



Member of the FM Global Group

Approval Standard for Combustible Gas Detectors

Class Number 6310/6320

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Foreword

The FM Approvals certification mark 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 Approval Standards is to present the criteria for FM Approval of various types of products and services, as guidance for FM Approvals personnel, manufacturers, users and authorities having jurisdiction.

Products submitted for certification by FM Approvals shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing shall ensure a consistently uniform and reliable product. Approval Standards strive to be performance-oriented. They are intended to facilitate technological development.

For examining equipment, materials and services, Approval Standards:

- a) must be useful to the ends of property conservation by preventing, limiting or not causing damage under the conditions stated by the Approval listing; and
- b) must be readily identifiable.

Continuance of Approval and listing depends on compliance with the Master Agreement, satisfactory performance in the field, on successful re-examinations of equipment, materials, and services as appropriate, and on periodic follow-up audits of the manufacturing facility.

FM Approvals LLC reserves the right in its sole judgment to change or revise its standards, criteria, methods, or procedures.

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1 INTRODUCTION

1.1 Purpose

- 1.1.1** This standard states Approval requirements for combustible gas detection instruments.
- 1.1.2** Approval criteria may include, but are not limited to, performance requirements, marking requirements, examination of manufacturing facility(ies), audit of quality assurance procedures, and a follow-up program.

1.2 Scope

- 1.2.1** This standard is concerned with the details of construction, performance and testing of portable, mobile and stationary electrical instruments that sense the presence of combustible gas or vapor concentrations in air. This standard considers the suitability of the instruments or parts thereof for use in Class I, hazardous (classified) locations as defined by the National Electrical Code® (ANSI/NFPA 70).

NOTE: IT IS STRESSED THAT ALTHOUGH COMBUSTIBLE GAS DETECTORS WARN OF COMBUSTIBLE ATMOSPHERES THAT MAY LEAD TO AN EXPLOSION, THEY DO NOT NECESSARILY WARN OF TOXIC GAS RELEASES. IT IS ALSO STRESSED THAT FINAL AND LONG-TERM EFFECTIVENESS OF ANY COMBUSTIBLE GAS DETECTION EQUIPMENT DEPENDS HEAVILY UPON THE USER, WHO MUST BE RESPONSIBLE FOR ITS PROPER APPLICATION, INSTALLATION, USE, AND REGULAR MAINTENANCE.

- 1.2.2** This standard contains requirements for combustible gas detectors of the fixed, portable and transportable types. The following product categories and class numbers are included in the scope of this standard.

Table 1.2.2 – Product Categories and Class Numbers

Class	Product Category
6310	Portable and Transportable Gas Detectors
6320	Fixed Gas Detectors

- 1.2.3** This standard applies to line-voltage operated instruments rated at 250V nominal or less, and to portable, mobile, or stationary-type instruments supplied by battery of a non-rechargeable (primary) type or a rechargeable (secondary) type.
- 1.2.4** For intrinsically safe instruments, this standard applies only to systems which utilize defined associated intrinsically safe apparatus (protective barrier assemblies). “Entity” concept does not apply to the performance Approval of combustible gas detectors.
- 1.2.5** This standard addresses combustible gas detection instruments intended to provide an indication or alarm, the purpose of which is to give warning of potential hazard.
- 1.2.6** This standard does not address gas detection instruments of the laboratory or scientific type used for analysis or measurement, instruments used for process control and process monitoring purposes, open path (line of sight) area monitors, or instruments used for residential purposes.
- 1.2.7** This standard is written for gas detection instruments that are intended to detect gas concentrations in air in the range from zero up to the lower flammable limit (LFL), since this is the most commonly used range for instruments intended to measure or monitor the degree of explosion hazard. This does

not preclude instruments intended for higher concentration ranges, such as those intended to warn of a drop in concentration from a high value down to the upper flammable limit (UFL).

- 1.2.8** For instruments used for sensing the presence of oxygen, non-flammable toxic gases, and flammable gases or vapor concentrations in air, this standard applies only to the portion of the instrument sensing the flammable gases or vapor concentrations in air.

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, and loss control specialists was also considered.
- 1.3.2** The construction, testing and marking required by this standard correspond, in general, to ANSI/ISA-60079-29-1.
- 1.3.3** The requirements of this standard reflect tests and practices used to examine characteristics of combustible gas detectors for the purpose of obtaining FM Approval. These requirements are intended primarily as guides, and strict conformity is not always mandatory. Combustible gas detectors having characteristics not anticipated by this standard may be Approved if performance equal or superior to that required by this standard is demonstrated, or if the intent of the standard is met. Alternatively, gas detectors which do meet all the requirements identified in this standard may not be Approved if other conditions which adversely affect performance exist or if the intent of this standard is not met.

