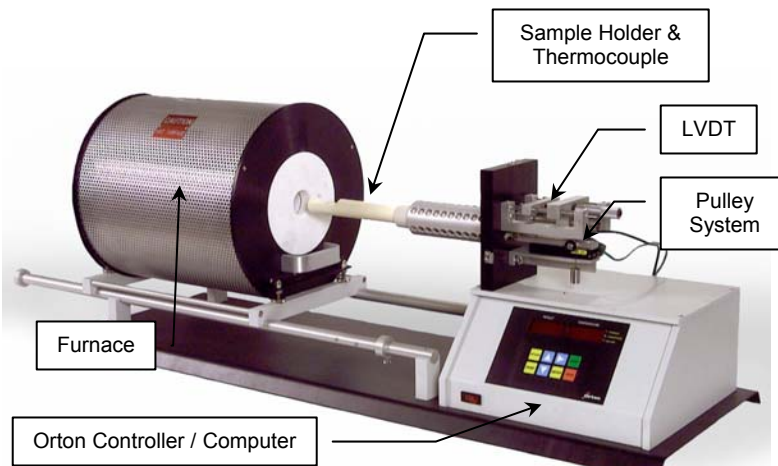


Orton Standard Dilatometers

Orton dilatometers are designed to measure the dimensional changes of ceramics, glasses, metals, carbon composites, cermets, minerals, and polymers as a function of temperature. The dilatometer records reversible and irreversible changes in length (expansion and shrinkage) during heating and cooling. Samples are quickly and easily measured for determining firing ranges and firing schedules, measuring thermal expansion ranges for glaze fits, and measuring thermal expansion ranges for R&D, QC or product certification. Orton standard dilatometers are used for ASTM E-228 and C-372 testing to measure the Coefficient of Linear Thermal Expansion (CLTE or CTE), softening point, glass transition temperature, curie point, crystalline transformation, phase transition, shrinkage, warping, bloating, sintering rate, isothermal creep, stress relaxation.



System Description

The Orton Standard Dilatometer Series is a complete, compact, easy to use, benchtop system comprised of a furnace (for a variety of temperature ranges, including sub-ambient); a sample holder system (fused quartz or high alumina); a 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; an on-board furnace controller (user programmable, 20 segment, PID control); an on-board data acquisition computer (stores temperature and displacement data for downloading to an independent computer); software for an independent personal computer system; and a bench-top support structure.

All Orton standard systems are factory calibrated to NIST platinum data. Other customer supplied calibration materials can be used for initial calibration upon request. A standard alumina reference sample and calibration file are provided. The standard systems require 120-VAC, 15-amp, or 240-VAC 20-amp, 50/60 hertz power. Standard options include controlled atmosphere/vacuum components, water-cooled head measuring head panel, over-temperature protection, and exchangeable furnaces for rapid sample turnaround.

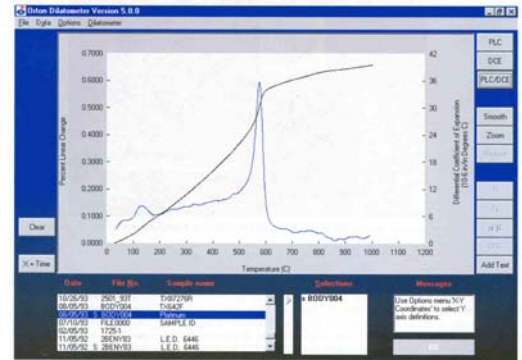
Principle of Operation

A sample specimen is placed between the end of the sample holder and the end of the movable probe rod, and the furnace is heated according to a pre-programmed thermal cycle. As the sample temperature changes (as recorded by the sample thermocouple), the sample expands (pushing against the probe rod) or shrinks (pulling away from the probe rod). The probe rod, which is kept in constant pressure contact by the pulley system, transmits the amount of sample movement to the electronic displacement sensor (LVDT) located outside of the heated chamber. The displacement sensor (LVDT) generates an electronic signal corresponding to the positive or negative change in sample length and continuously sends the signal to the Orton on-board computer. The Orton on-board computer converts the signal to the percent of length change (PLC) and saves it along with the elapsed time and the sample temperature. The stored data can be retrieved using the keypad and display, or it can be downloaded via the supplied RS232 cable to an independent computer system either during the run or after the run. The data can then be easily analyzed using the Orton Data Analysis Software.

