



AEROSPACE RECOMMENDED PRACTICE	ARP4737™	REV. J
	Issued 1992-10 Revised 2008-07 Cancelled 2017-08	
	Superseded by AS6285	
Aircraft Deicing/Anti-Icing Methods		

RATIONALE

This document is cancelled and superseded by AS6285 - Aircraft Ground De/Anti-Icing Processes.

Technical data in this document is superseded by technical data in AS6285. AS6285 was developed as a global deicing standard with the intent of replacing the recommended practices in this document as well as encompassing additional topics needed to specify the complete de/anti-icing process. AS6285 is technically superior to ARP4737.

Technical data in this document is no longer current. Use of this document will lead to unsafe practices as well as confusion when third parties provide aircraft de/anti-icing services.

CANCELLATION NOTICE

This Technical Report has been declared "CANCELLED" as of August 2017 and has been superseded by AS6285. By this action, this document will remain listed in the respective index, if applicable. Cancelled Technical Reports are available from SAE.

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FOREWORD

The purpose of this document is to provide guidelines for the methods and procedures used in performing the maintenance operations and services necessary for proper deicing and anti-icing of aircraft on the ground.

Exposure to weather conditions, on the ground, that are conducive to ice formation, can cause accumulation of frost, snow, slush, or ice on aircraft surfaces and components that 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 certification process, 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.

Regulations governing aircraft operations in icing conditions shall be followed. Specific rules for aircraft are set forth in United States Federal Aviation Regulations (FAR), Joint Aviation Regulations (JAR), Canadian Air Regulations, and others. Paraphrased, these rules relate that NO ONE SHOULD DISPATCH OR TAKE OFF AN AIRCRAFT WITH FROZEN DEPOSITS ON COMPONENTS OF THE AIRCRAFT THAT ARE CRITICAL TO SAFE FLIGHT. A critical component is one which could adversely affect the mechanical or aerodynamic function of an aircraft. The intent of these rules is to ensure that no one attempts to dispatch or operate an aircraft with frozen deposits adhering to any aircraft component critical to safe flight.

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

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1. SCOPE

1.1 Field of Application

- 1.1.1 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. This document does not specify requirements for particular airplane models.

NOTE: Particular airline or aircraft manufacturers' published manuals, procedures, or methods supplement the information contained in this document.

1.1.2 Agreements and Contracts

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

1.1.3 Safety - Hazardous Materials

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure 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.

- 1.1.4 All guidelines referred to herein are applicable only in conjunction with the referenced SAE specifications. Specific requirements for airplane model type are not included. Due to aerodynamic and other concerns application of deicing/anti-icing fluids shall be carried out in compliance with engine and aircraft manufacturers' requirements.

2. 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 SAE Publications

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

AMS1424	Deicing/Anti-Icing Fluid, Aircraft, SAE Type I
AMS1428	Fluid, Aircraft Deicing/Anti-Icing, Non-Newtonian (Pseudoplastic), SAE Types II, III, and IV
ARP1971	Aircraft Deicing Vehicle - Self-Propelled, Large and Small Capacity
ARP5149	Training Program Guidelines for Deicing/Anti-Icing of Aircraft on Ground
AS5635	Message Boards (Deicing Facilities)
AIR9968	Viscosity Test of Thickened Aircraft Deicing/Anti-Icing Fluids

2.2 U.S. Government Publications

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094 or from the FAA web site at <http://www.faa.gov>.

AC 20-117	Hazards Following Ground Deicing and Ground Operations in Conditions Conducive to Aircraft Icing
AC 120-60	Ground Deicing and Anti-icing Program
AC 150/5300-14	Design of Aircraft Deicing facilities
FSAT 00-05 and FSAW 00-02	Approving Infrared Technology for Aircraft Ground De-Icing/Anti-Icing Facilities.

3. DEFINITIONS

3.1 Abbreviations

C = Celsius

F = Fahrenheit

OAT = Outside Air Temperature

FP = Freezing point

h = Hours

min = Minutes

LOUT = Lowest Operational Use Temperature

3.2 Buffer/Freezing Points

The difference between OAT and the freezing point of the fluids used.

3.3 Fluids

CAUTION: SAE Type I fluids supplied as concentrates for dilution with water prior to use shall not be used undiluted, unless they meet aerodynamic performance and freezing point buffer requirement (reference AMS1424).

3.3.1 Deicing fluids are:

- a. Heated water
- b. SAE Type I fluid (see caution)
- c. Heated concentrates or mixtures of water and SAE Type I fluid
- d. Heated concentrates or mixtures of water and SAE Type II fluid
- e. Heated concentrates or mixtures of water and SAE Type III fluid
- f. Heated concentrates or mixtures of water and SAE Type IV fluid

Deicing fluid is normally applied heated to assure maximum deicing efficiency.

