AEROSPACE STANDARD	AS6285™	REV. D
	Issued 2016-08 Revised 2021-05 Effective 2021-08 Superseding AS6285C	

(R) Aircraft Ground Deicing/Anti-Icing Processes

RATIONALE

The purpose of this document is to provide industry standards for the methods and procedures used in performing the treatments necessary for the proper deicing and anti-icing of aircraft on the ground using AMS1424 and AMS1428 qualified fluids (Types I, II, III, and IV) and non-fluid methods.

AS6285 forms one part of three related SAE Aerospace Standards (AS) and should be read in conjunction with AS6286 and AS6332. Collectively, AS6285, AS6286, and AS6332 are known to the international community as the “global aircraft deicing standards.”

Exposure to weather conditions on the ground conducive to ice formation can cause the accumulation of frost, snow, slush, or ice on aircraft surfaces and components. These contaminants can adversely affect aircraft performance, stability, and control, and operation of mechanical devices such as control surfaces, sensors, flaps, and landing gear. If frozen deposits are present, other than those considered in the aircraft certification process, the performance of the aircraft may be compromised.

Regulations governing aircraft operations in icing conditions shall be followed. Specific rules for aircraft are set forth in the United States Code of Federal Regulations (14 CFR), EASA Operation Regulations (EU-OPS), Canadian Aviation Regulations (CAR), and others. Paraphrased, these rules specify that no one may dispatch or take off an aircraft with frozen deposits on components of the aircraft that are critical to safe flight. A critical surface or component is one which could adversely affect the mechanical or aerodynamic function of an aircraft. In the event of differences or discrepancies in the requirements set out in this standard and any requirements set out in the domestic regulations applicable to the end user, the domestic regulation requirements shall supersede those set out in this standard.

As individual icing situations or aircraft types and models may require special procedures, this document can never replace the aircraft operator’s judgement. The responsibility for the correct deicing and anti-icing procedures for aircraft always rests with the operator of the aircraft.

The ultimate responsibility for the determination that the aircraft is clean and meets airworthiness requirements rests with the pilot-in-command of the aircraft.

Changes in this revision (AS6285D) include:

- Reference to the Federal Aviation Administration (FAA) and Transport Canada (TC) deicing program guidance.
- Additional definitions and abbreviations of commonly used terms.
- Alignment of definitions, ordered alphabetically.
- Additonal language for fluid appearance.

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- Alignment and clarification of postdeicing/anti-icing communication that includes the anti-icing code.
- Additional note to reference fluid manufacturer documentation.
- Removal of fluid application tables, replaced by reference only.
- Additional note on gravel deflectors and the requirements to be free of frozen contamination.
- Editorial modifications, particularly on capitalization and hyphenation of words.

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1. SCOPE

1.1 Field of Application

This document establishes the minimum requirements for ground-based aircraft deicing/anti-icing methods and procedures to ensure the safe operation of aircraft during icing conditions on the ground. This document does not specify the requirements for particular aircraft models.

NOTE: Refer to particular aircraft operator or aircraft manufacturer's published manuals and procedures.

The application of the procedures specified in this document are intended to effectively remove and/or prevent the accumulation of frost, snow, slush, or ice contamination which can seriously affect the aerodynamic performance and/or the controllability of an aircraft. The principal method of treatment employed is the use of fluids qualified to AMS1424 (Type I fluid) and AMS1428 (Type II, III, and IV fluids).

All guidelines referred to herein are applicable only in conjunction with the applicable documents. Due to aerodynamic and other concerns, the application of deicing/anti-icing fluids shall be carried out in compliance with engine and aircraft manufacturer's recommendations.

1.2 Agreements and Contracts

This information is recommended as a basis for operations and service support agreements.

1.3 Hazardous Materials

While the materials, methods, applications, and processes referenced to, or described in, this specification may involve the use of hazardous materials, this standard does not address the hazards which may be involved in their use. It is the sole responsibility of the user to ensure their familiarity with the safe and proper use of any hazardous materials and processes and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS1424 Fluid, Aircraft Deicing/Anti-Icing, SAE Type I

AMS1424/1 Deicing/Anti-Icing Fluid, Aircraft, SAE Type I Glycol (Conventional and Non-Conventional) Based

AMS1424/2 Deicing/Anti-Icing Fluid, Aircraft, SAE Type I Non-Glycol Based

AMS1428 Fluid, Aircraft Deicing/Anti-Icing, Non-Newtonian (Pseudoplastic), SAE Types II, III, and IV

AMS1428/1 Fluid, Aircraft Deicing/Anti-Icing, Non-Newtonian (Pseudoplastic), SAE Types II, III, and IV Glycol (Conventional and Non-Conventional) Based

AMS1428/2 Fluid, Aircraft Deicing/Anti-Icing, Non-Newtonian (Pseudoplastic), SAE Types II, III, and IV Non-Glycol Based

AIR6232 Aircraft Surface Coating Interaction with Aircraft Deicing/Anti-Icing Fluids

AIR6284 Forced Air or Forced Air/Fluid Equipment for Removal of Frozen Contaminants

ARP1971 Aircraft Deicing Vehicle - Self-Propelled

ARP5660 Deicing Facility Operational Procedures

ARP6257 Aircraft Ground De/Anti-Icing Communication Phraseology for Flight and Ground Crews

AS5116 Minimum Operational Performance Specification for Ground Ice Detection Systems

AS5681 Minimum Operational Performance Specification for Remote On-Ground Ice Detection Systems

AS5900 Standard Test Method for Aerodynamic Acceptance of AMS1424 and AMS1428 Aircraft Deicing/Anti-Icing Fluids

AS6286 Aircraft Ground Deicing/Anti-Icing Training and Qualification Program

AS6332 Aircraft Ground Deicing/Anti-Icing Quality Management

AS9968 Laboratory Viscosity Measurement of Thickened Aircraft Deicing/Anti-Icing Fluids with the Brookfield LV Viscometer

2.1.2 Other Publications

2.1.2.1 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

FAA Holdover Time Guidelines: Winter 20xx-20yy (annual publication).

FAA, Notice N 8900.XXX Revised FAA–Approved Deicing Program Updates, Winter 20xx–20yy (annual publication)

2.1.2.2 Transport Canada Publications

Transport Canada documents are available from Transport Canada, Tower C, Place de Ville, 330 Sparks Street Ottawa, Ontario K1A 0N5, Tel: 1-800-305-2059, www.tc.gc.ca.

Transport Canada Holdover Time Guidelines: Winter 20xx-20yy (annual publication)

Transport Canada, Guidelines for Aircraft Ground Icing Operations, TP 14052E, Issue x (annual publication)

2.1.3 Aircraft Manufacturer Manuals

Aircraft Manufacturer Manuals

Aircraft Operator Manuals

2.2 Abbreviations and Definitions

2.2.1 Abbreviations

ACARS	aircraft communications addressing and reporting system
APU	auxiliary power unit
CDF	central deicing facility
DDF	designated deicing facility
DIS	deicing/anti-icing supervisor
°C	degrees Celsius
°F	degrees Fahrenheit
FOD	foreign object debris or foreign object damage
EASA	European Union Aviation Safety Agency
EFB	electronic flight bag
EMB	electronic message board
FAA	Federal Aviation Administration
h	hours
HOWV	highest on-wing viscosity
LOUT	lowest operational use temperature
LOWV	lowest on-wing viscosity
OAT	outside air temperature
QA	quality assurance
QC	quality control
SDS	safety data sheet
TC	Transport Canada

2.2.2 Definitions

For the purposes of this document, the following definitions apply.

2.2.2.1 Advisory Word Definitions

The following advisory words are to be used as defined.

MAY: This means the practice is encouraged and/or optional.

SHALL: This means the practice is mandatory. A synonym for must.

SHOULD: This means the practice is recommended or strongly encouraged.

MUST: This means the practice is mandatory. A synonym for shall.

2.2.2.2 Definitions

ACTIVE FROST: Condition when frost is forming. Active frost occurs when (1) the aircraft surface temperature is at or below the frost point, or (2) there is water in liquid form (e.g., dew) on the aircraft surface and the surface falls to/or below 0 °C (frozen dew).

