

Field Viscosity Test for Thickened Aircraft Anti-Icing Fluids

RATIONALE

This new SAE Aerospace Information Report (AIR) provides a description of a screening method for use in the field for verifying if an AMS 1428 anti-icing fluid is above its minimum low shear viscosity as published with the holdover time guidelines. The test will determine if the fluid is (a) satisfactory, (b) unsatisfactory, or (c) borderline needing more advanced viscometry testing.

FOREWORD

Aircraft operators rely on the use of AMS 1428 anti-icing fluids during winter operations to provide a limited period of protection against frozen or freezing precipitation while the aircraft is on the ground. Methods of protection of aircraft surfaces with anti-icing fluids are described in ARP4737. The protection time can be estimated using fluid specific holdover time guidelines that are published by the FAA and Transport Canada. Holdover time values for thickened anti-icing fluids are derived from endurance time testing standard procedures described in ARP5485.

The viscosity values of the fluids listed with the holdover guidelines are those for the fluid samples provided by the fluid manufacturers for endurance time testing. For the holdover time guidelines to be valid, the viscosity of the fluid on the wing shall not be lower than that listed with the holdover tables. The fluid user should periodically ensure that the viscosity value of a fluid sample taken from the wing is not lower than that listed. The viscosity should ideally be measured by the method recommended by the manufacturer and which is described with the holdover time guidelines or the method described in AIR9968 which can be correlated to the fluid manufacturer viscosity method. However, both of these methods require the use of a Brookfield rotational viscometer and precise temperature control equipment, both of which are not suited for field use. The method described in this AIR5704 is better suited for use in the field as it requires less sophisticated equipment.

This AIR5704 is meant as a screening field test to verify that the anti-icing fluid will have a sufficient low shear viscosity which relates to the minimum acceptance for holdover performance.

1. SCOPE

1.1 Purpose

This SAE Aerospace Information Report (AIR) provides a description of a screening method for use in the field for verifying an AMS 1428 anti-icing fluid is above its minimum low shear viscosity as published with holdover time guidelines. The test will determine if the fluid is (a) satisfactory, (b) unsatisfactory, or (c) borderline needing more advanced viscometry testing. Other field tests may be required to determine if an anti-icing fluid is useable, such as refractive index, appearance or other tests as may be recommended by the fluid manufacturer.

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<http://www.sae.org/technical/standards/AIR5704>**

1.2 Safety

While the materials, methods, applications, and processes described or referenced in this AIR may involve the use of hazardous materials, this AIR does not address the hazards that 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.

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.

AMS 1428 Fluid, Aircraft Deicing/Anti-icing Fluid, Non-Newtonian (Pseudoplastic), SAE Types II, III, and IV

ARP4737 Aircraft Deicing/Anti-icing Methods

ARP5485 Endurance Time Tests for Aircraft Deicing/Anti-icing Fluids SAE Type II, III, and IV

AIR9968 Viscosity Test of Thickened Aircraft Deicing/Anti-icing Fluids

3. TEST METHOD

3.1 Equipment list

- a. Stony Brook PDVdi-120 field viscometer or equivalent
- b. Hand operated centrifuge or equivalent
- c. Digital thermometer
- d. Acceptability chart as provided by the fluid manufacturer

3.2 Sample Preparation

The anti-icing fluid should be tested within the temperature range of the acceptability chart provided by the fluid manufacturer. The sample should be void of large air bubbles. One method of removing entrained air is by centrifugation. A hand operated centrifuge is illustrated below.



3.3 Basic Method

3.3.1 Stony Brook PDVdi-120 Field Viscometer

1. Unscrew the syringe cap if needed.
2. Pull down the syringe plunger until it remains at the bottom of the syringe (25 mL).
3. Slide the syringe into the viscometer main body and then place it on a flat and level surface. (Figure 1)
4. Pour the sample into the syringe up to the top of the viscometer main body. (Figure 2)
5. Screw the extension bar into the needle.
6. Insert the needle into the syringe until the top of the needle reaches the top of the syringe and then drop the needle. (Figure 3)

NOTE: In order to drop the needle, hold and release the tip of the extension bar attached to the top of the needle.

7. Measure and record the falling time between two markings on the extension bar attached to the needle. (Figure 4)

NOTE: After dropping the needle, start and stop the stopwatch when the bottom and top markings on the extension bar meet the top of the syringe, respectively.

8. Measure and record the sample temperature by using the digital thermometer supplied.
9. Empty out the fluid and repeat steps 2 through 8. Accept the falling time results if both values are within ± 1 s. Make sure that the temperature of the fluid in the syringe is within 0.1°C for both measurements.
10. Average the two results and record as the average falling time.
11. Determine the acceptability of the anti-icing fluid by using the corresponding graph for the fluid being tested, as provided by the fluid manufacturer.

3.4 Cleaning

Use water, mild soap and water or alcohol to clean the viscometer main body, syringe and needle. Rinse, and dry the viscometer main body, syringe and needle after cleaning.

4. ACCEPTABILITY CHART

It is the fluid manufacturer's responsibility to verify the accuracy and reliability of this method for the specific fluid to be tested and to produce the acceptability chart. The fluid manufacturer must also determine the acceptable sample temperature range suitable for use with this test. The fluid manufacturer must also take into consideration time dependence viscosity variation of the fluid; for instance, specify the amount of time the fluid must sit in the test chamber before taking the measurements.

5. INTERPRETATION OF TEST RESULTS

The falling time values obtained from measurement in accordance with a method of this AIR5704 must only be compared with values if these have been established with exactly the same method. Other methods will produce different results.

6. REPORT

The report shall state this method (AIR5704), the anti-icing fluid product name, sample point, sampling date, test date, all falling times, average falling time and the temperature of the sample for each measurement.



FIGURE 1



FIGURE 2