Also, avoid spilling of de-icing fluid on wheels and brakes during under wing de-icing. Brake malfunction or damage can occur. Spraying will also cause de-greasing of lubricated joints. Keep spraying of glycol/water mixtures in this area to a minimum.

CAUTION: When removing ice, snow, slush or frost from aircraft surfaces care shall be taken to prevent it entering and accumulating in auxiliary intakes or control surface hinge areas. Remove snow from wings, stabiliser, ailerons and elevators by spraying from the leading edge to the trailing edge. Start at the highest point of the surfaces and work to the lowest parts, i.e. on most aircraft start at the wing tip and work towards the wing root.

(g) Nose / Radome Area and Flight Deck Windows
Type I / water fluid or manual methods of removal (e.g. brushes) are recommended.
When thickened fluids are used, avoid spraying near flight deck windows, as fluid residues can cause a severe loss of visibility during flight.
Any thickened fluid remaining on nose areas where it could blow back onto the windscreens should be removed prior to departure, using squeegees or equivalent. If flight deck windows are contaminated with thickened fluids, use water or an approved windshield cleaner.

CAUTION: Prior to cleaning of the flight deck windows ensure that the window heating system is switched off

D. Anti-Icing

If icing conditions exist or freezing precipitation is expected prior to the take-off, anti-icing application must be performed after de-icing, before contaminant starts to accumulate again. It should be started within three minutes after de-icing. The purpose of the treatment is to give the aircraft protection against icing weather conditions.

Application of anti-icing fluids will, for a period of time, prevent ice, snow, slush or frost from accumulating on aircraft surfaces. The following procedures shall be adopted when using anti-icing fluids.

WARNING: Before anti-icing fluid is applied, all ice and frozen material must be removed from the aircraft. Melted ice and water mixed with the anti-icing fluid can freeze again and prevent movement of controls. A malfunction of flight controls can cause a crash take-off or landing. For specific requirements, the aircraft maintenance manual for the affected aircraft type must be consulted.

(1) Required Usage

When freezing precipitation exists or there is a risk of contamination of the surface at the time of take off, aircraft surfaces must be anti-iced.

(2) Optional Usage

Anti-icing fluid may be applied to aircraft surfaces at the time of arrival (preferably before unloading begins) on short turnarounds during freezing precipitation, and on overnight aircraft. This will minimize ice accumulation prior to departure and often makes subsequent de-icing easier. However, the holdover time of the treatment must not be exceeded; see paragraph 1.9.E.

NOTE: The Local Frost Prevention in Cold Soaked Wing Tank Areas treatment in accordance with paragraph 1.8.F. is a special treatment for specific conditions and must not be mixed up with this standard anti-icing procedure!

On receipt of a frost, snow, freezing rain or freezing fog warning from the local meteorological service, anti-icing fluid may be applied to aircraft surfaces prior to the start of freezing precipitation. This will minimize or reduce the accumulation of frozen precipitation on aircraft surfaces and facilitate subsequent de-icing.

(3) General

(a) For effective anti-icing, an even layer of sufficient thickness of fluid is required over the prescribed aircraft surfaces which are clean (free of frozen deposits). For longer anti-icing protection, undiluted type II or type IV fluid should be used.
CAUTION: ISO/SAE type I fluids have limited effectiveness when used for anti-icing purposes. Little benefit is gained from the minimal holdover time generated.

(b) As a second step in a two-step procedure, anti-icing shall be performed before first step freezes (typically within 3 minutes), if necessary area by area. If freezing has occurred, the first step has to be repeated.

(c) In moderate to heavy freezing precipitation weather conditions, when anti-icing, the wing leading edge slats shall be extended on the Station Engineer's command, and the wing surfaces below the slats shall be anti-iced.

(4) Anti-icing Fluid Application Strategy

Anti-icing fluid is applied unheated and with low pressure spray so that it just covers the aircraft surfaces without run off.
The high fluid pressures and flow rates normally associated with de-icing are not required for this operation and, where possible, pump speeds should be reduced accordingly. The nozzle of the spray gun should be adjusted to give a medium spray.

The most effective results for anti-icing are obtained by commencing spraying on the highest part of the wing section and covering from there towards leading and trailing edges.
Both wings and the stabilizer must always be treated symmetrically using the same method and the same fluid. Even if one wing is free from snow and ice, it must be treated in the same way as the other one.
The ground supervisor who manages anti-icing has to make sure that all the surfaces that need to be anti-iced are coated by a uniform film of anti-icing fluid. Anti-icing must always be done on clean surfaces.

The process should be continuous and as short as possible. Anti-icing should be carried out as near to the departure time as possible in order to utilize available holdover time. The anti-icing fluid shall be distributed uniformly over all surfaces to which it is applied. In order to control the uniformity, all aircraft surfaces shall be visually checked during application of the fluid. Spray from the leading edge to the trailing edge. Do not spray from the rear. Start at the highest point of the surfaces and work to the lowest parts, i.e. on most aircraft start at the wing tip and work towards the wing root. On vertical surfaces, start at the top and work down.

NOTE: The correct amount of fluid is applied when the fluid is just beginning to run off the leading and trailing edges.

The following surfaces shall be treated:

- fuselage upper surfaces, depending upon outside air temperature and the amount and type of precipitation (especially important on aircraft with tail mounted engines);
- wing upper surfaces and leading edges;
- vertical stabilizer and rudder;
- horizontal stabilizer including leading edges and elevator surfaces.

CAUTION: De-icing of higher surfaces must be completed before start of anti-icing of lower surfaces, in order to prevent dilution of anti-icing fluid with de-icing fluid of lower concentration. For instance vertical stabilizer must be treated before horizontal stabilizer; fuselage must be treated before wing.
CAUTION: Anti-icing fluids may not flow evenly over wing leading edges, horizontal and vertical stabilizers. These surfaces must be checked to ensure that they are properly coated with fluid.
CAUTION: Do NOT spray de-icing fluid into engine and APU intakes and exhausts. De-icing/anti-icing fluid in engines can cause damage to the engines.
This is especially important for type II and type IV fluids. Remaining fluid must be removed before start of engine or APU.

On the wings, the most effective results are obtained by commencing on the highest part of the wing section and covering from there towards the leading and trailing edges. On vertical surfaces, start at the top and work down.
Anti-icing treatments shall always cover the entire wing and the entire horizontal stabilizer / elevator on both sides of the aircraft.
NOTE: Some operators have different requirements. In such a case, the specific operator's procedures must be applied.

E. Local Wing Frost Removal

For frost limited to a small patch on the upper wing surface only, and when no precipitation is falling or expected, 'local area' de-icing may be carried out. Spray the affected area with a heated fluid/water mix suitable for a One-Step Procedure, then spray the same area on the other wing. Both wings must be treated identically (same areas, same amount and type of fluid, same mixture strength), even if the frost is only present on one wing. The trained and qualified person releasing the aircraft must check that the treatment was done symmetrically and that all frozen deposits have been removed, and then report the details of the treatment to the Commander.
CAUTION: Holdover times do not apply.

Removal of local area contamination

When no precipitation is falling or expected, and when there is no active frost a "local area" De-icing may be carried out under the below mentioned or similar conditions. In some cases a full or complete De-icing is not necessary. When the presence of frost and/or ice is limited to localized areas on the surfaces of the aircraft and no holdover time is applicable, only the contaminated areas will require treatment.
This type of contamination will generally be found on the wing and/or stabilizer leading edges or in patches on the wing and/or stabilizer upper surfaces. Spray the affected area(s) with a heated

fluid/water mixture suitable for a one-step procedure. Both sides of the wing and/or stabilizer upper surfaces shall receive the same amount and type of fluid at the same concentration; the same area in the same location on each wing/stabilizer shall be sprayed including when conditions would not indicate the need for treatment of both wings/stabilizers.
Both sides of the aeroplane must be treated identically (same areas, same amount and type of fluid, same mixture strength), even if the contamination is only present on one side. A trained and qualified person must check that both the treatment was performed symmetrically and that all contamination has been removed.
After this check has confirmed that the treated areas are clean, the following statement shall be given to the Commander:
"De-icing only. Aeroplane is clean. Holdover times do not apply"

Under wing de-icing procedures

Treatments must be symmetrical. Spray the affected areas with a heated fluid/water mixture suitable for a One-Step Procedure (see caution below), and then spray the same areas under the other wing. Both wings must be treated identically (same areas, same amount and type of fluid, same mixture strength), even if the frozen contamination is only present under one wing. A trained and qualified person must check that the treatment was done symmetrically and that all frozen deposits have been removed, and then report the details of the treatment to the Commander. No holdover times apply to underwing treatments.

CAUTION: Under wing frost and ice are usually caused by very cold fuel in the wing tanks. Use a fluid/water mixture with a higher concentration of glycol than is usually required by the OAT to prevent re-freezing.

F. Local Frost Prevention in Cold Soaked Wing Areas

(1) Effectiveness

NOTE: This procedure is only permitted in combination with a tactile check in accordance with paragraph 1.8.F. (6) (b).

(2) General

Rain will form a layer of clear ice over the cold surfaces, which is very difficult to detect.
The only way to determine the need for de-icing is done visually and physically. Therefore, one must look and feel for ice and other contamination.
As the aircraft flies for long periods in very cold temperatures, both the aircraft surfaces and the structure under it and also the fuel carried on board reach temperatures well below freezing.
During ground stops, the surface of the aircraft warms up. The heavy structure and the fuel remain cold for a long period of time. The areas where they are in contact with the skin plates will remain below the freezing temperature. When the air is humid, water vapour will form frost on these cold surfaces. Rain will form a layer of clear ice over the cold surfaces, which is very difficult to detect.

On certain aircraft, frost accumulation in wing tank areas requires frequent de-icing also when no precipitation exists. Large masses of sub cooled metal such as landing gear fittings also can generate frost deposits on wings. When the conditions for this procedure are met, the Local Frost Prevention procedure may be applied to prevent frost formation in these critical areas.

(3) Limitations for Local Frost Prevention in Cold Soaked Wing Areas

(a) This Local Frost Prevention procedure shall be applied during transit stops and in dry weather conditions only. It shall be applied on clean wings immediately following arrival of the aircraft. Application is acceptable at the latest when frost just starts to build up, but in

this case the fluid shall be applied at a minimum temperature of 50 °C. If precipitation occurred between application of the fluid and dispatch of the aircraft and / or if precipitation is expected before take-off, a standard two-step de-icing/anti-icing treatment shall be performed in accordance with paragraph 1.8.

(b) This Local Frost Prevention procedure must not be applied on moderate or thick layers of frost, since it will not remove this kind of frost. Application on thin layers of frost is acceptable if the fluid is applied in heated condition, at a minimum temperature of 50 °C.

(c) The Holdover Time table is not effective in case of this Local Frost Prevention procedure. A holdover time must not be used, and the normal inspections before dispatch of the aircraft according to maintenance manuals must still be performed! If a re-treatment is necessary, a standard de-icing/anti-icing must be performed.

(d) This Local Frost Prevention procedure does not supersede standard de-icing/anti-icing treatments with standard equipment, clear ice checks or any other inspection requirements, nor the requirement that aircraft surfaces are clear of frost, slush, snow and ice accumulation.

(4) Materials

Undiluted ISO/SAE Type II or Type IV de-icing/anti-icing fluid

(5) Tools and Equipment

(a) For occasional use:
Manual compression sprayer, approximately. 5 litre capacity, with stainless steel vessel, such as a garden sprayer.

(b) For frequent application:
Handling/contracted agent shall use powered equipment, approved by Carpatair, allowing application of a fine spray of fluid in low quantities. The equipment must comply with the requirements for type II / type IV anti-icing fluids as per paragraph 1.5.C.

CAUTION: Light spray equipment for application of a thin layer of de-icing/anti-icing fluid for Local Frost Prevention in Wing Tank Areas must not be used for standard anti-icing with holdover time. Normal anti-icing must be applied with standard equipment and standard spray nozzle in accordance with paragraph 1.8.D. and requires application of larger amount of fluid.

(6) Procedure

(a) Immediately after arrival of the aircraft and before considerable frost has formed on the wings, equally apply on both wings a thin and even layer of Type II / Type IV / 100% (undiluted) anti-icing fluid on the top skin of the wing critical area, and on other cold soaked surfaces prone to frost build-up, such as the lower wing skin inboard of the vortilons.

CAUTION: The Local Frost Prevention in wing tank areas must be applied symmetrically on both wings, also if circumstances would require treatment of one wing only.

CAUTION: This procedure must only be applied under the conditions stated in paragraph "1.8.F. (3) Limitations". If precipitation starts unexpectedly after the Local Frost Prevention has been applied, a standard de-icing/anti-icing must be performed before dispatch!

NOTE: A manual compression sprayer may be used to apply a thin layer of fluid, in order to minimize fluid consumption and avoid spillage on the ramp. Paint rollers must not be used to apply the fluid since protection varies excessively with type of roller.

(b) A tactile check (by touch) of the treated areas and a visual check of the untreated areas of both wings shall be performed immediately before the aircraft leaves the parking position. These checks are conducted to ensure that both wings are clean and free of frost. The applied de-icing/anti-icing fluid shall still be liquid and shall show no indication of failure, such as colour turning to white, loss of gloss, getting viscous, showing ice crystals, etc.

(7) Recording / Reporting

The following information shall be provided to the cockpit crew:
"Local frost prevention was accomplished".

G. General Aircraft Requirements after De-icing/Anti-icing

When the treatment has been completed, the mechanic// qualified ground person checks all the aircraft surfaces for successful de-ice and anti-ice. The qualified ground person's report to the captain is the final clearance for airworthiness. The pilot in command then makes his decision to accept the performed treatment. As the aircraft starts moving under its own power, the transfer of the responsibility takes place.

Following the de-icing/anti-icing procedures and prior to take off, the critical aircraft surfaces must be clean of all frost, ice, snow and slush accumulations in accordance with the following requirements. For requirements specific to the aircraft type see Section 3.

(1) **Wings, Tail, Control Surfaces and Aileron Balance Plate Areas Wings**, tail, control surfaces including hinge points/shrouds/fairings/seals, and aileron balance plate areas must be free of ice, slush, snow and frost except that a coating of frost may be present on wing lower surfaces in areas in contact with cold soaked fuel between forward and aft spars, in accordance with the manuals published by the aircraft manufacturers.
NOTE: Except for frost due to cold-soaked fuel as mentioned above, and unless otherwise specified in the Aircraft Flight Manual or other aircraft manufacturer's documentation, contamination is not acceptable on: the upper or lower surfaces of the horizontal stabilizer and elevator/tab; strakes; inboard, outboard, upper, and lower surfaces of the wing and wing tip devices; and either side of the vertical stabilizer and rudder.

(2) Pitot Heads, Static Ports, Angle of Attack Sensors, Ice Detection Probes

Pitot heads, static ports, angle of attack sensors and ice detection probes must be clear of ice, frost, slush, snow and fluid residues, and protective covers.
NOTE: Ice ridges can form on the nose of the fuselage while on the ground. These ridges will disrupt air flow into the pitot tubes and which can result in false measurements. All contamination shall be removed from this area.

(3) Engine / APU Inlets and Exhausts

Engine / APU inlets and exhausts must be clear of internal ice, frost, slush, snow, and remaining de-icing/anti-icing fluid, and fans must be free to rotate.
Under freezing fog conditions, the rear side of the fan blades shall be checked for ice build-up prior to start-up (for details refer to aircraft and engine manufacturer’s documentation). Any deposits discovered shall be removed by directing air from a low flow hot air source, such as a cabin heater, onto the affected areas, or by other means recommended by the aircraft and engine manufacturer.

(4) Air Conditioning Inlets and Outlets

Air conditioning inlets and outlets must be clear of ice, frost, slush and snow. Outflow valves must be clear and unobstructed.

(5) Landing Gear, Landing Gear Doors and Landing Gear Wheel Wells

Landing gear, landing gear doors and landing gear wheel wells must be unobstructed and clear of ice, frost, slush and snow.

(6) Fuel Tank Vents

Fuel tank vents must be clear of ice, frost, slush and snow.

(7) Fuselage

Fuselage must be clear of ice, slush and snow. Frost may be present on the fuselage in accordance with the aircraft manufacturer's manuals, provided that no other forms of contamination are present, and inlets, outlets, and other devices (as identified by the aircraft manufacturer) are free of contamination.

Do not close any door until all ice or snow has been removed from the surrounding area.

(8) Antennas

Antennas must be clean.

(9) Flight Compartment Windows

Flight compartment windows and windshields must be clean.
Any significant deposits of frost, snow, slush, or ice on the windscreens or on areas forward of the windscreens shall be removed prior to departure. Heated flight deck windows will not normally require De-icing. Any forward area from which fluid may flow back onto windscreens during taxi or subsequent takeoff shall be free of fluid prior to departure.

If SAE Type II fluid has been used, all traces of the fluid on flight deck windows shall be removed prior to departure, with particular attention paid to windows fitted with wipers. Thickened-fluid (SAE Type II,) can be removed by using a diluted Type I mixture, water (where it has been determined that refreezing will not occur), a manual method (ensuring that windscreen heat is turned off), or another cleaner as approved by the aircraft manufacturer.
NOTE: During falling precipitation, heated windows may cause liquid runoff to freeze near sensors, requiring De-icing**.**

(10)Flight Control Check

A functional flight control check is required after de-icing/anti-icing depending upon aircraft type (see relevant manuals); an external observer may be required for this check. This check is particularly important in case of an aircraft that has been subjected to an extreme ice or snow covering.

Dried fluid residues when the aeroplane has not been flown after anti-icing

Dried fluid residue could occur when surfaces have been treated but the aeroplane has not subsequently been flown and not been subject to precipitation. The fluid may then have dried on the surfaces. In such situations the aeroplane must be checked for residues from de-icing / anti-icing fluids and cleaned as necessary.

Special maintenance considerations

Proper account should be taken of the possible side-effects of fluid use. Such effects may include, but are not necessarily limited to, dried and/or rehydrated residues, corrosion and the removal of lubricants.

1.9. LIMITS, PRECAUTIONS AND HOLDOVER TIME

A. Fluid Related Limits

(1) Temperature Limits

When performing two-step de-icing/anti-icing, the freezing point of the fluid used for the first step shall at or below the OAT.

(2) ISO/SAE Type I Fluids

CAUTION: Type I fluids supplied as concentrates for dilution with water prior to use shall not be used undiluted. For exceptions, refer to fluid manufacturer's documentation.

The freezing point of the type I fluid mixture used for either one-step de-icing/anti-icing or as a second step in the two-step operation shall be at least 10 °C below the ambient temperature.
For other type I fluid requirements and limitations see paragraph "1.5. Fluids".

NOTE: When longer holdover times are desired, use of undiluted type II or IV fluid should be considered.

(3) ISO/SAE Type II / Type IV Fluids

Type II / type IV fluids used as de-icing/anti-icing agents have a lower temperature application limit of approximately -25°C. The application limit for a specific product may be lower, provided a 7°C buffer is maintained between the freezing point of the neat fluid and outside air temperature. In no case a product must be used if the outside air temperature is lower than the Lowest Operational Use Temperature as defined by the aerodynamic acceptance test.

For other type II / type IV fluid requirements and limitations see paragraph "1.5. Fluids".
For restrictions regarding application of type II or IV fluids as second step over type I fluid in first step, see paragraph 1.8.B.(2).

CAUTION: The repeated application of Type II or IV fluids may cause residues to collect in aerodynamically quiet areas, cavities and gaps. The application of hot water or heated Type I fluid in the first step of the de-icing/anti-icing process may minimize the formation of residues.
Residues may re-hydrate and freeze under certain temperature, high humidity and/or rain conditions and may block or impede critical flight control systems. These residues may require removal.
When checking for residues, their visibility may be facilitated by misting with water.

NOTE: For use of holdover time guidelines, consult fluid manufacturer's technical literature for minimum viscosity limits of fluids as applied to aircraft surfaces.

(4) Application Limits

Under no circumstances shall an aircraft that has been anti-iced receive a further coating of anti-icing fluid directly on top of a contaminated film.
If an additional treatment is required before flight, a complete de-icing/anti-icing shall be performed (see Section 2). Ensure that any residues from the previous treatment are flushed off. Anti-icing only is not permitted.

(5) Overnight Protection with SAE Type IV Fluids

Although type IV fluids provide a very long holdover time, these fluids shall not be used for overnight protection unless a complete two-step de-icing/anti-icing is performed before dispatch of the aircraft.

(6) **Pre-de-icing/anti-icing with Type II or Type IV Fluids**

Pre-de-icing/anti-icing early in the morning with thickened fluids shall always be done in a two step treatment.

Performance Degradation of Anti-icing Fluids – Reduced Holdover Times

Recent research tests showed that when mixing thickened aircraft anti-icing fluid (ADF) with minimal amounts of runway de-icing fluids (RDF) (formate or acetate based), anti-icing protection provided by the ADF could be diminished due to a separation of the thickening agents in this fluid, consequently reducing holdover time.

The scenario for combining airplane de-/anti-icing fluids and runway De-icing fluids happens when fluids from the runway are splashed onto the wing by the nose gear wheels or from the engine thrust reversers. Runway fluids are known as “hydroscopic fluids”, which means they don’t dry out very fast, and can leave a thin wet layer on the wing that can be difficult to see.

Using the two-step process will reduce the formation of gel residues in the critical area and will reduce the chances of wing contamination from runway deicers causing failure of airplane anti-icing fluid holdover times. Therefore, it is recommended that de-icing/anti-icing applications are performed in a two-step process.

(Excerpt from EASA SIB no. 2010-26 issued at 14 September 2010)

B. Aircraft Related Limits

(1) Consult the applicable aircraft maintenance manual and carrier’s instructions for any specific aircraft or engine related requirements.

(2) The application of de-icing/anti-icing fluid shall be in accordance with the requirements of the airframe/engine manufacturers. Specifically, the type of fluid and the fluid/water mixture must be approved by airframe/engine manufacturers.
CAUTION: If aircraft manufacturer’s maintenance manual or carrier’s instruction is not available, the mixture shall be selected and applied in accordance with instructions from the Commander or from the carriers engineer responsible for the release of the aircraft.

(3) After prolonged periods of de-icing/anti-icing it is advisable to check aerodynamic quiet areas and cavities for residues of thickened de-icing/anti-icing fluid. Consult airframe manufacturers for details and procedures.

(4) On the horizontal stabilizers/elevators, a normal amount of anti-icing fluid shall be applied to ensure sufficient anti-icing performance. Application of an excessive amount of thickened anti-icing fluid shall be avoided in order to minimize the influence of the fluid on the aircraft characteristic during rotation.

(5) Carpatair Fleet
If a type IV fluid is applied to a horizontal stabilizer / elevator, a work order must be opened. An inspection has then to be carried out by maintenance within 3 days, with a possible extension to 4 days, applicable from the date of issue of that work order.

For Non Spray Areas, please consult the operator de/anti icing manual. If not available, please consult SAE AS6286B De-icing/Anti-Icing Diagrams/No Spray Zones.

