

GAS VERTICAL TUBE BURNING VELOCITY TESTER



Gas Vertical Tube Burning Velocity Tester - ToronFT™ GBS

ToronFT™ GBS is a precision Cell Thermal Runaway Combustible Gas Burning Speed Tester utilizing the vertical tube method to characterize the burning (flame propagation) speed of combustible gases discharged during lithium battery thermal runaway events. As a critical safety testing instrument for the lithium battery industry, the ToronFT™ GBS quantifies the fundamental burning velocity of thermal runaway gas mixtures — a key parameter in battery fire hazard assessment, safety group classification, and the design of battery energy storage system (BESS) safety systems.

The ToronFT™ GBS platform integrates advanced visual image detection technology with automated image processing, providing objective, high-resolution data on flame shape and burning rate that surpasses traditional manual observation methods. The explosion-proof design ensures safe operation when testing the potentially energetic combustible gas discharges from lithium battery thermal runaway events.

APPLICATIONS

Gas Vertical Tube Burning Velocity Tester - ToronFT™ GBS Applications

- Combustible gas burning speed measurement for lithium battery thermal runaway gas discharge characterization
- Vertical tube method flame propagation speed testing for battery safety assessment programs
- Safety group classification testing of refrigerants per ANSI/ASHRAE standards (burning velocity determination)
- Gas burning speed characterization for lithium battery energy storage system (BESS) fire hazard analysis
- Research and development testing of lithium battery thermal runaway gas compositions and their fire behavior
- Regulatory compliance testing for lithium battery product certification programs requiring burning speed data



Standards

- UL 9540A: Appendix A: Vertical Tube Method for Measuring Combustion Speed (Battery Energy Storage Systems)
- ANSI/ASHRAE 34: Safety Group Classification: Vertical Tube Method for Fundamental Burning Velocity
- ISO 817: Refrigerants: Designation, Safety Classification, and Designation — Naming and Safety Requirements (Appendix C, combustible gas burning speed)
- ASTM E681: Standard Test Method for Concentration Limits of Flammability of Chemicals (Vapors and Gases)

FEATURES

Gas Vertical Tube Burning Velocity Tester - ToronFT™ GBS Key Features

- Vertical tube method burning speed measurement specifically designed for combustible gases discharged during lithium battery thermal runaway events
- Fully automated test process with automatic recording of raw test data, flame images, and system-generated judgment of test results — eliminating operator subjectivity
- Explosion-proof cut-off solenoid valve capable of withstanding instantaneous pressure surges for safe, reliable gas supply management during testing of energetic thermal runaway gas mixtures
- Explosion-proof rating compliant with NEMA standards for safe operation in potentially explosive gas environments
- Advanced visual image detection technology using a high-resolution CCD camera for real-time recording of flame status throughout the burning speed test
- Integrated image processing algorithm that automatically extracts flame shape geometry and calculates the flame burning rate from recorded images, providing objective and precise burning velocity data
- Suitable for characterizing the burning speed of refrigerant mixtures, thermal runaway gas compositions from lithium battery cells, and other combustible gas-air mixtures

THEORY & METHOD

Theory and Method

The ToronFT™ GBS employs the vertical tube method to measure the burning speed of combustible gas-air mixtures discharged during lithium battery thermal runaway. A calibrated gas-air mixture at a defined concentration is introduced into a vertical glass tube under controlled conditions. An ignition source initiates flame propagation at the open end of the tube, and the flame front travels upward (or downward, depending on the mixture) through the tube at a speed characteristic of the mixture's burning velocity.

A CCD camera records the flame status in real time throughout the propagation event. An integrated image processing algorithm analyzes the recorded flame images frame-by-frame, extracting the flame shape and calculating the flame burning rate with high accuracy and objectivity. The explosion-proof cut-off solenoid valve — capable of withstanding instantaneous pressure surges — provides rapid isolation of the gas supply in the event of an unexpected pressure spike, protecting both the system and the operator. This combination of automated image analysis and explosion-proof safety systems makes the GBS the definitive instrument for vertical tube burning speed measurement of lithium battery thermal runaway gases.

TECHNICAL SPECIFICATIONS

Gas Vertical Tube Burning Velocity Tester - ToronFT™ GBS Technical Specifications

Parameter	Specification
Product Name	Cell Thermal Runaway Combustible Gas Vertical Tube Burning Velocity Tester
Brand	ToronFT™ GBS

Parameter	Specification
Test Method	Vertical tube method
Image System	CCD camera (real-time flame recording)
Image Processing	Automated algorithm: flame shape extraction and burning rate calculation
Safety Valve	Explosion-proof cut-off solenoid valve (instantaneous pressure rated)
Explosion-Proof Rating	NEMA compliant
Data Output	Raw data, flame images, automated test result judgment
Applicable Test Media	Combustible gases from lithium battery thermal runaway, refrigerant mixtures, gas-air mixtures
Applicable Standards	UL 9540A Appendix A, ANSI/ASHRAE 34, ISO 817 Appendix C, ASTM E681



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