ANTI-ICING: Procedure by which fluid is applied to provide protection against the formation of frost or ice or the accumulation of snow or slush on treated surfaces of an aircraft for a limited period of time.

ANTI-ICING FLUID:

1. Mixture of water and Type I fluid;
2. Premix Type I fluid;
3. Type II, III, or IV fluids;
4. Mixture of water and Type II, III, or IV fluids.

NOTE: For deicing/anti-icing purposes in a one-step procedure, fluids in 1, 2, and 4 shall be heated to ensure a temperature of 60 °C (140 °F) minimum at the nozzle.

ANTI-ICING CODE: Code is given to the flight crew that deicing/anti-icing has been carried out and the details of the anti-icing procedure that was applied.

BRIX (DEGREES BRIX or °BRIX): Unit of measurement of refraction. See also refraction and refractometer.

CHECK: Examination against a relevant standard by a trained and qualified person to ascertain satisfactory condition.

CHEMICAL CONTAMINATION: Condition when substances (chemicals) are present where they should not be or are at concentrations higher than they should be.

CLEAR ICE: Ice difficult to detect visually. It is normally formed in the area of the wing fuel tanks, caused by cold-soaking. Clear ice may break loose during or after takeoff, and poses a hazard particularly to aircraft with rear mounted engines.

COLD-SOAKING: Ice can form on aircraft surfaces even when the outside air temperature (OAT) is well above 0 °C (32 °F). 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. The low temperature of the fuel may come from flying at a high altitude, where cold temperature prevails, for a period of time, or from fueling with cold fuel. This phenomenon is known as cold soaking. While on the ground, the cold-soaked aircraft will cause ice to form when water as rain or as vapor (humidity), comes in contact with cold-soaked surfaces.

CONTAMINATION: All forms of frozen or semi-frozen deposits on an aircraft, such as frost, snow, slush, or ice (also known as frozen contamination).

CONTAMINATION CHECK: A check of aircraft surfaces and components for contamination to establish the need for deicing.

DEICING: Procedure by which frost, snow, slush, or ice are removed from an aircraft in order to provide clean surfaces and components.

DEICING/ANTI-ICING: Combination of or referring to both of the procedures for “deicing” and “anti-icing.” It may be performed in one or two steps.

DEICING FLUID:

1. Heated water;
2. Heated mixture of water and Type I fluid;
3. Heated premix Type I fluid;
4. Heated Type II, III, or IV fluids;
5. Heated mixture of water and Type II, III, or IV fluids.

NOTE: Unheated fluids are ineffective to deice.

DEICING SERVICE PROVIDER: The company responsible for the aircraft deicing/anti-icing operations on an airfield.

FREEZING DRIZZLE: Fairly uniform precipitation composed exclusively of fine drops [diameter less than 0.5 mm (0.02 inch)] very close together, which freeze upon impact with the ground or other exposed objects.

FREEZING FOG: A suspension of numerous very small water droplets which freeze upon impact with the ground or other exposed objects; generally reduces the horizontal visibility at the earth’s surface to less than 1 km (5/8 mile).

FREEZING POINT: Temperature at which a liquid starts to become a solid.

FREEZING POINT BUFFER: The difference between the outside air temperature (OAT) and the freezing point of the fluid used.

FREEZING POINT BUFFER, NEGATIVE: Condition when the freezing point of a deicing/anti-icing fluid is above the OAT.

FREEZING RAIN, LIGHT: 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 up to 2.5 mm/h (0.10 in/h) or 25 g/dm^2/h with a maximum of 0.25 mm (0.01 inch) in 6 minutes.

FREEZING RAIN, MODERATE: Precipitation of liquid water particles which freezes upon impact with the ground or other exposed objects. Moderate freezing rain may appear in the form of large drops or can appear to fall in sheets where individual drops are not identifiable. Moderate freezing rain has a measured intensity of between 0.10 to 0.30 in/h.

FREEZING RAIN, HEAVY: 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 0.30 in/h.

FROST/HOARFROST: Tiny ice crystal formed on a surface at or below the frost point. Frost generally occurs with clear skies at temperatures below freezing point. Frost can also occur from the freezing of dew.

FROST, LOCALIZED: The limited formation of frost in localized wing areas cooled by cold fuel or large masses of cold metal in the wing structure; this type of frost does not cover the entire wing.

FUEL FROST: Frost, normally in the area of the wing fuel tanks, caused by the cold-soaking. Also known as non-environmental frost or cold-soaked fuel frost.

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

HIGHEST ON-WING VISCOSITY (HOWV): Highest viscosity of a thickened deicing/anti-icing fluid which is still aerodynamically acceptable.

HOARFROST: A synonym for frost. See frost/hoarfrost.

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 treated surfaces of an aircraft.

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

LOWEST ON-WING VISCOSITY (LOWV): Lowest viscosity of a thickened deicing/anti-icing fluid for which the applicable holdover timetable can still be used.

LOWEST OPERATIONAL USE TEMPERATURE (LOUT): The LOUT is 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 (18 °F) for Type I fluid and 7 °C (13 °F) for Type II, III, or IV fluids.

POSTDEICING CHECK: A check by qualified ground personnel to ensure that all critical surfaces are free of adhering contamination after the deicing procedure has been completed.

POSTDEICING-/ANTI-ICING CHECK: A check by qualified ground personnel to ensure that all critical surfaces are free of adhering contamination after the deicing/anti-icing procedure has been completed.

PREDEICING PROCESS: A process to remove large quantities of frozen contamination prior to the regular deicing/anti-icing process with the objective of reducing the quantity of deicing fluid to be used.

PREFLIGHT CONTAMINATION CHECK: A check performed by the flight crew or ground crew prior to departure to verify the presence of adhering contamination to establish the need for deicing/anti-icing. It may be part of the flight crew walk-around before the flight.

PRETAKEOFF CHECK: A check by the flight crew prior to takeoff and within holdover time. This check is normally conducted from inside the flightdeck. It is normally accomplished by a continuous assessment of the conditions that affect holdover time and includes an assessment and adjustment of holdover time.

PRETAKEOFF CONTAMINATION CHECK: A check of the critical surfaces for adhering contamination. This check is accomplished after the holdover time has been exceeded and must be completed within 5 minutes prior to the beginning of takeoff.

PROXIMITY SENSOR: A proximity sensor is a safety feature on some models of deicing 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.).

QUALIFIED STAFF: Trained staff who have passed theoretical and practical training tests and have been qualified for performing this type of job; refer to AS6286.

REFRACTION: The bending of light as it passes from one transparent substance into another. For solutions, the refraction will vary upon the concentration of the solute in the solvent. Using a calibration curve, it is possible to determine the concentration of the solute in the solvent. For example, for aqueous glycol solutions, it is possible to determine the concentration of the glycol in water by measuring refraction with a refractometer and comparing the result to the calibration curve. Refraction can be expressed as a dimensionless number (index of refraction) or as a scale of concentration, e.g., degrees Brix (°Brix), or freezing point (°C or °F). See also refractometer.

REFRACTIVE INDEX: Unit of measurement of refraction expressed in the form of a dimensionless number. See also refraction and refractometer.

REFRACTOMETER: An instrument to measure refraction. Result of measurement with a refractometer can be expressed as a dimensionless number (index of refraction) or as a scale of concentration, e.g., degrees Brix (°Brix), or freezing point (°C or °F).

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

RIME ICE: Small, frozen, spherical water droplets, opaque/milky and granular in appearance, which look similar to frost in a freezer; typically, rime ice has low adhesion to the surface and its surrounding rime ice particles.

SLUSH: Snow or ice that has been combined with water.

SNOW: Precipitation of ice crystals, most of which are branched, star-shaped, or mixed with unbranched crystals. At temperatures higher than -5 °C (23 °F), 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 inch); when snow grains hit hard ground, they do not bounce or shatter.

SNOW PELLETS: Precipitation of white, opaque particles of ice. The particles are round or sometimes conical, their diameters range from approximately 2 to 5 mm (0.08 to 0.2 inch), they are brittle and easily crushed, and they do bounce and may break upon contact with hard ground.

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

TACTILE CHECK: Process by which a person touches 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 deicing/anti-icing check process to ensure the critical surfaces are free of frozen contaminants.

THICKENED FLUID. A fluid that contains polymeric thickeners. AMS1428 Type II, III and IV fluids are thickened fluids; AMS1424 Type I fluids are not thickened.

3. ROLES AND RESPONSIBILITIES

3.1 Pilot-in-Command

The pilot-in-command has the ultimate responsibility for the aircraft and shall not commence take-off unless the external surfaces are clear of any deposit which might adversely affect performance and/or controllability, except as permitted in the aircraft operator manuals.

3.2 Aircraft Operator

Shall have responsibility for:

- Aircraft ground deicing programs.
- The pilot-in-command.
- Management responsibilities.

3.3 Deicing Service Provider

Shall have responsibility for:

- The safety and operability of the designated deicing facilities.
- Aircraft ground deicing/anti-icing procedures.

A deicing service provider shall have aircraft deicing/anti-icing procedures, including a quality control (QC) program. These procedures, which ensure compliance with the relevant regulations and global aircraft deicing standards such as AS6285, AS6286, and AS6332, shall cover all aspects of the aircraft ground deicing/anti-icing process, including (but not limited to) instructions, tasks, responsibilities, authorizations, and infra-structure for the deicing/anti-icing process as follows:

- Use of suitable deicing/anti-icing treatment method according to this Aerospace Standard.
- Remote deicing/anti-icing instructions (when applicable).
- Sufficient number of trained and qualified deicing/anti-icing personnel.
- Qualified staff to coordinate and supervise the deicing/anti-icing treatments.
- Use of suitable deicing/anti-icing equipment meeting specification ARP1971.
- Special handling procedures for Type II, III, and IV deicing/anti-icing fluids to maintain quality.
- Postdeicing/anti-icing check (when applicable).
- Protocol for communications with flight crew for both gate and remote locations (when applicable).
- Reporting the anti-icing code to the flight crew (when applicable).
- Documentation of all deicing/anti-icing treatments.
- Personnel safety arrangements.
- Provisions for tools and clothing for deicing/anti-icing personnel.
- Environmental arrangements.
- A QC program.

3.4 Airports

Shall have the responsibility for:

- Following local environmental regulations.
- The logistics of bringing fluid onto a field.
- The operability of the dedicated deicing facilities.
- Message boards.
- Weather support.
- Health and safety.

3.5 Regulatory Authority

Has the responsibility for:

- Regulatory and guidance material, plus the advocacy of the clean aircraft concept.
- The policies and standards that support the operability of the clean aircraft concept.
- Review and approval of airline operator ground deicing programs (as applicable).

3.6 Air Traffic Control

Has the responsibility for:

- The flow of aircraft through the regional system.

4. QUALITY

All companies providing deicing/anti-icing services shall have a quality program. The purpose of the program is to ensure that deicing/anti-icing of aircraft on the ground is accomplished in accordance with regulatory requirements and guidance, industry standards, and the operator's program. To verify effectiveness of the deicing/anti-icing of aircraft on the ground, the quality program should include both quality assurance (QA) and quality control (QC) processes and procedures.

4.1 Quality Assurance

To meet QA requirements, a company must provide proof it follows the rules and instructions in any specific field correctly, and that it has a proper and efficient QC program. QA is confirmed by auditing. Sometimes "audit pools" are formed so that companies are not audited several times on the same process by different entities; for example, IATA's Deicing/Anti-Icing Quality Control Pool (DAQCP). All companies should have a QA program in place. QA programs shall follow the standards published in AS6332.

4.2 Station Quality Control Program

A QC program shall cover all aspects of aircraft ground deicing/anti-icing and shall include, but is not limited to, the following checks:

- Procedures and instructions are up-to-date.
- Responsibilities and tasks are clearly defined and up-to-date.
- Communication procedures/protocols are up-to-date.
- All personnel are trained and qualified.
- The quality of deicing/anti-icing fluid from all storage tanks, all equipment tanks, and all spray nozzles are within limits.
- Correct and safe functioning of deicing/anti-icing spray equipment.
- Correct and safe functioning of (remote/centralized) deicing/anti-icing facility (if applicable).
- Reporting methods and reports are up-to-date.

NOTE 1: Prior to the start of each winter, perform all above listed checks.

NOTE 2: During each winter season, perform QC checks on deicing/anti-icing fluids from all spray nozzles at operational settings on a regular basis and file test results until the start of the next winter period.

4.3 Fluid Quality Control

To ensure the necessary safety margins are maintained in the deicing/anti-icing operation, the fluid used to both deice and anti-ice aircraft surfaces must meet specification and be at the correct concentration. Factors like pumping, storing, heating, and spraying may cause degradation/contamination of deicing/anti-icing fluids. To assure the correct quality of these fluids, follow fluid manufacturer's recommendations and perform the following checks and tests. Results of all testing shall be recorded.

4.3.1 Fluid Delivery/Acceptance

Fluid acceptance consists of delivery documentation checks, seal checks and fluid tests. Fluid acceptance 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.

4.3.1.1 Delivery Documentation

a. The delivery shall be accompanied by a certificate of analysis or certificate of conformance.

    1. For Type I, II, III, and IV fluids, the certificate shall include delivery specification limits and test results of the following:

        (a) Appearance.

        (b) Refraction.

        (c) pH.

    2. For deliveries of Type II, III, and IV fluids, the certificate shall also include (delivery) viscosity specification limits 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 name 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 specification limits.

4.3.1.2 Shipment Seal Checks

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.

4.3.1.3 Bulk Shipments (e.g., Tank Trucks and Rail Cars)

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.

4.3.1.4 Fluid Samples

A fluid sample shall be taken from the delivery vessel.

a. For bulk shipping containers, a sample from each separate compartment is required, if applicable.

b. For deliveries of multiple containers (i.e., totes or drums), only one sample from each production lot or batch is required.

4.3.1.5 Sample Tests

a. The following tests shall be performed on each sample taken at delivery:

    1. Appearance (visual examination):

        (a) Color.

        (b) Foreign body contamination (e.g., rust particles, debris, etc.).

    2. Refraction check (refractive index or freezing point) to verify fluid concentration.

b. The following tests are optional for each sample. These checks can be helpful if fluid degradation is suspected:

    1. pH.

    2. Field viscosity or laboratory viscosity tests for Type II, III, or IV fluids.

c. All test results shall be within the fluid manufacturer's specification limit.

4.3.1.6 Nonconformities or Discrepancies

Users and service providers shall have a documented procedure in place on the appropriate action to be taken when irregularities or discrepancies are identified during the fluid delivery documentation checks and fluid sample tests.

Fluid manufacturers should have information contained within their documentation outlining specific procedures and/or contact information to assist and provide support to service providers in such occurrences.

4.3.2 Fluid Preseason and Within-Season Tests

Fluids that are applied to the aircraft shall meet the fluid manufacturer's specification. A program shall be in place that assures the safe use and performance parameters of fluids are always followed and met.

One way of complying with this requirement is to carry out mid-season tests.

4.3.2.1 Type I Fluid

Test Frequency. These tests shall be performed:

- At the start of the deicing season.
- On any vehicle or storage tank when fluid contamination or degradation is suspected.

Fluid samples shall be taken from all deicing/anti-icing fluid spray nozzles of all deicing/anti-icing spraying equipment in the most common concentrations used for deicing/anti-icing, and from all storage tanks in use. For vehicles without a mixing system, the sample may be taken directly from the vehicle pre-mix tank after ensuring that the fluid is at a uniform mixture. Perform the following tests on the fluid samples:

- Appearance (visual examination).
  - Color.
  - Foreign body contamination (e.g., rust particles, debris, etc.).
- Refraction.
- pH*.

*Perform this test if fluid degradation or contamination is suspected.

