

CONE CALORIMETER



Cone Calorimeter — ToronFT™ CC

ToronFT™ CC Cone Calorimeter is a state-of-the-art fire science instrument that measures heat release rate, mass loss rate, smoke production amount, smoke production rate, and other critical combustion properties of fireproof, fire-retardant, and all solid materials under precisely controlled preset conditions. Designed on the oxygen consumption principle (in which the heat release rate of a material is calculated from the oxygen concentration in the combustion product gas stream) the ToronFT™ CC delivers the most accurate, comprehensive picture of a material's combustion performance available in a laboratory instrument.

The cone calorimeter is widely recognized as the most important instrument for predicting fire hazards and evaluating the effectiveness of flame retardant prevention and treatment strategies. Its data can be directly imported into mathematical fire models to predict real-scale combustion behavior, making the ToronFT™ CC an essential resource for fire safety engineers, materials scientists, fire protection researchers, and quality inspection institutions worldwide.

APPLICATIONS

Cone Calorimeter — ToronFT™ CC Applications

- Fire retardant material manufacturers: comprehensive combustion performance characterization of coatings, treated substrates, and composite materials
- Building and construction product manufacturers: heat release and smoke production qualification for construction material fire classification
- Research institutions and universities: fundamental fire science research, mathematical fire model development, and material combustion database generation
- Third-party fire testing and certification laboratories: heat release rate testing per ISO 5660-1 and ASTM E1354

- Quality inspection departments: detection and quantification of heat release properties for regulatory compliance and product approval
- Flame retardant chemical and additive manufacturers: evaluation of flame retardant treatment effectiveness across material types



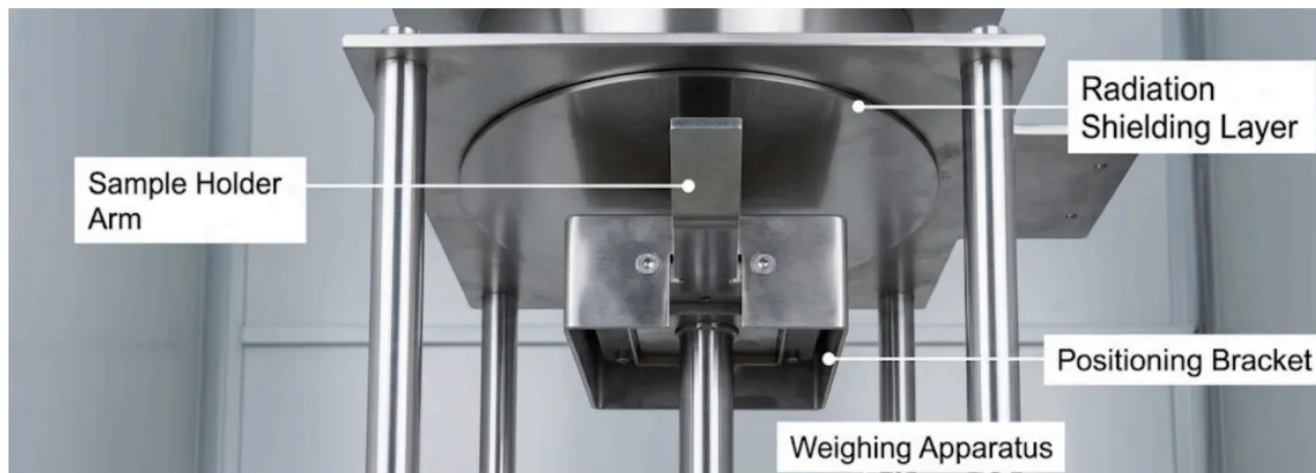
Standards

The ToronFT™ CC supports cone calorimeter testing in compliance with internationally recognized fire science and material testing standards, including:

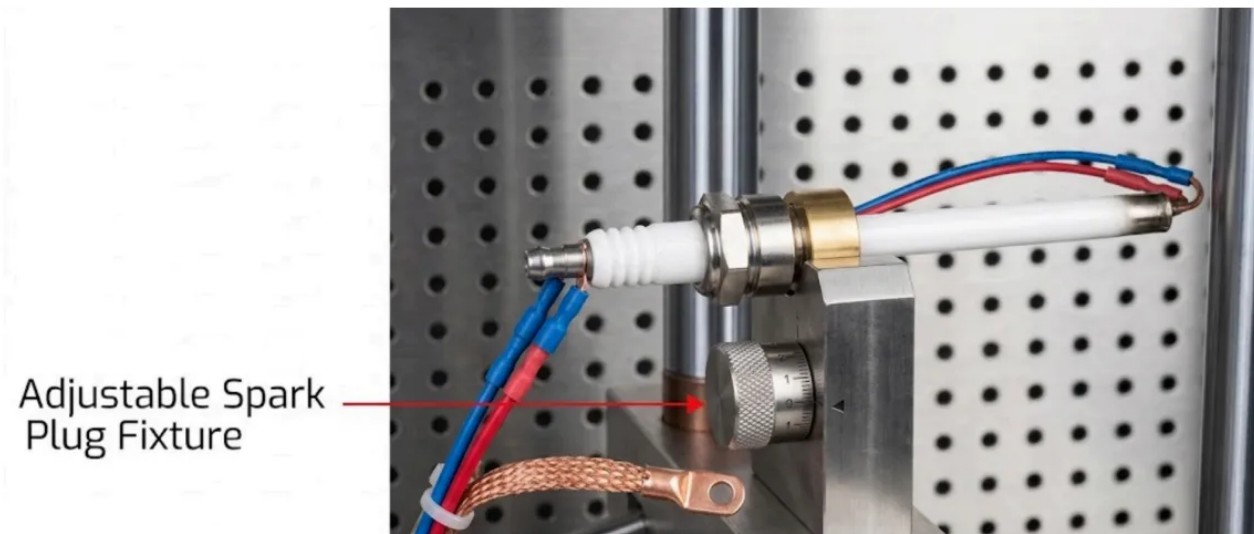
- ISO 5660-1: Reaction to fire tests — Heat release, smoke production, and mass loss rate — Heat release rate (cone calorimeter method)
- ASTM E1354: Standard test method for heat and visible smoke release rates for materials and products using an oxygen consumption calorimeter
- EN 13823: Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item (data input reference)
- ASTM E1474: Standard test method for determining the heat release rate of upholstered furniture and mattress components or composites using a bench scale oxygen consumption calorimeter
- ISO 5660-2: Reaction to fire tests — Smoke production rate (dynamic measurement)

FEATURES

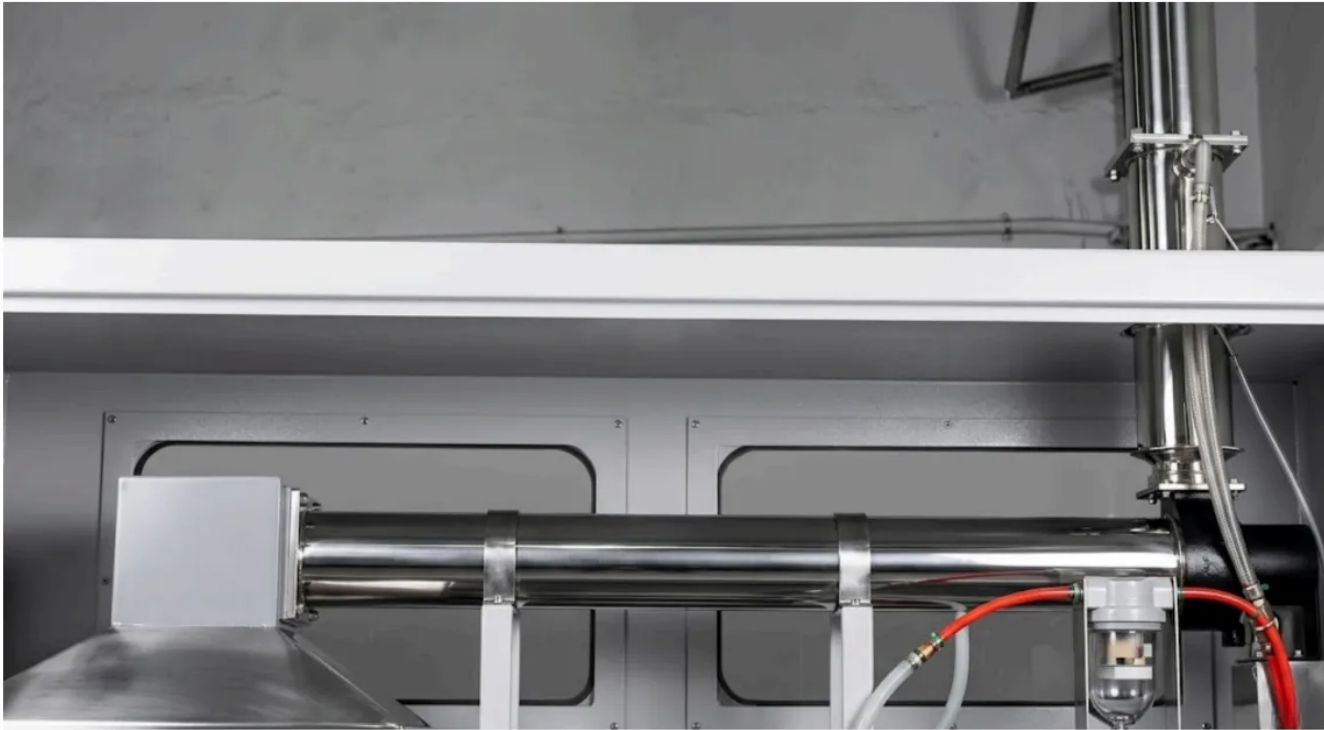
Cone Calorimeter — ToronFT™ CC Key Features