C. Procedure Precautions

WARNING: If a de-icing or an anti-icing treatment cannot be fully completed or if it must be interrupted, the Commander must be informed accordingly.

CAUTION: Wing skin temperature may differ and, in some cases, be lower than OAT. A mix with a higher de-icing/anti-icing fluid concentration can be used under these conditions. As fluid freezing may occur, a 50 % diluted type II or type IV fluid shall not be used for the anti-icing step on a cold soaked wing.
CAUTION: The application of Type II or IV fluid, especially when used in a one-step process, may cause fluid to collect in aerodynamically quiet areas, cavities and gaps which can dry out and leave dried residues. Dried residues may rehydrate and freeze following a period of high humidity and/or rain conditions. This may impede flight control systems. These dried residues may require removal. Consult the aircraft manufacturer with regard to inspection methods and frequency, related maintenance requirements and aircraft washing recommendations.

(1) In order to avoid subsequent aerodynamic problems, it is vital that the aircraft is treated symmetrically at all times, that is, the same fluid/fluid mix must be applied to both the left hand and the right hand sides of the aircraft and this fluid must be applied to the corresponding areas on both sides. Although frozen deposits may only be present on one side of the aircraft, the same procedure must be repeated on the other side, to ensure that the aerodynamic effect of the fluid remaining on the wing/tail surfaces during take-off, is the same on both sides of the aircraft.

WARNING: Aerodynamic problems could result if this requirement is not met.

(2) Precautions must be taken to avoid any excess of fluid in the rudder, elevator and aileron control areas, but enough fluid shall be used to eliminate frost, ice, slush and snow.

NOTE: If the layer of snow is too thick, remove most of the snow with brooms. Use brooms with soft bristles in order to avoid damage to the skin of the aircraft.

WARNING: Spraying must generally be done in forward-to-aft direction to avoid penetration of excessive amounts of fluid into cavities and protected or shielded areas. Aerodynamic problems could result if this requirement is not met.

During de-icing and anti-icing, the movable surfaces shall be in a position as specified by the aircraft manufacturer.

(3) On Carpatair aircraft, the APU may be running and engines may be running at idle speed during de-icing/anti-icing, but the air conditioning systems and the APU air shall be selected "OFF".
Particular care shall be taken to avoid positioning the sprayer basket and occupant too close to engine inlets and engine / APU exhausts.

NOTE: During the time that the air conditioning system is shut down, the temperature in the cabin can become uncomfortable. De-icing/anti-icing shall therefore be performed without delay.

(4) Fluid entry into engines shall be avoided and all reasonable precautions shall be taken to minimise fluid entry into other intakes/outlets and control surface cavities. Fluid shall not be sprayed on thrust reversers. See relevant manuals.

WARNING: Remaining fluid in engine inlets and exhausts must be removed before engine start. Uncontrolled ingestion of de-icing/anti-icing fluids can cause internal damage to engines and APU hot section parts and is a potential fire hazard.

CAUTION: Fluid in the air outlet of the air conditioning can cause malfunction of the outflow valve.

(5) When removing ice, snow, slush or frost from aircraft surfaces, care shall be taken to prevent the frozen deposits from entering and accumulating in auxiliary intakes or control surface hinge areas. Remove snow from wings and stabilizer surfaces forward towards the leading edge and remove from ailerons and elevators back towards the trailing edge.

(6) De-icing/anti-icing fluids shall not be sprayed directly into the orifices of pitot tubes, static vents/ports, air intakes/outlets, or directly onto airstream direction detector probes/angle of attack airflow sensors.

(7) De-icing/anti-icing fluids shall not be sprayed directly on wiring harnesses and electrical components (receptacles, junction boxes, etc.).

(8) Fluids shall not be directed onto flight deck or cabin windows as this can cause crazing of acrylics or penetration of the window seals.

(9) Any forward area from which fluid can blow back onto windscreens during taxi or subsequent take off shall be free of fluid residues prior to departure. If type II / type IV fluids are used, all traces of the fluid on flight deck windows shall be removed prior to departure. Particular attention shall be paid to windows fitted with wipers.

De-icing/anti-icing may be removed by rinsing with clear water or an approved cleaner and a soft cloth, or by flushing with Type I fluid. Windscreen wipers shall not be used for this purpose.

(10) All cabin windows of importance in an emergency evacuation shall be free from any deposits which can obscure visibility from inside; anti-icing fluid from fuselage treatment however is acceptable.

(11) Landing gear and wheel bays shall be kept free from build-up of slush, ice or accumulations of blown snow. Ice and snow shall be removed from landing gear doors, door latches, up-lock mechanisms, up-lock hooks, down-lock mechanisms, down-lock springs, lock actuators, position indicating switches, and control cables.

NOTE: Besides of landing gear and components malfunction, ice or hard frozen snow can break loose from landing gears during taxi/take off, and, on aircraft with tail mounted engines, cause severe damage to engines.

CAUTION: De-icing/anti-icing fluid must not be sprayed on wheels and brakes. Contact of carbon brakes with de-icing/anti-icing fluid shall be avoided. During spraying of the wing leading edge, direct the spray such that it does not hit the landing gear or wheels and brakes.

(12) Ice can build-up on aircraft surfaces when descending through dense clouds or precipitation during an approach. When ground temperatures at the destination are low, it is possible for flaps to be retracted and for accumulations of ice to remain undetected between stationary and moveable surfaces. It is therefore important that these areas are checked during de-icing/anti-icing and any frozen deposits are removed.

(13) Proper application and even distribution of de-icing/anti-icing fluid is more difficult in strong winds.

CAUTION: If excessive wind prevents proper application of anti-icing fluid in icing conditions, the anti-icing code (ref. paragraph 1.12.B.) must not be used and the aircraft must not be released for flight.

(14) Hot water may be used to remove large amounts of contamination (such as ice) from an aircraft, provided that the Outside Air Temperature is -3°C and above as per the application procedures for SAE Type I, II and IV fluids.

Safety Issues

Jet Blast/wash propeller

Engine Exhaust-Caution must be exercised when in the engine exhaust heat and velocity hazard areas. The hazard areas exist in a reverse funnel fashion, which extends past the tail of the aircraft. Aircraft manufactures specify the hazards area dependent on the engine type. Even when an aircraft engine is running at low thrust or idle equipment, operators must maintain safe distances from the aircraft.

Engine Inlet

Engine inlet vortices are normally only visible when water or steam exhaust is present in them. Foreign objects are capable of being ingested and causing damage to aircraft engines. Personnel can also be ingested when in close proximity to operating engines, which can be fatal. Aircraft manufactures specify the hazardous area dependent on the engine type.

Safety Zones

Safe Zones are designated areas used for manoeuvring de-icing equipment and provide clearance for aircraft to transition through the de-icing pad.

Slippery Aprons

Areas sprayed with de-icing fluid may become slippery. Exercise caution when walking or when operating equipment on apron areas where fluid has been deposited. If an accumulation of fluid occurs on the apron, it is recommended that mechanical means, such as vacuum trucks, should be used to pick up the over sprayed fluid.

Visibility/Wind/Weather

Extreme weather conditions may warrant the change of vehicle patterns due to safety concerns. De-icing equipment may have operating restrictions under high wind conditions; consult the equipment manufacturers for restrictions. Under poor visibility conditions de-icing operations may need to be slowed or ceased until conditions improve.

Aircraft and Vehicle Movement

The vehicle movement patterns around aircraft must be established with regard to the facility/area in which they are operating. Adherence to established procedures will sustain a consistent and safe operation.

Procedures

Front line employees must follow the de-icing procedures as defined by their employer. If a problem with a process or procedure is identified then the employee is responsible for reporting the problem, without delay, to his or her immediate supervisor.

D. Clear Ice Precautions

(1) Clear ice can form on cold aircraft surfaces during precipitation, and also below a layer of snow or slush. It is therefore important that surfaces are closely examined during and following each de-icing operation, in order to ensure that all deposits have been removed.
Clear ice normally builds up at low wing temperatures and when large quantities of cold fuel remain in wing tanks during the turnaround/transit and any subsequent refuelling is insufficient to cause a significant increase in fuel temperature.

(2) Significant deposits of clear ice can form on the top and underside of wing fuel tanks. Aircraft are most vulnerable to this type of ice build-up when one or more of the following conditions exist:
a) wing temperatures remain well below 0°C during the turnaround/transit;
b) ambient temperatures between -2°C and +15°C are experienced;
c) ambient humidity is high and/or precipitation occurs while the aircraft is on the ground.

NOTE 1: Clear ice can form at other temperatures if conditions a) and c) exist.
NOTE 2: Low wing temperatures associated with this type of build-up normally occur when large quantities of cold fuel remain in wing tanks during the turnaround/transit and any subsequent refueling does not cause a sufficient increase in wing temperature

(3) This type of ice formation is crystal clear and extremely difficult to detect. Therefore, when the above conditions prevail, or when there is otherwise any doubt whether clear ice has formed, a close inspection shall be made immediately prior to departure, in order to ensure that all frozen deposits have in fact been removed.

NOTE: Clear ice build-up normally occurs at low wing temperatures and when large quantities of cold fuel remain in wing tanks during the turnaround/transit and any subsequent re-fuelling is insufficient to cause a significant increase in fuel temperature.
NOTE: Clear ice can form at other temperatures if conditions a) and c) exist.

NOTE: Clear ice inspections must be performed in accordance with the appropriate aircraft maintenance manual. On some aircraft, clear ice checks are mandatory.

(4) On tail mounted engine aircraft, ice shedding from the wing surface during take-off can cause severe damage to the engines, leading to engine surge, engine vibration, or a compete loss of engine thrust. On other aircraft there is a risk of lift loss and/or damage to the stabilizers after take-off. Due to different fuel tank system designs, some aircraft are more critical.

Proximity Sensor Activation Reporting Procedures
For equipment types furnished with a proximity sensor requiring physical contact in order to activate, in the event of sensor contact, the Pilot-in-Command shall be informed immediately, and be provided with specific information pertaining to the location on the aircraft where contact was made. The equipment involved shall remain in position until investigation can occur to inspect the affected area for damage.

Carpatair maintenance staff or his absence, on duty pilot in command shall visually inspect the affected area for any signs of visual damage. If no visible damage is observed, the de/anti-icing process may continue at the discretion of the Pilot-in-Command. If damage is suspected or detected, the Pilot-in-Command shall be notified and the de/anti-icing process shall cease. Further inspection of the affected area should be performed by an individual deemed qualified under the air operators program to determine the aircraft's airworthiness.

NOTE: By design, this type of proximity sensor normally will not cause damage to an aircraft surface if contact is made to a fixed aircraft surface, while the equipment chassis is stationary. In certain circumstances, however, damage may occur outside of the sensors design limitations. This includes but is not limited to:
• Contact with an aircraft surface while the equipment chassis is maneuvering;

• Contact with an aircraft surface while the aircraft is maneuvering;

• Contact with a moving/rotating aircraft surface (i.e., propeller, engine fan blade, etc.); and/or

• Contact is made or suspected to have been made between a component of the deicing vehicle and aircraft.

In these circumstances, the procedures mentioned above this note shall apply. Should a proximity sensor be activated, all pertinent and relevant details shall be documented, including (at a minimum):

• Date

• Time

• Vehicle operator name(s)

• Vehicle identification (e.g., number)

• Flight number

• Aircraft registration number

• Deicing location (e.g., bay or gate number)

• Location on the aircraft where the contact was made, including specifics (e.g., side, aircraft part, etc.)

• Proximity sensor location on the vehicle and point where the contact was made (e.g., nozzle, left side of sensor, etc.)

• Name and job title of the third party individual that performed inspection

• Third party company name (not required if third party is from the deicing/anti-icing company)

• Result of the third party inspection (e.g., no visual damage detected or damage suspected/present)

E. Application Guideline / Holdover Times Tables

It is the objective that the holdover time of the applied fluid is equal to or greater than the estimated time from start of anti-icing to start of take-off, based on existing weather conditions.

Holdover time tables are used to determine the time of effectiveness of different types of fluids during various meteorological conditions. They also give guidance about the usable fluid to water mixing ratio in different conditions. These tables should only be used as a guideline since, as described earlier, the holdover time is affected by the combination of numerous factors.
One important factor with unthickened fluids is viscosity.

Holdover protection is achieved by a layer of anti-icing fluid remaining on and protecting aircraft surfaces for a period of time. With a one-step de-icing/anti-icing procedure, the holdover time begins at the commencement of de-icing/anti-icing. With a two-step procedure, the holdover time begins at the commencement of the second (anti-icing) step. The holdover time runs out when the frozen deposits start to form/accumulate on aircraft surfaces.

Holdover time guidelines are presented in Section 2.1
The duration of holdover protection may vary subject to the influence of factors other than those specified in holdover tables. These other factors may include:

- atmospheric conditions (e.g. the exact type and rate of precipitation, the wind velocity, the relative humidity, solar radiation, fast dropping OAT); and
- the aircraft and its surroundings (e.g. such as aircraft component inclination angle, contour and surface roughness, surface temperature, operation in close proximity to other aircraft (jet or propeller blast) and ground equipment and structures).

Due to their properties, type I fluids form a thin liquid wetting film which provides limited holdover time, especially in conditions of freezing precipitation. With this type of fluid no additional holdover time would be provided by increasing the concentration of the fluid in the fluid/water mix. It should also be recognized that there are no holdover time guidelines for type I fluids below -25°C.

Type II and type IV fluids contain thickening agents which enable the fluid to form a thicker liquid wetting film on external aircraft surfaces. This film provides a longer holdover time especially in

conditions of freezing precipitation. With this type of fluid additional holdover time will be provided by increasing the concentration of fluid in the fluid/water mix, with maximum holdover time available from undiluted fluid.

The application guideline and holdover tables are included in Section 2.1. Relevant tables give an indication of the time frame of protection that could reasonably be expected under different conditions of precipitation. However, due to the many variables that can influence holdover, these times should not be considered as minimums or maximums as the actual time of protection may be extended or reduced, depending on the particular conditions existing at the time. The lower limit of the published time span is used to indicate the estimated time of protection during moderate precipitation, and the upper limit indicates the estimated time of protection during light precipitation.
When a longer holdover time is needed/desired, use of undiluted type II or IV fluid should be considered.

NOTE: For use of holdover time guidelines consult Fluid Manufacturer Technical Literature for minimum viscosity limits of fluids as applied to aircraft surfaces.

NOTE: A degraded type II shall be used with the holdover time guideline for type I fluids. A type II or type IV fluid is considered to be degraded if the viscosity is below the minimum limit as provided by the fluid manufacturer. A degraded fluid must not be used on aircraft of Carpatair unless approved in writing by Carpatair.

CAUTION: The times of protection represented in holdover time tables are for general information purposes and shall be used as guidelines only. The time of protection will be shortened in heavy weather conditions. Heavy precipitation rates or high moisture content, high wind velocity or jet blast may reduce the holdover time below the lowest time stated in the range. Holdover time may also be reduced when the aircraft skin temperature is lower than OAT. Also, if the aircraft wing skin temperature is lower than the OAT, there may be a need to carry out aircraft de-icing/anti-icing. Therefore, the indicated times should be used only in conjunction with a Pre-takeoff Check; see paragraph 1.11.

CAUTION: For type I fluids the holdover time guidelines require that the freezing point of the mixed fluid is at least 10 °C below ambient temperature. Take care that the holdover time of type I fluid is never exceeded. Use type II fluid for longer holdover protection.

Fluid Holdover Times for Active Frost Conditions

Fluid holdover times in active frost conditions differ from holdover times in other conditions as they incorporate an allowance for the temperature differential (typically 6 to 8°C) between the OAT and the exposed surface temperature due to radiation cooling. As a result of this allowance, the OAT should be used to determine the appropriate active frost holdover time.

Active frost holdover times may be reduced in the presence of combined cooling effects or extreme surface cooling. In extreme cases, the surface temperature may be below the fluid LOUT and cause a risk of fluid freezing.

1.10. COMMUNICATION PROCEDURES

The person communicating with the flight crew shall have basic knowledge of English language in order to communicate properly (Operational level).
Communication between the Commander and the de-icing crew will usually be achieved using a combination of printed forms and verbal communication. For treatments carried out after aircraft doors are closed, use of flight interphone (headset) or VHF radio will usually be required. Electronic message boards may also be used in 'off stand' situations. Use of hand signals is not recommended except for the final 'all clear' signal.

Communication prior to starting De-icing/Anti-Icing treatment

a) Before de-icing/anti-icing, the Commander shall be requested to confirm the treatment required (areas to be de-iced, anti-icing requirements, special de-icing procedures).
b) Before fluid application starts, the Commander shall be requested to configure the aircraft for de-icing/ anti-icing (surfaces, controls and systems, as per aircraft type requirements). The de-icing crew shall wait for confirmation that this has been completed before commencing the treatment.
c) For treatments carried out without the flight crew present, a suitably qualified individual shall be nominated by the aircraft operator to confirm the treatment required and to confirm correct configuration of the aircraft.

Pre-Operations Briefing

Prior to daily de-icing operations, it is essential that all employees be made aware of the expected weather conditions, the anticipated aircraft traffic and any changes or non-standard equipment or procedures that may arise during the operation. This briefing is not only important for operational efficiency purposes but is a key safety of operations tactic.

Post-Operations Briefing

Following a period of de-icing operations, once operations have ceased, it is appropriate for management to conduct an evaluation of the operation with the involvement of the employees.

It is recommended that each de-icing operation be followed by a debriefing session with the participants in order to discuss operational matters, to evaluate overall performance by everyone, as well as to discuss any specific operational topics deemed necessary.

This kind of post-operations debriefing serves many functions including:
- identifying safety issues;
- identifying process or procedure errors;
- identifying employee errors which require training;
- identifying deficiencies in the training program;
- identifying communication weaknesses; and
- identifying circumstances which, if changed, may improve the overall safety and efficiency of de-icing operations.

1.11. CHECKS BEFORE AIRCRAFT DISPATCH

A. Flight Crew / Ground Crew Pre-flight Check

This walk-around pre-flight check must be performed by trained and qualified personnel prior to departure. Any aircraft surface contamination must be noted, and any required de-icing/anti-icing operations must be directed. See also paragraph 1.6.

NOTE: For individual aircraft types and models, additional checks may be necessary in accordance with airframe and engine manufacturer requirements!

B. Post De-icing/Anti-icing Check (Final Check after De-icing/Anti-icing)

An aircraft shall not be dispatched after a de-icing/anti-icing operation until the aircraft has received a final check by a trained and qualified person.
After the treatment, it is very important to test the free movement of the flight controls. After the treatment, it is possible that some slush enters the cavities between the control surfaces. This may refreeze and jam the flight controls. Therefore, it is important to check the free control movements prior to take-off.

After the de-icing/ anti-icing procedures and before take-off the following aircraft surfaces must be clean of ice, frost, snow and slush:

- Wings, tail and control surfaces. A thin coating of frost (3mm or less) on lower wing surfaces, in areas between forward and aft spars, cold-soaked by fuel is permitted.

Note:
Frost or any other contamination is not acceptable on the lower side of the horizontal stabilizer and elevators, unless specified in the Airplane Flight Manual (OM-A/ OM-B) or other aircraft manufacturer's documentation.

- Pitot tubes and static ports. Fluid residues must be removed as well.
- Outflow valves, air condition inlets and exits.
- Landing gear and landing gear doors.
- Fuel tank vents.
- Fuselage.

A thin layer of hoarfrost may be present if all vents and ports are clear. Hoarfrost is considered to be 'thin', if letters, markings, painted lines etc. on the aircraft surface are visible through the frost layer.

- Engines: Cowlings, inlets, exhaust nozzles, cooling intakes, control system probes and ports must be clear of ice, snow, and slush. Engine fan blades or propellers (as appropriate) must be clear of ice, frost and snow and have to be free to rotate.

The check shall be done in accordance with the respective aircraft maintenance manual and with special requirements which may have been released by the operator. For general requirements, see also paragraph 1.6. and 1.8.G. Any contamination shall be removed by further de-icing/anti-icing treatment, and the check shall be repeated.

Flight Control Check

A 'flight control check' using an external observer may be required after de-icing/ anti-icing depending on aircraft type. This is particular important if the aircraft has been covered by a thick cover of ice or snow.
The anti-icing code according to paragraph 1.12.B. shall not be transmitted to the flight crew before the post de-icing/anti-icing check is completed. The communication of the code confirms that the check after de-icing/anti-icing was completed and the aircraft critical parts are free of ice, frost, snow and slush.

The procedures in this document do not relieve from any inspection/check requirements in the appropriate aircraft maintenance manual, including freedom-of-movement check of the flight controls, and other checks which may be required.

1.12. PRE TAKE-OFF CHECK AND PRE TAKE-OFF CONTAMINATION CHECK

After the Post De-icing/Anti-icing Check was performed the Commander must monitor the environmental situation. Before take-off the crew must assess whether the assumptions applied for determination of the holdover time are still valid. This check is usually performed **from the inside** the aircraft.

When any doubt exists as to whether or not any deposit may have formed and might adversely affect the aircraft's performance and/or controllability, the Commander shall not commence the take-off unless:

- a Pre-Take off Contamination Check is performed **from the outside** the aircraft confirming the critical surfaces of the aircraft are free of contamination, OR
- a complete new de-icing/anti-icing procedure of the aircraft is performed

A. Pre Take-off Check

The Commander shall continuously monitor the weather after the performance of the de-icing/anti-icing procedure. Prior to take-off the crew shall assess whether the assumed holdover time is still valid whenever weather conditions deteriorate (change of the precipitations type and intensity, wind velocity increase, OAT decrease) or jet-blasts from aircraft in vicinity.

This check is normally performed **from the inside** the flight deck.

B. Pre Take-off Contamination Check

At some airports and in certain weather conditions a pre take-off contamination check may be activated by the airport operator or a designated handling company to carry out a final contamination check of aircrafts preliminarily having performed a de/anti icing procedure.
This is a check to verify that the critical surfaces of the aircraft are free of contamination and shall be performed when the condition of the critical surfaces of the aircraft cannot be effectively assessed by a Pre Take-off Check (from the inside of the aircraft), or if any doubt exists as to whether or not any deposit may adversely affect the aircraft's performance and / or controllability.

This check is normally accomplished **from the outside** the aircraft by qualified personnel and must be done just before the commencement of the take-off roll.

Whenever a Pre Take-off Contamination Check is necessary but not available a complete de-icing/anti-icing re-treatment of the aircraft is mandatory.

1.13. FLIGHT CREW INFORMATION AND DOCUMENTATION

A. Flight Crew information

The flight crew must be informed by handling/contracted agent of the beginning and completion of de-icing/anti-icing operations.
The person communicating with the flight crew shall have a basic knowledge of the English language in order to communicate properly
Communication between the Commander and the handling agent/contracted agent will usually be achieved using a combination of verbal communication and printed forms (De-icing checklist). For treatments carried out after aircraft doors are closed, use of aircraft interphone (headset) will be used.
The flight crew will be informed by the handling agent/contracted agent of the beginning and completion of de-icing/anti-icing operations. Use of hand signals is not recommended except for the final “all clear” signal.

An aircraft shall not be dispatched for departure after a de-icing/anti-icing treatment operation until the flight crew has been notified of the type of de-icing/anti-icing operation performed.
The notification shall include the results of the final inspection by qualified personnel, indicating that the aircraft critical parts are free of ice, frost, slush and snow.

In addition, the notification shall include the necessary de-icing/anti-icing codes as specified in paragraph B. below, to allow the flight crew to estimate the holdover time to be expected under the prevailing weather conditions.
The flight crew shall receive a confirmation from the ground crew that all de-icing/anti-icing operations are complete and that all personnel and equipment are clear before reconfiguring or moving the aircraft.

Communication prior to start de-icing/anti-icing treatment

a) Before de-icing/anti-icing, the Commander shall be requested to confirm the treatment required (areas to be de-iced, anti-icing requirements, special de-icing procedures).

b) Before fluid treatment starts, the Commander shall be requested to configure the aircraft for De-icing / anti-icing (surfaces, controls and systems, as per aircraft type requirements). The de-icing crew shall wait for confirmation that this has been completed before commencing the treatment.

c) For treatments conducted without the flight crew present, suitably Qualified Staff shall be nominated by the aircraft operator to confirm the treatment required (when applicable) and to confirm the correct configuration of the aircraft.

Post De/Anti-Icing Communication

An aircraft shall not be dispatched for departure after a de-icing/anti-icing treatment operation until the flight crew has been notified of the type of de-icing/anti-icing operation performed.
The notification shall indicate that the aircraft parts are free of frost, snow, slush, or ice. In addition, the notification shall include the necessary de-icing/anti-icing codes as specified in paragraph B in order to allow the flight crew to estimate the holdover time to be expected under the prevailing weather conditions.

The flight crew will receive a confirmation from the handling/contracted agent that all de-icing/anti-icing operations are complete and that all personnel and equipment are clear before reconfiguring or moving the aircraft.

Communication in case of Interruption of De/Anti–Icing Treatment

When a treatment is interrupted the Commander shall be immediately informed stating:

a) The reason for interruption (e.g. truck runs out of fluid, other);
b) Actions to be taken (in consultation with Commander);
c) Expected time of delay;

Before continuing the treatment:

d) Inform the commander;
e) Establish in consultation with the Commander, further treatment to be carried out, including any surfaces requiring repetitive treatment (in relation to Holdover time).

Once confirmation is received, handling agent/contracted agent shall, carry out the treatment as per agreement.

B. Anti-icing Codes

The following information shall be recorded and be communicated to the flight crew by referring to the last step of the de-icing/anti-icing procedure and in the sequence provided below:

a) the ISO/SAE fluid type, i.e. Type I for ISO/SAE type I, Type II for ISO/SAE type II, or Type IV for SAE type IV;
b) the concentration of fluid within the fluid/water mixture, expressed as a percentage by volume (this is no requirement for type I fluids);
c) the local time (hours/minutes) at the beginning of the final de-icing/anti-icing step;
d) in written communication also the date (day, month, year); optional for verbal communication;
e) the complete name of the anti-icing fluid, the so called "brand name" (optional, for type II and IV fluids only).

Examples:

TYPE I at 13:25 (20 FEB 2003) [**]	To be used if de-icing/anti-icing has been performed with a type I fluid.
TYPE II / 100 at 13:25 (20 FEB 2003) [**]	To be used if de-icing/anti-icing has been performed with undiluted type II fluid.
TYPE II / 75 at 13:25 (20 FEB 2003) [**]	To be used if de-icing/anti-icing has been performed with a mixture of 75% type II fluid and 25% water.
TYPE IV / 50 at 13:25 (20 FEB 2003) [**]	To be used if de-icing/anti-icing has been performed with a mixture of 50% type IV fluid and 50% water.

(....) date required for record keeping and for written communication, optional for verbal flight crew notification
[**] complete name of anti-icing fluid

The code shall be communicated to the flight crew. Also, if a one step or two-step de-icing /anti-icing was performed may optionally be communicated.

NOTE: The communication of the code to the flight crew confirms that the post de-icing/anti-icing check was completed and the aircraft is clean. If two different companies are involved in the de-icing/anti-icing treatment and the post de-icing/anti-icing check, it must be ensured that the anti-icing code is not communicated to the flight crew before this check is completed.
Warning: Risk of aerodynamic problems during take-off! For a safe take-off within the aircraft performance limits, the Cockpit Crew has to rely on a correct de-icing/ anti-icing treatment. The Anti-icing Code must not be transmitted to the Commander before the Post-De-icing/ Anti-icing Check has been completed properly and successfully.

C. Aircraft Technical Log

The following Information shall be written in the aircraft technical log:

- the time when the ground de-icing and / or anti-icing was started
- the type of fluid applied (in case if two step treatment the fluid for second step)
- the mixture ratio of fluid / water used for anti-icing
- the holdover time

D. Application Report

It is recommended that a de-icing/anti-icing operation Form be developed which can be used to record the following required information:

a) Operation record number
b) Station identification
c) Date/Time of operation
d) Air Operator name
e) Aircraft registration
f) Type of Aircraft
g) Flight number
h) Weather conditions
i) Aircraft condition upon arrival
j) Outside air temperature
k) De-icing location
l) Quantity of glycol Type I used
m) Quantity of glycol Type II or IV used
n) Start/Finish time for Type I application
o) Start/Finish time for Type II or IV application
p) Refractometer reading for fluid in use
q) Glycol Type I mixture ratio
r) De-icing trucks involved
s) Truck driver and operator identification
t) Type of de-icing/anti-icing requested by the pilot
u) Remarks (e.g. Type of inspection)

This document will become the official record that the de-icing operation was carried out. The signatures of the individuals that accomplished the de-icing/anti-icing operation should be present.

1.14. TRAINING AND QUALIFICATION OF PERSONNEL

Everyone involved in each step of the de-icing process must be trained and qualified. This includes ground personnel, mechanics, sprayers, drivers, managers and supervisors, quality assurance personnel, flight crew. Although there is an operational difference regarding who performs each individual task, the need for proper training and qualification is the same for every employee involved in this process.

Flight safety may be jeopardized if de-icing/anti-icing is improperly performed. Therefore, the de-icing/anti-icing activities shall be carried out exclusively by personnel trained and qualified on this subject. The following below requirements are compulsory and are to be complied with.

Companies providing de-icing/anti-icing services shall have both a Qualification Programme and a Quality Assurance Programme to monitor and maintain an acceptable level of competence.

De-icing/anti-icing crews shall receive initial and annual recurrent training. Records of personnel training and qualification shall be maintained for proof of qualification.

Both initial and annual recurrent training for flight crews and ground crews shall be conducted to ensure that all such crews obtain and retain a thorough knowledge of aircraft de-icing/anti-icing policies and procedures, including new procedures and lessons learned. Training program shall follow the guidelines published in SAE AS6286B

Training success shall be proven by an examination/assessment which shall cover all training subjects laid down below. The pass mark shall be 75% and only persons passing this examination can be qualified.

For personnel performing the actual de-icing/anti-icing treatment on aircraft, practical training with the de-icing/anti-icing equipment shall be included.

Depending on the size of the local de-icing/anti-icing organization, many or only few individual persons may be involved. Each person must be trained and must be qualified for his part of the de-icing/anti-icing operation.

Additional training is required if any of the following is introduced:

- a new procedure
- a new type of fluid and / or equipment
- new type(s) of aircraft.

The operator shall take all reasonable measures to ensure that if subcontracting the task of de-icing/anti-icing, the subcontractor is competent to execute the task.

Both initial and annual recurrent trainings shall be conducted according to the syllabi included in the attachment of this manual in order to ensure that all such crews obtain and maintain thorough knowledge of aircraft ground de-icing/anti-icing principles and procedures.
The training shall cover the following subjects as a minimum:

- personnel safety precautions and emergency procedures;
- activation of the local de-icing/anti-icing organisation if conditions are such that frost, ice, snow or slush may reasonably be expected to be on the aircraft;
- the specific duties and responsibilities of each operational position or group responsibilities, for getting the aircraft airborne while ground de-icing/anti-icing operational procedures are in effect;
- aircraft surface contamination (i.e. frost, ice, snow or slush), and how contamination adversely affects aircraft performance, flight characteristics and control;
- techniques for recognizing the different kinds of deposits (frost, ice, snow, slush) on the aircraft, and techniques for removing such deposits from aircraft surfaces;
- anti-icing techniques;

- problems involved with clear ice;
- types of checks required;
- basic characteristics of de-icing/anti-icing fluids; determination of fluid type and required mix, based on actual weather conditions, application guideline tables and interpretation of holdover time tables, including limitations;
- names and location of major aircraft parts/components such as wings, fuselage, stabilizers, flight control surfaces, engine inlets/exhausts, APU inlet/exhaust, antennas, fuel vents, pitot tubes, static ports, delicate sensors/probes which must not be sprayed directly, etc.;
- de-icing/anti-icing facilities and equipment handling and operation, including actual operation of equipment and communication with cockpit crew;
- special provisions, procedures, and critical areas for individual aircraft types and for contract de-icing/anti-icing;
- Procedure Local Frost Prevention in Cold Soaked Wing Areas, and associated limitations;
- ISO/SAE code determination and communication after de-icing/anti-icing operation;
- procedures and methods for storage and handling of de-icing and anti-icing fluids;
- checking of fluid quality / equipment quality;
- emergency procedures;
- special provisions and procedures for contract de-icing/anti-icing;
- environmental considerations, e.g. where to deice, spill reporting, hazardous waste control.

Records of personnel training and qualifications shall be maintained for proof of qualification for at least 2 years.

1.15. QUALITY CONTROL

Handling Companies performing de-icing/anti-icing treatment of aircraft on ground shall periodically be checked in accordance with regulations in force.

The Carpatair quality insurance programme stipulates the performing of periodical audits in accordance with the specific procedures of the quality system and the Annual Audit Plan at all the stations where Carpatair operates.

Ground handling companies performing de-/anti-icing of airplanes on ground shall be periodically checked in accordance with regulations in force.

Fluid Delivery/Acceptance Check

This check shall be performed for each delivery of aircraft deicing and anti-icing fluids before the first use of the delivered fluid for filling a storage tank or deicing vehicle tank.

Delivery Documentation

a. The delivery shall be accompanied by a Certificate of Analysis or Certificate of Conformance.
1. For all fluid types, the certificate shall include delivery specifications and test results of the following:
(a) Fluid appearance
(b) Refraction (Refractive Index)
(c) pH
2. For deliveries of Type II and IV fluids, the certificate shall also include delivery specifications and test results for laboratory viscosity testing

b. The documentation and paperwork accompanying the delivery shall be checked to verify the following:
1. The delivered fluid corresponds to the fluid ordered
2. The delivered fluid brand name corresponds to product identification labels or tags for each delivery vessel
3. The delivered fluid concentration corresponds to product identification labels or tags for each delivery vessel
4. The lot or batch number on delivery documents correlate with other shipping documents provided
5. The test results noted on the Certificate of Analysis or Certificate of Conformance meet the applicable fluid manufacturer's specifications

Shipment Seals

a. Shipment seals shall be checked to ensure:
1. The product has not been tampered with
2. Identification numbers align with those noted on delivery documentation (where applicable).
b. If seals contain identification numbers, the numbers should be noted on acceptance documentation.

Bulk Shipping (e.g. road tankers and rail tankers)
The fluid supplier shall provide an assurance that one of the following has been met prior to loading the bulk shipping container for delivery to the customer:
a. The shipping container and included delivery hoses were cleaned.
b. The previous load consisted of fluid identical to the delivered fluid.

Visual Contamination Check

Put fluid from the sample into a clean glass bottle or equivalent.
Check for any kind of contamination (e.g. rust particles, metallic debris, rubber parts, etc.)

Check can be made by any equivalent method /Refractive Index Check;
Ensure the refractive index is within the limits published by the manufacturer for the fluid as delivered.

Refractive Index Check

Refractive index (concentration) check from fluid/mixtures at the nozzle must be performed on a daily basis from spraying nozzle, when vehicle is in use!
Make sure the refractometer is calibrated and clean.
Put a fluid drop taken from the sample or from the nozzle onto the test screen of the refractometer and close the prism.
Read the value on internal scale and use the correction factor given by the manufacturer of the fluid in case the temperature of the refractometer is not 20 ºC
Compare the value with the refractive index limits provided by the fluid manufacturer, to ensure it is within tolerance.

Clean the refractometer and return it into the protective cover.

Refractometer Calibration

Refractometers should be tested every 6 months and prior to the de-icing season. A record of these tests should be kept on file at the station for a minimum of two (2) years. The information recorded should be in accordance with the manufacturer's recommendations.

pH-Value Check

This check may be performed either with pH indicator paper (litmus paper) or with a calibrated or functionally tested pH measurement instrument.
In laboratory, this check should always be performed with a calibrated or functionally tested pH measurement instrument.

Viscosity Check

Viscosity check of fluid shall be performed at the beginning and in the middle of the de-/anti-icing season. Fluid-samples shall be taken from the nozzle.

For thickened de-icing/anti-icing fluids take the sample as described in fluid sampling procedure for type II and type IV fluids. Samples shall be taken in all concentrations used for anti-icing.

Auditing

All stations performing de-/anti-icing have to be audited according to regulations in force.

Carpatair operations inspector may choose to inspect the operation at any time. However, a regularly conducted internal audit, by the de-icing service provider, will provide feedback to company managers and thereby assist in keeping the de-icing operation safe and efficient.

It is suggested that these self-audits be carried out on an ad-hoc basis with the results being discussed and documented at the management level. A corrective action process should be established for the items identified as a concern during the audit. A record of the implementation or disposition of the corrective measures recommended by the auditor should be retained on file.

Corrective Action
This process should ensure that internal and external audit findings are addressed in an appropriate manner through a documented corrective action plan. This approach serves several important functions, in addition to making the company management aware of perceived operational shortcomings, including: the recording of issues, the documentation of proposed corrective measures, the tracking of corrective measures completion, and it serves as a record for the future.

When a new Station is to be opened, an initial inspection must be carried out, before the beginning of operation. First, period a "De-icing/Anti-icing – Quality Assurance Checklist and Report" must be completed and copies of this report distributed to the persons in charge on each Carpatair operational station.
Immediately prior to the start of operations carry out a follow up inspection, ensuring that all negative responses have been actioned. Then complete and distribute updated copies of the "De-icing/Anti-icing – Quality Assurance Checklist and Report.

SECTION 2

APPLICATION GUIDELINES AND HOLDOVER TIMES TABLES

Generic Holdover Times Tables

Holdover time tables laid down in this section are the so called Generic Holdover Time Tables (in short 'Generic Tables'). That means they are not brand specific and therefore valid for all fluids of a certain type like Type I, II, IV fluid.

Generic Tables / “SAE” (Global Aircraft De-icing Standards / Non Branded)
Only SAE (generic, non- branded) Type I, Type II and Type IV Fluids are included in present manual.
All Type III Fluids, without exception, are forbidden for application as anti-icing protection on Fokker 100 and Airbus 319 aircraft.

Adjusted FAA Holdover Times Tables (de-icing with extended flaps, adjusted at 76%)
Tables adjusted for de-icing with extended flaps and slats are not included in present manual.

FAA Tables 48,49 and 50 - Procedure Requiring Special Training and Authorization

Holdover times tables exist also for individual fluid products. They are called Brand Name Holdover Times Tables (in short 'Brand Name Tables'). They are only valid for an individual fluid (like e.g. Kilfrost ABC-S). Holdover times in these tables may be longer than in the 'Generic Table'.

2.1.

FAA HOLDOVER TIME GUIDELINES FOR WINTER 2021-2022

FAA Holdover Time Guidelines **Winter 2021-2022**

TABLE 1: ACTIVE FROST HOLDOVER TIMES FOR SAE TYPE I, TYPE II, TYPE III, AND TYPE IV FLUIDS

Outside Air Temperature[1,2,3]	Type I
-1 °C and above (30 °F and above)	0:45 *(0:35)*[5]
below -1 to -3 °C (below 30 to 27 °F)	
below -3 to -10 °C (below 27 to 14 °F)	
below -10 to -14 °C (below 14 to 7 °F)	
below -14 to -21 °C (below 7 to -6 °F)	
below -21 to -25 °C (below -6 to -13 °F)	
below -25 °C to LOUT (below -13 °F to LOUT)	

Outside Air Temperature[2,3]	Concentration Fluid/Water By % Volume	Type II	Type III[4]	Type IV
-1 °C and above (30 °F and above)	100/0	8:00	2:00	12:00
	75/25	5:00	1:00	5:00
	50/50	2:00	0:30	3:00
below -1 to -3 °C (below 30 to 27 °F)	100/0	8:00	2:00	12:00
	75/25	5:00	1:00	5:00
	50/50	1:30	0:30	3:00
below -3 to -10 °C (below 27 to 14 °F)	100/0	8:00	2:00	10:00
	75/25	4:00	1:00	5:00
below -10 to -14 °C (below 14 to 7 °F)	100/0	6:00	2:00	6:00
	75/25	1:00	1:00	1:00
below -14 to -21 °C (below 7 to -6 °F)	100/0	3:00	2:00	6:00
below -21 to -25 °C (below -6 to -13 °F)	100/0	2:00	2:00	4:00
below -25 °C (below -13 °F)	100/0	No Holdover Time Guidelines Exist		

NOTES

1 Type I Fluid / Water Mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
2 Ensure that the lowest operational use temperature (LOUT) is respected.
3 Changes in outside air temperature (OAT) over the course of longer frost events can be significant; the appropriate holdover time to use is the one provided for the coldest OAT that has occurred in the time between the de/anti-icing fluid application and takeoff.
4 To use the Type III fluid frost holdover times, the fluid brand being used must be known. AllClear AeroClear MAX must be applied unheated.
5 Value in parentheses is for aircraft with critical surfaces that are predominantly or entirely constructed of composite materials.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pretakeoff check procedures.

FAA Holdover Time Guidelines **Winter 2021-2022**

TABLE 2: HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF ALUMINUM

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals	Very Light Snow, Snow Grains or Snow Pellets[4,5]	Light Snow, Snow Grains or Snow Pellets[4,5]	Moderate Snow, Snow Grains or Snow Pellets[4]	Freezing Drizzle[6]	Light Freezing Rain	Rain on Cold-Soaked Wing[7]	Other[8]
-3 °C and above (27 °F and above)	0:11 - 0:17	0:18 - 0:22	0:11 - 0:18	0:06 - 0:11	0:09 - 0:13	0:02 - 0:05	0:02 - 0:05	
below -3 to -6 °C (below 27 to 21 °F)	0:08 - 0:13	0:14 - 0:17	0:08 - 0:14	0:05 - 0:08	0:05 - 0:09	0:02 - 0:05	CAUTION: No holdover time guidelines exist	
below -6 to -10 °C (below 21 to 14 °F)	0:06 - 0:10	0:11 - 0:13	0:06 - 0:11	0:04 - 0:06	0:04 - 0:07	0:02 - 0:05		
below -10 °C (below 14 °F)	0:05 - 0:09	0:07 - 0:08	0:04 - 0:07	0:02 - 0:04				

NOTES

1 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
2 Ensure that the lowest operational use temperature (LOUT) is respected.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle.
6 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
7 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
8 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions. Heavy precipitation rates or high moisture content, high wind velocity, or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pretakeoff check procedures.

FAA Holdover Time Guidelines — Winter 2021-2022

TABLE 3: HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF COMPOSITES

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals	Very Light Snow, Snow Grains or Snow Pellets[4,5]	Light Snow, Snow Grains or Snow Pellets[4,5]	Moderate Snow, Snow Grains or Snow Pellets[4]	Freezing Drizzle[6]	Light Freezing Rain	Rain on Cold-Soaked Wing[7]	Other[8]
-3 °C and above (27 °F and above)	0:09 - 0:16	0:12 - 0:15	0:06 - 0:12	0:03 - 0:06	0:08 - 0:13	0:02 - 0:05	0:01 - 0:05	
below -3 to -6 °C (below 27 to 21 °F)	0:06 - 0:08	0:11 - 0:13	0:05 - 0:11	0:02 - 0:05	0:05 - 0:09	0:02 - 0:05	CAUTION: No holdover time guidelines exist	
below -6 to -10 °C (below 21 to 14 °F)	0:04 - 0:08	0:09 - 0:12	0:05 - 0:09	0:02 - 0:05	0:04 - 0:07	0:02 - 0:05		
below -10 °C (below 14 °F)	0:04 - 0:07	0:07 - 0:08	0:04 - 0:07	0:02 - 0:04				

NOTES

1 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
2 Ensure that the lowest operational use temperature (LOUT) is respected.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle.
6 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
7 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
8 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions. Heavy precipitation rates or high moisture content, high wind velocity, or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pretakeoff check procedures.

FAA Holdover Time Guidelines — Winter 2021-2022

TABLE 4: GENERIC HOLDOVER TIMES FOR SAE TYPE II FLUIDS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals	Snow, Snow Grains or Snow Pellets[3,4]	Freezing Drizzle[5]	Light Freezing Rain	Rain on Cold-Soaked Wing[6]	Other[7]
-3 °C and above (27 °F and above)	100/0	0:55 - 1:50	0:25 - 0:50	0:30 - 1:00	0:20 - 0:35	0:07 - 0:45	
	75/25	0:25 - 0:55	0:15 - 0:25	0:15 - 0:40	0:10 - 0:20	0:04 - 0:25	
	50/50	0:15 - 0:25	0:05 - 0:10	0:08 - 0:15	0:06 - 0:09	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:30 - 0:45	0:20 - 0:35	0:20 - 0:45	0:15 - 0:20		
	75/25	0:25 - 0:50	0:10 - 0:20	0:15 - 0:25	0:08 - 0:15		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:30 - 0:45	0:15 - 0:30	0:20 - 0:45[8]	0:15 - 0:20[8]		
	75/25	0:25 - 0:50	0:08 - 0:20	0:15 - 0:25[8]	0:08 - 0:15[8]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:20	0:02 - 0:07				
below -18 to -25 °C[9] (below 0 to -13 °F)	100/0	0:15 - 0:20	0:01 - 0:03				
below -25 °C to LOUT[9] (below -13 °F to LOUT)	100/0	0:15 - 0:20	0:00 - 0:01				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
4 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle.
5 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
6 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
7 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
8 No holdover time guidelines exist for this condition below -10 °C (14 °F).
9 If the LOUT is unknown, no holdover time guidelines exist below -25 °C (-13 °F).

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions. Heavy precipitation rates or high moisture content, high wind velocity, or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pretakeoff check procedures.