4.3.2.2 Type II, III, and IV Fluids

Test frequency. These tests shall be performed:

- At the start of the deicing season.
- On any vehicle or storage tank when fluid contamination or degradation is suspected.
- After equipment maintenance on the fluid pump and spray system that has the potential to affect the quality of the fluid (e.g., pumps, nozzles, etc.).

Fluid samples shall be taken from all deicing/anti-icing fluid spray nozzles of all deicing/anti-icing spraying equipment for all of the concentrations used for anti-icing and from all storage tanks in use. Perform the following tests:

- Appearance (visual examination).
  - Color.
  - Foreign body contamination (e.g., rust particles, debris, etc.).
- Refraction.
- pH*.
- Laboratory viscosity.

*Perform this test if fluid degradation or contamination is suspected.

4.3.2.3 Sample Test Requirements

- Results of the appearance, refraction and pH tests shall be within the limits set by the applicable fluid manufacturer specification.

- Results of the Type II, III, and IV viscosity tests on samples from spray nozzles shall be no lower than the lowest on-wing viscosity (LOWV) and no higher than the highest on-wing viscosity (HOWV). Fluids with a viscosity less than the LOWV shall not be used with holdover time guidelines.

- Results of the viscosity tests on samples from storage tanks shall be within the limits needed to ensure the viscosity of fluid when applied to aircraft will remain within the LOWV and the HOWV. Any expected degradation during fluid storage and handling and during the use of fluid application equipment must be taken into account.

NOTE: The LOWV for specific fluids are listed in Transport Canada and FAA Holdover Time Guidelines. The HOWV for specific fluids are provided by the applicable fluid manufacturer. The LOWV and HOWV are unique for each specific fluid and fluid concentration (i.e., 50%, 75%, and 100%).

4.3.3 Daily Concentration Tests

Fluids or fluid/water mixture samples shall be taken from the deicing/anti-icing equipment nozzles on a daily basis when the equipment is in use. Perform a refraction test on the samples taken. The sample shall be protected against precipitation. Combustion heaters and trucks shall not be operated in confined or poorly ventilated areas to prevent asphyxiation. Requirements for suitable equipment are described in ARP1971.

NOTE 1: Equipment without a mixing system: samples may be taken from the mix tank instead of the nozzle. Ensure the fluid is at a uniform mix.

NOTE 2: Equipment with proportional mixing systems: operational setting for the flow and pressure shall be used. Allow the selected fluid concentration to stabilize before taking a sample.

4.3.3.1 Type I Fluid from Nozzles

- Maximum permitted concentration shall not be exceeded.

- For use in a one-step method and in the second step of a two-step method, the concentration shall be such that the freezing point of the fluid is at least 10 °C (18 °F) below the OAT.

- For use in the first step of a two-step method, the concentration shall be such that the freezing point of the fluid is at the OAT or below.

4.3.3.2 Type I Fluid in Tanks

- The concentration shall be within the “in-service” limits published by the manufacturer for fluid at the applicable concentration.

4.3.3.3 Type II, III, and IV Fluids

- For fluids from nozzles and in tanks, the concentration shall be within the “in-service” limits published by the manufacturer for fluid at the applicable concentration.

- For Type II, III, and IV fluid/water mixtures (50/50 or 75/25), a tolerance range of 0 to +7% from the setting may apply, depending on the product.

4.3.4 Check on Directly or Indirectly Heated Type II, III, or IV Fluids

SAE Type II, III, and IV deicing/anti-icing fluids, if heated (directly or indirectly), shall be heated in a manner to preclude fluid degradation in storage or application. The integrity of the fluid following heating shall be checked periodically. Factors like heating rate and heating time cycles should be considered in determining the frequency of fluid inspections. Refer to the fluid manufacturer's recommendations.

4.3.5 Fluid Test Methods

The following tests may be performed by any appropriate equivalent method.

a. Appearance

1. Put fluid from the sample into a clean transparent bottle.
2. Check visually for color.
3. Check visually for any kind of contamination (e.g., rust particles, debris, rubber, or discoloration, etc.).

b. Refraction

1. Perform a functionality check on the refractometer.
2. Put a fluid drop taken from the sample or from the nozzle onto the test screen of the refractometer and close the cover plate.
3. Read the value (usually expressed as refractive index, degrees Brix or freezing point) and use the correction factor given by the manufacturer of the fluid in case the temperature of the refractometer is not 20 °C (68 °F).
4. Compare the refraction result to the specification limit or in-use limit, as appropriate.
5. Clean the refractometer by wiping with a water-wet cloth, wipe dry and return it into the protective cover.

c. pH

1. This test may be performed either with pH indicator paper (litmus paper) or with a calibrated or functionally tested pH meter. Read the value and compare with the limits for the fluid.

NOTE: In the laboratory, this pH check shall be performed with a calibrated or functionally tested pH meter.

d. Field Viscosity Test

1. This test may be performed using the fluid manufacturer's recommended method, like a falling ball or the Stony Brook device. Read the value and compare with the limits for the fluid.

e. Laboratory Viscosity Test

1. Perform the viscosity test using the fluid manufacturer's method or AS9968. Compare the viscosity values with the applicable limits.

4.3.6 Fluid Sampling Procedure for Type II, III, or IV Fluids

To ensure that the necessary safety margins are maintained between the start of the deicing/anti-icing operation and takeoff, the fluid used to both deice and anti-ice aircraft surfaces must meet specification and be at the correct concentration. Due to the possible effect of vehicle/equipment heating and/or delivery system components on fluid condition, it is necessary for the sampling method to simulate typical aircraft application. This section describes some methods for collecting samples of Type II, III, and IV fluids, sprayed from operational aircraft deicing/anti-icing vehicles and equipment, prior to the necessary QC checks being carried out.

a. Method Using a Purpose-Built Stand

Spray the fluid onto a purpose-built stand, consisting of a suitable plate (for application) and an associated fluid collection system. In the absence of such a stand, a suitable apparatus can be used. The distance between the spray nozzle and the surface shall be approximately 1 to 3 m, and the fluid shall be sprayed perpendicular to the surface. By following this simple procedure, a representative nozzle sample can be obtained. If there are any questions about the deicing fluid, contact and consult the fluid manufacturer. If there are any questions about the deicing vehicle or unit, pump, pump pressure, etc., consult the ground service equipment shop or the vehicle manufacturer.

1. Select the required flow rate/spray pattern for the fluid to be sampled simulating routine operations.
2. Spray the fluid to purge the lines and check the concentration of a sample, taken from the gun/nozzle after purging.
3. Should the refraction indicate that the lines have not been adequately purged, repeat the previous step until the concentration is correct for the fluid to be sampled (on certain vehicles it may be necessary to spray more than 50 L of fluid, before the lines are completely purged).
4. Direct the fluid onto the sampling surface and spray an adequate amount of fluid to allow for a 1 L sample to be taken.

b. Trashcan Method

Items required:

1. Large garbage cans, buckets, or 55-gallon drums.
2. Large trash can liners.
3. Sample bottle that is clean and dry.

Procedure for nozzle sample:

1. Set trash cans out and put two liners in each trash can.
2. Weigh the trash can down with sand or blocks.
3. Stand about +1 to 3 m (4 to 10 feet) away from the cans.
4. Open the nozzle and spray into one of the trash cans so that the lines are purged of any old fluid.
5. When the line has been purged, move the nozzle to the next trash can, keeping the nozzle open.
6. Do not close the nozzle and restart as that will shear the fluid.
7. Spray 2 to 3 gallons (8 to 12 L) into the second trash can.
8. Pull the liner out and put a small hole in bottom of bag to fill the sample bottle.

c. Sample Identification

Attach a label to each sample bottle providing the following data:

1. Manufacturer's brand name and full name and type of the fluid (e.g., Kilfrost ABC-3/Type II).
2. Identification of deicing/anti-icing equipment (e.g., Elephant Beta DT04, Fixed Rig R001, etc.).
3. Detail where the sample was taken from (e.g., nozzle, storage tank, or equipment tank).
4. Mixture strength (e.g., 100/0, 75/25, etc.).
5. Station (e.g., BAK, etc.).
6. Date sample was taken.

