Technical Specification
ASTM D 5341–93a Coke Reactivity Test Unit

ASTM D 5341-93a Method for Measuring Coke Reactivity Index (CRI) and Coke Strength after Reaction (CSR).

Technique for determining lump coke reactivity in carbon dioxide gas at elevated temperatures and its strength after reaction in carbon dioxide gas by tumbling in a cylindrical chamber referred to as the 'I - tester'.

When coke lumps descend in the blast furnace, they are subjected to reaction with countercurrent CO_2 and to abrasion as they rub together and against the walls of the furnace. These concurrent processes physically weaken and chemically react with the coke lumps, producing an excess of fines that can decrease burden permeability and result in increased coke rates and lost hot metal production. This test method is designed to indirectly measure this behaviour of coke in the blast furnace.

A dry coke sample of designated size and origin is reacted with CO2 gas in a retort at a specified elevated temperature for a specified length of time. Two indices, coke reactivity index (CRI) and coke strength after reduction (CSR) are determined using the reacted coke residue. The weight retained after reduction determines the CRI. The weight retained after sieving the tumbled reacted coke in a designated number of revolutions over a designated turning rate determines the CSR.

Maximum temperature	1100ºC.
Heating zones	Three - overall heated length 700mm.
Construction	A painted steel frame will support the furnace and retort hanger. A rolled stainless steel case will provide support for the furnace inner insulation package. A mesh double skin allows the passage of hot air and helps in keeping the outer case cool. The framework will be painted in Carbolite's standard grey.
Overall dimensions	Height 1800mm, width 1625mm and depth 1100mm. Please note that these dimensions are approximate only. Should they be considered critical by the end user, it should be highlighted prior to order placement.
Insulation type	Within the furnace, high quality, suitably graded ceramic fibre material forms the basis of the insulation package. The vacuum formed hot face insulation is backed by low thermal mass blanket insulation material to ensure maximum thermal efficiency. Other high alumina components may be utilised in the construction of the insulation package.
Heating elements	Kanthal AF resistance wire will be coiled and vacuum formed into modular heating elements.
Temperature sensor	Type 'R' (platinum-13%rhodium / platinum) thermocouples will be located within the heating chamber. Each thermocouple will be located in a protective ceramic sheath.
Temperature control	Cascade control. The standard control system senses the temperature close to the heating elements. The temperature of the load is usually slightly lower than the elements. Cascade control is used to correct this offset and utilises a second controller and type 'N' thermocouple. The load controller communicates with the element controller, calling for heat according to the load temperature and the current program or setpoint. The element controller regulates the heat according to element temperature and the requests from the load controller.
Instrumentation	The Eurotherm 2704 is a complex dual loop process controller. Input and output boards enable the process gases to be switched on and off as required. The instrument offers sixteen programmable segments, each of which may be configured as a ramp, step or dwell. The instrument software will be pre-configured for the ASTM test. The controller offers straight line process control and high stability, its dual display offering both setpoint and measured temperatures. The 2704 is a compact unit measuring just 96mm x 96mm ($^1/_4$DIN). The end zones will be monitored by two further Eurotherm instruments.

Process control	The test profile will be controlled by the main temperature controller, both temperature and gas flow will be directed through this instrument. Please note that due to the function of instrumentation, the equipment is considered to be semi-automatic – the operator is required to load the furnace and unload the furnace.
Overtemperature control	An independent thermocouple and temperature controller monitor the furnace temperature. Should an overtemperature condition occur, power to the heating elements would be cut.
Control location	The instrumentation and associated power control equipment will be housed within the integral control cabinet.
Process gas	Nitrogen and carbon dioxide are required at pressures between 1.0 and 2.0 bar. Pipe-fittings will be provided for customer connection. Propane or natural gas (0.5l/min) will be required for a pilot safety burner. Gas purity is the responsibility of the end user, reference should be made to the ASTM specification. With the exception of the propane line, the gas supplies will be divided and pass through a series of Flostat needle valves and flowmeters, allowing flow control of process gas. The gas lines will be equipped with non-return valves and rapid response solenoid valves. The gases will combine to provide a single gas inlet into the retort. The retort is of double skin construction in order to pre-heat the gas prior to entering the reduction tube. An independent purge line will enable one retort to cool whilst a second test is started (providing a second retort is available). Please note that whilst low flow alarms are provided, it is the responsibility of the end user to ensure that the gas flows are within defined tolerances. Please note that mass flow meters will not be used to control gas flow. On/off control of the gas flow will be accomplished using relay outputs from the process controller. The outputs will actuate solenoid valves in the gas lines, thus allowing automated gas changeover at specification temperature and time. Manual adjustment of the gas flow may be required during changeover.
Gas safety	A pilot gas burner is provided to burn off toxic waste gas. An ionisation type flame detector senses a flame failure and sounds an alarm. Should the flame not automatically re-establish itself within 30 seconds, process gas flow is shut down and a nitrogen purge is activated. Please note that an extraction system will be required to remove excess heat from the retort outlet.
Alarm conditions	Audible alarms are provided for the following conditions: overtemperature, low gas flow and flame failure on the gas burn off. Potentially dangerous alarm conditions will abort the process and render the equipment safe.

Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

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