FAA Holdover Time Guidelines — Winter 2021-2022

TABLE 19: GENERIC HOLDOVER TIMES FOR SAE TYPE IV FLUIDS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals	Very Light Snow, Snow Grains or Snow Pellets[3,4]	Light Snow, Snow Grains or Snow Pellets[3,4]	Moderate Snow, Snow Grains or Snow Pellets[3]	Freezing Drizzle[5]	Light Freezing Rain	Rain on Cold-Soaked Wing[6]	Other[7]
-3 °C and above (27 °F and above)	100/0	1:15 - 2:40	1:55 - 2:20	1:00 - 1:55	0:30 - 1:00	0:40 - 1:10	0:20 - 0:35	0:08 - 1:05	
	75/25	1:25 - 2:40	2:05 - 2:25	1:15 - 2:05	0:40 - 1:15	0:50 - 1:20	0:30 - 0:45	0:09 - 1:15	
	50/50	0:30 - 0:55	1:00 - 1:10	0:25 - 1:00	0:10 - 0:25	0:15 - 0:40	0:09 - 0:20		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:20 - 1:35	1:45 - 2:05	0:55 - 1:45	0:25 - 0:55	0:25 - 1:10	0:20 - 0:25		
	75/25	0:30 - 1:20	1:50 - 2:10	1:00 - 1:50	0:30 - 1:00	0:20 - 1:05	0:15 - 0:25		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:20 - 1:35	1:20 - 1:40	0:45 - 1:20	0:25 - 0:45	0:25 - 1:10[8]	0:20 - 0:25[8]		
	75/25	0:30 - 1:20	1:40 - 2:00	0:45 - 1:40	0:20 - 0:45	0:20 - 1:05[8]	0:15 - 0:25[8]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:20 - 0:35	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -18 to -25 °C[9] (below 0 to -13 °F)	100/0	0:20 - 0:35	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03				
below -25 °C to LOUT[9] (below -13 °F to LOUT)	100/0	0:20 - 0:35	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02				

CAUTION: No holdover time guidelines exist

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
4 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle.
5 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
6 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
7 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids and Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail. If the glycol type is unknown, the allowance times for SAE Type IV PG fluids should be used).
8 No holdover time guidelines exist for this condition below -10 °C (14 °F).
9 If the LOUT is unknown, no holdover time guidelines exist below -23.5 °C (-10 °F).

CAUTIONS

- The responsibility for the application of these data remains with the user.
- The time of protection will be shortened in heavy weather conditions. Heavy precipitation rates or high moisture content, high wind velocity, or jet blast may reduce holdover time below the lowest time stated in the range. Holdover time may be reduced when aircraft skin temperature is lower than outside air temperature.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pretakeoff check procedures.

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FAA Holdover Time Guidelines — Winter 2021-2022

TABLE 55: GUIDELINES FOR THE APPLICATION OF SAE TYPE I FLUID

Outside Air Temperature (OAT)[1]	One-Step Procedure De/Anti-icing[2]	Two-Step Procedure	
		First Step: Deicing	Second Step: Anti-icing[3]
0 °C (32 °F) and above	Fluid/water mixture heated to at least 60°C (140°F) at the nozzle with a freezing point of at least 10°C (18°F) below OAT	Heated water or a heated fluid/water mixture	Fluid/water mixture heated to at least 60°C (140°F) at the nozzle with a freezing point of at least 10°C (18°F) below OAT
Below 0 °C (32 °F) to LOUT		Heated fluid/water mixture with a freezing point at OAT or below	

NOTES

1 Fluids must not be used at temperatures below their lowest operational use temperature (LOUT).

2 When anti-icing using the one-step procedure, a minimum quantity of 1 litre/m² (~2 gal./100 sq. ft.) of Type I fluid mixture heated to at least 60°C (140°F) is required after all frozen contamination is removed. This is achieved using a continuous process. This application is necessary to heat the surfaces, as heat contributes significantly to the Type I fluid holdover times.

3 To be applied before first-step fluid freezes, typically within 3 minutes. This time may be higher than 3 minutes in some conditions, but potentially lower in heavy precipitation, colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

CAUTIONS

- This table is applicable for the use of Type I holdover time guidelines in all conditions, including active frost. If holdover times are not required, a temperature of 60 °C (140 °F) at the nozzle is desirable.
- If holdover times are required, the temperature of water or fluid/water mixtures shall be at least 60 °C (140 °F) at the nozzle. Upper temperature limit shall not exceed fluid and aircraft manufacturers' recommendations.
- To use Type I Holdover Times Guidelines in all conditions including active frost, an additional minimum of 1 liter/m² (~2 gal./100 sq. ft.) of heated Type I fluid mixture must be applied to the surfaces after all frozen contamination is removed. This application is necessary to heat the surfaces, as heat contributes significantly to the Type I fluid holdover times. The required protection can be provided using a 1-step method by applying more fluid than is strictly needed to just remove all of the frozen contamination (the same additional amount stated above is required).
- The lowest operational use temperature (LOUT) for a given Type I fluid is the higher (warmer) of:
  a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
  b) The actual freezing point of the fluid plus a freezing point buffer of 10 °C (18 °F).
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage. Consult the appropriate guidance (HOT Tables and FAA N 8900.XXX series notice "Revised FAA-Approved Deicing Program Updates, Winter 2021-2022") for the contaminant in question.
- When conducting aircraft deicing using a Type I fluid and not using the 10°C/18°F buffer, procedures must be developed and approved to ensure refreezing does not occur prior to takeoff.

FAA Holdover Time Guidelines — Winter 2021-2022

TABLE 56: GUIDELINES FOR THE APPLICATION OF SAE TYPE II AND IV FLUID

(FLUID CONCENTRATIONS IN % VOLUME)

Outside Air Temperature (OAT)[1]	One-Step Procedure De/Anti-icing	Two-Step Procedure	
		First Step: Deicing	Second Step: Anti-icing[2]
0 °C (32 °F) and above	100/0, 75/25 or 50/50 Heated[3] Type II or IV fluid/water mixture	Heated water or a heated Type I, II, III, or IV fluid/water mixture	100/0, 75/25 or 50/50 Heated or unheated Type II or IV fluid/water mixture
Below 0 °C (32 °F) to -3 °C (27 °F)	100/0, 75/25 or 50/50 Heated[3] Type II or IV fluid/water mixture	Heated Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0, 75/25 or 50/50 Heated or unheated Type II or IV fluid/water mixture
Below -3 °C (27 °F) to -14 °C (7 °F)	100/0 or 75/25 Heated[3] Type II or IV fluid/water mixture	Heated Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0 or 75/25 Heated or unheated Type II or IV fluid/water mixture
Below -14 °C (7 °F) to LOUT	100/0 Heated[3] Type II or IV fluid	Heated Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0 Heated or unheated Type II or IV fluid

NOTES

1 Fluids used for the anti-icing procedure must not be used at temperatures below their lowest operational use temperature (LOUT). First step fluids must not be used below their freezing points. Consideration should be given to the use of Type I/III fluid when Type II/IV fluid cannot be used due to LOUT limitations (see Tables 55 and 57). The LOUT for a given Type II/IV fluid is the higher (warmer) of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
b) The actual freezing point of the fluid plus its freezing point buffer of 7 °C (13 °F).

Although some LOUTs are lower than the temperatures stated in the HOT table, holdover times do not apply when anti-icing below the lowest temperature stated in the band.

2 To be applied before first step fluid freezes, typically within 3 minutes. Time may be longer than 3 minutes in some conditions, but potentially shorter in heavy precipitation, colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

3 Clean aircraft may be anti-iced with unheated fluid.

CAUTIONS

- For heated fluids, a fluid temperature not less than 60 °C (140 °F) at the nozzle is desirable.
- Upper temperature limit shall not exceed fluid and aircraft manufacturers' recommendations.
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage. Consult the appropriate guidance (HOT Tables and FAA N 8900.XXX series notice "Revised FAA-Approved Deicing Program Updates, Winter 2021-2022") for the contaminant in question.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilutions of Type II or IV shall not be used for the anti-icing step because fluid freezing may occur.
- An insufficient amount of anti-icing fluid may cause a substantial loss of holdover time. This is particularly true when using a Type I fluid mixture for the first step in a two-step procedure.
- When conducting aircraft deicing using a Type I fluid and not using the 10 °C/18 °F buffer, procedures must be developed and approved to ensure refreezing does not occur prior to takeoff.

2.2. FAA ADJUSTED HOLDOVER TIME GUIDELINES FOR WINTER 2021-2022

FAA Adjusted Holdover Times Tables (de-icing with extended flaps, adjusted at 76%) are excluded in this manual. Carpatair has not developed yet a policy for the respective procedure, the benefits of anti-icing with flaps deployed to a take-off position are very uncertain, therefore anti-icing with flaps deployed must not be carried until further notice.

2.3. LIMITATIONS RELATED TO THE USE OF TABLES 48,49 AND 50 ONLY AS A TOOL FOR DOUBLE CHECKING THE REPORTED INTENSITY OF SNOWFALL

Pilot assessment of precipitations intensities as a function of prevailing visibility is not permitted. Until further notice the use of FAA HOT Tables 48,49 and 50 is limited to pilots' double check of any obvious gross discrepancies between the reported intensity of snowfall and pilot witnessed visibility, at the scene/on spot, given the outside conditions (day or night and OAT).

Whenever **the REPORTED VISIBILITY** or the **visibility (obscuration) perceived by the pilots during snowfall DOES NOT MATCH the reported snowfall intensity,** the pilots must reassess the feasibility of departure, if the type and/or mixture of de/anti-icing fluid is still appropriate and decide whether to continue taxying out for take-off or holding their position in order to review earlier determined HOT.

The following factors are decisive for assessment of snowfall intensity:

- day or night: outside perceived conditions such as daylight or darkness (vision obscuration);
- actual OAT or the reported OAT.

In the future Carpatair considers developing a specific training program provisioned in the FAA Notice N 8900.557, / 9. Guidelines for Pilot Assessments of Precipitation Intensity Procedures. / e. Permissible Use of Pilot Assessment of Precipitation Intensity. / (4) Training Requirements.

"(4) Training Requirements.

Pilots who are limited in their precipitation intensity assessments to determining whether or not precipitation is falling will only be required to have instruction on how that assessment should be made (e.g., how and where to perform the physical feel cues to determine if precipitation is present).

(a) Pilots who determine precipitation intensity will be required to be trained on their company's pilot precipitation intensity assessment procedures. These pilots will need training on the methods used by weather observers to determine precipitation types and intensities and on how to conduct their own assessment under the different precipitation conditions. The FMH-1 and Table 50 must be used as the source documents for this training.

(b) Additionally, § 121.629 requires anti-icing fluid failure recognition training under the various precipitation conditions for pilots and all other persons responsible for conducting pretakeoff contamination checks if anti-icing fluids are used"

Authorizations for Pilot Assessments of Precipitation Intensity and application of tables 41 and 42 will be granted only in conjunction with Special Company Coordination Procedures which will involve a case by case assessment of the specific airport and weather conditions by the NP Flight Operations, NP Training, FSO or Flight Operations Representative on Duty of the day.

TABLE 48: ALLOWANCE TIMES FOR SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS[1]

Precipitation Types or Combinations	Applicable METAR Codes	Outside Air Temperature			
		-5 °C and above	Below -5 to -10 °C	Below -10 to -16 °C	Below -16 to -22 °C[2]
Light Ice Pellets	-PL	70 minutes	50 minutes	30 minutes	30 minutes
Light Ice Pellets Mixed with Light Snow	-PLSN, -SNPL	50 minutes	30 minutes	15 minutes	
Light Ice Pellets Mixed with Light Freezing Drizzle or Moderate Freezing Drizzle	-PLFZDZ, -FZDZPL, FZDZPL	40 minutes	30 minutes	Caution: No allowance times currently exist	
Light Ice Pellets Mixed with Light Freezing Rain	-PLFZRA, -FZRAPL	40 minutes	30 minutes		
Light Ice Pellets Mixed with Light Rain	-PLRA, -RAPL	40 minutes[3]			
Moderate Ice Pellets (or Small Hail[4])	PL, GS	35 minutes	25 minutes	10 minutes	10 minutes
Moderate Ice Pellets (or Small Hail[4]) Mixed with Moderate Freezing Drizzle	PLFZDZ, GSFZDZ,	20 minutes	10 minutes	Caution: No allowance times currently exist	
Moderate Ice Pellets (or Small Hail[4]) Mixed with Moderate Rain	PLRA, GSRA, RAPL, RAGS	15 minutes[5]			

NOTES

1 These allowance times are for use with undiluted (100/0) ethylene glycol based fluids applied on aircraft with rotation speeds of 100 knots or greater. The following fluids are ethylene glycol based; AllClear ClearWing EG, ASGlobal 4Flite EG, AVIAFLUID AVIAFlight EG, CHEMCO ChemR EG IV, CHEMCO ChemR Nordik IV, Clariant Max Flight AVIA, Clariant Safewing EG IV NORTH, Dow EG106, JSC RCP Nordix Defrost EG 4, JSC RCP Nordix Defrost NORTH 4, and Newave Aerochemical FCY-EGIV. If the glycol type is unknown, the allowance times for SAE Type IV PG fluids should be used.

2 Ensure that the lowest operational use temperature (LOUT) is respected.

3 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of light ice pellets mixed with light freezing rain.

4 In the US, small hail is included with regular hail and the remarks section is used saying "GR LESS THAN ¼". Outside of the US the code GS is used when the hail is less than 5 mm and GR when it is 5mm or greater. If no intensity is reported with small hail, use the "moderate ice pellets or small hail" allowance times. If an intensity is reported with small hail, the ice pellet condition with the equivalent intensity can be used, e.g. if light small hail is reported, the "light ice pellets" allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the "light ice pellets mixed with light snow" allowance times.

5 No allowance times exist in this condition for temperatures of 0 °C and below.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pretakeoff check procedures.
- Allowance time cannot be extended by an inspection of the aircraft critical surfaces.
- Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. The OAT must not decrease during the 90 minutes to use this guidance in conditions of light ice pellets mixed with either: light freezing drizzle, moderate freezing drizzle, light freezing rain, or light rain

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TABLE 49: ALLOWANCE TIMES FOR SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS[1]

Precipitation Types or Combinations	Applicable METAR Codes	Outside Air Temperature			
		-5 °C and above	Below -5 to -10 °C	Below -10 to -16 °C	Below -16 to -22 °C[2]
Light Ice Pellets	-PL	50 minutes	30 minutes	30 minutes[3]	30 minutes[3]
Light Ice Pellets Mixed with Light Snow	-PLSN, -SNPL	40 minutes	15 minutes	15 minutes[3]	
Light Ice Pellets Mixed with Light Freezing Drizzle or Moderate Freezing Drizzle	-PLFZDZ, -FZDZPL, FZDZPL	25 minutes	10 minutes	Caution: No allowance times currently exist	
Light Ice Pellets Mixed with Light Freezing Rain	-PLFZRA, -FZRAPL	25 minutes	10 minutes		
Light Ice Pellets Mixed with Light Rain	-PLRA, -RAPL	25 minutes[4]			
Moderate Ice Pellets (or Small Hail[6])	PL, GS	15 minutes	10 minutes	10 minutes[3]	
Moderate Ice Pellets (or Small Hail[6]) Mixed with Moderate Freezing Drizzle	PLFZDZ, GSFZDZ	10 minutes	7 minutes	Caution: No allowance times currently exist	
Moderate Ice Pellets (or Small Hail[6]) Mixed with Moderate Rain	PLRA, GSRA, RAPL, RAGS	10 minutes[5]			

NOTES

1 These allowance times are for use with undiluted (100/0) propylene glycol based fluids applied on aircraft with rotation speeds of 100 knots or greater. All Type IV fluids are propylene glycol based with the exception of AllClear ClearWing EG, ASGlobal 4Flite EG, AVIAFLUID AVIAFlight EG, CHEMCO ChemR EG IV, CHEMCO ChemR Nordik IV, Clariant Max Flight AVIA, Clariant Safewing EG IV NORTH, Dow EG106, JSC RCP Nordix Defrost EG 4,JSC RCP Nordix Defrost NORTH 4, and Newave Aerochemical FCY-EGIV, which are ethylene glycol based. If the glycol type is unknown, the allowance times for SAE Type IV PG fluids should be used.

2 Ensure that the lowest operational use temperature (LOUT) is respected.

3 No allowance times exist for propylene glycol (PG) fluids when used on aircraft with rotation speeds less than 115 knots.

4 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of light ice pellets mixed with light freezing rain.

5 In the US, small hail is included with regular hail and the remarks section is used saying "GR LESS THAN ¼". Outside of the US the code GS is used when the hail is less than 5 mm and GR when it is 5mm or greater. If no intensity is reported with small hail, use the "moderate ice pellets or small hail" allowance times. If an intensity is reported with small hail, the ice pellet condition with the equivalent intensity can be used, e.g. if light small hail is reported, the "light ice pellets" allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the "light ice pellets mixed with light snow" allowance times.

6 No allowance times exist in this condition for temperatures of 0 °C and below.

CAUTIONS

- The responsibility for the application of these data remains with the user.
- Fluids used during ground de/anti-icing do not provide in-flight icing protection.
- This table is for departure planning only and should be used in conjunction with pretakeoff check procedures.
- Allowance time cannot be extended by an inspection of the aircraft critical surfaces.
- Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. The OAT must not decrease during the 90 minutes to use this guidance in conditions of light ice pellets mixed with either: light freezing drizzle, moderate freezing drizzle, light freezing rain, or light rain.

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FAA Holdover Time Guidelines — Winter 2021-2022

TABLE 50: SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY

Time of Day	Temp.		Visibility in Statute Miles (Meters)									Snowfall Intensity
	Degrees Celsius	Degrees Fahrenheit	≥ 2 1/2 (≥ 4000)	2 (3200)	1 3/4 (2800)	1 1/2 (2400)	1 1/4 (2000)	1 (1600)	3/4 (1200)	1/2 (800)	≤ 1/4 (≤ 400)	
Day	colder/equal -1	colder/equal 30	Very Light	Very Light	Very Light	Light	Light	Light	Moderate	Moderate	Heavy	
	warmer than -1	warmer than 30	Very Light	Light	Light	Light	Light	Moderate	Moderate	Heavy	Heavy	
Night	colder/equal -1	colder/equal 30	Very Light	Light	Light	Moderate	Moderate	Moderate	Moderate	Heavy	Heavy	
	warmer than -1	warmer than 30	Very Light	Light	Moderate	Moderate	Moderate	Moderate	Heavy	Heavy	Heavy	

NOTE 1: This table is for estimating snowfall intensity. It is based upon the technical report, "The Estimation of Snowfall Rate Using Visibility," Rasmussen, et al., Journal of Applied Meteorology, October 1999 and additional in situ data.

NOTE 2: This table is to be used with Type I, II, III, and IV fluid guidelines.

NOTE 3: The use of Runway Visual Range (RVR) is not permitted for determining visibility used with the holdover tables.

NOTE 4: Some METARS contain tower visibility as well as surface visibility. Whenever surface visibility is available from an official source, such as a METAR, in either the main body of the METAR or in the Remarks ("RMK") section, the preferred action is to use the surface visibility value.

NOTE 5: If visibility from a source other than the METAR is used, round to the nearest visibility in the table, rounding down if it is right in between two values. For example, .6 and .625 (5/8) would both be rounded to .5 (1/2).

HEAVY = Caution—No Holdover Time Guidelines Exist

During snow conditions alone, the use of Table 50 in determining snowfall intensities does not require pilot company coordination or company reporting procedures since this table is more conservative than the visibility table used by official weather observers in determining snowfall intensities.

Because the FAA Snowfall Intensities Table, like the FMH-1 Table, uses visibility to determine snowfall intensities, if the visibility is being reduced by snow along with other forms of obscuration such as fog, haze, smoke, etc., the FAA Snowfall Intensities Table does not need to be used to estimate the snowfall intensity for HOT determination during the presence of these obscurations. Use of the FAA Snowfall Intensities as a Function of Prevailing Visibility Table under these conditions may needlessly overestimate the actual snowfall intensity. Therefore, the snowfall intensity being reported by the weather observer or automated surface observing system (ASOS), from the FMH-1 Table, may be used.

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SECTION 3

DE-ICING / ANTI-ICING PROCEDURES FOR FOKKER 100

3.1. GENERAL CONSIDERATIONS

DE-ICING / ANTI-ICING PROCEDURES FOR FOKKER 100

Aircraft category	C-29
Wing area	94 m^2
Horizontal stabilizer	24m^2
Total surface area	118m^2

De-icing/anti-icing fluid residue rehydration and freezing

Repeated application of type II or type IV anti-icing fluid, without subsequent application of type I or hot water, may cause a residue to collect in aerodynamically quiet areas. Under certain temperature, high humidity and/or rain conditions this residue may rehydrate and form into a gel that swells to many times its original size and may freeze during flight. This may cause problems to operate certain flight controls. Areas between the control surfaces and the wings, horizontal stabilizer and vertical fin can be considered aerodynamically quiet areas. These areas are included in the critical areas mentioned in the AMM chapter 12-31-00 that require a pre-flight inspection in ground icing conditions.

Recommendations

- If any gel residues of anti-icing fluids are found, the surfaces or areas must be cleaned and reprotected as necessary.
- Under no circumstances shall an aircraft, that has been anti-iced, receive a further coating of anti-icing fluid/water mixture on top of an existing film. Should it be necessary for an aircraft to be anti-iced again prior to the next flight, the critical surfaces shall first be de-iced with a hot de-icing fluid/water mixture before another application of anti-icing fluid.
- Operators are recommended to pay special attention to the reduced hold over times in freezing rain conditions.

WARNING:
Do not proceed to the aeroplane before the all-clear signal by the ground personnel is verified and do not drive faster than 6.5 km/h (4 mil/h) at the aircraft.

CAUTION:
Be aware of running engines and APU, if applicable, to avoid damage.

RESPONSIBILITY:

GROUND ENGINEER: Request for minimum de-icing prior taxiing; ISO-Code for de-icing; correct and complete de-icing/anti-icing accomplishment; report to the Commander.
COMMANDER: ISO-Code for anti-icing; request for de-icing/anti-icing; final decision; sufficient protection against reformation of contamination during taxiing.

NOTE:
In case of an emergency move away from the aeroplane with on-going application of the signal horn.

CAUTION: NO DIRECT FLUID SPRAYING:

01. Engine intakes & exhausts, APU inlet & exhaust
    To avoid smoke and smell in the cabin.
02. All types of windows
    To avoid restricted view and scratching.

03. All wheels, brakes and gear sensors
To avoid explosion of tyres and/or brakes and malfunction of indicators in the flight deck.
04. Pitot static system, angle of attack sensors and temperature bulbs
To avoid malfunction of the systems and/or total system failures.
05. Antennas and external lights
To avoid mechanical damage and/or electrical malfunction.
06. Passenger boarding devices, as part of the aeroplane
To avoid slipperiness and damage (hazardous situation for the passengers and the crew)
07. Passenger boarding devices, not part of the aeroplane
To avoid slipperiness and damage (hazardous situation for the passengers and the crew)

3.2. SNOW AND ICE REMOVAL SERVICING F100

Excerpts from the Aircraft Maintenance Manual

Remove Snow, Frost, Slush and Ice with De-icing and/or Anti-icing Fluid/Water Mixture

WARNING: Be careful, if you operate the engines during the snow and ice removal procedure:
- Operate the engines at the minimum power necessary
- Set the air conditioning system to off
- Do not go into the engine danger areas
- Do not let the de-icing and/or anti-icing fluid/water mixture go into the engine exhaust-gas area
- Do not let the de-icing and/or anti-icing fluid/water mixture go into the engine inlets. Injury to persons and/or damage to equipment can occur.

