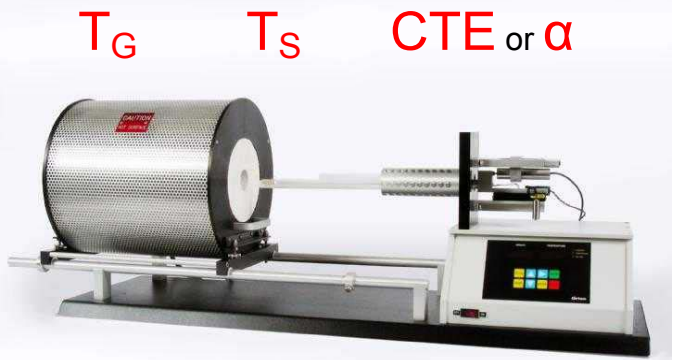


Orton Glass Dilatometer

(Model DIL 2010 STD)

The Orton DIL 2010 STD is a standard bench top, horizontal, digital dilatometer for ASTM E-228, ASTM C-372, and ISO 7791 testing that measures the expansion and softening characteristics of a glass specimen from room temperature up to 1,000°C. The Orton software quickly and easily finds the Glass Transition Point (T_G) and the Dilatometric Softening Point (T_S). By specifying the temperatures, or range of temperatures, the software quickly and easily calculates the Coefficient of Thermal Expansion (CTE) or alpha (α).



T_G

T_S

CTE or α

System Description

The Orton glass dilatometer is a digital, horizontal, single sample, compact, benchtop system comprised of a furnace (for operation from room temperature to 1,000°C in air); a fused quartz sample holder and probe rod system; a type “S” control/sample thermocouple; a sample displacement measuring system (probe rod and LVDT sensor); a user-adjustable counterweighted pulley system to provide a constant and uniform contact load on the test sample; the Orton control board for furnace control and data acquisition; and the Orton dilatometer software.



The Orton system is set up for a 1” long sample, and is factory calibrated against a 1” rod of high purity, platinum, thermal expansion standard. The system can be set up and calibrated for up to a 2” long sample upon initial request. The standard system requires 240 VAC, 15 amp, 50/60 hertz power. Standard options include controlled atmosphere/vacuum components, over-temperature protection, and exchangeable furnaces for rapid sample turnaround.

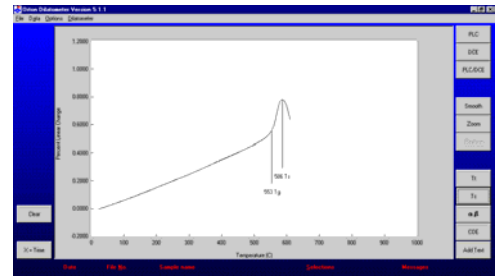


Principle of Operation

A sample specimen is placed between the end of the sample holder and the end of the movable probe rod. The furnace is placed over the sample, and heated according to a user defined thermal cycle. As the sample heats and cools, the sample expansion pushes against the probe rod, or the sample shrinkage pulls away from the probe rod. The probe rod is kept in constant contact with the sample by the pulley system. The probe rod transmits the amount of sample movement to the electronic displacement sensor (LVDT) which is located outside of the heated chamber. The LVDT generates an electronic signal corresponding to the change in sample length and continuously sends that signal to the Orton on-board computer. The Orton on-board computer saves the length change data along with the sample temperature from the thermocouple located next to the sample. The PLC and temperature data is downloaded to an independent computer system for real time observation and for post testing analysis

Orton Standard Dilatometer Software

The Orton Standard Dilatometer Software (Version 5.2.1) is included. The software is loaded on to the PC system supplied by the user, and communicates with the dilatometer. The operator enters the critical run parameters into the user-friendly screens, and the software sends the information to the controller board inside the dilatometer. The software extracts data from the dilatometer during the run so the operator can monitor the run in real time. Upon completion of the run, the software extracts the data from the dilatometer and creates a data file for post testing review and analysis. The operator can view and analyze the past run on the same PC, or can transfer the data file to another PC for independent viewing and analysis.



The software collects and displays time, temperature, and percent linear change data, and stores it in a binary file. PLC data is displayed on the PC monitor in temperature or time based modes. Data can be printed graphically or in tabular form, or exported as an ASCII file. Software features include comparisons against temperature or time of up to six runs; zoom into part of the curve; display differential or alpha CTE curves; T_G (between 400 and 850°C) softening point temperatures; α - β quartz transition temperature, and coefficient of expansion calculation for any temperature range.

The Orton Dilatometer Software (Version 5.2.1) is supplied on a CD, and is compatible with the operator's PC using the English language version of Windows 95/98/2000/XP/Vista.

Typical Specifications

Model Number	DIL 2010 STD
Temperature Range	RT to 1,000°C
Furnace	Kanthal Wire
Isothermal Zone for a 1" Sample	±1.5
Thermocouple	Type "S"
Sample Holder and Probe Rod	Standard: Fused Quartz
Sample Size (maximum)	50 mm long by 20 mm diameter
LVDT Linear Range	±0.100 inch or ±100,000 µ-inches or ±100,000,000 nano-inches (±2.54 mm or ±2,540 µm or ±2,540,000 nm)
LVDT Resolution	Infinite - <0.1 nanometer
Practical Resolution	0.0000009 inch or 0.0009 micro-inch or 0.9 nano-inch (0.000022 mm or 0.022 µm or 22.8 nm)
Practical PLC Resolution (for a 1" Sample)	0.00009%
Reproducibility	Limited by sample preparation and ability to reproduce testing conditions
Practical Reproducibility Range	± 0.004 PLC (± 1 µm / ± 40 µ-inches)
Contact Load	Adjustable 4 to 100 grams (or more)
Temperature Control	Orton Controller Board: PID control, User Programmable, 20-segment maximum, and Automatic Melting Point Protection
Controller Heating Rates	Heating Rates from 0.1 to 999°C/minute at 0.1°C/minute increments
Furnace Heating Rates	0.1°C/minute to 120°C/minute
Contact Load	Adjustable 4 to 100 grams (or more)
Data Acquisition	Data stored in Orton Controller Board at 1°C increments. Data can be downloaded manually or via PC Software. Data saved until next run.
Data Analysis	Orton Dilatometer Software Version 5.2.1 is included. Requires English Language Version of Windows 95/98/2000/XP/Vista.
Computer Interface	RS232 Cable included - User can attached USB converter to RS232 cable
Factory Calibration	All systems are calibrated with 1" rod of high purity platinum. The Cryogenic system is calibrated with a platinum rod and a copper rod. Calibration with a 2" rod is available upon request.
Secondary Calibration Sample	All systems are shipped a 1" rod of 99.8% high purity, polycrystalline high alumina. A 2" rod can be substituted upon request.
Calibration Sample	Platinum Rod is available as an Option
Water Cooled Bulkhead (circulation system not included)	Included
Measuring Head Cover	Available as Option (included with a controlled atmosphere option)
Controlled Inert Atmosphere	Available as an option
Controlled Reactive Atmosphere	Available as an option
Bench-top Footprint (open)	49" x 14" x 17"
Length x Depth x Height	(1,250 x 360 x 430 mm)
Transformer Footprint	Transformer not Required
Power Requirements	240 VAC, 20 A, 50/60 Hz