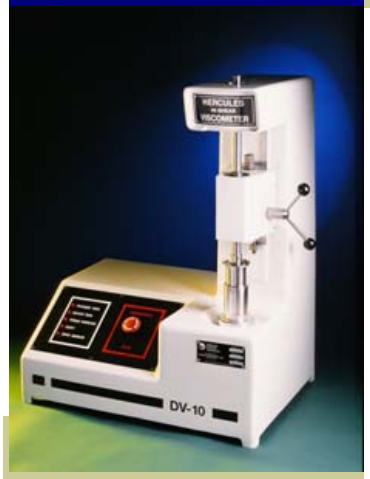
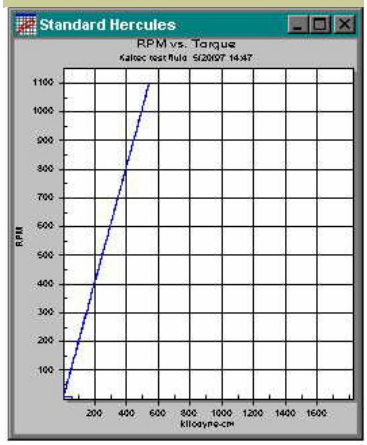
Hercules Viscometer DV-10 Calibration Procedure



Hercules Hi-Shear Viscometer Model DV-10

Topics Covered:

- Verify Calibration
- Conditioning Sample
- Calibration Kit
- "Known Viscosity" Procedure
- "Known Weight" Procedure



All Hercules Hi-Shear Viscometers are calibrated at the factory and are ready for use at delivery. However, calibration should be checked periodically (after every 100 tests or monthly) as outlined in the Operator's Manual. The viscometer should be re-calibrated only after the operator has determined it is not in conformance.

NOTE: If any errors occur during the calibration procedure, all tests performed afterwards will be incorrect. Please follow the directions carefully.

Verify Calibration

To determine whether your viscometer requires calibrating, conduct the following Standard Test:

- "A" Bob (P/N 10020)
- 1100 RPM
- 100K Spring Constant
- Kaltec Test Fluid (P/N 10307)
- Bob, Cup and Test Fluid conditioned (see Conditioning Sample) to exactly 25°C.

Run the AUTO test with 20.4 second ramp time using the above Standard Test Parameters. After the test is complete, select Calculations under the View menu. Compare the Apparent Viscosity results to the value on the Kaltec Test Fluid bottle.

There is no need to calibrate your viscometer, if the value is ±2% from the Kaltec Test Fluid value. If your value falls outside this parameter, you need to calibrate by using one of the following methods:

- **Known Viscosity**—Calibrating the DV-10 using a sample of known viscosity, such as Kaltec Test Fluid (P/N 10307).
- **Known Weight**—To use this option, you must have the DV-10 Calibration Kit (P/N 40850).

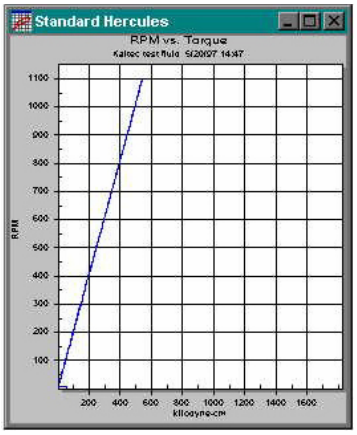
Damp cloth wrapped around the Bob, Cup and Test Fluid with microprobe thermocouple inserted reaching 25°C.

Bob, Cup and Test Fluid placed in a water bath conditioned to 25°C.

Conditioning Sample

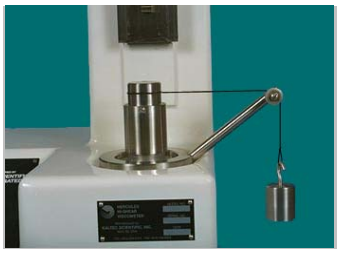
Install the Cup into the Cup Holder. Pour the Kaltec Test Fluid into the Cup using a Fluid Depth Gauge (P/N 10310) up to the "A" Bob mark. Install the "A" Bob on to the Spindle and lower it into the Cup. It is imperative that the Cup, Bob and Test Fluid are exactly 25°C before running the calibration procedure. Conditioning by use of a precision constant temperature bath is an acceptable method. Kaltec recommends using a calibrated microprobe thermocouple (less than 0.018" in diameter) to measure temperature in the gap. To lower the temperature, use a cold, damp cloth wrapped around the Cup. To raise the temperature, use a hot, damp cloth.