WARNING: be careful, if you operate the APU during the snow and ice removal procedure:
- Put the minimum load on the APU
- Set the air conditioning system to off
- Do not let the de-icing and/or anti-icing fluid/water mixture go into the APU

WARNING: When you apply anti/icing fluids, you must obey the manufacturer's instructions for application and the correct holdover times. If local airworthiness authorities have set more conservative regulations, you must use these regulations.

CAUTION: Do not use sharp tools to remove ice, frost, snow and slush. Sharp tools can cause damage to the aircraft.

CAUTION: Be careful when you apply the de-icing and/or anti-icing fluid/water mixture to lubricated parts. When you apply de-icing and/or anti-icing fluid/water mixture with a spray gun, it can remove or damage the lubricant, and may cause damage to lubricated components. During times of regular aircraft de-icing and/or anti-icing, it is recommended that components are lubricated more frequently.

CAUTION: If the de-icing and/or anti-icing fluid/water mixture is regularly applied to the aircraft, the remaining of the thickened de/anti-icing fluid can cause a blockage in the drain holes. As a result, fluid collects in the empty spaces of the tail and flight control areas, and cannot be drained from the aircraft. To prevent this, regularly open the drain holes in the tail area and the lift dumper boxes.

CAUTION: If there is an indication of frozen seals and slots, manually operate the flight controls before you use the hydraulic power. Damage to equipment can occur.

CAUTION: Do not start the APU immediately after the de-icing and/or anti-icing procedure is completed:
- Allow several minutes for any remaining de-icing and/or anti-icing fluid/water mixture to drain – allow several minutes for any de-icing and/or anti-icing fluid/water mixture vapours to dissipate. The gas from the de-icing and/or anti-icing fluid/water mixture can go into the air conditioning system when the APU operates.

NOTE: The publications issued by the Society of Automotive Engineers (SAE) and the International Organization for Standardization also give useful information on de-icing and anti-icing procedures.

NOTE: For purposes of this chapter, contamination is the presence of frozen or semi-frozen moisture on the aircraft surfaces or its components. Some forms of contamination are: ice, frost, snow, hail, sleet and slush.

NOTE: The procedure of this task is a corrective action as a result of the pre-flight exterior check. Two procedures are given, the one-step method and the two-step method:
- In the one-step method the fluid/water mixture, used to de-ice the aircraft, stays on the aircraft surfaces to give limited holdover time capability. The fluid/water mixture is heated before application to assure maximum de-icing efficiency.

- The two-step method consists of two separate fluid/water mixture application steps, the first de-icing and the second anti-icing. The anti-icing step is applied to protect the aircraft surfaces to give the maximum possible anti-icing capability. The second step is done within 3 minutes from the start of the first step, if necessary, surface by surface.

The first step (de-icing), fluid/water mixture is heated before application to assure maximum de-icing efficiency. The second step (anti-icing), fluid/water mixture can be applied hot or cold on clean aircraft surfaces. When an SAE Type II fluid/water mixture is used cold, on clean aircraft surfaces, it provides longer anti-icing protection.

1. Materials – Rubber scrapers A/R
2. Special Tools and Equipment – Not applicable
3. Standard Tools and Equipment
4. Consumable Materials
5. Expendable Parts – Not applicable
6. Referenced Procedures
7. Job Set-Up

A. Park the aircraft with the nose in the wind.

B. If the engines and/or the APU are running when the de-icing and/or anti-icing procedure is carried out, do the steps that follow:
   - On the air conditioning control panel, push the PACK 1 , PACK 2, BLEED 1, APU BLEED and BLEED 2 push switches; make sure the OFF lights come on
   - Operate the engines at idle
   - Do not use the APU any longer than necessary, select it off when it is no longer required
   - Use the minimum engine power necessary, if a taxi-through de-icing facility is used.

C. Find out the required holdover time that is applicable to:
   - The type of de-icing and/or anti-icing fluid to be used
   - The outside air temperature (OAT)
   - The mix ratio of the de-icing and/or anti-icing fluid/water mixture to be used
   - The weather conditions.

NOTE: The holdover time is defined as the estimated time the application of de-icing and/or anti-icing fluid/water mixture will prevent the formation of frost or ice, and the accumulation of snow on the treated surfaces of an aircraft. Holdover time begins when the final application of de-icing and/or anti-icing fluid/water mixture commences, and it expires when the de-icing and/or anti-icing fluid water mixture applied to the aircraft loses its effectiveness. The flight crew makes the decision when the holdover time of the de-icing and/or anti-icing fluid/water mixture is expired.

NOTE: The holdover time is a function of such variables as:
- The ambient temperature
- The aircraft surface (wing) temperature
- The wind conditions
- The Type of fluid
- The de-icing and/or anti-icing fluid/water mixture thickness
- The procedure used (one step or two step method)
- The type and intensity of precipitation.

The most important variable is the intensity of precipitation, which adds moisture and dilutes the de-icing and/or anti-icing fluid/water mixture. With continuous precipitation, in any form:
- The holdover time will be shortened
- Frozen deposits will no longer be absorbed and will start to accumulate and adhere to the previously protected surfaces. Due to the many variables that can influence the holdover time, the times should be used as guidelines for estimating the time of protection. The time of protection will be shortened considerably in extreme weather conditions. Heavy winds and jet blast can also degrade the film of

de-icing and/or anti-icing fluid/water mixture, and shorten the holdover times. The objective is that the holdover time be greater than the anticipated time between the start of the final application of the de-icing and anti-icing fluid/water mixture and take-off, based on existing conditions.

WARNING: IF THE APU AND/OR ENGINES IS/ARE IN OPERATION, DO NOT GO INTO THE DANGER AREAS. INJURY TO PERSONS AND/OR DAMAGE TO EQUIPMENT CAN OCCUR.

D. Prepare the aircraft for the removal of contamination
(1) Put the access platform 2 m (7 ft) in position.
(2) Put the access platform 3 m (10 ft) in position.
(3) Put the access platform 7 m (23 ft) in position.
(4) Put the warning sign "DO NOT OPERATE THE AIRCONDITIONING SYSTEM" in the flight compartment.

PROCEDURE

WARNING: Be careful when you use the consumable material(s).Obey the operator's and the de-icing and/or anti-icing fluid manufacturer's health and safety instructions.

WARNING: When you apply anti/de-icing fluids, you must obey the manufacturer's instructions for application and the correct holdover times.

If local airworthiness authorities have set more conservative regulations, you must use these regulations.

CAUTION: Do not apply type II or type IV de/anti-icing fluid repeatedly. Residues of these fluids may collect in certain aerodynamically quiet areas, which are included in critical areas that must be inspected after de/anti-icing. Remove the residues with hot water or a hot mixture of de-icing fluid type I and water. Use hot water or a hot mixture of de-icing fluid type I and water for the first step of the de/anti-icing process to keep the formation of residues to a minimum.
CAUTION: SAE Type I fluids supplied as concentrates for dilution with water prior to use must not be used undiluted. This is due to adverse aerodynamic effects of propylene glycol and diethylene glycol based fluids and the freeze point characteristics of ethylene glycol and diethylene glycol based fluid.
CAUTION: Under no circumstances shall an aircraft, that has been anti-iced, receive a further coating of anti-icing fluid/water mixture directly on top of the existing film. Should it be necessary for an aircraft to be anti-iced again prior to the next flight, the critical surfaces shall first be de-iced with a hot de-icing fluid/water mixture before a further application of anti-icing fluid/water mixture is used.
CAUTION: The aircraft must be de-iced and/or anti-iced symmetrically, that is, the left-hand and right-hand side shall receive the same and complete treatment. Aerodynamic problems could result if this requirement is not met.
CAUTION: Do not let the de-icing and/or anti-icing fluid/water mixture go into the APU air-inlet. The gas from the de-icing and/or anti-icing fluid/water mixture can go into the air conditioning system when the APU operates.
CAUTION: Use the minimum quantity of the de-icing and/or anti-icing fluid/water mixture in the engine inlets and exhaust-gas areas. The gas from the de-icing and/or anti-icing fluid/water mixture can ignite when the engines are operated.
CAUTION: Do not point the de-icing/anti-icing spray into the engine core. The gas from the fluid can ignite when you operate the engines.
CAUTION: Use the minimum quantity of the de-icing and/or anti-icing fluid/water mixture in the air conditioning intake areas. The gas from the de-icing and/or anti-icing fluid/water mixture can go into the air conditioning system and cause unwanted odours.
CAUTION: Remove the contamination from the ailerons before you move them. Damage to equipment can occur.
CAUTION: Do not spray directly on the brakes, switches, sensors, connectors, hinge points and shock absorbers. Damage to equipment can occur.

NOTE: Use the applicable
- de-icing and/or anti-icing fluid/water mixture
- procedure (one step or two step method) depending on the local weather conditions and the amount of contamination.

A. Use the one-step method

NOTE: This procedure is applicable to the one-step method:
In the one-step method the fluid/water mixture, used to de-ice the aircraft, stays on the aircraft surfaces to give limited holdover time capability. The fluid/water mixture is heated before application to assure maximum de-icing efficiency.

(1) General

Some forms of accumulation of ice contamination are as follows:
- Thin layers of ice resulting from frost (overnight under a clear sky and temperature just below freezing) or freezing fog may cause contamination (sand paper roughness) on wings and horizontal tail surfaces. This roughness may seem insignificant but however be aware that this roughness will cause deterioration of the aerodynamic properties of the wing and the tail to such an extent that a safe take-off is not possible.
- When the fuel tanks contain sufficient fuel of sub-zero temperature – as may be the case after a long flight – wet snow, rain or water condensation can freeze on the wing upper surface during the ground stop (even if the OAT is well above freezing), forming a smooth ice layer that may not be visible from certain angles. The top of this layer may appear wet, hiding the ice underneath. This form of ice may not be visible from a distance, in poor lighting conditions or at night. Absence of such contamination must be verified during the pre-flight exterior check. Not only will this ice seriously affect the aerodynamic properties of the wing, but it may also damage the engine if the ice becomes loose when the wing flexes during take-off.
- Relatively warm fuel, uplifted during a stop, may cause dry snow to melt on the wings. This melted snow can refreeze when the temperature is below freezing, forming an invisible ice layer under the snow. Never assume that snow will be blown off during the take-off roll.
- Snow falling on warm leading edges will melt but may refreeze under certain conditions, forming run-back ice on wings and stabilizer.

(2) Prepare the de-icing and anti-icing fluid/water mixture

Write these data:
- The OAT
- The weather conditions
- The weather forecast
- The holdover time range.

Use these data to determine:
- The Type of de-icing and anti-icing fluid to be used
- The correct mix ratio of the de-icing and anti-icing fluid and water.

(a)Tell these data to the captain, the responsibility for determining the applicable holdover time remains with the captain. Also tell the captain the time when the final application of the de-icing and anti-icing fluid/water mixture coating started, this is the start of the holdover time.
(b) Prepare the correct de-icing and anti-icing fluid/water mixture.
NOTE: This mixture is referred to as the de-icing and anti-icing fluid/water mixture.
(c) Use the large-capacity heater to increase the temperature of the de-icing and anti-icing fluid/water mixture, to a maximum temperature of 85 °C
NOTE: The desired temperature of the de-icing and anti-icing fluid/water mixture should be a minimum of 60 °C at the nozzle.

(3) Make sure all doors, panels and windows are closed.

(4) Apply the de-icing and anti-icing fluid/water mixture
(a) Hold the nozzle of the spraying lance 3 to 4 m (10 to 13 ft) from the aircraft surface
(b) Move the nozzle at the maximum speed necessary to remove the contamination.

(5) Remove the contamination from the fuselage

(a) Do not apply directly the de-icing and anti-icing fluid/water mixture to the following surfaces:
- The windows or windshields
- The static ports
- The angle-of-attack vanes
- The pitot heads
- The air conditioning intakes
- The ice detection probe
- The APU air-inlet and exhaust.

(b) Start at the front of the aircraft, and carefully apply the de-icing and anti-icing fluid/water mixture to all of the fuselage.
(c) Use the cleaning, low-lint cloth (material No. Fk05-044) to clean the flight compartment windows and windshields.

(6) Remove the contamination from the wings

(a) Start at the wing tip and apply the de-icing and anti-icing fluid/water mixture, from the wing leading edge to the trailing edge, to remove the contamination from:
- The wings
- The flaps
- The ailerons and tabs.

NOTE: A thin layer of frost on the UNDERSIDE of the wings between the front and the rear spar (fuel tank area), is acceptable. The maximum allowable thickness of the layer is 3 mm (0.125 in).
(b) On the pedestal, set the FLIGHT CONTROL LOCK lever to the OFF (not locked) position.
(c) Manually operate the ailerons and remove the contamination from the aileron balance-plates.

(7) Remove the contamination from the stabilizers

(a) Apply the de-icing and anti-icing fluid/water mixture to the vertical stabilizer:
1. Remove the contamination from the vertical stabilizer tip
2. Remove the contamination from the leading edge
3. Start at the top and remove the contamination (with horizontal movements of the spraying lance) from the vertical stabilizer and the rudder.

(b) Apply the de-icing and anti-icing fluid/water mixture to the horizontal stabilizer:
1. Set the horizontal stabilizer in the aircraft nose down (AND) position
2. Start at the stabilizer tip
3. Remove the contamination (with movements of the – spraying lance from the leading edge of the stabilizer to the trailing edge of the elevator) from the stabilizer tip to the vertical stabilizer.

(8) Remove the contamination from the nacelles and the engines

(a) If necessary, remove the engine inlet and exhaust covers.
(b) Apply the de-icing and anti-icing fluid/water mixture to the nacelles and the engines. Do not spray directly into:
- The engine inlet cowls
- The engine inlet cowl drain-holes
- The exhausts.

(c) Apply the de-icing and anti-icing fluid/water mixture to the LP compressor fan blades

1. Hold the nozzle of the spraying lance 0.6 to 0.9 m (2 to 3 ft) from the front surface of the LP compressor fan blades.
2. Point the nozzle of the spraying lance at the LP compressor fan and apply the spray to the face of each fan blade at 90 degrees.
(d) When the procedure is completed and before an engine is operated, try to turn the LP compressor fan by hand or by wind milling in the correct direction-of-rotation.
- If the LP compressor turns, continue this subtask
- If the LP compressor does not turn, do steps (8)(c)1 and (8)(c)2 again.

(9) Remove the contamination from the landing gear and the wheel bay components with the de-icing and anti-icing fluid/water mixture:

(a) Remove the contamination from the components by spraying with the de-icing and anti-icing fluid/water mixture and a synthetic sponge
(b) Examine the landing gear and the wheel bay components, and make sure they are clean. If necessary, clean the components with the hot air unit

(10) Remove the contamination from the doors

(a) Remove the contamination from the following parts of the doors with the de-icing and anti-icing fluid/water mixture and a synthetic sponge or by spraying the de-icing and anti-icing fluid/water mixture:
- The seals
- The latches
- The hinges.
(b) If necessary, clean the parts with the hot air unit.
NOTE: Dehydrated de/anti-icing fluid residues are not easily to detect. When you check for thickened de/anti-icing fluid residues in aerodynamically quiet areas, gaps and cavities, use a fine spray of water to rehydrate the fluid residues. This makes the detection of the residues better.

(11) Examine the aerodynamically quiet areas

Make sure they are free from snow, ice, clear ice frost and thickened de/anti-icing fluid residues.

(12) Examine the following critical surfaces for contamination and make sure they are clean:

- The fuselage
- The ice-detection probe
- The pitot heads
- The flight compartment windows and windshields
- The angle-of-attack vanes
- The temperature sensors
- The landing gear
- The landing gear doors
- The wheel bay components
- The drain holes
- The air conditioning intakes and exhausts
- The antennas
- The static ports
- The wings
- The fairings
- The stall promotor strips and wing fences
- The flight control surfaces, their hinge points, shrouds, fairings and seals
- The slots between components
- The aileron balance-plates
- The flaps, the flap tracks, the flap vanes and the flap shrouds

- The fuel tank vents
- The engine inlets and the exhausts
- The nacelles
- The stub wings
- The APU air-inlet and exhaust
- The vertical stabilizer
- The horizontal stabilizer

PROCEDURE

B. Use the two-step method

NOTE: This procedure is applicable to the two-step method:
The two step method consists of two separate fluid/water mixture application steps, the first de-icing and the second anti-icing. The anti-icing step is applied to protect the aircraft surfaces to give the maximum possible anti-icing capability. The second step is done within 3 minutes from the start of the first step, if necessary, surface by surface. The first step (de-icing), fluid/water mixture is heated before application to assure maximum de-icing efficiency. The second step (anti-icing), fluid/water mixture can be applied hot or cold on clean aircraft surfaces.

(1) General

Some forms of accumulation of ice contamination are as follows:
- Thin layers of ice resulting from frost (overnight under a clear sky and temperature just below freezing) or freezing fog may cause contamination (sandpaper roughness) on wings and horizontal tail surfaces. This roughness may seem insignificant but however be aware that this roughness will cause deterioration of the aerodynamic properties of the wing and the tail to such an extent that a safe take-off is not possible.
- When the fuel tanks contain sufficient fuel of sub-zero temperature - as may be the case after a long flight – wet snow, rain or water condensation can freeze on the wing upper surface during the ground stop (even if the OAT is well above freezing), forming a smooth ice layer that may not be visible from certain angles. The top of this layer may appear wet, hiding the ice underneath. This form of ice may not be visible from a distance, in poor lighting conditions or at night.
Absence of such contamination must be verified during the pre-flight exterior check. Not only will this ice seriously affect the aerodynamic properties of the wing, but it may also damage the engine if the ice becomes loose when the wing flexes during take-off.
- Relatively warm fuel, uplifted during a stop, may cause dry snow to melt on the wings. This melted snow can refreeze when the temperature is below freezing, forming an invisible ice layer under the snow. Never assume that snow will be blown off during the take-off roll.
- Snow falling on warm leading edges will melt but may refreeze under certain conditions, forming run-back ice on wings and stabilizer.

(2) Do the first step (de-icing)

(a) Prepare the de-icing fluid/water mixture

1. Write these data:
- The OAT
- The weather conditions
- The weather forecast
- The holdover time range.

Use these data to determine:
- The Type of de-icing fluid to be used
- The Type of anti-icing fluid to be used
- The correct mix ratio of the de-icing fluid and water.

- The correct mix ratio of the anti-icing fluid and water.
Tell these data to the captain, the responsibility for determining the applicable holdover time remains with the captain. Also tell the captain the time when the final application, the anti-icing fluid/water mixture application, started. This is the start of the holdover time.

2. Prepare the correct de-icing fluid/water mixture.
NOTE: This mixture is referred to as the de-icing fluid/water mixture.

3. Use the large-capacity heater to increase the temperature of the de-icing fluid/water mixture, to a maximum temperature of 85 °C.
NOTE: The desired temperature of the de-icing fluid/water mixture should be a minimum of 60 °C at the nozzle.

(b) Make sure all doors, panels and windows are closed

(c) Apply the de-icing fluid/water mixture

1. Hold the nozzle of the - spraying lance 3 to 4 m (10 to 13 ft) from the aircraft surface
2. Move the nozzle at the maximum speed necessary to remove the contamination.

(d) Remove the contamination from the fuselage

1. Do not apply directly the de-icing fluid/water mixture to the following surfaces:
- The windows or windshields
- The static ports
- The angle-of-attack vanes
- The pitot heads
- The air conditioning intakes
- The ice detection probe
- The APU air-inlet and exhaust
2. Start at the front of the aircraft, and carefully apply the de-icing fluid/water mixture to all of the fuselage.
3. Use the cleaning, low-lint cloth (material No. Fk05-044) to clean the flight compartment windows and windshields.

(e) Remove the contamination from the wings

1. Start at the wing tip and apply the de-icing fluid/water mixture, from the wing leading edge to the trailing edge, to remove the contamination from:
- The wings
- The flaps
- The ailerons and tabs.
NOTE: A thin layer of frost on the UNDERSIDE of the wings between the front and the rear spar (fuel tank area) is acceptable. The maximum allowable thickness of the layer is 3 mm (0.125 in).
2. On the pedestal, set the FLIGHT CONTROL LOCK lever to the OFF (not locked) position.
3. Manually operate the ailerons and remove the contamination from the aileron balance-plates.

(f) Remove the contamination from the stabilizers

1. Apply the de-icing fluid/water mixture to the vertical stabilizer:
- Remove the contamination from the vertical stabilizer tip
- Remove the contamination from the leading edge
- Start at the top and remove the contamination (with horizontal movements of the spraying lance) from the vertical stabilizer and the rudder.
2. Apply the de-icing fluid/water mixture to the horizontal stabilizer:
- Set the horizontal stabilizer in the aircraft nose down

- Remove the contamination (with movements of the spraying lance from the leading edge of the stabilizer to the trailing edge of the elevator) from the stabilizer tip to the vertical stabilizer.

(g) Remove the contamination from the nacelles and the engines

1. If necessary, remove the engine inlet and exhaust covers.
2. Apply the de-icing fluid/water mixture to the nacelles and the engines. Do not spray directly into:
- The engine inlet cowls
- The engine inlet cowl drain-holes
- The exhausts.
3. Apply the de-icing and anti-icing fluid/water mixture to the LP compressor fan blades
a. Hold the nozzle of the spraying lance 0,6 to 0,9 m (2 to 3 ft) from the front surface of the LP compressor fan blades.
b. Point the nozzle of the spraying lance at the LP compressor fan and apply the spray to the face of each fan blade at 90 degrees.
4. When the procedure is completed and before an engine is operated, try to turn the LP compressor fan by hand or by wind milling in the correct direction-of-rotation.
- If the LP compressor turns, continue this subtask
- If the LP compressor does not turn, do steps (2)(g)3a and (2)(g)3b above again.

(h) Remove the contamination from the landing gear and the wheel bay components with the de-icing fluid/water mixture:

1. Remove the contamination from the components by spraying with the de-icing fluid/water mixture and a synthetic sponge (material No. Fk05-079).
2. Examine the landing gear and the wheel bay components, and make sure they are clean. If necessary, clean the components with the hot air unit.

(j) Remove the contamination from the doors

1. Remove the contamination from the following parts of the doors with the de-icing fluid/water mixture and a synthetic sponge or by spraying the de-icing fluid/water mixture:
- The seals
- The latches
- The hinges
2. If necessary, clean the parts with the hot air unit.

(3) Do the second step (anti-icing)

(a) Prepare the anti-icing fluid/water mixture

1. Tell the captain the time when the final application, the anti-icing fluid/water mixture application, started. This is the start of the holdover time.
   The responsibility for determining the applicable holdover time remains with the captain.
2. Prepare the correct anti-icing fluid/water mixture.
   NOTE: This mixture is referred to as the anti-icing fluid/water mixture.
3. If necessary, use the large-capacity heater to increase the temperature of the anti-icing fluid/water mixture, to a maximum temperature of 85 °C.