1.4 Basis for Approval

Approval 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 by FM Approvals; 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 is 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. These examinations may be repeated as part of FM Approvals' Surveillance Audit program.

1.5 Basis for Continued Approval

Continued Approval is based upon:

- production or availability of the product as currently FM Approved;
- the continued use of acceptable quality assurance procedures;
- satisfactory field experience;
- compliance with the terms stipulated in the Approval report;
- satisfactory re-examination of production samples for continued conformity to requirements; and
- satisfactory Surveillance Audits conducted as part of FM Approvals' product follow-up program.

Also, as a condition of retaining Approval, manufacturers may not change a product or service without prior authorization by FM Approvals.

1.6 Effective Date

The effective date of an Approval standard mandates that all products tested for Approval after the effective date shall satisfy the requirements of that standard. Products FM Approved under a previous edition shall comply with the new version by the effective date or else forfeit Approval.

The effective date of this Standard is January 1, 2020 for compliance with all requirements.

1.7 System of Units

Units of measurement used in this Standard are 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. Conversion of U.S. customary units is in accordance with ANSI/IEEE/ASTM SI 10.

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 undated references, the latest edition of the referenced document (including any amendments) applies. For dated references, only the cited edition applies.

ANSI/ISA-60079-29-1, “*Explosive Atmospheres – Part 29-1: Gas Detectors – Performance requirements of detectors for flammable gases*”

ANSI/IEEE/ASTM SI 10 “*American National Standard for Metric Practice*”

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

EN 50270 “*Electromagnetic compatibility. Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen*”

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 Approval Standard 3600.

NOTE 1: 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 Definitions

For purposes of this standard, the definitions within ANSI/ISA-60079-29-1 apply, including the following additional terms:

Alarm

An audible, visual or physical presentation designed to alert the instrument user that a specific level of combustible gas concentration has been reached or exceeded.

Calibration

The act of adjusting an instrument to “zero” and setting the desired “span”. This procedure is repeated frequently by the instrument user and included in certain tests called for in this standard. It verifies that the response of an instrument to a known gas concentration is within performance requirements of this standard. This may necessitate adjustment of zero, span, and alarm set point.

Calibration gas concentration

The concentration of the combustible gas in ambient air used to set the instrument span or alarm set point.

Combustible gas

Any flammable gas or vapor that, in sufficient concentration by volume in air, can become the fuel for an explosion or fire hazard. Materials that cannot produce sufficient gas or vapor to form a flammable mixture at ambient or operating temperatures and mists formed by the mechanical atomization of combustible liquids are NOT considered to be combustible gases.

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

Control unit

That portion of a gas detection instrument that is not directly responsive to the combustible gas, but which responds to the electrical signal obtained from one or more detector heads. This unit produces the output function when such gas is present at the detector head location.

Dead space

An actual or potential area within a chamber where the gas is stagnant (not mixing and/or still).

Detector head

The gas responsive portion of a gas detection instrument located in the area where sensing the presence of gas is desired. It may be integral with or removed from its control unit.

NOTE: THE DETECTOR HEAD MAY INCORPORATE, IN THE SAME HOUSING, CIRCUITRY SUCH AS SIGNAL PROCESSING AND AMPLIFYING COMPONENTS IN ADDITION TO THE GAS SENSING ELEMENT (SENSOR).

Fault signal

Audible, visible or other type of output, different from the alarm signal, permitting, directly or indirectly, a warning or indication that the apparatus is not working satisfactorily, Fault Signals and Trouble Signals are synonymous.

Flammable range

The range of flammable vapor concentrations or gas-air mixtures in which propagation of flame will occur on contact with a source of ignition.

NOTE 1: THE TERMS “LOWER FLAMMABLE LIMIT (LFL)” AND “LOWER EXPLOSIVE LIMIT (LEL)” ARE DEEMED TO BE SYNONYMOUS. THE TERMS “UPPER FLAMMABLE LIMIT (UFL)” AND “UPPER EXPLOSIVE LIMIT (UEL)” ARE DEEMED TO BE SYNONYMOUS. FOR EASE OF REFERENCE, THE TWO ABBREVIATIONS “LFL” AND “UFL” ARE USED HEREINAFTER TO DENOTE THESE TWO SETS OF TERMS. IT SHOULD BE RECOGNIZED THAT PARTICULAR AUTHORITIES HAVING JURISDICTION MAY PREFER THE USE OF ONE OF THE SETS OF TERMS AND NOT THE OTHER.

NOTE 2: THE ACTUAL GAS CONCENTRATION CORRESPONDING TO THE LOWER FLAMMABLE LIMIT OF THE SPECIFIC GAS SHALL BE THE VALUE SHOWN FOR THAT GAS IN THE LATEST EDITION OF NATIONALLY RECOGNIZED DOCUMENTS, FOR EXAMPLE, NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 325 GUIDE TO FIRE HAZARD