



AEROSPACE STANDARD

AS9968

Issued 2014-07

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

RATIONALE

Renamed the document from AIR to AS since it is meant to be used as a standard and has been used as such over the past 10 years, so AS seems more appropriate to reflect this.

Added "Laboratory" and "the Brookfield viscometer" to the title to distinguish the document better from the AIR5704 (field viscosity test for thickened aircraft anti-icing fluids).

Text cleaned-up in whole document to make it more clear and better readable.

Deleted the reference to AS5485 as this document is not referenced in the text and has no relation to this AS9968 document.

Deleted the reference to ASTM D2196 as this AS9968 deviates from the D2196 document with specific requirements. Further, the reference was only to a small part of the D2196 document anyhow, which is replaced by referring to the instrument manufacturer's instructions taking away the need for keeping track of changes to the D2196 document.

The role of alternate viscosity measurement methods established by fluid manufacturers is provided in the scope. This role is specified in the Transport Canada and FAA Holdover Time Guidelines.

Some items in 3.3 (Requirements) have been moved to get a more logic order of items.

A method for removing air bubbles from fluid samples has been added.

The UL Adaptor (including corresponding spindle) is added for measurements of very low viscosities for accuracy reasons.

A specific measurement container (600 mL low form beaker) is added for use with spindles LV1 and LV2 disc. This has been done as Brookfield states that beaker size/form can have an impact on viscosity measurement (narrower/smaller container = higher viscosity reading).

Words have been added to emphasize that in order to compare results of two viscosity measurements, the measurements MUST be conducted using the exact same method, including spindle and measurement container. This is made clearer by separating spindle selection into that for original/baseline (for fluid manufacturers) and comparative (for fluid users) measurements.

More detailed information is provided for spindle selection in the range of 10 000 to 20 000 mPa.s.

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FOREWORD

In freezing weather conditions, situations conducive to aircraft icing on the ground may be encountered. Under these conditions, thickened anti-icing fluids (AMS1428) are applied (using application methods described in ARP4737) to protect aircraft surfaces.

Aircraft operators and deicing companies perform viscosity checks on these thickened anti-icing fluids for quality control purposes. Since checks are performed by various companies, a standard viscosity measurement method has been selected to allow comparison of results. This Aerospace Standard (AS) describes the selected method.

1. SCOPE

This AS describes a standard method for viscosity measurements of thickened (AMS1428) anti-icing fluids.

Fluid manufacturers may publish alternate methods for their fluids. In case of conflicting results between the two methods, the manufacturer method takes precedence.

To compare viscosities, exactly the same measurement elements (including spindle and container size) must have been used to obtain those viscosities.

1.1 Purpose

To provide a standard method for viscosity measurements. This method is intended to be used for field verification and auditing purposes to compare viscosities of different samples and to compare sample viscosities to limits published for aerodynamic acceptance and holdover time use.

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 724-776-4970 (outside USA), www.sae.org.

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

ARP4737 Aircraft Deicing/Anti-icing Methods

2.2 Abbreviations

LOWV: Lowest On Wing Viscosity

mPa.s: milli Pascal.seconds

3. MEASUREMENT METHOD

3.1 Instrument

A calibrated Brookfield LV series viscometer shall be used.

NOTE: RV, HA, or HB series Brookfield viscometers shall not be used for this measurement. It may be necessary to verify on the label on the back of the instrument if it is an LV series model, because normally the display on the front only indicates the sub model.

3.2 Basic Method

Viscosity is determined by measuring the torque on a spindle rotating at a constant speed in a fluid.

To carry out a measurement, follow the instrument manufacturer's instructions, while taking into account the requirements listed in 3.3.

3.3 Requirements

3.3.1 Fluid Shearing

The fluid may be degraded by shearing; therefore, the fluid processing shall avoid excessive shaking/stirring and inappropriate methods of filling the measurement container.

3.3.2 Air Bubbles

The fluid shall be substantially free of air bubbles. Air bubbles can be removed by centrifuging the fluid at 3000 rpm. To avoid fluid stratification (layers), it is important that the fluid is centrifuged only for a short time (5 to 10 minutes is typically appropriate).

3.3.3 Fluid Condition

The fluid shall be homogeneous (no lumps or stratification) before filling the sample container.

3.3.4 Fluid Temperature

The viscosity reading shall be taken at a fluid temperature of $20\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$.

3.3.5 Measurement Container

- For spindles LV1 and LV2 disc, the measurement container size/form shall be a 600 mL low form beaker. The beaker shall be filled so that the fluid level reaches the marking (notch) on the spindle shaft (approximately 570 to 600 mL of air bubble free fluid is needed).
- For the UL Adaptor, the container size/form is defined by the adaptor.

3.3.6 Guard Leg

The guard leg shall be attached to the viscometer when using the LV1 or LV2 disc. The guard leg is not used with the UL adaptor..

3.3.7 Rotation Speed

The viscometer shall be set at a rotation speed of 0.3 rpm before inserting the spindle into the fluid.

3.3.8 Spindle Selection

3.3.8.1 Original/Baseline Measurement (for Fluid Manufacturers)

The spindle to be chosen for an original/baseline measurement depends on the viscosity of the fluid/fluid dilution.

- For viscosities up to 2000 mPa.s, the Brookfield UL Adaptor with corresponding spindle shall be used.
- For viscosities between 2000 and 10 000 mPa.s, the Brookfield spindle LV1 shall be used.
- For viscosities between 10 000 and 20 000 mPa.s the following spindle shall be used:

LV1: For fluids/fluid dilutions with a production viscosity range/typical dilution viscosity range below 20 000 mPa.s.

LV2 disc: For fluids/fluid dilutions with a LOWV below 20 000 mPa.s and a production viscosity range/typical dilution viscosity range partly or completely above 20 000 mPa.s.

- For viscosities equal to or above 20 000 mPa.s, the Brookfield spindle LV2 disc shall be used.

When viscosity results are outside the range given for the used spindle, the measurement shall be repeated using the appropriate spindle.

3.3.8.2 Comparative Measurement (for Fluid Users)

To compare results of two viscosity measurements, these measurements must be made using the same spindle. Therefore a comparative measurement shall use the same spindle as was used for the original/baseline measurement.

NOTE: Typically, viscosities of anti-icing fluids are compared to the fluid's LOWV. In this case, measurements must be made using the spindle that was used to determine the LOWV. The spindle number used is typically published with the LOWV.

3.3.9 Spindle Insertion

Any air bubbles clinging to the flat bottom side of the spindle must be avoided. This may be accomplished by inserting the spindle in the fluid sample at an angle (approximate 30 to 45 degrees) to the vertical, then put it upright and attach it to the device while keeping the spindle in the fluid sample.

3.3.10 Measurement Duration

The viscosity reading shall be taken exactly 10 minutes after spindle rotation is started.

4. INTERPRETATION OF MEASUREMENT RESULTS

Viscosity values obtained using the measurement method described in this AS can only be compared with other viscosity values if these have been established with exactly the same method, including the same spindle and container size/form. Other methods (including spindle and container size/form) may produce different values.

5. REPORT

The report shall include, at a minimum:

- a statement that measurements were carried out according to this method (AS9968);
- all measured viscosity values;
- for each measured viscosity value, all parameters used to obtain this value (i.e., fluid temperature, spindle, container size/form, rotation speed, and measurement duration).