

NEW HORIZONS IN TEMPERATURE TECHNOLOGY



**coal ash
fusibility furnaces**

CARBOLITE



introduction

The introduction of the Carbolite Coal Ash Fusibility test furnace has revolutionised coal sample testing where time and accuracy are both critical.

Where previously an operator's time was dedicated to the continuous monitoring of a test with only 1 or 2 samples, the CAF furnace allows up to 12 samples to be tested at any one time. Continuous image recording allows laboratory technicians to carry out other tasks while the test is in progress.

The latest addition to this product is the capture of test images via computer. This new option gives both accurate and rapid analysis of the tests.

The computer is used to automatically generate a test report once the relevant fusion temperatures have been identified by quickly scrolling through the stored images.

coal ash fusibility testing

At high temperatures, the heat from burning coal is often sufficient to melt its own ash which when cooled solidifies into clinker.

In industrial coal burning applications, clinkers can be extremely large and can cause both disposal problems and operation downtime. Coal ash fusibility testing is therefore required by users to determine the ash fusibility characteristics of the fuel.

The published standards require that the ash fusion temperature is measured and recorded at 4 points: the initial rounding of the cone tip, when the cone has softened, when melted to a hemisphere and finally when it flows into a puddle.



the furnace

The Coal Ash Fusibility furnace is designed to heat coal ash samples up to a maximum temperature of 1600°C in a controlled atmosphere and visually record the fusion of the samples for analysis.

The furnace work tube is sealed and has a 'fail safe' gas control system for safety when testing with toxic and flammable gases. A sliding and rotating door mechanism provides unrestricted access to the work tube, allowing easy loading and unloading of the test samples using the sample loading tool provided. The large diameter work tube can accept

up to 12 samples at any one time. The use of lightweight insulation allows the furnace to cool quickly, permitting multiple tests to be completed during the day.

The start and finish temperatures can be pre-set and the rate of temperature rise is adjustable within the parameters of the relevant published standards. Independent overtemperature protection is provided by a separate temperature controller using its own thermocouple and contactor to override the heating circuit.



CAF Digital.

gas controls

A 'fail-safe' gas system is incorporated into the furnace. Oxidising or reducing gases are automatically introduced into the work tube during a coal ash fusibility test. The flow rate and required atmosphere are controlled from the furnace control panel.

To ensure operator safety, the following features are included:

- safety purge of the work tube prior to and after carrying out a coal ash fusibility test
- 'Purge Gas Failure' audible and visual alarm
- safety purge of work tube in the event of a power failure during a test
- test in progress indicator to warn the operator that oxidising or reducing gases are present within the work tube
- 'gas tight' work tube



CAF Video.

image recording

A choice of video tape recording or digital capture of the images onto a high specification PC is offered:

VIDEO A high resolution video system is used to observe the shapes of the samples as they are heated. A digital temperature reading, date and a batch identifier are recorded with the video picture.

On completion of the test, the recording can be replayed at high speed to find the deformation temperatures for each sample. The precise stages of fusion are then determined, moving the recording between deformation points and simply noting the temperatures shown on the screen. The recording can be maintained as a permanent record of the test.

DIGITAL An image from the video camera is captured at specified time and temperature intervals and stored on computer in sequence order, including date, time, a batch identifier and the temperature at the point of capture. A real time image of the samples is displayed on the computer monitor throughout the test. The precise stages of fusion are then determined by quickly and accurately scrolling through the stored images to the required point and recording the deformation temperature using the automatic results feature in the software. To ensure accurate comparison of sample height and width, a grid overlay feature is

provided in the software. The scale of the grid is adjustable and can easily be moved on the screen to analyse each sample in turn.

A results print out can be generated using the test software. Also, the results and their associated images can be easily imported into a Windows based word processor and spreadsheet software package. Tests can be stored on computer disc for future analysis and a high density storage media and drive are provided to allow compact and secure archiving of test data.

