QUALITEST™

ADVANCED TESTING TECHNOLOGIES

CONE CALORIMETER

Cone Calorimeter

The Cone Calorimeter is **a laboratory instrument used to evaluate material combustion behavior based on the oxygen consumption principle, originally developed in 1982 by V. Babrauskas at NIST.** It has since become one of the most widely used tools for fire testing and combustion research.

Samples are mounted on a specimen holder and ignited electrically under controlled heat flux. The system measures heat release rate, mass-loss rate, time to ignition, and related parameters. Based on oxygen consumption, the heat released per unit of oxygen burned is approximately 13.1 MJ/kg ± 5%.

Combustion gases are captured through integrated ducts and an exhaust hood, while sensors monitor gas concentration, temperature, and smoke pressure differences. Optical devices measure smoke density, enabling calculation of effective combustion heat and specific extinction area.

This cone calorimeter provides fast, accurate fire-performance data for product development, safety evaluation, and quality control.

ASTM AND ISO STANDARDS
for Reliable Cone Calorimeter Testing

Using a cone calorimeter in fire testing must follow strict standards. **The ASTM E1354 and ISO 5660 standards are two primary guidelines that outline the protocols for cone calorimeter testing.**

The ASTM E1354 standard establishes methods for measuring heat release rate and smoke production in materials under controlled conditions. This ensures that results are accurate, reliable, and suitable for product evaluation.

Similarly, ISO 5660 provides procedures for conducting cone calorimeter tests to maintain uniformity and consistency across international testing laboratories.

These standards are essential in fire testing, enabling labs to generate dependable data that supports product safety and industry compliance. Adhering to ASTM E1354 cone calorimeter and ISO 5660 cone calorimeter requirements builds confidence in the testing process and aligns with the safety expectations of multiple industries.

Other compliance standards :

- ASTM E1474
- ASTM F1550
- ASTM E1740
- ASTM D6113
- IMO MSC 40(64)
- BS 476-15
- NFPA 264
- NFPA 271
- CSN EN 45545-2+A1
- CSN EN 13501-1+A1

APPLICATIONS

Polymers: Provides reliable heat release rate (HRR) data, essential for material development, replacing outdated tests like UL94 and LOI.

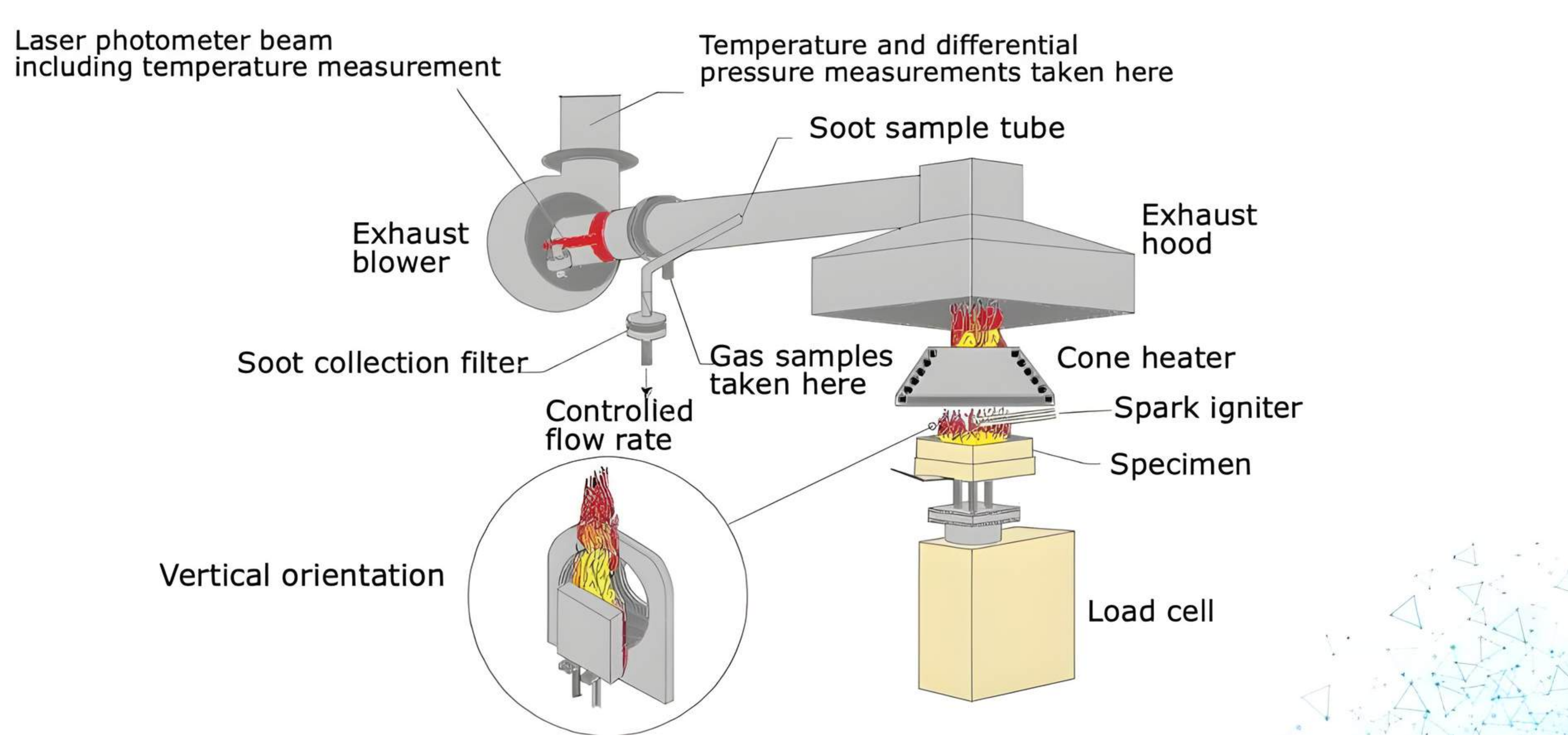
Building Materials: Used to evaluate non-combustibility and the degrees of combustibility for construction materials, aiding in compliance with fire safety codes.