Sample mounting device



Electronic automatic ignition



Smoke exhaust system



SIEMENS Paramagnetic Gas Analysis System



Radiating cone



Calibrate burner



Weighing equipment



Heat flow meter



Radiating cone

- Measures all critical combustion parameters: heat release amount, heat release rate, mass loss rate, smoke production amount, smoke production rate — comprehensive combustion performance characterization in one test
- Based on the oxygen consumption principle: the most accurate method for heat release rate determination across all fireproof and fire-retardant solid materials
- Data suitable for import into mathematical fire models for real-scale combustion behavior prediction: essential for fire safety engineering applications
- Radiation cone device: high-temperature-resistant stainless steel outer shell, high-temperature-resistant conical heating tube plate, and accurate temperature measurement thermocouple

- Non-reflective shielding layer with connecting rod transmission and positioning mechanism: precise cone heater positioning and irradiance control
- Ignition device with safety cut-off mechanism: safe, reliable specimen ignition with automatic safety protection
- Compliant with ISO 5660-1 and ASTM E1354: the two primary international cone calorimeter test standards
- Beautiful appearance, convenient, and accurate testing: designed for sustained laboratory operation with minimal operator effort

THEORY & METHOD

Theory and Method

The cone calorimeter measures heat release rate using the oxygen consumption principle: for most organic materials, a nearly constant amount of heat (approximately 13.1 MJ per kg of oxygen consumed) is released per unit mass of oxygen consumed during combustion. By continuously measuring the oxygen concentration and flow rate in the combustion product gas stream exiting the test chamber exhaust, the instrument calculates the instantaneous heat release rate with high accuracy throughout the entire combustion event.

The ToronFT™ CC radiation cone device and control system consist of a high-temperature-resistant stainless steel outer shell, a high-temperature-resistant conical heating tube plate, and an accurate temperature measurement thermocouple. The cone heater is composed of a non-reflective shielding layer using a connecting rod transmission and positioning mechanism, along with an ignition device equipped with a safety cut-off device. The specimen is exposed beneath the cone heater at a defined irradiance level, and the resulting combustion gases are captured by the exhaust hood and analyzed for oxygen, CO, and CO₂ content. Simultaneously, smoke optical density is measured and mass loss is recorded by the load cell throughout the test event.

