



Member of the FM Global Group

Examination Standard for Explosion Venting Devices

Class Number 7730

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Foreword

This standard is intended to verify that the products and services described will meet stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of this standard is to present the criteria for examination of various types of products and services.

Examination in accordance with this standard shall demonstrate compliance and verify that quality control in manufacturing shall ensure a consistent and reliable product.

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1. INTRODUCTION

1.1 Purpose

- 1.1.1 This standard describes testing and certification requirements for explosion venting devices for the protection against explosions involving combustible dust hazards.
- 1.1.2 Testing and certification criteria may include performance requirements, marking requirements, examination of manufacturing facilities, audit of quality assurance procedures, and a surveillance audit program.

1.2 Scope

- 1.2.1 This standard contains requirements for devices used to protect vessels by venting internal pressure caused by deflagrations arising from the rapid burning of suspended dust in the protected volume. These devices are commonly referred to as explosion venting devices. The following product categories and class numbers are included in the scope of this standard:

<i>Class</i>	<i>Product Category</i>
7731	Standard Explosion Venting Devices
7732	Flameless Explosion Venting Devices

- 1.2.2 A standard explosion venting device typically comprises a pressure sensitive element that is affixed to the vessel it is intended to protect, and designed to immediately open a vent area when a certain predetermined pressure is reached in the vessel. The vent area must be large enough, and vent pressure low enough, to ensure that the maximum pressure reached in the vessel from a deflagration does not exceed the maximum pressure the vessel is designed to resist.
- 1.2.3 A flameless explosion venting device typically combines a standard explosion venting device with an additional flame arresting element to minimize the external hazards that can be generated during venting, such as a flame jet, blast wave effects, and potential external explosion of vented unburned explosive mixture.

1.3 Basis for Requirements

- 1.3.1 The requirements of this standard are based on experience, research, and testing, and/or the standards of other organizations. The advice of manufacturers, users, trade associations, jurisdictions, and/or loss control specialists was also considered.
- 1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of explosion venting devices (hereinafter referred to as “devices”) for the purpose of obtaining certification.

1.4 Basis for Certification

Certification is based upon satisfactory evaluation of the product and the manufacturer in the following areas:

- 1.4.1 Examination and tests on production samples shall be performed to evaluate:
- the suitability of the product;
 - the performance of the product as specified by the manufacturer and required for certification;
 - the durability and reliability of the product.
- 1.4.2 An examination of the manufacturing facilities and audit of quality control procedures may be conducted to evaluate the manufacturer's ability to consistently produce the product that is examined and tested, and the marking procedures used to identify the product. Subsequent surveillance may be required by the certification agency in accordance with the certification scheme to ensure ongoing compliance.

1.5 Basis for Continued Certification

The basis for continued certification may include the following based upon the certification scheme and requirements of the certification agency:

- production or availability of the product as currently certified;
- continued use of acceptable quality assurance procedures;
- compliance with the terms stipulated by the certification;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory surveillance audits conducted as part of the certification agency's product surveillance program.

1.6 Effective Date

The effective date of this examination standard mandates that all products tested for certification after the effective date shall satisfy the requirements of this standard.

The effective date of this standard is twenty-four (24) months after the publication date of the standard for compliance with all requirements.

1.7 System of Units

Units of measurement used in this standard are typically United States (U.S.) customary units. These are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement; the converted equivalent value may be approximate. In certain instances, the SI units are the acceptable industry standard, and are therefore used solely in place of the U.S. customary units with no conversions. Conversion of U.S. customary units is in accordance with ANSI/IEEE/ASTM SI-10. Two units of measurement (liter and bar), outside of but recognized by SI, are commonly used in international fire protection and are used in this standard.

1.8 Normative References

The following referenced documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the cited edition applies.

ANSI/IEEE/ASTM SI 10 *American National Standard for Metric Practice*
ASTM B 117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*
ASTM D 412, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers*
ASTM E 1226, *Test Method for Pressure and Rate of Pressure Rise for Combustible Dusts*
ASTM G 155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*
NFPA 68, *Standard on Explosion Protection by Deflagration Venting*
VDI 3673, *Pressure Venting of Dust Explosions*
Chao, J. and Dorofeev, S.B. (2012) Proceedings of the 9th International Seminar on Hazard Prevention and Mitigation of Industrial Explosions, Krakow, Poland, 22-27 July 2012, *A Methodology to Evaluate the Efficiency of a Flameless Explosion-Venting Device*.

1.9 Terms and Definitions

For the purposes of this standard, the following terms shall apply:

Accepted

Installations acceptable to the authority having jurisdiction and enforcing the applicable installation rules. Acceptance is not a characteristic of a product; acceptance is installation specific for that one location/occupancy. A product "Accepted" for one installation may not be suitable at another location/occupancy.

Authority Having Jurisdiction (AHJ)

The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

Combustible Dust

A finely divided combustible particulate solid that presents a flash fire hazard or explosion hazard when suspended in air or the process-specific oxidizing medium over a range of concentrations.

Corrosion Resistant

Able to withstand damage caused by oxidation or other chemical reactions.

Deflagration

Propagation of a combustion zone at a velocity that is less than the speed of sound in an unreacted medium.

Dust Class

The categorization of the deflagration rate of a combustible dust based on the dust reactivity, K_{st} value, measured in bar m/s, where: $K_{st} = 0 < ST1 \leq 200 \text{ bar m/s} < ST2 \leq 300 \text{ bar m/s} < ST3$.

Dust Concentration

The mass per volume of suspended combustible dust.

Dust Load

The total dust mass in the protected enclosure or test vessel per unit of nominal vent area.

Dust Reactivity (K_{st})

The maximum rate of pressure rise of a dust deflagration in a 1 m³ vessel or a 20-L sphere, measured in bar m/s.

Dust, Fibrous

Dust particles in the shape of a fiber or filament, e.g., paper, textile, flock, wood shavings. Because of their shape, it is possible that these types of dusts can cause additional clogging of explosion venting devices.

Dust, Low Melting Point

Dust particles with a melting temperature less than 500°F (260°C), e.g., plastics (PVC, PP, PE, nylon) and sugar. Because of their low melting point, it is possible that melted material could cause additional clogging of explosion venting devices.

Dust, Metal

Dust particles consisting of metals, e.g., aluminum, magnesium, iron, zinc. Because of their high heat of combustion (twice or more times that of ordinary organic materials) and flame temperature, these types of dusts can have a detrimental effect on the components of explosion venting devices.

Dynamic Operating Pressure

The actual pressure at which an explosion venting device operates.

Explosion

A rapid release of energy that can generate potentially damaging overpressures. This may lead to the bursting or rupturing of an enclosure or container.

Flameless Explosion Venting Device

A type of explosion venting device that includes a flame arresting element to quench a vented explosion. These devices can minimize the external hazards that can be generated during venting, such as a flame jet, blast wave effects, and potential external explosion of vented unburned explosive mixture.

Maximum Explosion Pressure (p_{max})

The peak pressure reached in an explosion test vessel during an unvented explosion test.

Pressure Relief Valve

A reusable, resealable pressure relief device designed to operate at some pre-determined differential pressure.

Reduced Explosion Pressure (p_{red})

The peak pressure reached in an explosion test vessel during a vented explosion test.

Rupture Disc

A single-use, non-reclosing pressure relief device designed to fail at some pre-determined differential pressure.

Specified

The value of a design parameter set by the manufacturer that shall be equal to, or more conservative than, the limiting values of this standard.

Standard Explosion Venting Device

A device used to protect an enclosure against explosion hazards, consisting of a pressure sensitive element that is affixed to the vessel it is intended to protect, and designed to immediately open a vent area when a certain predetermined pressure is reached.

Static Operating Pressure

The nominal pressure at which an explosion venting device operates under hydrostatic pressure.

Vent Area

The actual open area of an explosion venting device through which a deflagration is vented.

2. GENERAL INFORMATION

2.1 Certification Application Requirements

The manufacturer shall provide the following preliminary information with any request for certification consideration:

- a complete list of all models, types, sizes, and options for the products being submitted for certification consideration;
- general assembly drawings, component drawings, materials list, anticipated marking format, nameplate format, brochures, sales literature, specification sheets, and design, installation, operation and maintenance procedures; and
- the number and location of manufacturing facilities.
- All documents shall identify the manufacturer's name, document number or other form of reference, title, date of last revision, and revision level. All documents shall be provided with English translation.