(b) Make sure all doors, panels and windows are closed

(c) Apply the anti-icing fluid/water mixture

1. Hold the nozzle of the spraying lance 3 to 4 m (10 to 13 ft) from the aircraft surface
2. Move the nozzle at the maximum speed necessary to apply the anti-icing fluid/water mixture.

(d) Apply the anti-icing fluid/water mixture to the fuselage

1. Do not apply directly the anti-icing fluid/water mixture to the following surfaces:
- The windows or windshields
- The static ports
- The angle-of-attack vanes
- The pitot heads
- The air conditioning intakes
- The ice detection probe
- The APU air-inlet and exhaust.

2. Start at the front of the aircraft, and carefully apply the anti-icing fluid/water mixture to the entire fuselage.
3. Use the cleaning, low-lint cloth to clean the flight compartment windows and windshields.

(e) Apply the anti-icing fluid/water mixture to the wings

1. Start at the wing tip and apply the anti-icing fluid/water mixture, from the wing leading edge to the trailing edge, to:
- The wings
- The flaps
- The ailerons and tabs.

NOTE: A thin layer of frost on the UNDERSIDE of the wings between the front and the rear spar (fuel tank area), is acceptable. The maximum allowable thickness of the layer is 3 mm (0.125 in).
2. On the pedestal, set the FLIGHT CONTROL LOCK lever to the OFF (not locked) position.
3. Manually operate the ailerons and apply the anti-icing fluid/water mixture to the aileron balance-plates.

(f) Apply the anti-icing fluid/water mixture to the stabilizers

1. Apply the anti-icing fluid/water mixture to the vertical stabilizer:
   a) Apply the anti-icing fluid/water mixture to the vertical stabilizer tip
   b) Apply the anti-icing fluid/water mixture to the leading edge
   c) Start at the top and apply the anti-icing fluid/water mixture (with horizontal movements of the spraying lance) to the vertical stabilizer and the rudder.
2. Apply the anti-icing fluid/water mixture to the horizontal stabilizer:
   a) Set the horizontal stabilizer in the aircraft nose down (AND) position
   b) Start at the stabilizer tip
   c) Apply the anti-icing fluid/water mixture (with movements of the - spraying lance to the leading edge of the stabilizer to the trailing edge of the elevator) from the stabilizer tip to the vertical stabilizer.

(g) Apply the anti-icing fluid/water mixture to the nacelles and the engines

1. If necessary, remove the engine inlet and exhaust covers.
2. Apply the anti-icing fluid/water mixture to the nacelles and the engines. Do not spray directly into:
   - The engine inlet cowls
   - The engine inlet cowl drain-holes
   - The exhausts.
3. Apply the de-icing and anti-icing fluid/water mixture to the LP compressor fan blades
   a) Hold the nozzle of the spraying lance 0,6 to 0,9 m (2 to 3 ft) from the front surface of the LP compressor fan blades.
   b) Point the nozzle of the spraying lance at the LP compressor fan and apply the spray to the face of each fan blade at 90 degrees.
4. When the procedure is completed and before an engine is operated, try to turn the LP compressor fan by hand or by wind milling in the correct direction-of-rotation.
   - If the LP compressor turns, continue this subtask.

- If the LP compressor does not turn, do steps (3)(g)3a and (3)(g)3b above again.

(h) Apply the anti-icing fluid/water mixture to the doors

1. Apply the anti-icing fluid/water mixture to the following parts of the doors with a synthetic sponge or by spraying the anti-icing fluid/water mixture:
- The seals
- The latches
- The hinges.

NOTE: Dehydrated de/anti-icing fluid residues are not easily to detect. When you check for thickened de/anti-icing fluid residues in aerodynamically quiet areas, gaps and cavities, use a fine spray of water to rehydrate the fluid residues. This makes the detection of the residues better.

Examine the aerodynamically quiet areas. Make sure they are free from snow, ice, clear ice frost and thickened de/anti-icing fluid residues.

Examine the following critical surfaces for contamination and make sure they are clean:
- The fuselage
- The ice-detection probe
- The pitot heads
- The flight compartment windows and windshields
- The angle-of-attack vanes
- The temperature sensors
- The landing gear
- The landing gear doors
    - Physically touch the leading edge and at arm's length (as can safely be reached) the upper surfaces, feeling for contamination.
    - If installed, you can use the black lines for visual detection.

(k) Pre Take-off <u>Contamination</u> Check

(1) Do the Pre Take-off Contamination Check:
- If the operator requires performance of the Pre Take-off Contamination Check in accordance with FAR 121.629 (to find out if the aircraft must be de/anti-iced again).

(2) The Pre Take-off Contamination Check must be done:
- Visually from outside the aircraft;
- Not earlier than 5 minutes prior the initiation of a take-off roll.

(3) Qualified personnel should be positioned:
- Highly enough to visually scan the wing leading edge and the wing upper surfaces;
- No more than 5 m (16 ft.) from the wing black stripe at W. STA 11190.

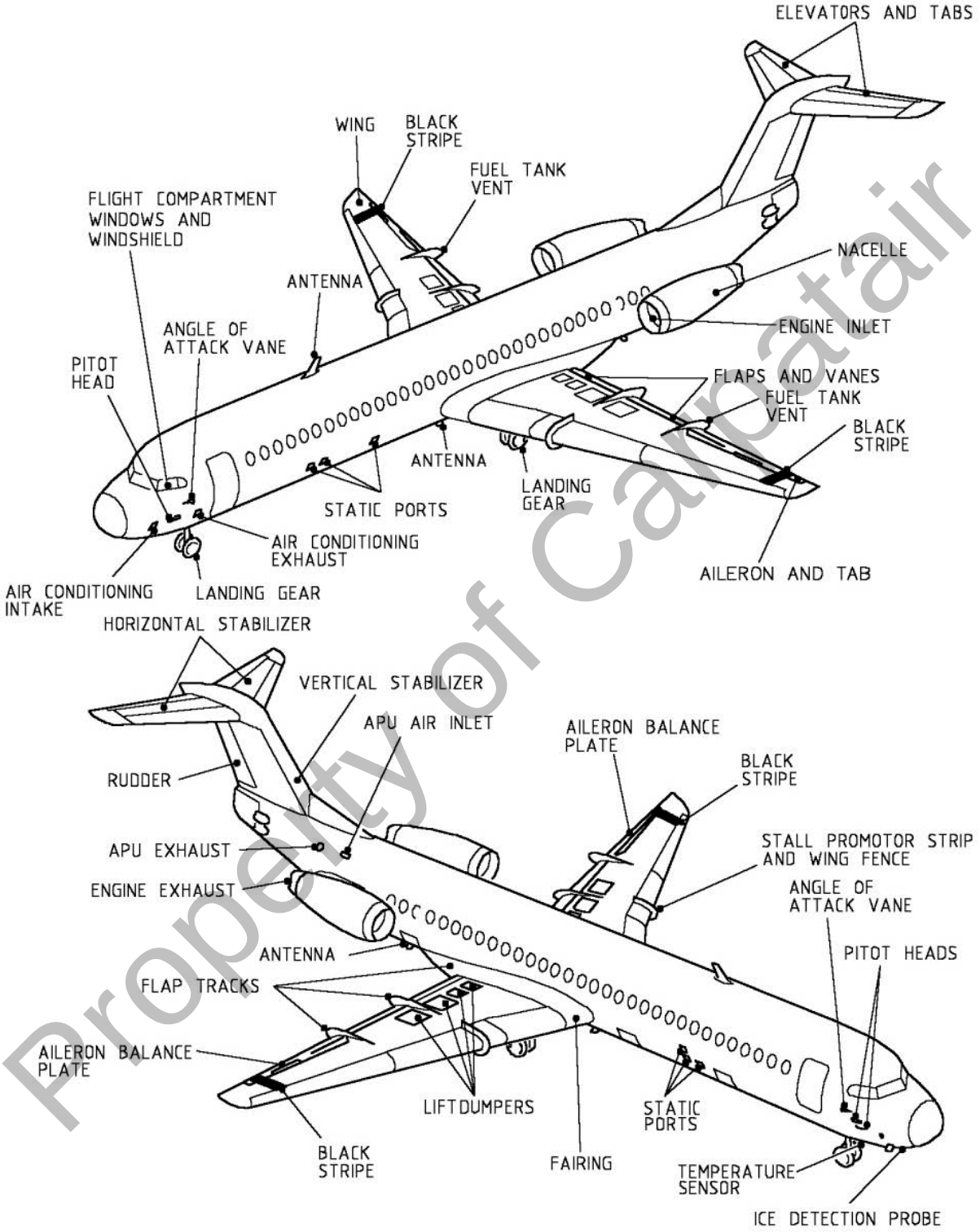
(4) The lighting brightness must be adequate to detect contamination.

(5) Do the Pre Take-off Contamination Check on both Left and Right wings:
- Visually scan the wing (the leading edge and the upper surfaces) including the black stripe at W. STA 11190, to make sure there is no contamination on the wing surfaces.

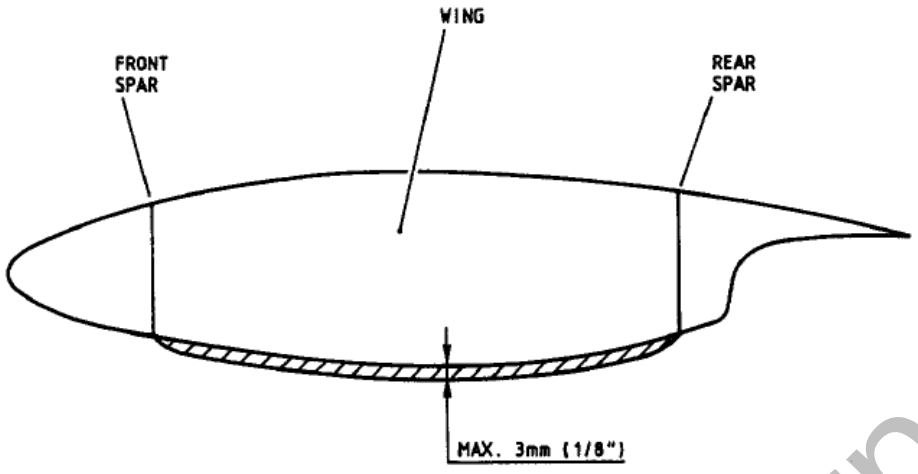
(l) Job Close-Up

a. Remove all tools, materials and equipment from the work area. Make sure the area is clean.

Critical Surfaces Fokker 100



Acceptable Layer of Frost



NOTE:

Avoid high fluid spillage at the spraying position, as high amount of fluid may cause slipperiness with high danger for staff and equipment.

This checklist is applicable for stations, where the complete de-icing/anti-icing is performed at the gate/park position (no movement of the aeroplane before start of the treatment).

RESPONSIBILITY:

01. GROUND ENGINEER: ISO Code for de-icing, correct and complete de-icing/anti-icing accomplishment, report to the Commander.
02. COMMANDER: ISO Code for anti-icing, request for de-icing/anti-icing, final decision, sufficient ice-protection during taxiing.

WARNING:
Do not splash fluid at pitot tubes, static ports, air in- and outlets / scoops, engine and APU in- and outlets, flight deck- and cabin windows, wheels and brakes.

WARNING:
Special care during movement of persons and/or vehicles should be taken, as ground maybe slippery due to de-icing/anti-icing fluid sprayed.

A. PREPARATION:

01. Wing and stabiliser moveable surfaces free of contamination ..... CHECKED
Pressurisation of hydraulic system may cause a movement of the wing and stabiliser moveable surfaces with a possible damage if contamination is present. Hard contamination must be removed, soft contamination checked for possible damage.

B. DE-ICING/ANTI-ICING:

01. Communication ground - flight deck ..... ESTABLISHED
Disconnect during de-icing/anti-icing operation. In case of thunderstorm interphone communication between ground and flight deck staff is not permitted. The interphone cable has to be disconnected from the aeroplane and communication must be performed by hand-signals.

02. Wing and boarding devices (e.g. flaps, slats, airstairs, etc.) ..... RETRACTED
03. All doors and windows ..... CLOSED
04. All access panels ..... CLOSED
05. Aeroplane ..... CHECKED

For slush / frost / snow / ice accumulation.

06. Clean Wing Check ..... PERFORMED
According to picture in “Limitations“.
In case of contamination found during the accomplishment of this special check, inform the Commander and the handling agent.
07. Ready for de-icing/anti-icing from the Commander ..... OBTAINED
08. De-icing/anti-icing ..... ORDERED
Ordering has to be done at each individual vehicle if no co-ordinator is available.
09. Aeroplane free of all contamination ..... CHECKED
10. Flight deck windows / nose section ..... CHECKED
Free of de-icing/anti-icing fluid.
11. Clean Wing Check ..... PERFORMED
According to picture in “Limitations“.
In case of contamination found during the accomplishment of this special check, inform the Commander and the handling agent.
12. Ground equipment ..... REMOVED
If applicable.

13. The following items have to be reported to the Commander ..... CHECKED
De-icing/anti-icing completed and ISO-Code of anti-icing.

WARNING:
Release of aeroplane is only allowed, when the use of the correct fluid(s) and fluid mixture(s) had been verified.

14. Wait for aeroplane to start taxiing.
Leave the airport tarmac only after successfully performed take-off and 3 minutes flying time.

Clean Wing Check – F100

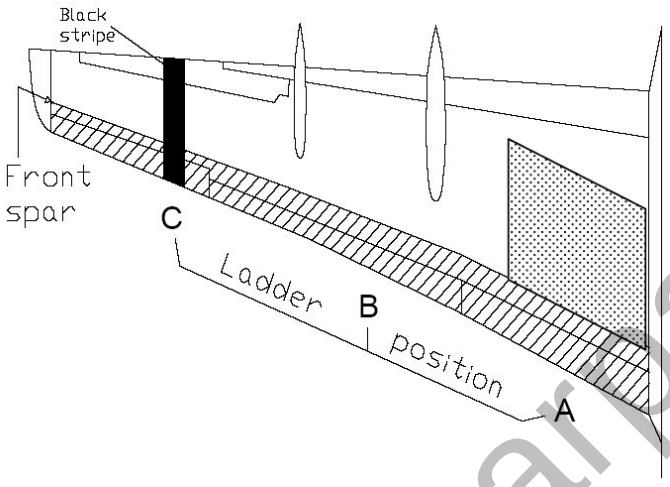
In addition to the standard visual inspection of the aircraft a tactile (hands on) check of the wing leading edge and upper surface has to be performed on both wings when the OAT is at or below 15 °C and either the difference between OAT and dew point temperature is less than 3 °C or visible moisture (fog, rain, drizzle, sleet, snow, ice crystals, etc.) is present.

The following check is normally performed by certified staff or maintenance.

Note: To perform the following check, an appropriate device (e.g. a ladder or stair with min. 2 m height) is required.
It is not required to step on the wing.

1. Device (ladder) _____PLACED

- Place the device in front of wing leading edge at position “A” as indicated on the figure below.



2. Upper wing area _____CHECK VISUALLY

- If frost, snow or ice is detected, de/anti-icing is required.

3. Inner wing area _____CHECK

- Check with bare hand that wing upper surface in front of the engines (dotted area – as fare as reachable) is free of frost or ice.
- If frost or ice is detected, de/anti-icing is required.

4. Wing nose area _____CHECK

- Check with bare hand that wing leading edge and wing upper surface back to front spar (hatched area in figure above) is free of frost or ice.
- Repeat this check at least on the positions “B” and “C” according to the figure above. If in doubt, check on additional positions.
- If frost or ice is detected, de/anti-icing is required.

5. Lower wing skin _____ CHECK VISUALLY

- If frost or ice is detected, de/anti-icing is required.

  Note: A frost layer up to 3 mm within the tank area is acceptable without de-icing.

6. Device (ladder) _____ REMOVED

After de/anti-icing:

Perform/repeat the CLEAN WING check to verify that wing area is free of ice, snow or frost.

NOTE: Do not use the leading edge black stripe to determine whether the wing upper surface is clean while the aircraft is on ground!

The Clean Wing Check has to be performed by a well-trained person. Well-trained means either de-icing or ground handling staff with a special Clean Wing Check Training or an engineer who acts according to the Clean Wing Check instruction above.

The checking staff has to inform the commander immediately of the result of the check. This information has to be transmitted in a form which guarantees that it could be filed in an on-board system (cockpit voice recorder done via headset or verbal in the cockpit or in written).

SECTION 4

DE-ICING / ANTI-ICING PROCEDURES FOR AIRBUS 319

4.1. SNOW AND ICE REMOVAL SERVICING Airbus 319

Excerpts from the Aircraft Maintenance Manual

De-Icing of the Aircraft in Power-Off Condition

CAUTION: Before you start the engine or you pressurize the hydraulic systems, make sure that there is no ice or snow on the flight controls area (elevator, rudder and aileron). If you do not obey this precaution, damage to the flight control system can occur.

CAUTION: Do not try to operate the flight control surfaces if there is ice on them. if you do, you can cause damage to the system. Small surface movement is permitted at hydraulic power-up of aircraft.

CAUTION: Do not apply anti-icing and de-icing fluid directly in:
- the pitot, ice detection, static probes and the AOA sensors
- the air intakes and exhausts of the engine and the APU
- all other air intakes or outlets.

If you do, electrical malfunctions and/or damage to equipment can occur.

CAUTION: Do not use jet exhaust to remove snow or ice from the airframe. The high pressure and high temperature of jet exhaust can cause damage to the aircraft.

CAUTION: Do not point the jets directly at the cockpit, cabin and door windows. The jets can cause crazing of the acrylic and can push the fluid into the window seals.

CAUTION: Do not use high-pressure jets or vapor to do the anti-icing/ de-icing procedure. This type of equipment can put fluid in parts, and can cause damage to equipment, specially to:
- electrical equipment such as harnesses, proximity sensors and connectors (with short circuits or incorrect indications as a result)
- equipment such as gear box seals, steady bearings, rotary actuators and universal joints.

High pressure jets can push liquids into bearings, joints, brakes, electrical connectors and other sealed components. Liquids that get into these areas can cause corrosion, freeze during aircraft flight, remove necessary lubricants or start incorrect electrical functions.

CAUTION: Do this procedure at the last possible opportunity before the aircraft departure.
the anti-icing/de-icing material holdover-time can decrease. This can occur in one (or more) of these conditions:
- low temperature
- heavy precipitation
- heavy moisture
- high wind speeds
- jet blasts
- an aircraft skin temperature of less than the oat.

1. Reason for the Job
This procedure gives guidelines for the removal of ice and snow from the aircraft.
This procedure is for an aircraft parked in an applicable de-icing area with:
- The engines and APU stopped,
- No Ground Power Unit (GPU) connected.

The data given in this procedure are guidelines only.

NOTE: On the ground, in specific weather conditions with very low temperatures, ice or snow accretion can occur in the lower part of the forward fuselage.
Ice or snow accretion can change the airflow.
This change can cause incorrect operation of the pitot probes, the static ports and the Angle Of Attack (AOA) sensors.
This can cause incorrect indications on the related cockpit instruments.

CAUTION: All persons who get access to the cargo compartment must remove snow/ice from their shoes and clothes. If not, snow/ice can go on the cargo compartment latches. This can cause the cargo loading system not to operate correctly.

CAUTION: Before you apply anti-icing/de-icing fluids, make sure that the supply pressure is not more than the specified values.

CAUTION: Do not make the anti-icing/de-icing fluid in tanks hot too many times or for long periods. if you do, the quantity of water in the fluid will decrease and there will be a possible degradation of the fluid performance.

Preparation of Equipment

NOTE: Refer to AC 5-9-0 for de-iced aircraft areas.
(1) Put the DE- ANTI-ICING EQUIPMENT - 12M SPRAYING HEIGHT in position. Make sure that the safety zone of the aircraft is clear. This is to make sure that the DE- ANTI-ICING EQUIPMENT - 12M SPRAYING HEIGHT moves easily.

NOTE: When used on the ramp, the DE- ANTI-ICING EQUIPMENT - 12M SPRAYING HEIGHT has a storage tank for the anti-icing/de-icing fluid. It is not permitted to mix other fluids with the anti-icing/de-icing fluid. The fluid must have the recommended concentration for the temperature to get a correct protection.
(2) On the DE- ANTI-ICING EQUIPMENT - 12M (39 FT) SPRAYING HEIGHT:
(a) Set the supply pressure to:
- Not more than an impact pressure of 1.5 psi (0.1034 bar) on the radome, belly fairing, rudder and elevators
- Not more than an impact pressure of 10 psi (0.6895 bar) on all other surfaces.

NOTE: Airbus recommends that you get the approval of the impact pressure values from the equipment manufacturer.
(b) Set the de-icing fluid temperature to the maximum of 90 deg C.

NOTE: The temperature of the de-icing fluid must be high as possible (but not more than the maximum temperature) to make the removal of the ice faster.

(3) It is permitted to use forced air or forced air mixed with de-icing fluid. The procedure and equipment must agree with SAE AIR6284.

Aircraft Maintenance Configuration

CAUTION: Do this task in a location with sufficient drainage for the anti-icing/de-icing fluids or move the aircraft before the engine start.
The anti-icing/de-icing fluids can make a pool under the engine air intake. This can cause the anti-icing/de-icing materials to go into the engine and prevent its correct operation

1) Park the aircraft on a flat surface. Make sure that the wheels of the NLG are on the aircraft axis and that the aircraft points into the wind.

(2) Make sure that the APU and the aircraft engines are stopped.
(3) Install the safety devices on the landing gears Ref. AMM TASK 32-00-00-481-001.
(4) Put the CHOCK – WHEEL(S) in position Ref. AMM TASK 10-11-00-555-015.
(5) Ground the aircraft Ref. AMM TASK 12-34-24-869-002.
(6**)** Make sure that the slats, flaps and thrust reversers are retracted.
If they are not in correct position:
(a) Do an inspection of the slats, flaps and thrust reversers for contamination (snow, frost, ice or slush).
(b) If you find contamination, remove it.
(7) Energize the aircraft electrical circuits Ref. AMM TASK 24-41-00-861-002.
(8) If necessary, put the slats and flaps in retracted position Ref. AMM TASK 27-50-00-866-009.
(9) If necessary, put the thrust reversers in retracted position.
(10) On the CABIN PRESS section of panel 25VU

Warning: Before you push the ditching pushbutton switch, make sure that there is no supply of air to the aircraft through the low pressure connection. If there is a supply of air, you can cause unwanted pressurization of the aircraft. This can cause injury to persons and/or damage to the aircraft.
(a) Make sure that the MODE SEL pushbutton switch is in the AUTO position:
- The FAULT and MAN legends of the MODE SEL pushbutton switch are off.
(b) Lift the guard and push the DITCHING pushbutton switch (the ON legend comes on).

CAUTION: All persons who get access to the cargo compartment must remove snow/ice from their shoes and clothes. if not, snow/ice can go on the cargo compartment latches. This can cause the cargo loading system not to operate correctly.

