Dilatometer DL 4000

ISO 349, DIN 51 739, ISO 8264, ASTM D 5515, ISO 23873

General description

DL 4000 Coal Dilatometer is a fully automatic system for determining the swelling properties of hard coal when heated under standard conditions: dilatation and contraction are obtained by inserting a sample of powdered coal, formed under pressure, in a narrow tube topped by a piston and reading the displacement of the piston as a function of the temperature. ISO Standard 349, DIN 51 739, ISO 8264, ASTM D 5515 and ISO 23873 specify slightly different methods for such determination. DL 4000 performs dilatometer tests according to ALL the above mentioned standards: dilatation and contraction of 2 samples, loaded in 2 tubes, are measured at the same time, by means of precision transducers. The Standard Test Method can be easily selected from the front panel before starting a test.
The double furnace version productivity is considerably increased due to the reduction of the heating and cooling waiting times. All the analysis procedure, even the insertion and removal of the tubes into the furnace, is automatic: the operator needs only to load the sample, to place the tubes above the furnace and to start the system.
Once started, DL 4000 will preheat the furnace, insert the tubes into the furnace, restore the start temperature, raise the temperature at uniform rate, and carry out the tests results.
Furnace temperature together with the dilatation and contraction readings are displayed and printed during the test.

Specifications	
Working temperature	250 ÷ 600 °C
Temp. rise rate set	0.5 ÷ 6.0 °C/min
Displacement transducers	LVDTs
Tubes movement	fully automatic (not in "K" Version)
Temperature display	°C
Dilatation display	-50% ÷ +300% (normal samples) -100% ÷ +600% (short samples)
Dilatation resolution	1%
Data print interval	60 seconds
Alphanumeric printer	non impact type
System diagnostics	automatic at start up
Host computer interface	RS 232 C
Power supply (single furnace)	230 / 120 V – 1.8 kVA max
Power supply (double furnace)	230 / 120 V – 3.6 kVA max

Double furnace version DL 4002

Single furnace version DL 4001

Available Versions

The Dilatometer DL 4000 is available in Single Furnace version (DL 4001) or in Double Furnace version (DL 4002).
With the Double Furnace Version is possible to reduce the time wasting waiting for the cooling down of the furnace at the end of the test.
While a dilatation test is running in the first furnace, the second furnace can be preheated at the warm up temperature. At the end of the first test, a second test can be immediately started on the other furnace. The Dilatometer DL 4000 can be supplied also as K Version: a less expensive unit designed without the automatic loading mechanism. The Dilatometer K version can be supplied in Single (DL 4001K) or Double Furnace (DL 4002K) version.
A special High Temperature Version (DL 4001HT) is also available and allows to test the samples up to 1000°C. This procedure is not described in any Standard but is useful for research purpose to investigate the behaviour of the coal over 600 °C.

Printer Output

The internal printer returns the results of the test on thermal paper. Every minute the current values of Time (minutes from the test start), Temperature (°C) and Dilatation (%) for tube A and B are printed. At the end of the test the Test Report is printed according to the international standard. The test report includes the automatic classification of the sample (Positive Dilatation, Negative Dilatation or Contraction Only) together with the G Factor.

Electronic Unit

The test control is completely devoted to the electronic unit. Thermal parameters of the test are set by means of a guided set-up procedure; three digital display groups are available to set warm-up temperature (3 digits), temperature rise rate (2 digits) and maximum temperature (3 digits). A led display group is used to set optional operation set-up (host computer data transmission enable, standard selection etc). A further four led display group allows system set-up (Diagnostics, Date and Time set, transducers calibration and special functions).
During the test three visualisation units show the current temperature (3 digits), and the current % contraction / dilatation (3 digits plus sign), for both A and B tubes. The electronic cage includes a thermal paper printer, 24 characters/line, for status messages and current data printing.
A remote host computer interface (RS232C) is included to allow data logging and/or graphic representation of the results. The archiving software Dilatometer Data Manager (DDM) is available as option and give a user friendly interface to archive and graphical print out the test results.

PC Archiving Software D.D.M.

The system can be connected to an external computer.
All current test data and end of test report are available on a serial port RS 232 in ASCII format. The software "D.D.M. - Dilatometer Data Manager" provides friendly interface and support for asynchronous RS232 communications to external PC.
Acquisition, archiving, printing and export of test data, together with test set up and sample identification is fully provided.
The software is compatible with Microsoft Windows© environment.

Accessories

Item codes	
Single Furnace Automatic Dilatometer System	DL 4001
Double Furnace Automatic Dilatometer System	DL 4002
Single Furnace Automatic Dilatometer System K Version	DL 4001 K
Double Furnace Automatic Dilatometer System K Version	DL 4002 K
TUBE and PISTONS:	
TUBE and PISTON - Type S - according to ISO 349, ASTM D 5515	DL 4000-80
TUBE and PISTON - Type L - according to ISO 8264, ISO 23873, ASTM D 5515, DIN 51739	DL 4000-82
OPTIONS:	
PC Archiving Software	DL 4000- 64
COAL SAMPLE PREPARATION KIT	
Coal sample preparation Kit according to ISO 349, ASTM D 5515	DL 4000-84
Coal sample preparation Kit according to ISO 8264, ISO 23873, ASTM D 5515, DIN 51739	DL 4000-86
Coal sample preparation Kit Multistandard	DL 4000-88