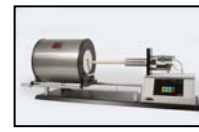
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Orton Data Analysis Software

The basic TDA curve is generated by plotting the percent of length change (PLC) on the Y-axis against the sample temperature. The Orton Data Analysis Software is an intuitive, easy-to-use executable program (requires an English language version of Windows® 95/98/2000/XP) that performs standard dilatometric analyses. The independent PC can receive up to 32,000 data points (time/temperature/percent linear change) for extremely long runs. Data from up to 6 runs can be compared. Data can be printed graphically or in tabular form or exported as an ASCII file. Software features include comparisons against temperature or time; zoom into part of the curve; and examine percent linear change, differential or average coefficient of expansion, calculation of transition and softening point temperatures, α - β quartz transition temperature, and coefficient of expansion calculation for any temperature range.



Typical Specifications



Model Number	DIL 2010 B	DIL 2010 C	DIL 2010 STD	DIL 2012 STD	DIL 2016 STD
Temperature Range	RT to 1,000°C	RT to 1,000°C or -170°C to +300°C	RT to 1,000°C	RT to 1,200°C	RT to 1,600°C
Furnace	Kanthal Wire	Nichrome Wire or Cryogenic Chamber	Kanthal Wire	Kanthal Wire	Silicon Carbide
Thermocouple	Type "N"	Type "N"	Type "S"	Type "S"	Type "S"
Sample Holder and Probe Rod	Fused Quartz	Fused Quartz	Fused Quartz	High Alumina	High Alumina
Sample Size (max)	50 mm long by 20 mm diameter	100 mm long by 10 mm diameter	100 mm long by 20 mm diameter	50 mm long by 20 mm diameter	50 mm long by 20 mm diameter
LVDT Displacement Range	±0.100 inch (±2.54 mm)				
Displacement Resolution	0.000009 inch or 0.9 micro-inch (0.00002 millimeter or 0.02 microns)				
PLC Resolution for a 1" Sample	0.00009%				
Contact Load	Fixed - 113 grams	Adjustable minimum 4 grams	Adjustable minimum 4 grams	Adjustable minimum 4 grams	Adjustable minimum 4 grams
Temperature Control	Orton User Programmable, 20-segment, PID Controller with Melting Point Protection				
Heat-up Rate	1 to 30°C/minute at 0.01°C increments	1 to 30°C/minute at 0.01°C increments	1 to 30°C/minute at 0.01°C increments	1 to 30°C/minute at 0.01°C increments	1 to 15°C/minute at 0.01°C increments
Data Acquisition	Orton On-board Computer (data stored in on-board computer, downloaded to independent PC system)				
Data Analysis	Orton Data Analysis Software (Requires English Language Version of Windows 95/98/2000/XP)				
Computer Interface	RS232 Cable for user's PC (Requires English Language Version of Windows 95/98/2000/XP)				
Standard Calibration	Factory Calibration with NIST Platinum Standard (other customer supplied calibration materials can be used)				
Reference Material Provided	1" High Alumina	1" High Alumina and 1" Copper	1" High Alumina	1" High Alumina	1" High Alumina
Controlled Atmosphere Option	Not Available	Yes	Yes	Yes	Yes
Bench-top Footprint (open) Length x Depth x Height	28" x 14" x 15" (710 x 360 x 380 mm)	49" x 14" x 24" (1,250 x 360 x 600 mm)	49" x 14" x 17" (1,250 x 360 x 430 mm)	49" x 14" x 17" (1,250 x 360 x 430 mm)	56" x 14" x 17" (1,420 x 360 x 430 mm)
Transformer Footprint	N/A	N/A	N/A	N/A	12" x 9" x 10" (305 x 230 x 250 mm)
Power Requirements (240 VAC, 50 Hz available)	120 VAC, 15 amp, 50/60 Hz	120 VAC, 15 amp, 50/60 Hz	120 VAC, 15 amp, 50/60 Hz	120 VAC, 15 amp, 50/60 Hz	240 VAC, 20 amp, 50/60 Hz

In addition to these standard systems, Orton manufactures vertical, multi-sample, creep (RUL), higher temperature, and custom dilatometers. Contact Orton for details.

Orton also manufactures other thermoanalytical instruments, such as DTA's, TGA's Simultaneous DTA/TGA's, a complete series of glass testing instruments, gradient firing furnaces, special tube furnaces, and other systems designed to suit individual application requirements. Contact Orton for more details.