



AEROSPACE STANDARD

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Water Spray and High Humidity Endurance Test Methods for AMS1424 and AMS1428 Aircraft Deicing/Anti-Icing Fluids

RATIONALE

This document brings minor modifications of wording and some editorial changes. Throughout the document, the refining elements in relation to droplet diameter have been changed in 4.2.1, 5.2.1, and 5.4.1. In 5.1, standard measuring devices have been updated, Section 7 anti-icing performance has been added, and 6.6 becomes Section 8.

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1. SCOPE

1.1 Minimum Requirements

This document establishes the minimum requirements for an environmental test chamber and test procedures to carry out anti-icing performance tests according to the current materials specification for aircraft deicing/anti-icing fluids. The primary purpose for such a test method is to determine the anti-icing performance under controlled laboratory conditions of AMS1424 Type I and AMS1428 Type II, III, and IV fluids.

1.2 Hazardous Materials

This test may involve the use of hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1.3 Standard Units

The values stated in the International System of Units (SI) are to be regarded as the standard.

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

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

AMS4037 Aluminum Alloy, Sheet and Plate, 4.4Cu - 1.5Mg - 0.60Mn (2024; -T3 Flat Sheet, -T351 Plate), Solution Heat Treated

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D1193 Reagent Water

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 ISO Publications

Available from International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, Tel: +41 22 749 01 11, www.iso.org.

ISO 9001 Quality Management Systems - Requirements

3. SUMMARY OF TEST

3.1 Introduction

This test describes how to determine the laboratory anti-icing performance of AMS1424 Type I and AMS1428 Type II, III, and IV fluids. The test fluids to be evaluated are applied to a test plate exposed to two types of freezing conditions, and their anti-icing performance is evaluated by measuring the minimum exposure time before a specified degree of freezing occurs. A general description of the two types of anti-icing tests referred to in this standard is as follows.

3.2 Water Spray Endurance Test (WSET)

This test involves pouring the unchilled fluid onto an inclined test plate (10 degrees from horizontal) at $-5.0\text{ }^{\circ}\text{C} \pm 0.5\text{ }^{\circ}\text{C}$ ($23\text{ }^{\circ}\text{F} \pm 1\text{ }^{\circ}\text{F}$) and applying a cooled water spray in air at $-5.0\text{ }^{\circ}\text{C} \pm 0.5\text{ }^{\circ}\text{C}$ ($23\text{ }^{\circ}\text{F} \pm 1\text{ }^{\circ}\text{F}$). The water spray endurance is recorded as the time for ice formation to reach the failure zone defined as the area 25 mm below the upper edge of the test plate and 5 mm in from either side of the test plate or the formation of slush on 10% of the plate surface (see Figure 1) when water spray intensity corresponds to $5.0\text{ g/dm}^2\cdot\text{h} \pm 0.2\text{ g/dm}^2\cdot\text{h}$. It is a fundamental requirement of this test that the spray impinges onto the surface of the test plate as water droplets, which freeze on impact. This is verified by observation of the untreated or ice catch panels. Whatever the WSET endurance time of the fluid tested, the minimum duration of the test shall be at least 30 minutes in order to validate the average icing intensity measurement.

3.3 High Humidity Endurance Test (HHET)

This test involves pouring the unchilled fluid onto an inclined test plate (10 degrees from horizontal) at $-5.0\text{ }^{\circ}\text{C} \pm 0.5\text{ }^{\circ}\text{C}$ ($23\text{ }^{\circ}\text{F} \pm 1\text{ }^{\circ}\text{F}$), when the air temperature is $0.0\text{ }^{\circ}\text{C} \pm 0.5\text{ }^{\circ}\text{C}$ ($32\text{ }^{\circ}\text{F} \pm 1\text{ }^{\circ}\text{F}$) and the relative humidity (RH) is more than 80%. The high humidity endurance is recorded as the time for ice formation to reach the failure zone defined as the area 25 mm below the upper edge of the test plate and 5 mm in from either side of the test plate (see Figure 1). Under these conditions, when the ice formation corresponds to $0.30\text{ g/dm}^2\cdot\text{h} \pm 0.05\text{ g/dm}^2\cdot\text{h}$, it is a fundamental requirement of this test that it be performed in the absence of any visible precipitation (such as mist, fog, or drizzle). Whatever the HHET endurance time of the fluid tested, the minimum duration of the test shall be at least 2 hours in order to validate the average icing intensity measurement.

4. EQUIPMENT AND TEST PARAMETERS

4.1 General

A description of the minimum requirements for the environmental test chamber and associated test equipment, including chilling unit, test plate, ice catch panels, spray equipment, humidity generator, and data acquisition, is given below. Other spray and humidity control equipment, which meet the requirements of this standard, are acceptable.