3.3.2 Anti-icing fluids are:

- a. Heated SAE Type I fluid (see previous caution)
- b. Heated mixtures of water and SAE Type I fluid
- c. Concentrates or mixtures of SAE Type II fluid and water
- d. Concentrates or mixtures of SAE Type III fluid and water
- e. Concentrates or mixtures of SAE Type IV fluid and water

NOTE: Temperature of both a. and b. shall be at least 60 °C (140 °F) at the nozzle. Upper temperature limit shall not exceed fluid and aircraft manufacturer's recommendations.

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.

3.3.3 Fluid terms are:

- a. Newtonian fluids are defined as fluids whose viscosities are shear independent and time independent. The shear rate of a Newtonian fluid is directly proportional to the shear stress. The fluid will begin to move immediately upon application of a stress; it has no yield stress to overcome before flow begins.

NOTE: SAE Type I fluids are considered Newtonian.

- b. Non-Newtonian fluids are defined as fluids whose viscosities are shear and time dependent and whose shear rate is not directly proportional to its shear stress. The fluid will not begin to move immediately upon application of a stress, it has a yield stress to overcome before flow begins.

NOTE: SAE Type II, III, or IV fluids containing thickeners demonstrate a pseudoplastic behavior which is defined as a decrease in viscosity with an increase in shear rate.

3.3.3.1 The lowest operational use temperature (LOUT) is the higher (warmer) of

- 1. 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

and

- 2. The freezing point of the fluid plus the freezing point 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.

3.4 Methods/Procedures

- 3.4.1 Deicing is a procedure by which frost, ice, slush, or snow is removed from the aircraft in order to provide clean surfaces.

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

3.4.3 Deicing/anti-icing is a combination of the two procedures described previously. It can be performed in one or two steps.

3.4.3.1 One step deicing/anti-icing is carried out with an anti-icing fluid. The fluid used to deice the aircraft remains on aircraft surfaces to provide limited anti-icing capability.

3.4.3.2 Two step deicing/anti-icing consists of two distinct steps. The first step, deicing, is followed by the second step, anti-icing, as a separate process. Anti-icing fluid is applied to protect the relevant surfaces thus providing maximum possible anti-icing capability.

3.4.4 Holdover time is the estimated time anti-icing fluid will prevent the formation of frozen contamination on the protected surfaces of an aircraft.

3.5 Conditions Conducive to Aircraft Icing on Ground

3.5.1 Frost

Ice crystals that form from ice saturated air at temperatures below 0 °C (32 °F) by direct sublimation on the ground or other exposed objects.

3.5.2 Freezing Fog

A suspension of numerous minute 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 1 km (5/8 mile).

3.5.3 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.

3.5.3.1 Snow is defined to include snow grains. Snow grains are 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.

3.5.4 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.

3.5.5 Light Freezing Rain

Precipitation of liquid water particles which freeze upon impact with 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 are up to 2.5 mm or 25 g/dm²/h (0.10 in/h) with a maximum of 0.25 mm (0.01 in) in 6 min.

3.5.6 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 (32 °F).

3.5.7 Rain and Snow

Precipitation in the form of a mixture of rain and snow. For operation in light "rain and snow" treat as light freezing rain.

3.5.8 Slush

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

3.5.9 Ice Crystals/Diamond Dust

A fall of unbranched ice crystals (snow crystals are branched) in the form of needles, columns, or plates.

CAUTION: There is no holdover time guideline for this condition.

3.5.10 Snow Pellets

Precipitation of white, opaque particles of ice. The particles are round or sometimes conical. Diameters range from about 2 to 5 mm (0.08 to 0.2 in). Snow pellets are brittle, easily crushed; they do bounce and may break on hard ground.

CAUTION: There is no holdover time guideline for this condition.

3.5.11 Moderate and Heavy Freezing Rain

Precipitation of liquid water particles which freeze upon impact with 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 larger than 2.5 mm or 25 g/dm²/h (0.10 in/h).

CAUTION: There is no holdover time guideline for this condition.

3.5.12 Hail

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

CAUTION: There is no holdover time guideline for this condition.

3.5.13 Active Frost

Active frost is a condition when frost is forming. Active frost occurs when aircraft surface temperature is both at or below 0 °C (32 °F) and at or below dew point

3.5.14 Hoarfrost

A deposit of interlocking ice crystals formed by direct sublimation on objects. Thin hoarfrost is a uniform white deposit of fine crystalline texture, which usually occurs on exposed surfaces on a cold and cloudless night, and which is thin enough to distinguish surface features underneath, such as paint lines, markings, or lettering.

3.5.15 Ice Pellets

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 in) or less. The pellets of ice usually bounce when hitting hard ground.

CAUTION: There is no holdover time guideline for this condition.

3.6 Check

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