Softening Range
Log 9.0 to Log 5.0 Poise

(Parallel Plate Viscometer – Viscous Compression - ASTM C-1351M)

Automatic Viscosity - Temperature Table
Eliminate Operator Errors !!
Improved Accuracy & Reproducibility !!

It's simple:

Insert the sample disc and apply the weight. Enter the dimensions and start the test. Return to print the viscosity versus temperature tables.

It's that easy!!

Orton Model PPV Series

(required computer system not shown)

The Orton Model PPV Series Parallel Plate Viscometer, is a laboratory benchtop system for measuring the viscosity of solid glass cylinders (6 to 12 mm OD by 3 to 6 mm thick) in the viscosity range of log 9.0 to log 5.0 Poise as a function of temperature according to the ASTM C-1351M procedure guidelines.

Operating the Model PPV-1000 is FAST and EASY. The operator requires little training. After the sample disc is prepared and the appropriate information is entered into the software, the operator lowers the motorized furnace, places the sample between the sample plates, lowers the probe and compensation rods, applies the weight, raises the motorized furnace, and clicks the START button on the computer monitor. The system does the rest. The operator is free to perform other tasks. At the end of the test, the operator returns and views the viscosity versus temperature curve on the computer monitor, as shown at the right.

The Model PPV-1000 is ACCURATE, RELIABLE, and REPRODUCIBLE. The instrument automatically measures the rate of compression and performs the calculations. Operator differences, errors, and biases are eliminated.

The Model PPV-1000 is FLEXIBLE. If other thermal cycles or other test parameters are desired, Orton can provide a custom software package to provide the desired testing condition or parameters.

The Orton Model PPV-1000 system is well suited for glasses that for one reason or another are not adaptable for flame working, or for applications where thermal expansion or effective length corrections (common to the fiber elongation method) are eliminated. The Model PPV-1000 can be used to measure the viscosity of glasses in the SOFTENING POINT RANGE.

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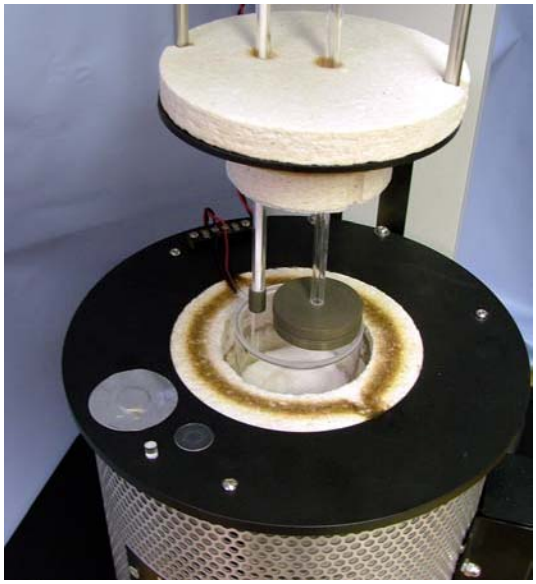
The Model PPV-1000 System is an updated version of the instrument presented in the ASTM C-1351M procedure. The system includes the Orton PPV Module (stand, furnace, sample support system, and measuring head assembly), PPV Control Console and Orton PPV Software. The system requires a dedicated personal computer system that is provided by Orton.



The sample is heated by a vertical tube furnace mounted on a support frame with a motorized system to raise and lower the furnace for sample loading and unloading. The glass sample is placed between the top and bottom plates, 44 millimeter diameter by 6 millimeter thick discs of a refractory metal alloy. Two thin sheets of platinum foil, 0.001 inch thick by 40 millimeter diameter, lie between the glass sample and top and bottom discs to make sample removal easy. The sample and parallel plate stack rest upon a fixed position ceramic tube pedestal.

Sample compression is monitored continuously by a vertical, counter-weighted, ceramic probe rod and overhead LVDT (± 2.5 mm linear range) assembly. The load to the sample is adjusted by placing various static weights on either side of the counter-weighted pulley system. Three weights are included. Sample plate expansion and system movement is negated by a ceramic compensation rod resting on a 12 mm tall compensation block (refractory metal alloy), and in contact with the LVDT coil assembly. Sample temperature is monitored by a type “S” thermocouple located immediately adjacent to the sample.

The heart of the Model PPV Series is the special Orton PPV Software. The software prompts the operator to select the mode of operation and enter the appropriate test parameters. The software directs the PID controller to follow the thermal cycle, collects the data signals from the sample thermocouple and LVDT, displays the data on the computer monitor in real time, performs the appropriate calculations on the data, stores the data and calculations in a text file on the hard drive, and waits for the operator to begin the next test. The software also opens past data files for post testing review, analysis, and report generation.

Operation: The operator positions the sample between the parallel plates, applies the load, raises /lowers the furnace, enters the appropriate data into the software, and clicks the start button to begin the test. The Orton software sends information to the PPV control console, and the furnace is heated according to the predetermined thermal cycle. As the temperature increases (or holds) and the sample compresses, the LVDT monitors the compression and continually sends its signal to the computer. The software calculates the compression rate as a function of time, and stores the temperature, amount of sample compression, and rate of sample compression as a function of time. Once the sample compression exceeds a predetermined value, the software concludes the test. The software immediately and

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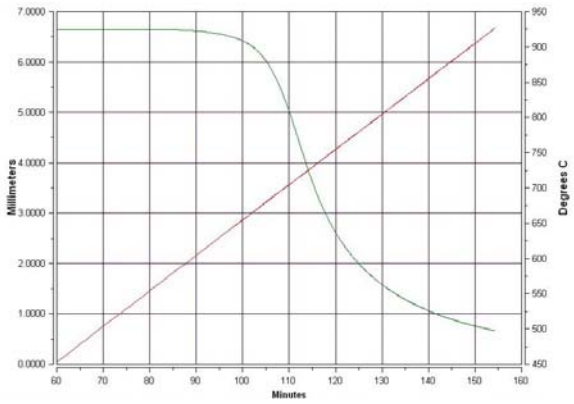
automatically calculates the viscosity for each time-temperature point using the formula in the ASTM C-1351M procedure.