Upholstered Furniture: Assesses HRR for furniture materials, assisting in fire safety research and product improvement.

Electric Wires and Cables: Predicts HRR results for large-scale vertical cable tests, providing reliable data for fire-resistant cable development.

Specialized Applications: Tests materials like wood, textiles, PVC products, and ornamental plants, supporting fire safety across diverse industries.

WORK PRINCIPLE



The cone calorimeter works by measuring oxygen loss during combustion to determine heat release. It applies controlled heat to a sample, ignites it, and measures heat release, gas emissions, and smoke. Below are its main components and functions:

Cone Heater and Spark Ignition
A conical heater applies controlled heat flux (10–100 kW/m^2) to the material, and a spark igniter starts combustion, ensuring consistent ignition and reliable comparison.

Specimen and Load Cell
The sample is placed on a load cell that measures mass loss during burning, providing key data on burning behavior and contributing to heat release calculations.

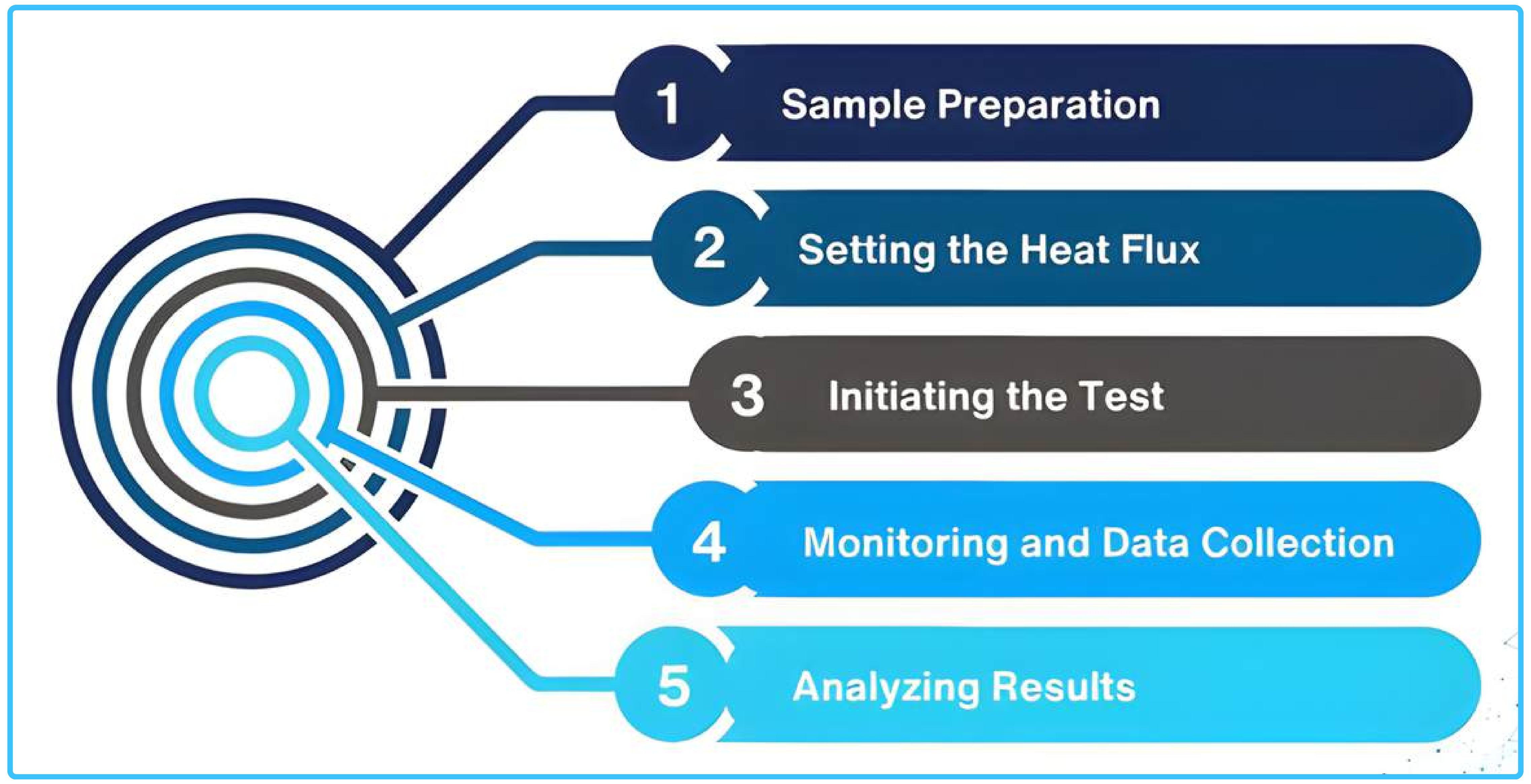
Exhaust Hood and Gas Sampling
Combustion gases are pulled into an exhaust hood with controlled flow, while oxygen, CO, and CO_2 levels are measured for accurate heat release calculations.