furnace specification

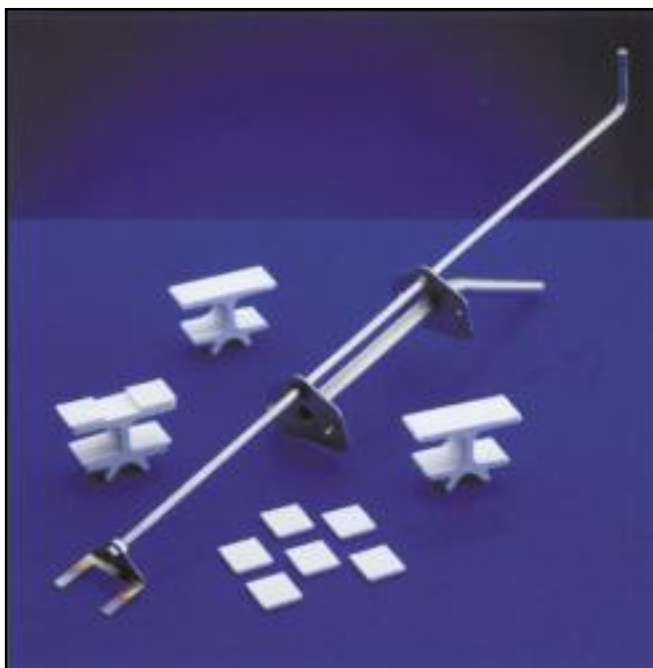
Furnace cabinet dimensions (mm) * (h x w x case depth x overall depth/including depth of door)	700 x 505 x 650 x 970														
Work tube (internal diameter mm)	79														
Tube material	Mullite														
Maximum no of samples	12														
Maximum temperature °C (°F)	1600 (2912)														
Maximum recommended heat up rate °C/minute (°F/minute)	8 (15)														
Heating elements	Silicon carbide														
Temperature control	Digital PID with multi offset parameters														
Temperature sensor	Pt & Pt/13%Rh thermocouple														
Overtemperature protection	Digital with single high alarm relay														
Power switching	Solid state relays														
Power supply	380/415V, 50/60Hz, two phase, 25A/phase or 220 & 240V, 50/60Hz, single phase, 50A Other voltages available on request														
Maximum power consumption (kW)	7														
Gases: Two options are available for uses with the following gases Gas option to be specified with order:	<table border="0"> <tr> <td>Reducing gas</td> <td>60% (V/V) CO + 40% (V/V) CO₂</td> </tr> <tr> <td>Oxidising gas</td> <td>Air</td> </tr> <tr> <td>Purge gas</td> <td>N₂</td> </tr> <tr> <td>or</td> <td></td> </tr> <tr> <td>Reducing gas</td> <td>50% (V/V) H₂ + 50% (V/V) CO₂</td> </tr> <tr> <td>Oxidising gas</td> <td>CO₂</td> </tr> <tr> <td>Purge gas</td> <td>CO₂ (for use with H₂)</td> </tr> </table>	Reducing gas	60% (V/V) CO + 40% (V/V) CO ₂	Oxidising gas	Air	Purge gas	N ₂	or		Reducing gas	50% (V/V) H ₂ + 50% (V/V) CO ₂	Oxidising gas	CO ₂	Purge gas	CO ₂ (for use with H ₂)
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Purge gas	CO ₂ (for use with H ₂)														

* For the video version, a monitor/video cabinet of the same dimensions is also supplied. In the case of the digital version, space will be required for the location of a PC

IMAGE CAPTURE SPECIFICATION

The following equipment is supplied:

- Both units are supplied with a Monochrome video camera. The standard lens is suitable for the 12.4mm cones of the British/ISO and the 19mm (3/4") cones of ASTM standards. An optional zoom lens is available for viewing up to 3 of the 3mm high samples of the ISO/DIN standard
- The video recording system also includes a 22.5cm (9") monitor and a 4 head video recorder
- The computer controlled digital image system also includes a high specification PC. This incorporates a frame grabber card, high capacity removable data storage medium, and Microsoft Windows and Microsoft Office software



Sample loading tool, sample carriers and sample tiles.

STANDARD ACCESSORIES INCLUDED

Sample carrier
Sample tiles
Sample loading tool
Cone mould
External mounting proprietary CO alarm

A comprehensive spares kit is available - please ask for details.

CONFORMANCE WITH STANDARDS

ISO 540: 1995 Solid mineral fuels - Determination of Fusibility of Ash - High Temperature Tube Method

BS 1016 : Part 113 : 1995 Methods for Analysis and Testing of Coal and Coke. Part 113. Determination of Ash Fusibility.

ASTM D 1857-87 Standard Test Method for Fusibility of Coal and Coke Ash

DIN 51730 Testing of Solid Fuels; Determination of Fusibility of Fuel Ash.

These units are compliant with all applicable European Directives.

OTHER UNITS FOR COAL AND COKE ANALYSIS INCLUDE PRODUCTS FOR

Ashing, volatile, moisture determination, swelling index, carbon and chlorine content, carbon and hydrogen content.

Also available are less frequently used furnaces manufactured to special order including the Gray King Coke Test Furnace, Leibig (low temperature) method for determination of carbon and hydrogen in coal.

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