(11) Put the WARNING NOTICE(S) in position to tell persons to remove snow or ice from their shoes and clothes before they go into the aircraft.
(12) De-energize the aircraft electrical circuits
Ref. AMM TASK 24-41-00-862-002.
(13) Make sure that the landing gear doors, passenger/crew doors, cargo compartment doors, emergency exits, service doors and sliding windows are closed.
(14) If necessary, use the BRUSH – BRISTLED, SOFT to remove contamination (snow, frost, ice or slush) from the adjacent area before you close the doors and the windows.

CAUTION: Before you apply anti-icing/de-icing fluids, make sure that the supply pressure is not more than the specified values.

CAUTION: Do not make the anti-icing/de-icing fluid in tanks hot too many times or for long periods. if you do, the quantity of water in the fluid will decrease and there will be a possible degradation of the fluid performance.

A. Manual Snow Removal

(1) Use the BRUSH - BRISTLED, SOFT to remove the snow from:
- The engine air intakes and exhausts,
- The APU exhaust,
- The landing gear (brakes, wheels, leg, etc.) and landing gear doors,
- The outflow valve air-outlet,
- The inlet and outlet of the avionics-compartment ventilation system,
- The inlets and outlets of the air conditioning system,
- The pitot probes,
- The static probes,
- The standby static probes,

- The AOA sensors,
- The Total Air Temperature (TAT) sensors,
- The ice detectors (if installed).

(2) Install the aircraft protection equipment Ref. AMM TASK 10-11-00-555-013.
(3) Install the FILM - POLYETHYLENE or equivalent on each landing gear wheel/brake.
(4) If the layer of snow is too thick, use the BROOM to remove most of the snow. Use the BROOM with soft bristles to prevent damage to the aircraft skin.
(5) At very low temperatures (-15 deg.C and less), the effect of the fluid becomes less satisfactory. If the temperature is less than -15 deg.C, remove the contamination manually or with the forced air.

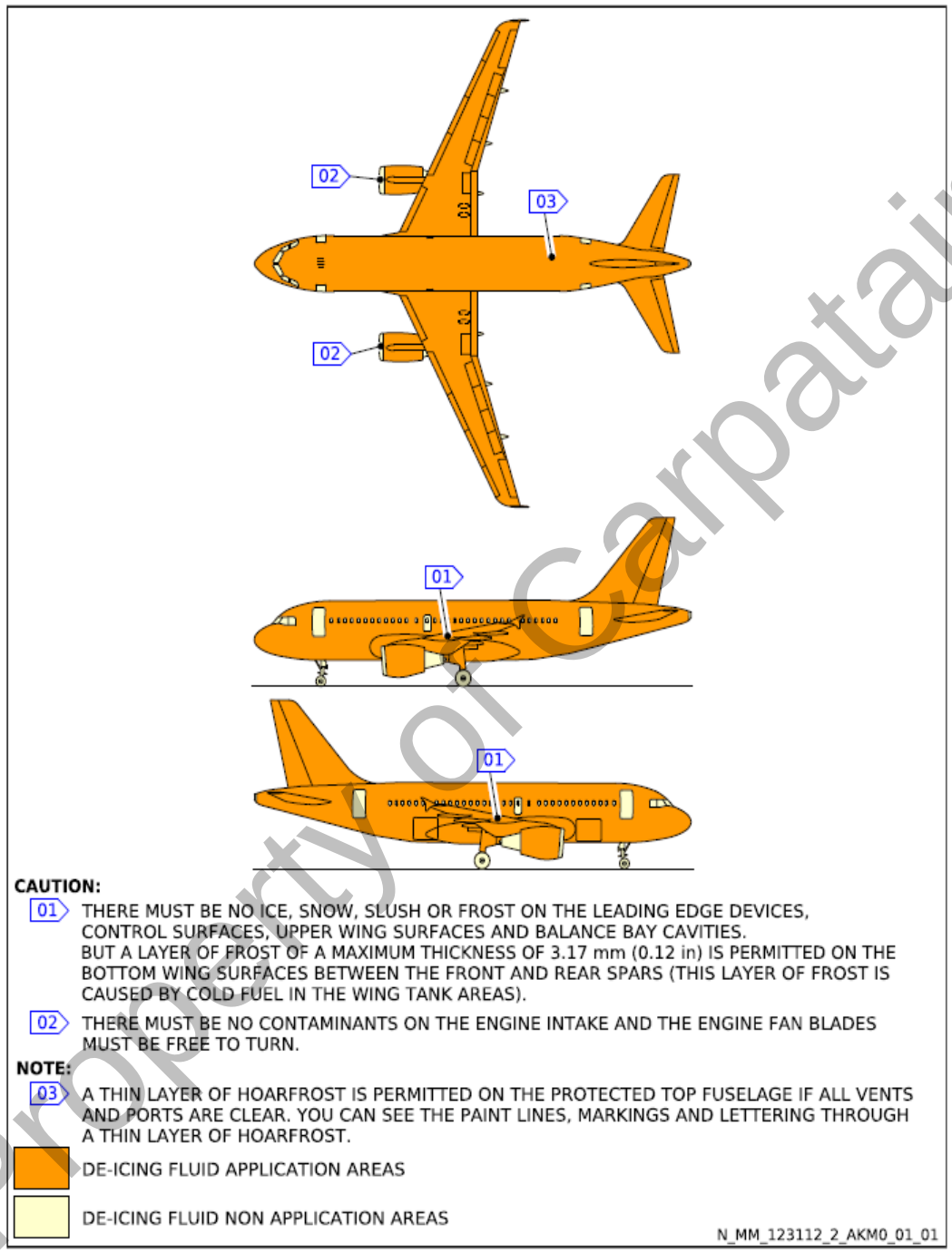
CAUTION: During the de-icing and cleaning procedures, make sure that the hot water or hot water/fluid mixtures do not cause the temperature of the aircraft skin to increase to more than +70°c. do not use steam. If you do not obey these precautions, you can cause damage to the surface or to parts.

CAUTION: For this special procedure, make sure that you point the spraying equipment nozzle from the rear to the front of the aircraft.
If you do not obey this precaution, there is a risk that the de-icing fluid will go into the pitot probes.

B. De-icing from the Forward Frame of Passenger/Crew Door 1 to the Radome (included) with the Spraying Equipment

NOTE: This paragraph is applicable for removal of the ice, frost, slush or snow with the de-icing fluid from the forward frame of passenger/crew door 1 to the radome (included). It is also applicable for removal of the ice accretion in front of the pitot probes.

This is a special procedure to make sure that the de-icing fluid does not go into the pitot probes or the TAT sensors. It is not applicable for the other areas of the aircraft.



CAUTION:

01 THERE MUST BE NO ICE, SNOW, SLUSH OR FROST ON THE LEADING EDGE DEVICES, CONTROL SURFACES, UPPER WING SURFACES AND BALANCE BAY CAVITIES.
BUT A LAYER OF FROST OF A MAXIMUM THICKNESS OF 3.17 mm (0.12 in) IS PERMITTED ON THE BOTTOM WING SURFACES BETWEEN THE FRONT AND REAR SPARS (THIS LAYER OF FROST IS CAUSED BY COLD FUEL IN THE WING TANK AREAS).

02 THERE MUST BE NO CONTAMINANTS ON THE ENGINE INTAKE AND THE ENGINE FAN BLADES MUST BE FREE TO TURN.

NOTE:

03 A THIN LAYER OF HOARFROST IS PERMITTED ON THE PROTECTED TOP FUSELAGE IF ALL VENTS AND PORTS ARE CLEAR. YOU CAN SEE THE PAINT LINES, MARKINGS AND LETTERING THROUGH A THIN LAYER OF HOARFROST.

DE-ICING FLUID APPLICATION AREAS

DE-ICING FLUID NON APPLICATION AREAS

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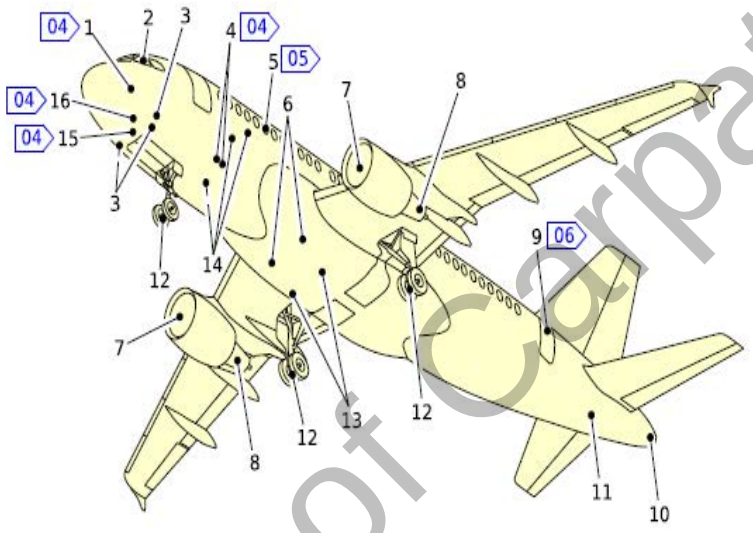

CAUTION:
DO NOT APPLY DE-ICING FLUID DIRECTLY ON THE AREAS THAT FOLLOW:

1 - STANDBY STATIC PROBE
2 - COCKPIT WINDOWS
3 - PITOT PROBES
4 - STATIC PROBES
5 - CABIN WINDOWS
6 - AIR-CONDITIONING SYSTEM INLETS
7 - ENGINE AIR INTAKE
8 - ENGINE EXHAUST
9 - CABIN DOORS
10 - APU EXHAUST
11 - APU AIR INTAKE
12 - L/G (BRAKES, WHEELS, LEG, ETC.)
13 - AIR-CONDITIONING SYSTEM OUTLETS
14 - AOA SENSORS
15 - ICE DETECTOR (OPTIONAL)
16 - TAT SENSOR

NOTE:
04 LH SHOWN, RH SYMMETRICAL
05 APPLICABLE FOR ALL CABIN WINDOWS
06 APPLICABLE FOR ALL CABIN DOORS

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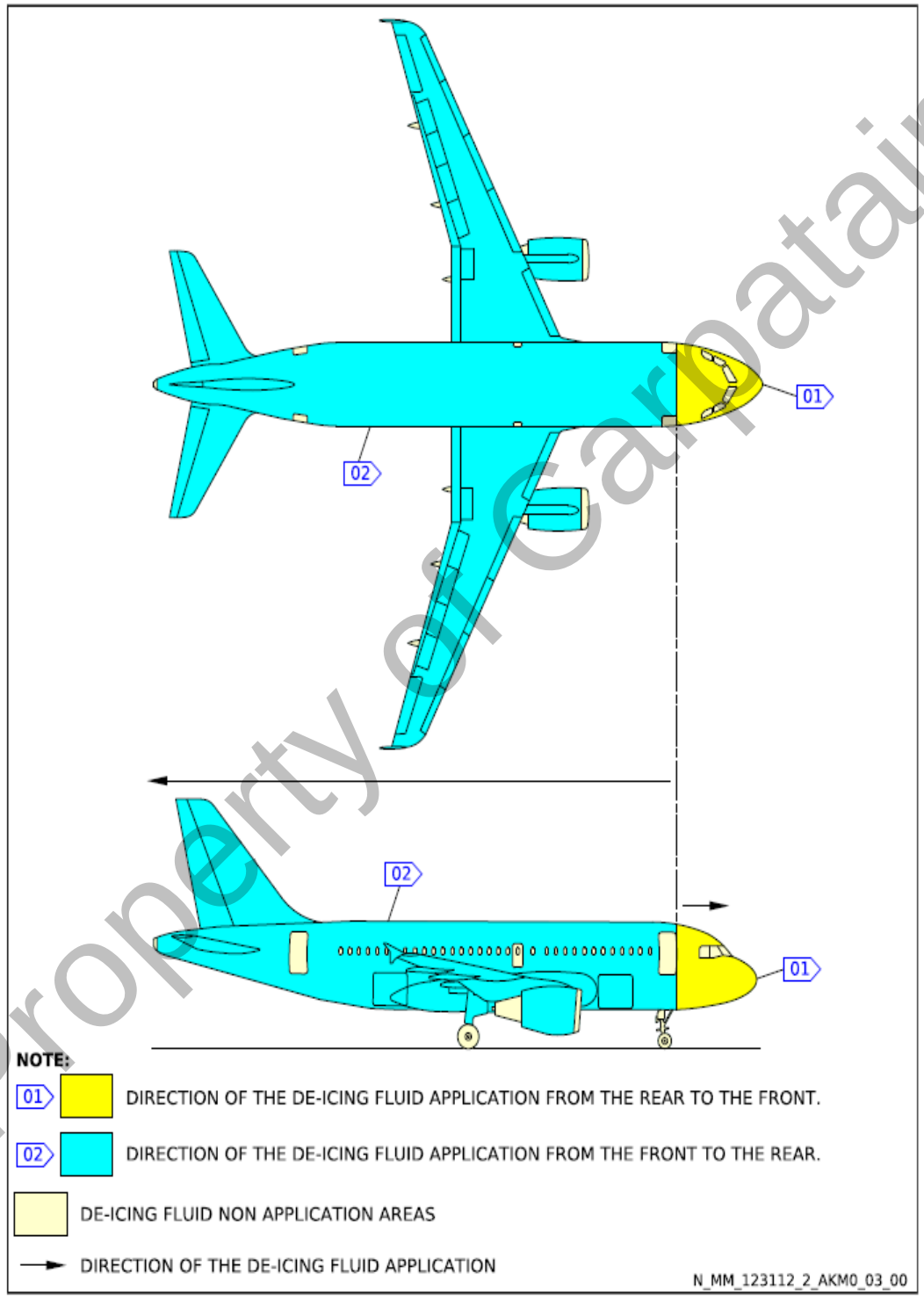


(a) You must apply the de-icing fluid directly from the rear to the front of the aircraft.
(b) Apply the de-icing fluid on the aircraft skin with the spray gun of the DE- ANTI-ICING EQUIPMENT - 12M SPRAYING HEIGHT. The spray gun nozzle must be at a distance of between 0.5 m and 3 m from the aircraft skin.

NOTE: At a distance more than 3 m, the effect of the de-icing fluid will not be satisfactory.

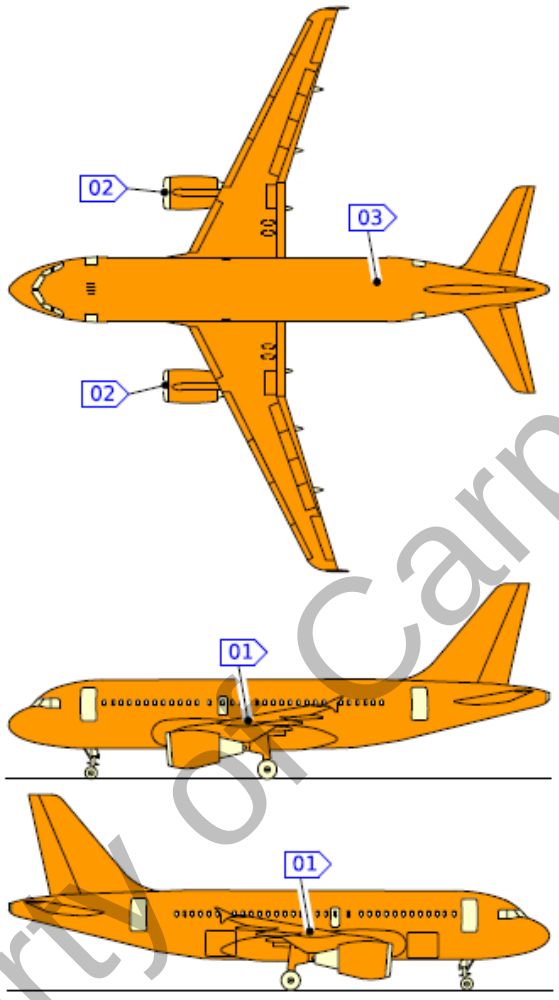
(c) Apply the de-icing fluid on the ice or snow accretion.
(2) Do not apply the de-icing fluid directly on:
- The standby static probes (1),
- The pitot probes (3),
- The TAT sensors (16),
- The ice detectors (15) (if installed),
- The cockpit windows (2) and
- The cabin doors (9).

(3) To prevent the flow of de-icing fluid on the cockpit windows, remove the remaining de-icing fluid from the forward areas. You can clean the surface with clean water and a soft cloth.
(4) If you find the de-icing fluid on the cockpit windows, clean the windows with clean water and a soft cloth.
Do not use the wipers to clean the de-icing fluid from the windshield.
Be careful to remove all the de-icing fluid from the windshield, specially in the wiper area.

(C) De-icing from the Forward Frame of Passenger/Crew Door 1 to the Rear of the Aircraft with the Spraying Equipment

CAUTION: During the de-icing and cleaning procedures, make sure that the hot water or hot water/fluid mixtures do not cause the temperature of the aircraft skin to increase to more than +70°c. Do not use steam. If you do not obey these precautions, you can cause damage to the surface or to parts.

CAUTION: Do not apply the de-icing or anti-icing fluid directly from the rear to the front of the structure of the aircraft (wings, horizontal stabilizer and elevator).



CAUTION:

01 THERE MUST BE NO ICE, SNOW, SLUSH OR FROST ON THE LEADING EDGE DEVICES, CONTROL SURFACES, UPPER WING SURFACES AND BALANCE BAY CAVITIES.
BUT A LAYER OF FROST OF A MAXIMUM THICKNESS OF 3.17 mm (0.12 in) IS PERMITTED ON THE BOTTOM WING SURFACES BETWEEN THE FRONT AND REAR SPARS (THIS LAYER OF FROST IS CAUSED BY COLD FUEL IN THE WING TANK AREAS).

02 THERE MUST BE NO CONTAMINANTS ON THE ENGINE INTAKE AND THE ENGINE FAN BLADES MUST BE FREE TO TURN.

NOTE:

03 A THIN LAYER OF HOARFROST IS PERMITTED ON THE PROTECTED TOP FUSELAGE IF ALL VENTS AND PORTS ARE CLEAR. YOU CAN SEE THE PAINT LINES, MARKINGS AND LETTERING THROUGH A THIN LAYER OF HOARFROST.

DE-ICING FLUID APPLICATION AREAS

DE-ICING FLUID NON APPLICATION AREAS

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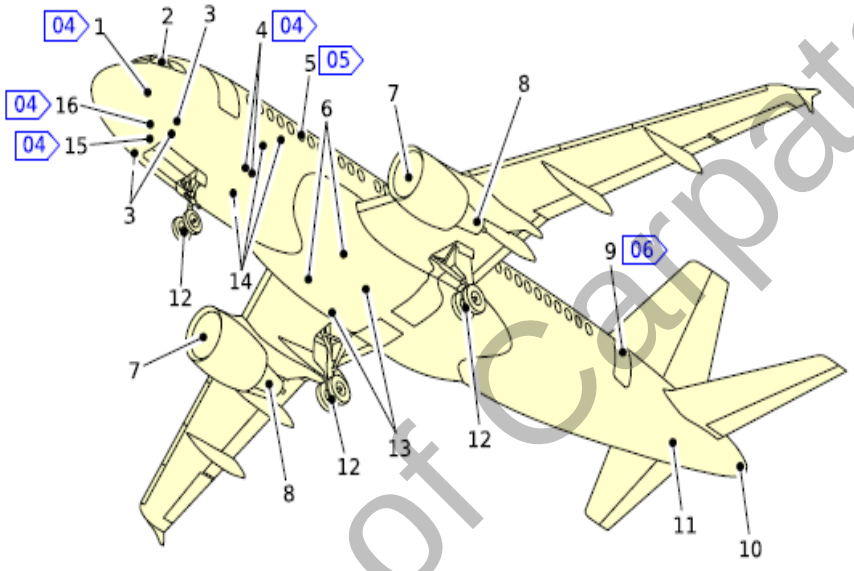

CAUTION:
DO NOT APPLY DE-ICING FLUID DIRECTLY ON THE AREAS THAT FOLLOW:

1 - STANDBY STATIC PROBE
2 - COCKPIT WINDOWS
3 - PITOT PROBES
4 - STATIC PROBES
5 - CABIN WINDOWS
6 - AIR-CONDITIONING SYSTEM INLETS
7 - ENGINE AIR INTAKE
8 - ENGINE EXHAUST
9 - CABIN DOORS
10 - APU EXHAUST
11 - APU AIR INTAKE
12 - L/G (BRAKES, WHEELS, LEG, ETC.)
13 - AIR-CONDITIONING SYSTEM OUTLETS
14 - AOA SENSORS
15 - ICE DETECTOR (OPTIONAL)
16 - TAT SENSOR

NOTE:
04 LH SHOWN, RH SYMMETRICAL
05 APPLICABLE FOR ALL CABIN WINDOWS
06 APPLICABLE FOR ALL CABIN DOORS

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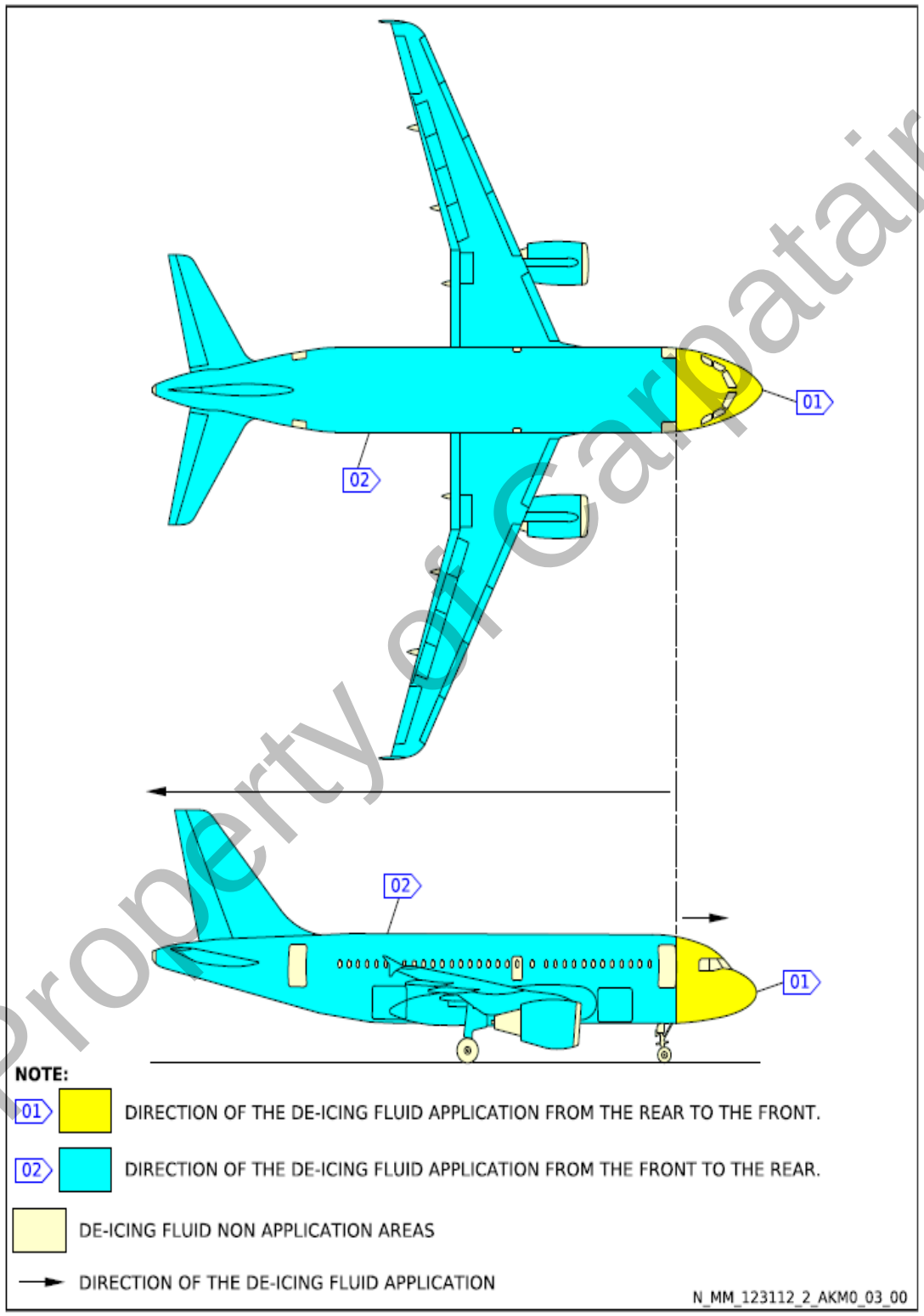

(a) Make sure that there are covers on the landing gear wheels and brakes.
(b) You must apply the de-icing fluid directly from the front to the rear of the aircraft.
(c) Apply the de-icing fluid on the aircraft skin with the spray gun of the DE- ANTI-ICING EQUIPMENT - 12M SPRAYING HEIGHT. The spray gun nozzle must be at a distance of between 0.5 m and 3 m from the aircraft skin.