Oxygen Depletion Calorimetry
Heat release is calculated from oxygen consumption, with organic materials averaging about 13.1 MJ per kilogram, using corrections for fire-retardant additives.

Smoke Measurement and Soot Collection
A laser photometer measures smoke density in the exhaust duct, and a filter collects soot particles to assess visibility and fire-related toxicity.

Data Collection and Analysis
The system records ignition time, heat release rate, mass loss, gas yields, and smoke output, enabling standardized material evaluation and fire-performance studies.

OPERATING PROCEDURES



Accurate operation of a cone calorimeter requires proper sample preparation and controlled procedures. Below are the standard steps to ensure consistent and reliable results.

Sample Preparation

Place a standardized 100 × 100 × 4 mm sample on the load cell to track mass loss throughout the test. Ensure the specimen is centered in the chamber to maintain uniform heating and reliable combustion measurements.

Setting the Heat Flux

Adjust the cone heater to the desired 10–75 kW/m² range to simulate different fire intensities. Allow the heater to reach the target temperature before testing to provide stable, consistent, and controlled thermal exposure.

Initiating the Test

Expose the sample to heat and activate the igniter to begin combustion. The igniter triggers pyrolysis gases to ignite, allowing the instrument to capture the material's ignition behavior under controlled thermal conditions.

Monitoring and Data Collection

The system continuously records heat release rate, ignition time, mass loss, smoke density, and CO/CO_2 levels. These measurements reflect decomposition, fuel load, gas output, and real-time combustion performance.

Analyzing Results

Review collected data to determine total smoke, average heat of combustion, and ignition trends. Generate HRR curves to model fire behavior, evaluate safety performance, and compare material response under identical conditions.

FEATURES/ADVANTAGES

Versatile Fire Testing Compatibility
Cabinet-style calorimeter supports single-burning, cable classification, and solid-room fire tests, fully compliant with ISO 5660, ASTM E1354

Integrated Touchscreen Control Unit
A 19-inch display with industrial touchscreen provides PC-based operation and real-time monitoring, ensuring seamless control throughout testing.

High-Performance 5000W Cone Heater
Delivers 0–100 kW/m^2 radiation with PID temperature regulation, offering stable heating performance and horizontal or vertical positioning flexibility.

Precision Sample Holding System
Accommodates 100×100×50 mm specimens with 0.1 g accuracy, supporting custom ranges to meet specific material testing requirements.

Reliable High-Voltage Ignition System
Equipped with ≥10 kV spark generator and rotating cylinder, ensuring consistent ignition placement and repeatable flame initiation.

Advanced Gas Analysis Platform
Paramagnetic O_2 (0–25%) and infrared CO/CO_2 analyzers provide rapid response, high linearity, and low drift for accurate combustion gas monitoring.

FEATURES/ADVANTAGES

Laser-Based Smoke Density Measurement
Helium-neon optical system with multi-detector setup delivers precise smoke density evaluation across varying combustion conditions.

Certified SB-Type Heat Flux Meter
Measures 0–100 kW/m^2 with ±3% accuracy and ±0.5 s repeatability, supported by calibration reporting for validated thermal measurement.

Comprehensive Automated Data Capture
System records analyzers, flowmeters, and thermocouples, generating standardized digital reports on heat release, gas output, and combustion behavior.

TECHNICAL SPECIFICATIONS

SPECIFICATIONS	DETAILS
Dimension	2250 × 1000 × 2230 mm^3
Weight	538 kg (1186.5 lbs)
INSTALLATION REQUIREMENTS	
Voltage	220V, 50 Amps (110V is also available)
Ambient Temperature	10°C to 35°C
Working Gas	Compressed Air
Calibration Gas	Methane, Nitrogen, CO_2/CO Mixed Gas

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