5. COMMUNICATIONS

5.1 Communication Procedures

Persons communicating with the flight crew shall have a basic knowledge of the English language (operational level or equivalent according to the current version of the training document AS6286). For local flights involving local flight and ground crew, local language may be used by them (refer to the current version of training document AS6286).

Communication between the flight crew and the deicing crew will usually be achieved using a combination of printed forms and verbal communication. For treatments carried out after aircraft doors are closed, the 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.

NOTE: No flight crew communication is required and no holdover time applies if the aircraft is deiced using Type I for overnight frost in the absence of further precipitation or active frost.

5.2 Communication Prior to Starting Deicing/Anti-Icing Treatment

a. Before starting deicing/anti-icing, the flight crew shall be requested to confirm the treatment required (i.e., surfaces and components to be deiced, anti-icing requirements, plus any special deicing procedures).

b. Before fluid treatment starts, the flight crew shall be requested to configure the aircraft for deicing/anti-icing (surfaces, controls, and systems as per aircraft type requirements or recommended procedures). The deicing 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 member shall be nominated by the aircraft operator to confirm the treatment required (when applicable) and to confirm the correct configuration of the aircraft.

5.3 Postdeicing/Anti-Icing Communication

An aircraft shall not be dispatched for departure after a deicing/anti-icing operation until the flight crew has been notified of the type of deicing/anti-icing operation performed (i.e., the anti-icing code). The anti-icing code (see 5.4) shall be provided by qualified staff upon completion of the treatment, indicating that the checked surfaces (see 7.3) are free of frost, snow, slush, or ice; that deicing/anti-icing is complete, that equipment is cleared from the area; and in addition, providing the necessary information for the flight crew to estimate the appropriate holdover time for the prevailing weather conditions when anti-icing fluid has been used. When a treatment is interrupted for a significant period of time (e.g., truck runs out of fluid), the flight crew shall be informed stating the reason, the action to be taken, and the estimated time delay. When continuing the treatment, the previously treated surfaces must be fully deiced and anti-iced again, when the holdover time of the treatment from before the interruption is not sufficient.

5.4 The Anti-Icing Code

The following elements comprising the anti-icing code shall be recorded and be communicated to the flight crew by referring to the final step of the fluid deicing/anti-icing treatment procedure. The elements below shall be provided:

NOTE: This information shall not be communicated in circumstances where anti-icing holdover times do not apply, e.g., local frost prevention in cold-soaked wing areas, symmetrical local area deicing, or deicing of specific surfaces only (such as leading edges for removal of impact ice), etc. In these circumstances, upon completion of the treatment, the flight crew shall be provided with the deicing fluid type applied (e.g., “Type I”), a statement that holdover time does not apply (e.g., “Local area deicing only. Holdover times do not apply.”), and confirmation that the postdeicing check has been completed (e.g., “Postdeicing check completed.”).

a. The fluid type (i.e., Types I, II, III, or IV).

b. The fluid name (manufacturer and brand/trade name) of the Types II, III, or IV anti-icing fluid.

NOTE: Communication of this element is not required for Type I fluid.

c. The concentration of fluid (dilution) within the neat fluid/water mixture, expressed as a percentage by volume for Types II, III, or IV (i.e., 100% (“neat”) = 100% fluid, 75% = 75% fluid and 25% water, 50% = 50% fluid and 50% water).

NOTE: Communication of this element is not required for Type I fluid.

d. The local time (hours and minutes), either:

1. For a one-step deicing/anti-icing operation: at the start of the final treatment, or

2. For a two-step deicing/anti-icing operation: at the start of the second step (anti-icing)

e. The date in the following format: day, month, year (DDMMMYY (e.g., 28JAN15 = January 28, 2015))

NOTE: This element is required for record keeping and is optional for flight crew notification.

f. The statement “Postdeicing/anti-icing check completed.”

NOTE: For specific aircraft types, additional requirements exist; e.g., tactile checks for clear ice on wing surfaces. Additional confirmation for these checks may be required.

EXAMPLE: The last step of a deicing/anti-icing procedure is the application of a mixture of 75% Type II fluid and 25% water, made by the Manufacturer as Brand X, commencing at 13:35 local time on 20 February 2016, is reported and recorded as follows:

“TYPE II/MANUFACTURER, BRAND X/75%/1335/20FEB16/POSTDEICING/ANTI-ICING CHECK COMPLETED”

NOTE: An alternative means of visual communication of the anti-icing code to the flight crew can be used (e.g., written on paper, EMBs, ACARS, EFBs, etc.).

5.5 Postdeicing/Anti-Icing Check and Transmission of the Anti-Icing Code to the Flight Crew

It shall be clearly defined by the aircraft operator which company is responsible for conducting the postdeicing/anti-icing check and providing the flight crew with the anti-icing code. If two different companies are involved in the deicing/anti-icing treatment and postdeicing/anti-icing check, it must be ensured that the anti-icing code is not given before the postdeicing/anti-icing check has been completed.

The company conducting the deicing/anti-icing treatment shall be responsible for the treatment and transmit all information about the treatment to the company conducting the postdeicing/anti-icing check. The company conducting the postdeicing/anti-icing check shall have overall responsibility for the performance of the company conducting the deicing/anti-icing treatment.

5.6 Confirmation that Equipment and Personnel are Safely Away from the Aircraft

The flight crew shall receive a confirmation from the deicing crew that all deicing/anti-icing operations are complete and that all deicing personnel and equipment have been removed from the area before reconfiguring or moving the aircraft.

5.7 Off-Gate Communications

During deicing/anti-icing, a two-way communication between the flight crew and the deicing/anti-icing operator/supervisor must be established prior to the deicing/anti-icing treatment. This may be done either by interphone or by VHF radio. Alternate means of communication may be the use of ACARS, EFBs, and EMBs. In the event of conflict, verbal communication shall take precedence.

During treatment, all necessary information must be transmitted to the flight crew, including the beginning of treatment, treatment of the sections requiring de-activation of aircraft systems, the anti-icing code, etc. (using standardized deicing/anti-icing phraseology). Communication contact with the flight crew may be concluded after transmission of the anti-icing code and readiness for taxi-out has been announced. During deicing/anti-icing operations with engines running, both verbal and visual communications shall be utilized and positive control maintained during the deicing/anti-icing operation in accordance with ARP5660.

a. General Instructions: The deicing/anti-icing operator and/or airport authority must ensure that all necessary information regarding operation of the off-gate/CDF/DDF site is published and available to flight crews. This information shall be included within the deicing/anti-icing operator's and/or airport authority's local procedures documentation and be made available to air operators and flight crews (e.g., it can be included as part of flight release documentation, etc.). This information should also be published in applicable state aeronautical navigation documents/publications. This information shall include, at a minimum:

    1. The location of and standard taxi routing to, within, and from the deicing/anti-icing site;

    2. How to coordinate the deicing/anti-icing operation;

    3. How to communicate before, during, and after the deicing/anti-icing operation;

    4. How taxi-and-stop guidance is provided to the flight crew (e.g., VHF, EMBs, etc.); and,

    5. Any unique requirements or procedural differences affecting the flight crew and/or flight crew/ground crew interface.

b. Responsibilities: The responsibility to conduct a contamination check before dispatch rests with trained and qualified personnel. The results of the contamination check must be provided to the flight crew via verbal or visual (written or electronic) means. Subsequently, the flight crew is responsible for acquiring the proper treatment. After treatment, the treated surfaces and components must be checked by a trained and qualified staff (see Section 11) and the anti-icing code must be given to the flight crew (see 5.4). Subsequently, the flight crew is responsible for the airworthiness of the aircraft.

c. Emergency Procedures: Whether conducting deicing/anti-icing operations at a remote location or at a centralized deicing/anti-icing facility, local procedures shall be established to ensure that both aircraft and ground emergencies are handled safely, expeditiously, and are coordinated with the local emergency plan.

5.8 Scripts

The following standard communication terminology is recommended during off-gate deicing/anti-icing procedures:

- DIS = Deicing/anti-icing supervisor.
- COMMANDER = Pilot-in-command.

