



CARBOLITE[®]
IGERO 30-3000 °C

NEW!

CAF G5 – Ash Fusibility Furnace

**Automatic
Analysis
Software**

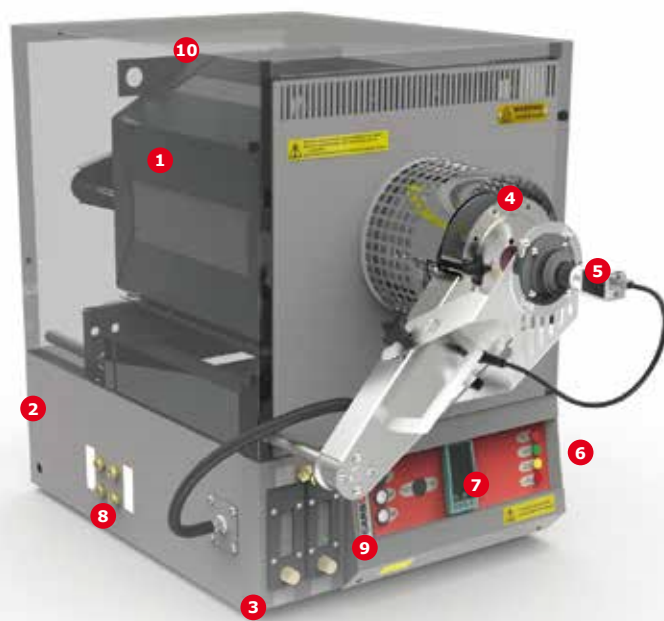


The original CAF Digital was designed by Carbolite Gero to test ash fusibility of coal, biomass and solid recovered fuels to determine sintering, melting and flow temperatures. The new Carbolite Gero CAF G5 encompasses and enhances the original features whilst new features such as automated image analysis and increased camera resolution along with zoom facility greatly improve the quality of test results and increased efficiency in laboratories.

CAF G5 – New Generation Ash Fusibility Furnace

The CAF G5 is designed to test ash fusibility, and optionally, the increasingly popular determination of biomass or solid recovered fuels testing and conforms to the Standards ISO 540:2008; ASTM D 1857 / D1857M – 04 (2010); DD CEN/TS 15370-1:2006 (biomass) and PD CEN/TR 15404:2010 (solid recovered fuels (SRF)).

The CAF G5's automatic and continuous recording of digital images allows laboratory technicians to carry out other tasks while the test is in progress, reviewing results later. The new CAF G5 greatly enhances the quality of the recorded images and test results increasing efficiency in laboratories. The maximum temperature of 1600°C enables both biomass and coal testing. An optional work tube integrated lighting system is also available when testing low 'initial deformation' temperature of SRF or biomass samples.



Standard features

- **NEW!** Analysis software which can be used in fully automatic or manual modes
- **NEW!** Software zoom function to enable accurate post-test analysis of individual samples with improved resolution
- **NEW!** One configurable grid assigned to each test piece
- **NEW!** Temperature controller program set up within the software
- **NEW!** Space saving embedded computer with Windows 7 Embedded Professional software runs future proof firmware
- **NEW!** Default software settings and individual analysis form for coal ash, biomass and SRF
- **NEW!** An optional work tube integrated lighting system when testing low 'initial deformation' temperature of biomass or SRF samples
- Lightweight insulation allows quick cooling permitting multiple tests to be completed during the day
- Automated digital image capture of samples. The frequency of images recorded is set by customer preference, from every 1°C increment to every 20°C

- 1 1600 °C tube furnace with integral SiC elements
- 2 External link to embedded PC & software
- 3 Flow meters for oxidising, reducing gas flow (dependant on the requirements of the standards)
- 4 79 mm inner diameter work tube allows more than 6 samples
- 5 Digital camera for fast and accurate image recording
- 6 Gas tight seal for efficient use of gases & safety of operator
- 7 Automatic temperature programmer with multiple PID control
- 8 Gas inlets for reducing, oxidising & purge gasses
- 9 Oxidising or reducing gas selection switch
- 10 Work tube integrated light for use when testing low 'initial deformation' temperature of biomass and SRF samples (optional)

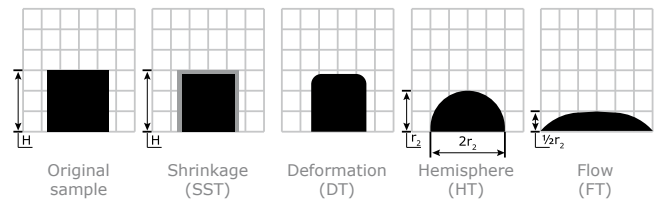
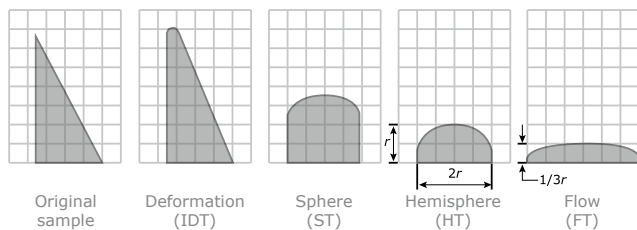


A large diameter work tube ensures that only one unit is required to test more than six test pieces at any one time. Heating and cooling rates allow up to three tests per day to be completed. A grid overlay feature ensures accurate comparisons of the height and width of each sample for manual or automatic analysis

