



# Technical Update

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Issue 2

## Advantages and Proper Use of SimAir® Test Cells for Brookfield D2983 Testing



### *This Issue*

- ▷ Advantages: No 'duplicate' or 'reference' samples needed
- ▷ Proper Use of the SimAir Technique
- ▷ Calibration

### Advantages

SimAir® cells have several significant advantages in obtaining precise results in running ASTM D2983 in constant-temperature liquid baths manufactured by either King Refrigeration, Inc. or Tannas Co.

**First**, the design of the patented SimAir cell provides the cooling profile required by the original, air-bath technique without the air bath's complexity and effort.

**Second** (and very important to know and apply), the SimAir technique requires only one sample per analysis and no reference oil (unless reference oil is used to check bath temperature by viscosity, in which case the spindle must be calibrated). Use of only one sample for any SimAir analysis is in significant contrast to the air bath which requires two samples for each analysis.

In the case of the Air Bath, because of the effects of sample heating when the sample is removed from the cold-air cabinet during analysis, the first sample is used to determine the highest spindle speed to apply and no viscosity value is taken. It is only when the second sample is analyzed quickly at the speed previously determined by the first sample that a reasonably reliable value is obtained. Since the constant-temperature liquid bath and use of the patented SimAir test cells allow the samples to remain in the liquid bath for their viscosity analysis, no duplicate sample is required.

**Third**, the SimAir method permits any sample to be individually started at any time and analyzed 16 hours later rather than to have to commit to simultaneous batch analysis with a number of oils. The reason for this is that each sample in a SimAir cell placed in a liquid bath held at the desired final temperature (such as -40°C), cools at the air bath rate.

### Proper Use of the SimAir Technique

Although modern Brookfield Viscometers permit a viscosity value to be read from the viscometer head, a more precise and correct value is gained by calibrating the spindle according to the technique shown in Annex 3 of the new ASTM method being balloted. The reason for calibration is that the value on the viscometer screen is generic for that model viscometer head and does not take into account the various small but significant differences among spindles. Thin spindles used in the D2983 method not only have larger effects of small manufacturing dimensional variations but greater effects of being bent. Application of simple calibration erases these effects and all spindles will then give very similar results.

Contact us at:

#### Tannas Co.

4800 James Savage Rd.  
Midland, MI 48642 USA  
Tel: 989-496-2309  
Fax: 989-496-3438

[www.savantgroup.com](http://www.savantgroup.com)

[tannas@savantgroup.com](mailto:tannas@savantgroup.com)

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**Calibration** – Annex 3 of the ASTM D2983 method provides the details for calibrating the spindles. A summary is provided here for the SimAir composite spindles. Simply put a reference oil having about 20,000 cP (mPa•s) at some test temperature and set up the instrument to run at that temperature.

When the reference oil is at the desired temperature, set the spindle speed at the highest RPM that will still give a % torque reading on the viscometer and note if the reading is relatively stable (indicating that the temperature of the reference oil is constant). Record the % torque and speed values.

Reduce the spindle speed 4 times to get % torque values approximately (not precisely) about 75%, 50%, 25%, and 10%, and record these torque and speed values. Use the five sets of torque-speed values and enter them into a spreadsheet program such as Excel to obtain the slope of the best line through the data (linear regression). The calibration factor for that spindle and viscometer head is:

$$F = V_T/S$$

(where **F** is the calibration factor, **V<sub>T</sub>** is the reference fluid viscosity at the temperature of calibration, and **S** is the slope of the best line through the data).

The viscosities of subsequent oils measured at any temperature by that spindle are:

$$V = F \cdot \% T / R$$

(where %T is percent torque and R is spindle speed on the viscometer head).

As previously mentioned, under Advantages only one test sample needs to be analyzed when using the SimAir technique and samples may be started at any time to be analyzed 16 hours after initiation of test.

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If, after reading the above information, you feel further training and instruction is needed, please contact us to arrange a personal training course by one of our authorized engineers.

*Thank you for your time.*

The Tannas *Technical Update* is written for the benefit of the operators of Tannas instruments – a continuing effort to provide our customers with precision and excellence in instrument operation and performance. If you have any suggestions, ideas or questions that can make future issues more informative, please contact us or one of our [authorized Representatives](#) in your area.