DIS: “Set parking-brake, confirm the airplane is ready for treatment, inform on any special requests.”

After the airplane is configured for treatment:

COMMANDER: “Parking brake is set, you may begin treatment and observe … (any special requests like: ice under wing/flaps, clear-ice on top of wing, snow on fuselage, anti-ice with Type IV fluid, etc.).”

DIS: “The treatment will begin now … (special request given, like ice under wing, etc.). I will call you back when ready.”

Only after all equipment is cleared from the airplane and all checks are completed:

DIS: “Deicing/anti-icing completed, anti-icing code is: … (plus any additional info needed). I am disconnecting. Standby for clear signal at right/left and/or contact ground/tower for taxi clearance.”

COMMANDER: “Deicing/anti-icing completed, anti-icing code is …”

5.9 Phraseology

Guidelines for establishing clear, concise standardized communication and phraseology between aircraft flight and ground crews during an aircraft deicing operation is contained in ARP6257. It is very important that both parties communicate fully about contact requirements, aircraft configuration, de/anti-icing treatment needed, and postdeicing reporting requirements.

5.10 Communication for Proximity Sensor Activation by Physical Contact

For equipment types furnished with a proximity sensor requiring physical contact in order to activate (see 8.7.20 for further information), and, in the event of sensor contact, the pilot-in-command shall be informed using the following phraseology:

Ground crew to flight crew:

“A safety proximity sensor (identify location on the deicing equipment) has been activated on the (specify specific location on the aircraft). (Name of third party title that performed inspection) has performed a visual inspection on the affected area. Provide results of the third party inspection (e.g., there is no visual damage detected or damage is suspected or present). Advise your intentions.”

6. AIRCRAFT REQUIREMENTS AFTER DEICING/ANTI-ICING

Following the deicing/anti-icing procedures and prior to takeoff, the critical aircraft surfaces shall be free of all frost, snow, slush, or ice accumulations in accordance with the following requirements.

6.1 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.

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.

6.2 Pitot Tubes, Static Ports, and All Other Air Data Sensing Devices

Pitot tubes, static ports, and other air data sensing devices shall be free of frost, snow, slush, ice, and fluid.

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.

6.3 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.

6.4 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.

6.5 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 deicing/anti-icing fluids directly onto wiring harnesses and electrical components (receptacles, junction boxes, etc.) brakes, wheels, exhausts, or thrust reversers.

6.6 Fuel Tank Vents

Fuel tank vents shall be free of frost, snow, slush, or ice.

6.7 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.

6.8 Flightdeck 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 flightdeck windows will not normally require deicing. 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, III, or IV fluids have been used, all traces of the fluid on flightdeck windows shall be removed prior to departure, with particular attention paid to windows fitted with wipers. Thickened fluid (SAE Types II, III, 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 deicing.

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

Dried thickened-fluid (SAE Types II, III, or IV) residues can occur when surfaces have been deiced/anti-iced but the aircraft has not 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.

6.10 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 and the removal of lubricants.

7. CHECKS

The decision whether deicing/anti-icing is required shall be determined when one or more of the following circumstances is applicable:

- An aircraft is parked overnight and subjected to ice or snow conditions.
- When ice has accumulated in flight (in-flight ice accretion).
- During taxi to the gate occurring in icing and/or snow conditions.
- Following an inspection or check by the flight crew at a gate.
- As indicated by a check by a qualified deicing/anti-icing person.
- Active frozen or freezing falling precipitation is occurring.
- When cold-soaked fuel has created ice or frost on critical surfaces or components.
- When aircraft has been deiced/anti-iced some time prior to flight crew arrival.

7.1 Contamination Check to Establish the Need for Deicing

A contamination check shall include all areas mentioned in 6.1 through 6.8 and any other surfaces and components of the aircraft as indicated by the aircraft manufacturer, and shall be performed from points offering sufficient visibility of these parts (e.g., from the deicing/anti-icing vehicle, a ladder, or any other suitable means of access as necessary). Any contamination found on the surfaces or components of the aircraft that are critical to safe flight shall be removed by a deicing procedure; this shall be followed by anti-icing treatment when required.

Where an aircraft has been deiced and/or anti-iced some time prior to the arrival of the flight crew, an additional contamination check shall be carried out prior to departure, in order to establish whether further treatment is required. Requests for deicing/anti-icing shall specify the parts of the aircraft requiring treatment.

NOTE: For specific aircraft types, additional requirements exist; e.g., special clear ice checks, such as tactile checks on wings. These special checks are not covered by the contamination check. Aircraft operators shall make arrangements for suitably qualified personnel to meet these requirements.

7.2 Tactile Check

The need for a tactile check shall be determined by the aircraft manufacturer.

7.3 Postdeicing/Anti-Icing Check

An aircraft shall not be dispatched after a deicing/anti-icing procedure until the aircraft has received the following visual check by qualified staff. This check shall include wings, horizontal stabilizers (both lower and upper surfaces), vertical stabilizer, and fuselage, including pitot heads, static ports, temperature sensors, and angle of attack sensors. This check shall also include any other parts of the aircraft on which a deicing/anti-icing procedure was performed according to the requirements identified during the contamination check.

The postdeicing/anti-icing check shall be performed from points offering sufficient visibility of all treated surfaces (e.g., from a deicing/anti-icing vehicle, ladder, or other suitable means of access). Any contamination found shall be removed by further deicing/anti-icing treatment, and the postdeicing/anti-icing check shall be repeated. Before takeoff, the flight crew must ensure that they have received confirmation that this postdeicing/anti-icing check has been accomplished.

NOTE: For specific aircraft types, additional requirements exist; e.g., special clear-ice checks, such as tactile checks on wings. These special checks are not covered by the postdeicing/anti-icing check. Aircraft operators shall make arrangements for suitably qualified staff to meet any special check requirements.

When the deicing/anti-icing service provider performs the deicing/anti-icing treatment, as well as the postdeicing/anti-icing check, it may either be performed as a separate check, or incorporated into the deicing/anti-icing operation as specified below. The deicing/anti-icing service provider shall specify the method used in his winter procedures, by customer where necessary:

a. As the deicing/anti-icing treatment progresses, the deicing/anti-icing sprayer will closely monitor the surfaces receiving treatment in order to ensure that all forms of frost, snow, slush, or ice (with the exception of cold-soaked fuel frost on the lower surface of wings and light frost on the fuselage, which may be allowed per the aircraft manufacturer and state regulatory authority) are removed, and that upon completion of anti-icing treatment, these surfaces are fully covered with an adequate layer of anti-icing fluid as described in AS6286.

b. When the request for deicing/anti-icing did not specify the fuselage, a visual check of the fuselage shall be performed at this time, in order to confirm that it has remained free of contamination (with the possible exception of light frost, which may be allowed as per the aircraft manufacturer and state regulatory authority).

c. Any evidence of contamination that is outside the defined limits shall be reported to the flight crew immediately and be removed by further deicing/anti-icing treatment. Then the postdeicing/anti-icing check shall be repeated.

d. Once the treatment has been completed, the deicing operator will conduct a close visual check of the surface where the treatment commenced, to ensure that it has remained free of contamination (this check is not required for “frost only” conditions).

7.4 Pretakeoff Check

The flight crew shall continually monitor the weather conditions after the deicing/anti-icing treatment. Prior to takeoff, a flight crew member shall assess whether the applied holdover time is still appropriate and/or if untreated surfaces may have become contaminated. This check is normally performed from inside the flightdeck.

7.5 Pretakeoff Contamination Check

This is a check of the critical surfaces for contamination. This check shall be performed when the condition of the critical surfaces of the aircraft cannot be effectively assessed by a pretakeoff check or when the holdover time has been exceeded. This check is normally performed outside of the aircraft. The alternate means of compliance for a pretakeoff contamination check is to perform a complete deicing/anti-icing re-treatment of the aircraft.