Known Viscosity Calibration Procedure using WinShear32



1. Turn on computer and viscometer.
2. Start WinShear32.
3. Prepare the Standard Test Parameters mentioned in "Verify Calibration." Conditioning the sample to 25°C is very important.
4. Click on Diagnostics, then Calibrate. "Calibrate by Viscosity" and "Calibrate by Weight" will be your options.
5. Under "Calibrate by Viscosity." Enter the Apparent Viscosity value located on the Kaltec Test Fluid bottle. Select "Calibrate Now." The spindle will being to rotate and reach maximum RPM.
6. Once maximum RPM (1100) has been reached, the viscometer will automatically set the gain of the torque sensor. Your viscometer is now calibrated.
7. Confirm calibration by repeating the "Verify Calibration" procedure.

Known Weight Calibration Procedure using WinShear32



1. Turn on computer and viscometer.
2. Start WinShear32.
3. Remove the Cup and Bob from the viscometer.
4. Slip the Calibration Ring with the cantilever in front over the Cup Holder.
5. Install the Calibration Insert into the Cup Holder aligning the slot with the screw.
6. Wrap the string counterclockwise (top view) once around the Insert just above the hole located on the back of the Insert. (Do NOT overlap string.)
7. Lay string over the pulley on the cantilever allowing the looped end to hang freely. (Do NOT hang the weight at this time.)
8. Click on Diagnostics, then Calibrate.
9. Select "Calibrate by Weight" and then "Calibrate Now."
10. When prompted fasten the weight on to the looped end of the string hanging over the pulley.
11. Click OK. Your viscometer is now calibrated.
12. Confirm calibration by repeating the "Verify Calibration" procedure.

If any errors occur during the calibration procedure, all tests performed afterwards will be incorrect. Please follow directions carefully.

Calibration Kit

The Calibration Kit eliminates the use of calibration fluids at an exact temperature. It is very simple to use and can only be used with the Hercules Hi-Shear Viscometer, Model DV-10.

The kit includes an ASTM certified weight and mounting hardware. The weight is attached to the cup and hung over the side of the instrument. The force applied to the cup is converted into centipoise and entered into the computer, which sets the gain of the torque sensor. This setting is stored in the viscometer indefinitely or until it is re-calibrated.

Eliminates the use of calibration fluid at an exact temperature.

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For over 50 years, paper manufacturers and supplier companies have relied on the durable Hercules Hi-Shear Viscometer to characterize flow properties of paper coatings and pigment slurries. The viscometer is a well established instrument for predicting runnability and coat weight. Kaltec continues to manufacture, sell and service these high quality instruments on a world-wide basis.

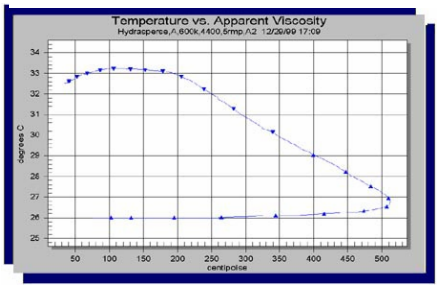
In addition to the Hercules Viscometer, Kaltec has acquired manufacturing rights to produce the AA-GWR Water Retention Meter. This instrument is used in conjunction with the viscometer to measure the de-watering properties of coating colors. The instrument is low cost, portable, and used by both paper mills and suppliers to identify potential retention problems during production and trials.

SPOTLIGHT ITEM—Infrared Temperature Sensor System

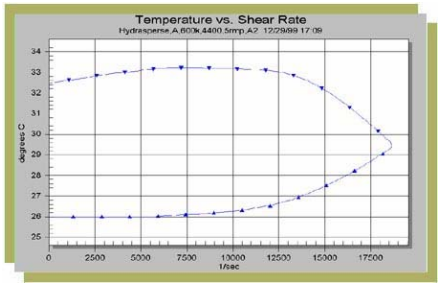
The infrared (IR) Temperature Sensor measures heat generated during viscosity tests on the Hercules model DV-10 Hi-Shear viscometer. The sensor system includes a viscometer test cup fitted with a crystalline window, the IR probe, the thermocouple control interface and WinShear32 software.

At very high shear rates samples being tested in the model DV-10 may experience heating. Since it is difficult to control the temperature at high shear rates we are now able to monitor and record it. Once a base line of results are established comparisons can then be made between the thermal and viscous properties of various samples.

Results can show heating differences between pigments of varying particle size distributions and solids levels. It can also show the relationship between water temperature and flow properties of pigment slurries, coating problems and heating characteristics.



The secret in measuring the heated fluid from a free turning sample is with the use of a crystalline window built into one side of the cup. This window is only visible to IR rays. Therefore any heat emitted from the liquid on the inside of the cup will pass through the window and into the IR probe.



The software controlling the Temperature Sensor is included in the WinShear32 program, which is used to operate and record information for the model DV-10. Temperature data is recorded in the data file and depicted graphically against a choice of other variables that include shear rate, shear stress, RPM, torque, time, Reynolds number, and apparent viscosity. The latest WinShear software projects an arrowhead on the plotted curves to indicate increasing and decreasing shear rates.