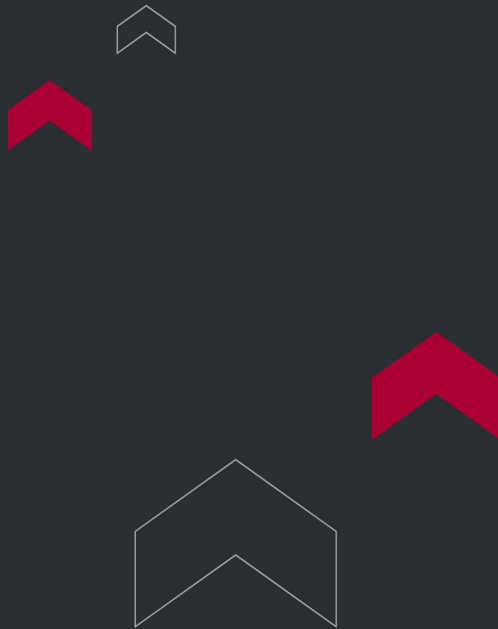
TECHNICAL SPECIFICATIONS

Cone Calorimeter — ToronFT™ CC Technical Specifications

Component / Parameter	Specification Details
General Information	
Model	ToronFT™ CC
Measurement Principle	Oxygen consumption calorimetry
Standard Compliance	ISO 5660-1; ASTM E1354
Applicable Materials	All fireproof, fire-retardant, and solid materials
Measured Parameters	• Heat release amount & rate • Mass loss rate • Smoke production amount & rate • CO and CO₂ concentration
Key Features	• Comprehensive multi-parameter measurement • High-precision automatic data acquisition and real-time monitoring
Enclosure & Construction	
Enclosure Structure	Integrated design combining the analysis cabinet and experimental operation cabinet
Observation Window	Tempered glass equipped with a pressure relief function
Radiation Cone System	
Cone Construction	High-temperature stainless steel shell with a conical heating tube plate
Power & Intensity	Rated 5000W; Radiation intensity up to 100 kW/m ²
Temperature Control	Computer + PID + SSR control for precise regulation

Component / Parameter	Specification Details
Radiation Shielding	- Material: 6 mm stainless steel (non-reflective) - Mechanism: Connecting rod transmission and positioning - Control: Automatic control system
Sensors & Heat Measurement	
Radiant Heat Flux Measurement	K-type stainless steel armored thermocouple
Heat Flow Meter System	Thermopile-type heat flow meter - Range: 0–100 kW/m² - Accuracy: ±3%
Sample Handling & Ignition	
Sample Mounting Rack	Stainless steel; adaptable to different material mounting requirements
Weighing Equipment	G&G load cell - Range: 0–6200g - Accuracy: 0.01g
Ignition Device & Circuit	- Equipped with a safety cut-off device - High-voltage spark generator (10KV transformer) - Safe, fast-response automatic ignition
Exhaust & Gas Acquisition	
Fume Exhaust System	- Fan: Adjustable wind speed (exhaust volume 0–50 g/s) - Hood: Conical design for optimized airflow collection - Flow Meter: Orifice plate flow meter with high-precision digital output
Gas Acquisition & Pretreatment	- Filtration: Three-stage (high-temp, acid/alkali resistant, ≥0.45μm accuracy) - Vacuum Pump: Flow rate 36 L/min; max outlet pressure 7 KG
Gas Analysis System	

Component / Parameter	Specification Details
Oxygen (O ₂) Analyzer	Siemens (Germany) - Range: 0–25% - Accuracy: $\pm 0.1\%$ O₂ - Response Time: <5 seconds
Carbon Dioxide (CO ₂) Sensor	AGM Sensors (Germany) - Range: 0–10% - Accuracy: $\pm 2\%$ FS - Response Time: ≤ 6 seconds
Carbon Monoxide (CO) Sensor	AGM Sensors (Germany) — Optional - Range: 0–1% - Accuracy: 0.1 ppm
Smoke Density Measurement	- Light Source: Helium-Neon laser (wavelength 632.8 nm, accuracy $\pm 5\%$) - Photodetector: Hamamatsu monocrystalline silicon (Japan)
Calibration & Gas Supply	
Calibration Burner	Equipped with an adjustable gas expansion device
Gas Supply System	Includes pressure regulating valve, pressure gauge, and Mass Flow Controller (MFC) for a stable gas source
Data & Control System	
Control Interface	Computer-based with dedicated LabelView software for real-time viewing, calculation, and processing
Data Output & Reporting	Automatic saving, test report printing, and multi-curve comparison support
Calibration Program	Built-in support for calibrating various internal devices to ensure data accuracy



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