7.6 Flight Control Check

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

8. AIRCRAFT GROUND DEICING/ANTI-ICING METHODS

8.1 Aircraft Ground Deicing/Anti-Icing Methods - General Comments

These procedures specify the methods for deicing and anti-icing of aircraft on the ground to provide safe takeoff. When aircraft surfaces are contaminated by frozen moisture, they shall be deiced prior to dispatch with fluids, mechanical methods, alternative technologies, or combinations thereof. When freezing precipitation exists and the precipitation is adhering to the surfaces at the time of dispatch, aircraft surfaces shall be deiced/anti-iced with fluids. If both deicing and anti-icing are required, the procedure may be performed in one or two steps. The selection of a one- or two-step procedure depends upon weather conditions, available equipment, available methods (generally the use of deicing and anti-icing fluids), and the holdover time needed. If a one-step procedure is used, then both 8.4 and 8.5 apply for guidance regarding fluid limitations.

CAUTION: Slippery conditions can exist on the ground or equipment following the deicing/anti-icing treatment.

8.2 Predeicing Procedure to Be Done Prior to Deicing/Anti-Icing

Companies may employ a predeicing procedure prior to the main deicing procedure, in order to remove large amounts of frozen contamination (e.g., snow, slush, or ice), in order to reduce the quantity of glycol-based deicing fluid that is needed. This predeicing procedure may be performed with various means (e.g., infrared technology, brooms, forced air, fluid injected into forced air, heat, heated water, heated fluids with negative buffer). If the predeicing procedure is used, make sure that the subsequent deicing procedure removes all frozen contamination including the contamination that may have formed on surfaces and/or in cavities due to the predeicing procedure.

8.3 Infrared Deicing

This subsection establishes the procedures for the removal of frozen precipitation by using infrared deicing technology. Specific information on facility requirements, as well as their inclusion in aircraft ground deicing programs, can be found in publications listed in Section 2 of this document.

a. General requirements: Frost, snow, slush, or ice shall be removed from aircraft surfaces prior to dispatch from the facility or prior to anti-icing.

b. Deicing: Deicing using infrared energy is accomplished through heat that breaks the bond of adhering frozen contamination. The application of infrared energy may be continued to melt and evaporate frozen contaminant. Wet surfaces require an application of heated deicing fluids to preclude refreezing after removal of the infrared energy source. When required, for operations other than frost or leading-edge ice removal, and when OAT is at or below 0 °C (32 °F), an additional treatment with hot deicing fluid shall be performed within the facility to prevent refreezing of water which may remain in hidden areas.

CAUTION: If the aircraft requires re-deicing and deicing/anti-icing fluids had been applied before flight, conventional deicing/anti-icing with fluids shall be performed.

c. Inspection: The aircraft shall be inspected in accordance with the requirements of Section 6.

d. Anti-Icing: If anti-icing is required, it shall be accomplished in accordance with 8.7.2. If anti-icing is performed inside the facility, infrared power levels must be adjusted as required during the anti-icing procedure to prevent the re-accumulation of frozen contamination because of snow blowing through the facility and to maintain fluid integrity for the time the aircraft is in the facility. Dehydration of the fluid can negatively impact the fluid performance.

8.4 Deicing by Fluids

Frost, snow, slush, or ice may be removed from aircraft surfaces by the use of deicing fluids. It is the responsibility of the deicing service provider to ensure that all frozen deposits (with the possible exception of frost, which may be allowed as described in Section 6) are removed from the specified surfaces during the deicing procedure.

CAUTION: Consult aircraft maintenance manuals for limitations for the maximum application pressure, temperature, and the use of glycol (AMS1424/1 and AMS1428/1) versus non-glycol (AMS1424/2 and AMS 1428/2) fluids.

8.4.1 Removal of Contaminants

For maximum effect, fluids shall be applied close to the surface to minimize heat loss. Fluid temperature and pressure should not exceed aircraft maintenance manual requirements. The heat in the fluid effectively melts any frost, as well as light deposits of snow, slush, 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 contamination. The deicing fluid will prevent refreezing for a period of time, depending on aircraft skin and OAT, the fluid used, the mixture strength, and the weather.

8.4.2 Removal of Frost and Light Ice

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

8.4.3 Removal of Snow

A nozzle setting sufficient to flush off deposits and minimize foam production is recommended. Foam could be confused as snow. The method adopted 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 of snow or ice, 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, the selection of a high fluid flow will be found to 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. However, where snow has bonded to the aircraft skin, the procedures detailed in 8.4.4 should be utilized. Heavy accumulation of snow will always be difficult to remove from aircraft surfaces and vast quantities of fluid will invariably be consumed in the attempt. Under these conditions, serious consideration should be given to removing the majority of the snow using a predeicing procedure before attempting a normal deicing procedure.

8.4.4 Removal of Ice

Heated fluid shall be used to break the ice bond. The high thermal conductivity of metal skin is utilized when a stream of hot fluid is directed at close range onto one spot, until the surface is just exposed. This will then transmit the heat laterally in all directions raising the temperature above the freezing point and thereby breaking the adhesion of the frozen mass with the aircraft surface.

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

8.4.5 General Deicing Fluid Application Strategy

For effective removal of snow and ice, the following techniques should be adopted. Aircraft may require unique procedures to accommodate design differences, and aircraft manufacturer's instructions should be consulted. Ice, snow, or frost dilutes the fluid. Apply enough hot deicing fluid to ensure that refreezing does not occur and all contaminated fluid is driven off. The application of deicing fluid must be done in a pattern that ensures all contaminants on the aircraft are removed. The preferred method is to spray the aircraft from top to bottom.

8.4.5.1 Wings, Horizontal Stabilizers, and Elevators

The direction of the spray shall be from the leading edge to the trailing edge in the vicinity of any control surfaces (i.e., the rudder). Caution must be used to ensure fluid is not sprayed directly into any vertical tail or control surface openings.

NOTE: There is an exception: On aircraft with no leading edge devices (i.e., hard wing and/or propeller driven), deicing/anti-icing fluid may be sprayed from highest point of the wing surface camber to the lowest, flowing forward over the leading edge of the wing ensuring sufficient rollover, and over the trailing edge. Caution must be used to ensure fluid is not sprayed directly into any wing openings.

8.4.5.2 Lower Wing Surface (Underside of Wing) Deicing Procedures

Treatments must be symmetrical and may include flaps and lower surfaces. Spray the affected areas with a heated fluid/water mixture suitable for a one-step procedure as required (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. Holdover times do not apply to underwing treatments.

It is the responsibility of the deicing service provider to ensure that the treatment is performed symmetrically, and that on completion, all frozen deposits (with the possible exception of frost, which may be allowed) have been removed. When it is confirmed that the treated areas are clean, the following statement shall be given to the flight crew: “Underwing deicing only, holdover times do not apply.”

CAUTION: Underwing 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 refreezing.

8.4.5.3 Vertical Surfaces

Start at the top and work down to the base of any vertical surface, spraying from forward to aft in the vicinity of control surfaces.

8.4.5.4 Fuselage

Spray the fluid along the top centerline and then towards the outboard of the fuselage. Ensure that it is clear of ice, snow, and slush in accordance with the aircraft manufacturer’s manuals. Hoarfrost may be allowed in accordance with the aircraft manufacturer’s manuals.

8.4.5.5 Nose/Radome Area and Flightdeck Windows

Type I fluid/water mixture or manual methods of removal (such as squeegees or brushes) are recommended.

When thickened fluids are used, avoid spraying near the flightdeck windows, as fluid can cause a severe loss of visibility. Any thickened fluid remaining on the nose areas where it could blow back onto the windscreens should be removed prior to departure, using a diluted Type I fluid, squeegees, or equivalent. If flightdeck windows are contaminated with thickened fluids, use water or an approved windshield cleaner (use of a low freezing point windshield washing fluid is recommended when OAT is at or below 0 °C (32 °F)).

CAUTION: Prior to cleaning of the flightdeck windows, ensure that the window heating system is switched off.

8.4.5.6 Landing Gear and Wheel Bays

Do not spray deicing fluid directly onto wheels and brakes. Remove all ice and snow from the landing gear; paying particular attention to uplocks, downlocks, sensors, door mechanisms, gravel deflectors, and steering systems.