Operating Modes: The Orton PPV Software prompts the operator to select one of several modes of operation: the ASTM C-1351M Mode or the User Defined Mode. The User Defined Mode follows the guidelines of the ASTM C-1351M modes, but allows the operator to change the test parameters (isothermal or dynamic, the heating rate, or the soak temperature) to suit individual testing requirements. The PPV isothermal mode can be used for stress relaxation studies.

Data Acquisition: The graph at the right is the real time display of the ASTM C-1351M test procedure. The computer continuously monitors and displays the LVDT and thermocouple outputs (sample compression and temperature) as a function of time:

- Disc compression (green curve)
- Temperature (red curve)

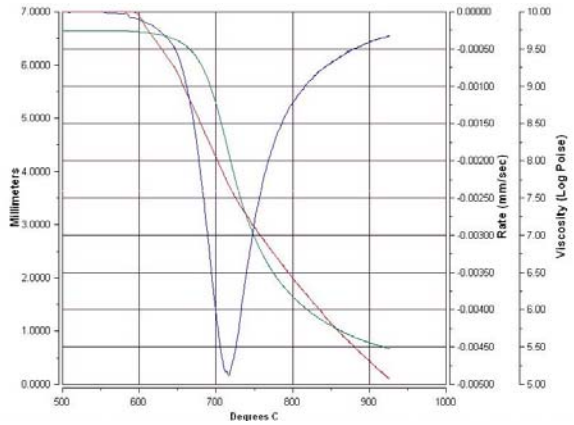
This process is performed WITHOUT the operator, so OPERATOR ERRORS in data acquisition are ELIMINATED !!



Data Analysis: At the end of the test, the software plots the sample compression and rate of compression versus temperature during heating, and calculates the viscosity for each temperature during the test:

- Disc compression (green curve)
- Rate of disc compression (blue curve)
- Viscosity (red curve)

This analysis is performed automatically WITHOUT the operator, so OPERATOR ERRORS and BIAS in data analysis are ELIMINATED !!



Data Analysis – ASTM C-1350M: At the end of the test, the computer software plots the deflection and deflection rate versus temperature, and calculates the viscosities at various temperatures according to the equations in C-1350M. This analysis is performed automatically WITHOUT the operator, so OPERATOR ERRORS and BIAS in data analysis are ELIMINATED !!

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Data Review: The Orton software will display and store the beam deflection, deflection rate, time, and temperature. The data is saved in a text file on the hard drive, and is available for post testing review, analysis, and permanent storage. The user can select a series of test files and generate a report that automatically averages the annealing and strain point temperatures, or the temperature / viscosity data for that series of tests.

The Model PPV Series is FAST, EASY, and FLEXIBLE. The Orton PPV Software prompts the operator to select one of the following **TWO** modes of operation.

ASTM C-1351M Heating Mode

The Orton PPV Software heats the furnace at 5°C and collects the data according to the parameters contained in ASTM C-1350M. At the conclusion of the test, the software automatically and immediately calculates the viscosities according to the ASTM C-1351M equations. The software displays the viscosity versus temperature on the computer monitor, and waits for the operator to begin the next test.

ASTM C-1351M Isothermal Mode

The Orton PPV Software heats the furnace at a predetermined heat-up rate to the predetermined isothermal test temperature, and collects data during the soak. At the conclusion of the test, the software automatically and immediately calculates and displays the viscosity versus time data on the computer monitor according to the ASTM C-1351M equations, and waits for the operator to begin the next test.

The Orton PPV Series is available in three temperature ranges. The selection of which system to use is based upon the temperature range of the glass composition in the log 9.0 to log 5.0 poise viscosity range.

Model PPV Series Specifications

	Model PPV-1000	Model PPV-1200	Model PPV-1600
Maximum Temperature	1,000°C	1,200°C	1,600°C
Heating Element	Kanthal A-1	Kanthal A-1	Molybdenum Disilicide
Thermocouples	Type “S”	Type “S”	Type “S”
Temperature Control System	PID – Automatic	PID – Automatic	PID – Automatic
Compression Tracking System	counterweighted LVDT (± 2.5 mm linear range) with differential compensating assembly		
Probe / Compensation Rods	Fused Quartz	High Alumina	High Alumina
Sample Plates	Inconel	Platinum (by purchaser)	Platinum (by purchaser)
Compensation Block	Must be the same material as the sample plates		
Data Acquisition & Display	Automatic via software supplied with system – computer system required (supplied by purchaser)		
Computer Requirements	Provided by Orton - PC system with English language version of Windows XPt		
Measuring Unit Dimensions	12” Wide x 14” Deep x 33” Tall (305 x 355 x 840 mm)		
PPV Control Console Dimensions	18” Wide x 12” Deep x 5” Tall (460 x 305 x 130 mm)		
Power Requirements	120 VAC, 10 amp, 50/60 Hz	120 VAC, 10 amp, 50/60 Hz	240 VAC, 20 amp, 50/60 Hz

For more assistance, please contact Orton.