Multiple sample testing at any one time

Auto Analysis Software

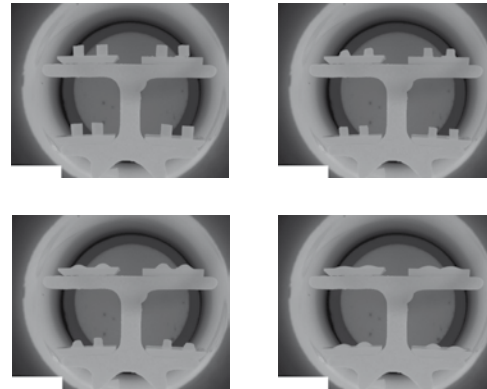
The CAF G5 includes a new software package which offers the choice of automatic or manual analysis of samples. The sample profiles are identified by individual grids for each test piece. When using the automatic analysis option the software identifies the four melt point profiles as defined in the coal ash, biomass and SRF standards and creates graphical data of the various form factors including height, width, area, circumference, shape factor ratio and height/width ratio. The user can select which data from these factors they want to show on the graph. The software automatically populates the results table and stores the deformation point images (SST, DT, HT, FT – Biomass & SRF) (IDT, ST, HT, FT – coal ash) and offers a printed report function.



Stages of Melt Points – Coal ash (left); Biomass ash (right)

Accurate digital image recording

The digital camera, mounted externally on the door, is simple to use, easy to access and can be quickly adjusted to different positions. Its automated and continuous high resolution images of the samples' four melt points are captured at temperature intervals set by customer preference with the computer software. The image capture rate can be set in increments from every 1°C to every 20°C. Multiple images are stored on an embedded computer in sequence including dates, time, a batch identifier and the temperature at the point of capture. The automatic and continuous recording of digital images allows laboratory technicians to carry out other tasks while the test is in progress, reviewing results later.



Example images taken from a typical test run

Image grid assistance

A grid overlay feature is provided within the software for each sample (more than 6 samples can be simultaneously tested). The grids are positioned to identify the samples for automatic analysis or are used to assist manual analysis. They ensure accurate comparison of the height and width of the sample melt points. The position and scale of each grid is easily adjustable. Figure (a) shows a zoomed image of two samples with analysis grids in position.



Standard accessories

- Sample carrier x 1
- Sample tiles x 100
- Sample loading tool x 1
- Test piece mould x 1 (coal ash)
- Test piece mould and hand press x 1 (biomass & SRF)
- External mounting proprietary CO alarm x 1





Technical details

Gas Options

All CAF G5 furnaces can be run in reducing or oxidizing gas mode but due to the two different sets of gases the furnace is constructed specifically for the gases that are to be used to the Standard:

Ash Material	Test standard	Reducing Gas	Oxidizing Gas	Purge Gas
Coal & Coke	ASTM D 1857-04	CO + CO ₂	Air	N ₂
Coal & Coke	BS ISO 540:2008	CO + CO ₂ or H ₂ + CO ₂	Air or CO ₂	N ₂ or CO ₂
Solid Recovered Fuels	PD CEN/TR 15404:2010	CO + CO ₂	Air	N ₂
Biomass	DD CEN/TS 15370-1:2006	CO + CO ₂	Air	N ₂

Specification Summary

Temperature Range	Up to 1600°C (1600°C required for some biomass samples)	Gas Requirements	(Specific gas choice must be made at time of ordering, see item numbers below)
Temperature Precision	± 3°C above 800°C	Purge	N ₂ or CO ₂
Temperature Ramp Rate	8°C per minute	Oxidising	O ₂ or Air
Temperature Control	Digital multiple PID terms with gain scheduling and multi offset parameters	Reducing	CO + CO ₂ or H ₂ + CO ₂
Temperature Display	°C	Ventilation	Forced air ventilation
Work Tube dimensions	79 mm internal diameter	Exhaust	Pipe to be vented into a separate fume hood
Tube material	Mullite	Safety	Fail safe gas system and CO alarm supplied
Heating Elements	Silicon carbide x 6	Physical Dimensions (mm)	700 (h) x 505 (w) x 765 (case depth) x 970 (overall depth)
Maximum Sample Load	12	Weight (kg)(furnace)	84
Conforms to Standards	BS ISO 540:2008; ASTM D 1857/D1857M-04 (2010); DD CEN/TS 15370-1:2006; PD CEN/TR 15404:2010	Power supply	380-415 V, 50/60 Hz two phase 25 A/phase or 220-240 V, 50/60 Hz single phase 50 A
Ash Fusibility Determination	Automatic or Manual (Coal & coke: DT, ST, H, FT) (Biomass / SRF: IST, DT, HT, FT)	Power switching	Solid state relays
Analysis Time	3 runs per working day (including cool down times)	Maximum power consumption (kW)	7
Image Collection	Digital - up to 1 frame per 1°C rise in temperature	Environment Conditions	Operating Conditions 5°C-40°C Relative Humidity maximum 80% up to 31°C decreasing linearly to 50% at 40°C
Image Resolution	1280 x 1024 pixels	Overtemperature protection	Digital with single high alarm relay

Item Number	Description	illumination	Gases
CAFG5-BIO-220	CAF G5 BIOMASS 220-240 V 1-PH	yes	COCO ₂ +AIR
CAFG5-BIO-380Z	CAF G5 BIOMASS 380-415 V 2PH+N	yes	COCO ₂ +AIR
CAFG5-CO-220	CAF G5 COCO ₂ +AIR 220-240 V 1-PH	no	COCO ₂ +AIR
CAFG5-CO-380Z	CAF G5 COCO ₂ +AIR 380-415 V 2PH+N	no	COCO ₂ +AIR
CAFG5-H2-220	CAF G5 H ₂ +CO ₂ 220-240 V 1PH	no	H ₂ +CO ₂
CAFG5-H2-380Z	CAF G5 H ₂ +CO ₂ 380-415 V 2PH+N	no	H ₂ +CO ₂