NOTE: It may be possible to mechanically remove accumulations such as blown snow; however, where deposits have bonded to surfaces, they can be removed by the application of hot air.

8.4.5.7 Engines

Deposits of snow should be mechanically removed from engines prior to departure. Any frozen deposits that may have bonded to either the lower surface of the intake or the fan blades including the rear side, or propellers, may be removed by hot air or other means recommended by the engine manufacturer. If use of deicing fluid is permitted, do not spray directly into the engine core.

8.4.6 Removal of Local Area Contamination

When no precipitation is falling or expected, and when there is no active frost, a “local area” deicing may be carried out under the below mentioned or similar conditions. In some cases, a full or complete deicing 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 type of fluid; 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.

It is the responsibility of the deicing service provider to ensure that the treatment is performed symmetrically and that upon completion, all frozen deposits have been removed. After this check has confirmed that the areas are clean, the following statement shall be given to the flight crew: “Local area deicing only. Holdover times do not apply.”

8.5 Anti-Icing by Fluids

Frost, snow, slush, or ice will, for a period of time, be prevented from adhering to or accumulating on aircraft surfaces by the application of anti-icing fluids. This section provides procedures for the use of anti-icing fluids.

a. Required usage: Anti-icing fluid shall be applied to the aircraft surfaces when freezing rain, snow, or other freezing precipitation may adhere to the aircraft at the time of dispatch.

b. Optional usage: Anti-icing fluid may be applied to clean 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 deicing easier.

CAUTION: This practice has the potential to build up dried residues. An appropriate inspection and cleaning program shall be established.

In anticipation of weather conditions that require deicing, anti-icing fluid may be applied to clean aircraft surfaces prior to the aircraft being exposed to the freezing precipitation. This will minimize the possibility of snow and ice bonding or reduce the accumulation of frozen precipitation on aircraft surfaces and facilitate subsequent deicing.

Prior to flight, the aircraft must be deiced, unless the integrity of the fluid can be ensured. Deice in accordance with 8.8, whenever possible, to reduce the potential for dried residue build up.

NOTE: Dehydration (water evaporation) of Type II, III, and IV fluids can negatively impact the fluid performance.

For effective anti-icing, an even layer of sufficient thickness of fluid is required over the prescribed aircraft surfaces which are free of frozen deposits. For maximum anti-icing protection, undiluted Type II, III, or IV fluid should be used. The high fluid flow pressure and flow rates normally associated with deicing are not required. When possible, pump speeds and nozzle spray patterns should be adjusted accordingly.

NOTE: Type I fluids provide limited holdover effectiveness when used for anti-icing purposes.

CAUTION: AMS1424/2 and AMS1428/2 Acetate- or formate-based fluids when used for deicing:

- May significantly shorten the holdover times of Type II, III, and IV fluids when used in combination with these fluids.
- May cause corrosion on aircraft materials.

Refer to aircraft manufacturers documentation, fluid manufacturer recommendations and AMS1424/1, AMS1424/2, AMS1428/1, and AMS1428/2 for more information.

8.5.1 Anti-Icing Fluid Application Strategy

The spraying procedure 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 and with sufficient thickness 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.

To use Type I holdover times guidelines in all conditions, including active frost, an additional minimum of 1 L/m^2 (~2 gallons/100 ft^2) of heated Type I fluid mixture with a nozzle temperature of at least 60 °C (140 °F) 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. Refer to local regulatory documents, such as the FAA Holdover Time Guidelines: Winter 20xx-20yy (annual publication) or to Transport Canada Holdover Time Guidelines: Winter 20xx-20yy (annual publication).

For Type II, III, or IV fluids which flow readily over surfaces, the correct amount is indicated by fluid just beginning to run off the leading and trailing edges. For fluids which form a more static layer, the minimum quantity required will typically be 1 L/m^2 applied in an even layer across the surface. For further guidance on the amount of fluid, refer to AS6286 training documentation and/or the fluid manufacturer's documentation. Spray from the leading edge to the trailing edge on wings, horizontal, and vertical stabilizers. The following surfaces shall be treated as specified by the aircraft manufacturer's documentation:

- Wing upper surfaces including leading edges and upper control surfaces.
- Wing tip devices.
- Both sides of vertical stabilizer and rudder to receive anti-ice protection when freezing precipitation conditions exist.
- Horizontal stabilizer upper surfaces including leading edges and elevator upper surfaces.
- When necessary, fuselage upper surfaces, dependent upon the amount and type of freezing precipitation (this is especially important on center-line engine aircraft).

CAUTION: Anti-icing fluids may not flow evenly over wing leading edges, horizontal, and vertical stabilizers. These surfaces should be checked to ensure that they are properly coated with fluid.

It is the responsibility of the deicing service provider to ensure that the surfaces mentioned above are free of frost, snow, slush, or ice prior to the start of the anti-icing treatment, and that on completion of the treatment, these surfaces are fully covered with an adequate layer of anti-icing fluid.

NOTE: SAE Type II, III and IV fluids used for anti-icing purposes are normally applied unheated on clean aircraft surfaces, but they may be applied heated and diluted for a one-step procedure. Refer to the fluid manufacturer's recommendation.

8.5.2 Local Frost Prevention in Cold-Soaked Wing Areas

Wing surface temperatures can be considerably below OAT due to contact with cold fuel and/or close proximity to large masses of cold-soaked metal in the wing structure. In these areas, frost can build up on wing surfaces and may result in the entire wing needing to be deiced and anti-iced prior to the subsequent departure. This section provides standards for the prevention of local frost formation in cold-soaked wing tank areas during transit stops in order to make deicing and anti-icing of the entire wing unnecessary under such circumstances. This procedure does not, however, supersede standard deicing and anti-icing procedures in accordance with 8.4 and 8.5, and it shall be applied in coordination with these subsections. This procedure also does not relieve the user from any requirements for treatment and checks in accordance with aircraft manufacturer manuals.

NOTE: This section is also applicable to other surfaces of the aircraft (e.g., stabilizers).

8.5.2.1 Procedure

Using suitable spray equipment, apply a proper coating of undiluted Type II, III, or IV fluid to the wings in the limited cold-soaked areas where the formation of frost may be expected, due to contact of the wing with cold fuel or masses of cold metal.

NOTE: A proper coating completely covers the treated area with visible fluid.

8.5.2.2 Limits/Precautions for Local Frost Prevention

Procedure limitation: This local frost prevention procedure is neither a substitute for standard deicing and anti-icing procedures in accordance with 8.4.1 and 8.5.1, clear ice checks, or any other aircraft manufacturer requirement, nor a substitute for the requirement that aircraft surfaces shall be clear of frost, snow, slush, or ice accumulations.

Operator approval: This procedure shall only be carried out if approved by the operator of the aircraft to be treated.

Training: This procedure shall only be carried out by trained and qualified personnel (refer to AS6286).

8.5.2.3 Application Limits

This local frost prevention procedure shall be applied to clean wings immediately following arrival of the aircraft. Application is acceptable at the latest when frost just starts to form, but in this case the fluid shall be applied at a minimum temperature of 50 °C (122 °F). If precipitation occurred between application of the fluid and dispatch of the aircraft, and/or if precipitation is expected before takeoff, a two-step procedure shall be performed (see 8.4 and 8.5).

8.5.2.4 Symmetrical Treatment Requirement

Wings shall receive the same and symmetrical treatment; the same area in the same location on each wing shall be sprayed, including when conditions would not indicate the need for treatment of both wings.

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

8.5.2.5 Holdover Time

A holdover time shall not be assigned to local frost prevention since this treatment does not cover the entire aircraft or wing surface, respectively.

8.5.2.6 Final Check - Local Frost Prevention

A tactile (by touch) check of treated areas and a visual check of 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 anti-icing fluid shall remain in a liquid state and shall show no indication of failure (e.g., color change to white, a loss of gloss, or the presence of ice crystals in the fluid film).

8.5.2.7 Flight Crew Information - Local Frost Prevention

The following information shall be provided to the flight crew: “Local frost prevention was accomplished; no holdover times applies.”