



Member of the FM Global Group

Examination Standard for Open Path Detectors for Flammable Gases

Class Number 6325

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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 states testing and certification requirements for open path detectors for flammable gases.
- 1.1.2 Testing and certification criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a surveillance program.

1.2 Scope

- 1.2.1 This standard is concerned with the details of construction, performance and testing of open path (line-of sight) gas detectors that sense the presence of flammable gas or vapor concentrations in air. Based on associated requirements, this standard considers the suitability of the apparatus, or parts thereof, for use in Class I, hazardous (classified) locations as defined by the National Electrical Code® (ANSI/NFPA 70).
- 1.2.2 For apparatus used for sensing the presence of multiple gases, non-flammable toxic gases, as well as a gas that is both toxic and flammable, this document applies only to the portion sensing the presence of flammable gas or vapor.
- 1.2.3 This standard addresses flammable gas detectors intended to provide a broad indication or alarm, the purpose of which is to give warning of possible presence of a potential flammable concentration of gas or vapor.
- 1.2.4 This standard does not address gas monitoring or monitoring apparatus of the laboratory or scientific type used for analysis or measurement, apparatus used for process control and process monitoring purposes, or apparatus used for residential purposes.
- 1.2.5 This standard is written for gas monitoring apparatus that are intended to monitor gases or vapors in ambient air by measuring the spectral absorption by the gases or vapors over an extended optical path. The units of measurement and range of the gas monitoring apparatus are a mathematical integral of the gas concentration along the optical path. The units of measurement are expressed as full concentration of the lower flammable limit (100%LFL or 1LFL) multiplied by the distance, in meters, at that concentration (e.g., LFL•meter, %LFL(Avg)).
- 1.2.6 The standard is limited to instrument applications where: calibration is performed using either the gas to be monitored or another gas for which response conversion data appears in the instruction manual.

NOTE: FOR CONVENIENCE, THE SHORTER TERM “GAS” MAY BE USED AS AN ABBREVIATION FOR “FLAMABLE GAS OR VAPOR” WITHIN THIS DOCUMENT.

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 construction, testing and marking required by this standard correspond, in general, to ANSI/FM-60079-29-4.
- 1.3.3 The requirements of this standard reflect tests and practices used to examine characteristics of open path detectors for flammable gases for the purpose of obtaining certification. Open path detectors for flammable gases having characteristics not anticipated by this standard may be certified if performance equal, or superior, to that required by this standard is demonstrated.

1.4 Basis for Certification

Certification is based upon satisfactory evaluation of the product and the manufacturer in the following major 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; and as far as practical,
 - the durability and reliability of the product.
- 1.4.2 An examination of the manufacturing facilities and audit of quality control procedures may be made to evaluate the manufacturer's ability to consistently produce the product which is examined and tested, and the marking procedures used to identify the product. Subsequent surveillance shall 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 continual certification may include, but is not limited to, the following based upon the certification scheme and requirements of the certification agency:

- production or availability of the product as currently certified;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- 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 certification 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 eighteen (18) months after the publication date of the standard for compliance with all requirements.

1.7 System of Units

Where units of measurement are expressed in U.S. customary units, they are followed by their arithmetic equivalents in International System (SI) units, enclosed in parentheses. Conversions are in accordance with ANSI/IEEE/ASTM SI-10. Where units of measurement are expressed in SI units, no US customary units are provided.

1.8 Normative References

The following 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

ANSI/FM 60079-29-4 Explosive Atmospheres – Part 29-4: Gas Detectors – Performance Requirements of Open Path Detectors for Flammable Gases

FM 3600, Electrical Equipment for Use in Hazardous (Classified) Locations – General Requirements

ANSI/ISA-61010-1 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General requirements

Any portion of a gas detection instrument that is intended for installation or use in a location where gas or vapor concentration is to be detected shall be suitable for use in Class I, Division 1 or 2 or Class I, Zone 0, 1 or 2 hazardous locations in accordance with the group classification of the gas. See FM 3600.

NOTE: IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE® (ANSI/NFPA 70), ONLY INSTRUMENTS WHICH UTILIZE INTRINSIC SAFETY (ia) CAN BE APPROVED FOR USE IN CLASS I, ZONE 0. INSTRUMENTS WHICH UTILIZE FLAMEPROOF (d) EITHER ENTIRELY OR IN CONJUNCTION WITH INTRINSIC SAFETY, CANNOT BE APPROVED FOR USE IN CLASS I, ZONE 0.

1.9 Terms and Definitions

For purposes of this standard, the definitions within *ANSI/FM 60079-29-4* apply.

2 GENERAL INFORMATION

2.1 Product Information

This standard shall apply to equipment for the detection and measuring of flammable gases or vapours in ambient air by measuring the spectral absorption by the gases or vapours over extended optical paths, ranging typically from one metre to a few kilometres.

2.2 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 or services being submitted for certification consideration;
- general assembly drawings, complete set of manufacturing drawings, materials list, anticipated marking format, electrical schematics, nameplate format, brochures, sales literature, spec. sheets, 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.

2.3 Requirements for Samples for Examination

2.3.1 Following authorization of a certification examination, the manufacturer shall submit samples for examination and testing based on the following:

- The test samples will typically be a complete assembly with all components mounted in a manner consistent with the manufacturer's instructions and intended application; but the exact sample requirements will be specified by the certification agency.

2.3.2 Requirements for samples may vary depending on design features, results of prior or similar testing, and results of any foregoing tests.

2.3.3 The manufacturer shall submit samples representative of production. Any decision to use data generated using prototypes is at the discretion of the certification agency.