2.2 Requirements for Samples for Examination

- 2.2.1 Following authorization of a certification examination, the manufacturer shall submit samples for examination and testing. Sample requirements are to be determined by the certification agency following review of the preliminary information provided.
- 2.2.2 Requirements for samples may vary depending on design features, results of a prior or similar testing, and results of any foregoing tests.
- 2.2.3 The manufacturer shall submit samples representative of production.
- 2.2.4 It is the manufacturer's responsibility to provide any necessary test fixtures, adapters, or hardware that may be required to evaluate the system.

3. GENERAL REQUIREMENTS

3.1 Review of Documentation

- 3.1.1 During the initial investigation and prior to physical testing, the manufacturer's specifications and details shall be reviewed to assess the ease and practicality of installation and use. The certification examination results may further define the limits of the final certification.

3.2 Physical or Structural Construction Features

3.2.1 Ambient Operating Range

All devices shall operate within the ambient temperature ranges of Table 3.2.1, at minimum. Evaluations will be based on the specified minimum and maximum ambient operating temperatures, as applicable.

Table 3.2.1 *Required Ambient Operating Temperature Range*

<i>Allowable Minimum Ambient Operating Temperature °F (°C)</i>	<i>Allowable Maximum Ambient Operating Temperature* °F (°C)</i>
32°F (0°C), or lower	120°F (49°C), or higher

3.2.2 Materials

- 3.2.2.1 All components shall be made of materials suitably corrosion resistant for their intended use, as confirmed by successful performance when subjected to the requirements listed in Section 4.7 (Salt Spray Corrosion Test).
- 3.2.2.2 Any seals used in the devices shall be suitable for the intended protected atmospheres.

3.3 Markings

- 3.3.1 Easily visible nameplates or other permanent markings shall be affixed to the device, and shall display the following information at a minimum:
- manufacturer's name and address;
 - device type and model number, as traceable to the manufacturer's DIOM and/or catalog designation, as applicable;
 - the certification agency's mark of conformity;
 - overall efficiency of the device and/or reference to an application-specific table, as applicable.
- 3.3.2 Nameplates shall be made of materials which will not corrode or otherwise become illegible due to normal environmental conditions.
- 3.3.3 When hazard warnings are required, the markings should be universally recognizable.
- 3.3.4 The device's model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the certification agency's mark of conformity.
- 3.3.5 The certification agency's mark of conformity shall be displayed visibly and permanently on the product and/or packaging, as appropriate and in accordance with the requirements of the certification agency. The manufacturer shall exercise control of this mark as specified by the certification agency and the certification scheme.
- 3.3.6 All markings shall be legible and durable.

3.4 Manufacturer's Design, Installation, Operation, and Maintenance Instructions

- 3.4.1 The manufacturer shall provide information required to properly design, install, operate, and maintain the device. These instructions shall be submitted to the certification agency prior to the examination of a device.
- 3.4.2 The manufacturer's instructions for a device submitted for certification shall be evaluated based on NFPA 68, and any other relevant standards required by the local authority having jurisdiction.

3.5 Calibration

- 3.5.1 Each piece of equipment used to verify the test parameters shall be calibrated within an interval determined on the basis of stability, purpose, and usage. A copy of the calibration certificate for each piece of test equipment is required. The certificate shall indicate that the calibration was performed against working standards whose calibration is certified and traceable to an acceptable reference standard and certified by an ISO/IEC 17025 accredited calibration laboratory. The test equipment shall be clearly identified by label or sticker showing the last date of the calibration and the next due date. A copy of the service provider's accreditation certificate as an ISO/IEC 17025 accredited calibration laboratory should be available.
- 3.5.2 When the inspection equipment and/or environment is not suitable for labels or stickers, other methods such as etching of control numbers on the measuring device are allowed, provided documentation is maintained on the calibration status of this equipment.

3.6 Tolerances

Tolerances on units of measure shall be as described in Appendix B, unless otherwise specified.