NOTE: At a distance more than 3 m, the effect of the de-icing fluid will not be satisfactory.

(d) Apply the de-icing fluid on the ice or snow accretion.
(e) Do not apply the de-icing fluid directly on:
- The APU air intake (11) and exhaust (10)
- The engine air intakes (7) and exhausts (8)
- The inlets (6) and outlets (13) of the air conditioning system
- The landing gears (brakes, wheels, leg, etc.) (12)
- The static probes (4)
- The AOA sensors (14)
- The cabin windows (5) and
- The cabin doors (9).

(f) Do not use too much de-icing fluid on the rudder, the elevator and the aileron servocontrol areas. Use sufficient de-icing fluid to remove the contamination (snow, frost, ice or slush).

CAUTION: In the trimmable horizontal stabilizer (THS) area, be specially careful to point the spray from the front to the rear.
If you do not obey this precaution, the fluid can go into the rear fuselage non-pressurized compartment and cause damage to the flight data recorder (FDR).

(g) In the Trimmable Horizontal Stabilizer (THS) area, carefully point the spray from the front to the rear of the aircraft.

NOTE: If you point the spray in the other direction (from the rear to the front), de-icing fluid can go into the THS or into the rear fuselage non-pressurized-compartment.

D. Inspection after De-icing

(1) Make sure that there is no ice, ice ridges, frost, slush or snow on:
- The radome and the forward fuselage, specially in front of the pitot probes, the static probes and the AOA sensors,
- The fuselage
- The wings,
- The fuel tank vents,
- The flap and slat tracks,
- The control surfaces,
- The tail cone,
- The vertical stabilizer,
- The THS,
- The APU air intake and exhaust,
- The engine intakes and exhausts,
- The ice detectors (if installed),
- The TAT sensors,
- The pitot probes,
- The static probes,
- The AOA sensors,
- The inlet and outlet of the avionics-compartment ventilation system,
- The inlets and outlets of the air conditioning system,
- The outflow valve,
- The landing gears and the landing gear doors.

NOTE: A thin layer of frost (less than 3 mm) is permitted on the wing lower surfaces in cold soaked areas.
This is not applicable to the THS.
(2) Make sure that there is no remaining de-icing fluid on:
- The pitot probes,
- The static probes,
- The APU inlet (clean the APU inlet if necessary).
(3) An aircraft that is prepared for flight must not have ice, snow, slush or frost on the areas that follow:
- The leading edge devices
- The control surfaces
- The upper wing surfaces
- The engines
- The aerodynamically quiet areas and the flight control cavities.

NOTE: The aerodynamically quiet areas and the flight control cavities are the areas and low points which are not on the aerodynamic airflow, where water, snow and ice can collect. Thin hoarfrost is permitted on the top surface of the fuselage if all the vents and ports are clear.

NOTE: Thin hoarfrost is usually a white crystalline deposit which usually occurs equally on the external surfaces during cold nights without clouds. It is sufficiently thin that you can see surface features (paint lines, markings or lettering) below it.

NOTE: A frost layer of a maximum thickness of 3.17 mm. is permitted on the bottom side of the wing between the front and rear spars. This is applicable if there is no effect on the take-off performance and if cold fuel caused it (low fuel temperature, OAT above freezing and high humidity). This is not applicable to the bottom side of the THS.

If you schedule an APU or engine start immediately after the de-icing operation:
- Operate the APU or the engine(s) for some minutes
- Wait for 5 minutes before you open the engine or APU bleed valve(s)

Cold Weather Maintenance - Anti-Icing Protection

CAUTION: Do not apply anti-icing and de-icing fluid directly in:
- the pitot, ice detection, static probes and the AOA sensors
- the air intakes and exhausts of the engine and the APU
- all other air intakes or outlets.

If you do, electrical malfunctions and/or damage to equipment can occur.

CAUTION: Do not use jet exhaust to remove snow or ice from the airframe. The high pressure and high temperature of jet exhaust can cause damage to the aircraft.

CAUTION: Do not point the jets directly at the cockpit, cabin and door windows. The jets can cause crazing of the acrylic and can push the fluid into the window seals.

CAUTION: Do not use high-pressure jets or vapor to do the anti-icing / de-icing procedure. This type of equipment can put fluid in parts, and can cause damage to equipment, specially to:
- electrical equipment such as harnesses, proximity sensors and connectors (with short circuits or incorrect indications as a result)
- equipment such as gear box seals, steady bearings, rotary actuators and universal joints.

High pressure jets can push liquids into bearings, joints, brakes, electrical connectors and other sealed components. Liquids that get into these areas can cause CORROSION, freeze during aircraft flight, remove necessary lubricants or start incorrect electrical functions.

CAUTION: Do this procedure at the last possible opportunity before the aircraft departure. The anti-icing/de-icing material holdover-time can decrease. This can occur in one (or more) of these conditions:

- low temperature
- heavy precipitation
- heavy moisture
- high wind speeds
- jet blasts
- an aircraft skin temperature of less than the oat.

This procedure gives the instructions to prevent the formation of ice in some zones (wings, vertical and horizontal stabilizers, rudder). It also gives instructions make the removal of snow from the aircraft easier.

NOTE: The protection time will be shorter in very bad weather conditions.
High wind speeds and jet blast can cause damage to the protective film. If these conditions occur, the protection time will be much shorter.
The protection time can also be much shorter if the wind temperature is lower than the Outside Air Temperature (OAT).

A. Anti-Icing General Information

(1) If the aircraft comes to the gate with the flaps/slats in a position other than fully retracted:
- You must do an inspection of these flaps/slats.
- You must remove the ice before retraction, if necessary.
(2) Application limits:
Do not apply a new layer of anti-icing fluid directly on a layer applied before.
If you must apply new anti-icing protection before the subsequent flight, you must:
- First, do the de-icing of the aircraft with a hot fluid solution of Type 1 fluid Ref. AMM TASK 12-31-12-660-002.
- Then, apply the anti-icing protection on the clean aircraft.
(3**)** Refer to Ref. AMM TASK 12-31-00-600-001 for:
- Definition,
- Cold weather procedures,
- De-icing and Anti-icing Guidelines,
- Useable Materials,
- General Information on Effects of Icing,
- De-icing and/or Anti-icing Equipment and Materials.

B. Aircraft Maintenance Configuration

CAUTION: Do this task in a location with sufficient drainage for the anti-icing/de-icing fluids or move the aircraft before the engine start.
The anti-icing/de-icing fluids can make a pool under the engine air intake. This can cause the anti-icing/de-icing materials to go into the engine and prevent its correct operation.

(1) Park the aircraft on a flat surface. Make sure that the wheels of the nose landing gear are on the aircraft axis and that the aircraft points into the wind.
(2) Install the safety devices on the landing gears Ref. AMM TASK 32-00-00-481-001.
(3) Put the wheel chocks in position Ref. AMM TASK 10-11-00-555-015.
(4) Ground the aircraft Ref. AMM TASK 12-34-24-869-002.
(5) Energize the ground service network Ref. AMM TASK 24-41-00-861-002.
(6) Make sure that the flaps, the slats, the spoilers, the speed brakes and the thrust reversers are retracted.

(7) Make sure that the Auxiliary Power Unit (APU) and the engine bleed-air systems are stopped.
(8) On the CABIN PRESS section of panel 25VU
(9) Put a WARNING NOTICE(S) to tell persons to remove snow from their shoes and clothes before they go into the aircraft. This is very important in the cargo compartments. If there is ice or snow on the latches, this can cause defective operation of the cargo loading system.
(10) De-energize the ground service network
Ref. AMM TASK 24-41-00-862-002.
(11) To prevent contamination of the aircraft interior, make sure that all the doors and the sliding windows are closed.
(12) Install the protection equipment Ref. AMM TASK 10-11-00-555-013.
(13) Install a FILM - POLYETHYLENE or equivalent on each landing gear wheel/brake.

C. Preparation of Equipment

CAUTION: Before you apply anti-icing/de-icing fluids, make sure that the supply pressure is not more than the specified values.

CAUTION: Do not make the anti-icing/de-icing fluid in tanks hot too many times or for long periods. if you do, the quantity of water in the fluid will decrease and there will be a possible degradation of the fluid performance.

(1) Put the DE- ANTI-ICING EQUIPMENT - 12M SPRAYING HEIGHT in position. Make sure that the safety zone of the aircraft is clear so that the DE- ANTI-ICING EQUIPMENT - 12M SPRAYING HEIGHT moves easily.

NOTE: When used on the ramp, the DE- ANTI-ICING EQUIPMENT - 12M (39 FT) SPRAYING HEIGHT has a storage tank for the anti/de-icing fluid. Do not mix other fluids with the anti/de-icing fluid. Use the fluid at the recommended concentration for the temperature to get a correct protection.

(2) On the DE- ANTI-ICING EQUIPMENT - 12M SPRAYING HEIGHT:
(a) Set the supply pressure to:
- Not more than 1.5 psi (0.1034 bar) impact pressure on the radome, belly fairing,rudder and elevators
- Not more than 10 psi (0.6895 bar) impact pressure on all other surfaces.

Aircraft Anti-Icing

(1)Apply the anti-icing fluid to all the external surfaces of the aircraft with the DE- ANTI-ICING EQUIPMENT - 12M SPRAYING HEIGHT.
You must apply the fluid directly from the front to the rear of the aircraft.
(2) Do not apply Type II, III or IV fluid directly on the fuselage area forward of the passenger/crew door.
(3) Do not apply fluid directly on:
The APU air intake (13) and exhaust (12)
The engine cowls (8), air intakes (7) and exhausts (10)
The inlets (6) and outlets (15) of the Air Conditioning System (ACS)
The landing gears (brakes, wheels, leg, etc.) (14)
The pitot probes (3)
The static probes (4)
The standby static probes (1)
The Angle of Attack (AOA) sensors (16)
The Total Air Temperature (TAT) sensors (18)
The ice detectors (17) (if installed)
The cabin windows (5)
The cockpit windows (2)
The cabin doors (11)

The radome (19)
The bleed-air precooler-exchanger ventilation-grids (9).
(4) Do not use too much anti-icing fluid on the rudder, the elevator and in the aileron servocontrol areas.

INTENTIONALLY

LEFT

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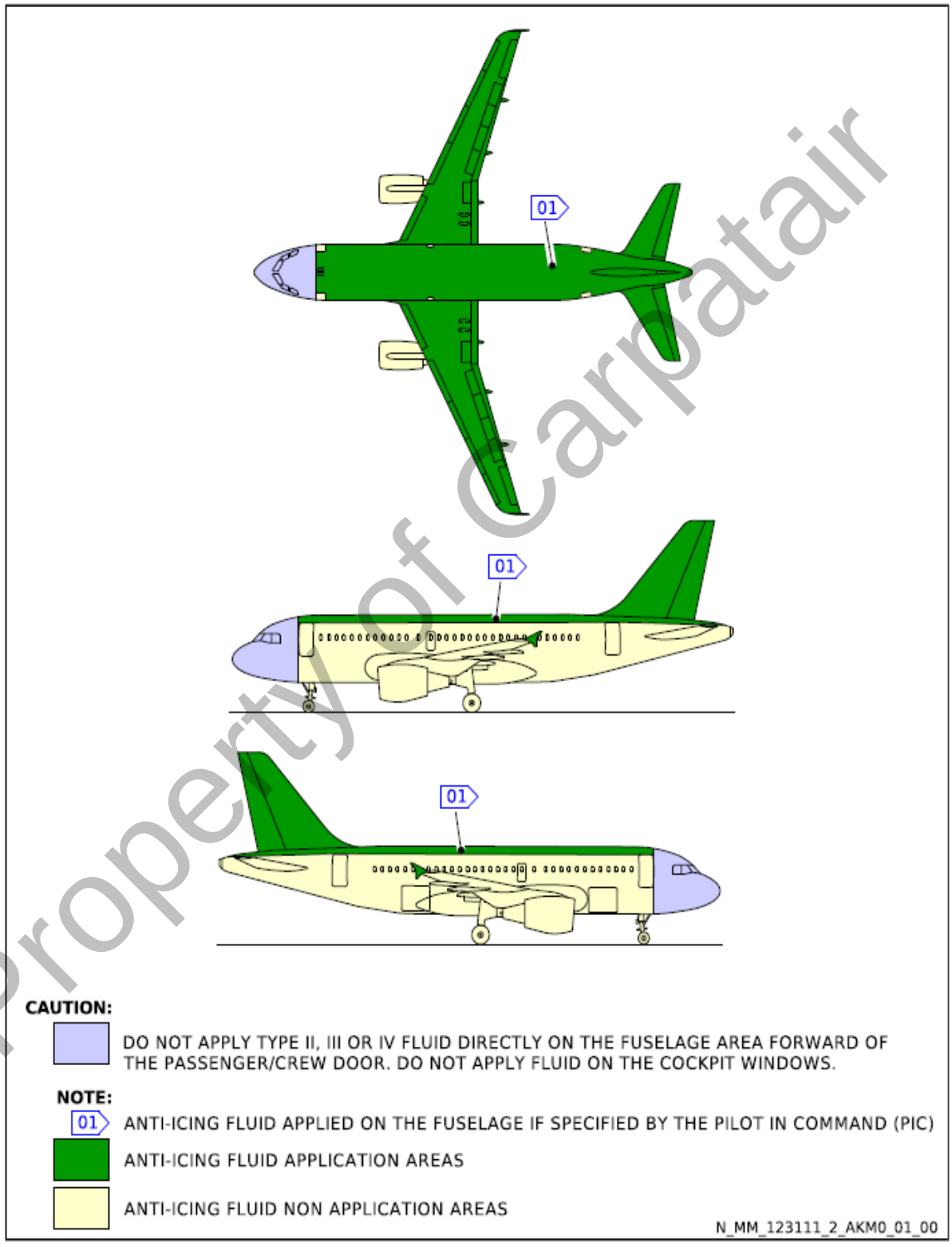

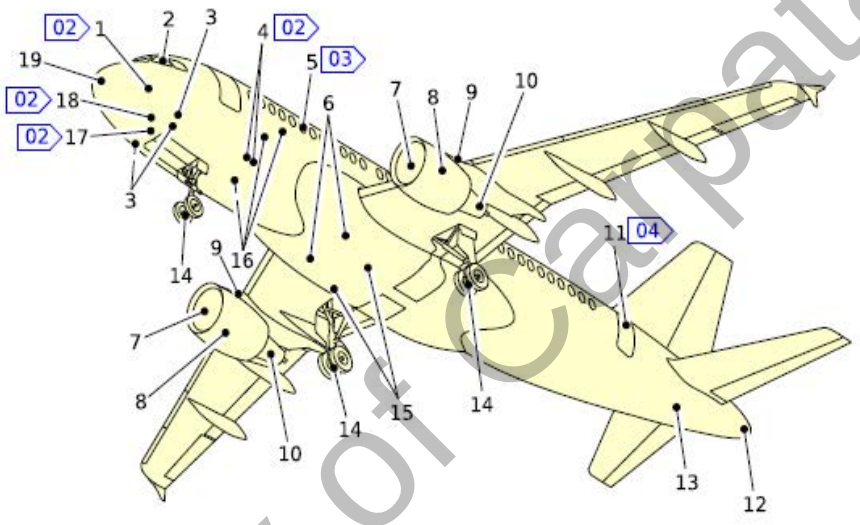

CAUTION:
DO NOT APPLY ANTI-ICING FLUID DIRECTLY ON THE AREAS THAT FOLLOW:

1 - STANDBY STATIC PROBE
2 - COCKPIT WINDOWS
3 - PITOT PROBES
4 - STATIC PROBES
5 - CABIN WINDOWS
6 - AIR-CONDITIONING SYSTEM INLETS
7 - ENGINE AIR INTAKE
8 - ENGINE COWL
9 - BLEED-AIR PRECOOLER-EXCHANGER VENTILATION-GRID
10 - ENGINE EXHAUST
11 - CABIN DOORS
12 - APU EXHAUST
13 - APU AIR INTAKE
14 - L/G (BRAKES, WHEELS, LEG, ETC.)
15 - AIR-CONDITIONING SYSTEM OUTLETS
16 - AOA SENSORS
17 - ICE DETECTOR (OPTIONAL)
18 - TAT SENSOR
19 - RADOME

NOTE:
02 LH SHOWN, RH SYMMETRICAL
03 APPLICABLE FOR ALL CABIN WINDOWS
04 APPLICABLE FOR ALL CABIN DOORS

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CAUTION: In the trimmable horizontal stabilizer (THS) area, be specially careful to point the spray from the front to the rear.
If you do not obey this precaution, the fluid can go into the rear fuselage non-pressurized compartment and cause damage to the flight data recorder (FDR).

(5) In the Trimmable Horizontal Stabilizer (THS) area, be specially careful to point the spray from the front to the rear.

NOTE: If you point the spray in the other direction (from the rear to the front), anti-icing fluid can go into the THS or into the non-pressurized compartment of the rear fuselage.
(6) To prevent the flow of fluid on the cockpit windows, remove the remaining fluid from the forward areas. You can clean the surface with clean water and a soft cloth.
(7) If you find fluid on the cockpit windows, clean the windows with clean water and a soft cloth.
- Do not use the wipers to remove the fluid from the windshield.
- Be careful to remove all the fluid from the windshield, specially in the wiper area.
(8) Inspection of the APU inlet:
(a)Make sure that there is no remaining anti-icing solution on APU inlet.
(b)If necessary, clean the APU inlet.

De-Icing of the Aircraft after a Landing with Snow on the Runway

WARNING: Let the brakes and the wheels become cool before you go near the landing gear. Do not apply a liquid or gas directly on a hot wheel or brake unit. This can cause a tire explosion and/or a wheel rim burst.

CAUTION: Do not try to operate the flight control surfaces if there is ice on them. If you do, you can cause damage to the system. Small surface movement is permitted at hydraulic power-up of aircraft.

CAUTION: Do not use jet exhaust to remove snow or ice from the airframe. The high pressure and high temperature of jet exhaust can cause damage to the aircraft.

CAUTION: Do not use high-pressure jets or vapor to do the anti-icing/ de-icing procedure. This type of equipment can put fluid in parts, and can cause damage to equipment, specially to:
- electrical equipment such as harnesses, proximity sensors and connectors (with short circuits or incorrect indications as a result)
- equipment such as gear box seals, steady bearings, rotary actuators and universal joints.

High pressure jets can push liquids into bearings, joints, brakes, electrical connectors and other sealed components. Liquids that get into these areas can cause corrosion, freeze during aircraft flight, remove necessary lubricants or start incorrect electrical functions.

NOTE: The data given in this procedure are guidelines only.

Job Set-up

A. De-Icing General Information
(1) Refer to Ref. AMM TASK 12-31-00-600-001 for:
- The definition
- The cold weather procedures
- The de-icing and anti-icing guidelines
- The materials that you can use
- The general information on effects of icing
- The de-icing and/or anti-icing equipment and materials.

B. Safety Precautions
(1) Put the wheel chocks in position Ref. AMM TASK 10-11-00-555-015.
(2) Install the safety devices on the landing gear Ref. AMM TASK 32-00-00-481-001.
(3) Make sure that the engines are stopped.

Procedure

A. Removal of Snow and Ice from the Aircraft
(1) Remove all signs of snow and ice from:
- The wing leading edges
- The flap and slat mechanisms
- The flap and slat tracks
- The rear spar area of the wing (above and in front of the flaps).

To do this, use:
- A BRUSH - BRISTLED, SOFT or
- A BROOM with soft bristles or
- Hot water or
- De-icing fluid at low pressure Ref. AMM TASK 12-31-12-660-002.

(2) Remove all signs of snow and ice from:
- The landing gears (the wheels and the brake system)
- The engine air intakes and the fan duct
- The engine fan blades (this includes the rear side of the engine fan blades).

To do this, use:
- A BRUSH - BRISTLED, SOFT or
- A BROOM with soft bristles or
- Hot water.

It is permitted to use forced air for the de-icing of the flaps/slats and mechanisms after a landing on a runway with contamination. The procedure and equipment must agree with SAE AIR6284.

Airbus does not recommend to use forced air mixed with de-icing fluid.
If the procedure to use forced air mixed with de-icing fluid is the only available procedure:
- Decrease the fluid to the lowest possible pressure.
- Do not spray fluid on the flap/slat actuator mechanisms.

For the flaps and flap track fairings, use only Type I de-icing fluid.

NOTE: De-icing fluid thickeners of Type II or IV will cause residue or gel.
When you use de-icing fluid, make an entry in the aircraft logbook. This is to tell persons to clean the flap/slat mechanisms immediately.

B. If you think that snow will fall, put the aircraft in this configuration
(1) Install the aircraft protection equipment Ref. AMM TASK 10-11-00-555-013.
(2) Make sure that you close all:
- Access doors and panels,
- Landing gear doors,
- Passenger/crew doors and exits,
- Cargo compartment doors,
- Sliding windows.

(3) Make sure that the flaps, slats, spoilers, speedbrakes and thrust reverser doors are retracted.
(4) Make sure that the trimmable horizontal stabilizer is in the neutral position.

AIRBUS 319 Structure