2.3.4 It is the manufacturer's responsibility to provide any necessary test fixtures, such as those which may be required to evaluate the open path detectors for flammable gases.

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 Markings

- 3.2.1 Marking on the product or, if not possible due to size, on its packaging or label accompanying the product, shall include the following information:

- name and address of the manufacturer or marking traceable to the manufacturer;
- date of manufacture or code traceable to date of manufacture or lot identification;
- specific model number and serial number
- 60079-29-4
- hazardous location information (if applicable);
- certification Mark. The word “APPROVED” associated with the mark may be supplemented as follows:

**APPROVED
FOR PERFORMANCE
or
APPROVED
FOR PERFORMANCE AND
HAZARDOUS (CLASSIFIED) LOCATIONS**

When hazard warnings are needed, the markings should be universally recognizable.

- 3.2.2 The model or type identification shall correspond with the manufacturer's catalog designation and shall uniquely identify the certification agency's mark of conformity.
- 3.2.3 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.
- 3.2.4 All markings shall be legible and durable.
- 3.2.5 The marking shall appear legibly and indelibly (markings shall be durable as defined by FM 3600) on each gas detection apparatus in the following manner, as applicable:
- For portable and transportable instruments, the marking shall appear both on the outside surface of the instrument and on its carrying case, if the later obscures the required markings.
 - For stationary apparatus, the marking shall appear in a location where it will be visible after installation and in direct sight during the routine periodic re-calibration and adjustment of set point(s).

- For modular control units comprising one or more control modules in a common enclosure or mounting assembly, the marking need not be repeated on each module, but may appear as a single marking on the common portion of the assembly.

3.3 Manufacturer's Installation and Operation Instructions

3.3.1 The manufacturer shall:

- prepare instructions for the installation, maintenance, and operation of the product;
- provide facilities for repair of the product and supply replacement parts, if applicable; and
- provide services to ensure proper installation, inspection, or maintenance for products of such nature that it would not be reasonable to expect the average user to be able to provide such installation, inspection, or maintenance.

3.4 Calibration

3.4.1 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.

3.4.2 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 thus equipment.

4 PERFORMANCE REQUIREMENTS

4.1 General

For purposes of this standard, the test methods within ANSI/FM-60079-29-4 apply, including the following additional requirements:

4.1.1 The tests required in this section are in *addition* to the requirements of FM 3600.

NOTE: Examination and tests required under FM 3600 shall be satisfactorily completed prior to the start of tests required in this section and any modifications or changes resulting from those requirements shall be incorporated in the instruments under test.

4.1.2 The instruments tested shall be fully representative of instruments intended for commercial production.

4.1.3 Unwarranted or false alarms shall be considered failure of the tests described below.

4.1.4 Tests shall be conducted with all equipment installed as intended for use.

4.1.5 For multiple gas sensing instruments, all unwarranted (false) alarms which require re-setting, re-adjusting, etc., to continue combustible gas detection tests shall be considered a failure.

5 OPERATIONS REQUIREMENTS

5.1 Demonstrated Quality Control Program

5.1.1 A quality assurance program is required to assure that subsequent open path gas detector(s) produced by the manufacturer shall present the same quality and reliability as the specific open path gas detector(s) examined. Design quality, conformance to design, and performance are the areas of primary concern.

- Design quality is determined during the examination and tests and may be documented in the certification report.
- Continued conformance to this standard is verified by the certifier's surveillance program.
- Quality of performance is determined by field performance and by periodic re-examination and testing.

5.1.2 The manufacturer shall demonstrate a quality assurance program which specifies controls for at least the following areas:

- existence of corporate quality assurance guidelines;
- incoming quality assurance, including testing;
- in-process quality assurance, including testing;
- final inspection and tests;
- equipment calibration;
- drawing and change control;
- packaging and shipping; and
- handling and disposition of non-conforming materials.

5.1.3 Documentation/Manual

There should be an authoritative collection of procedures/policies. It should provide an accurate description of the quality management system while serving as a permanent reference for implementation and maintenance of that system. The system should require that sufficient records are maintained to demonstrate achievement of the required quality and verify operation of the quality system.

5.1.4 Records

To assure adequate traceability of materials and products, the manufacturer shall maintain a record of all quality assurance tests performed, for a minimum period of two years from the date of manufacture.

5.1.5 Drawing and Change Control

- The manufacturer shall establish a system of product configuration control that shall allow no unauthorized changes to the product. Changes to critical documents, identified in the certification report, may be required to be reported to, and authorized by the certification agency prior to implementation for production.
- Records of all revisions to all certified products shall be maintained.

5.2 Surveillance Audit

- 5.2.1 An audit of the manufacturing facility may be part of the certification agencies surveillance requirements to verify implementation of the quality assurance program. Its purpose is to determine that the manufacturer's equipment, procedures, and quality program are maintained to insure a uniform product consistent with that which was tested and certified.
- 5.2.2 Certified products or services shall be produced or provided at, or provided from, location(s) disclosed as part of the certification examination. Manufacture of products bearing a certification mark is not permitted at any other location prior to disclosure to the certification agency.

5.3 Installation Inspections

Field inspections may be conducted to review an installation. The inspections are conducted to assess ease of application, and conformance to written specifications. When more than one application technique is used, one or all may be inspected at the discretion of the certification agency.

5.4 Manufacturer's Responsibilities

The manufacturer shall notify the certification agency of changes in product construction, components, raw materials, physical characteristics, coatings, component formulation or quality assurance procedures prior to implementation.

6 BIBLIOGRAPHY

ANSI/NFPA 70 National Electrical Code

ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories

NFPA 325 Guide to Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids