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Standard

Performance Requirements, Combustible Gas Detectors



The International Society for Measurement and Control

ISA-S12.13, Part I, Performance Requirements, Combustible Gas Detectors

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Preface

This preface, as well as all footnotes and annexes, is included for informational purposes and is not part of ISA-S12.13, Part I.

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Foreword

This standard is based primarily on the initiative of the Canadian Standards Association, which resulted in Standard C22.2 No. 152-1976.¹ The preface to that document, written by James E. Duncan of the Canadian Standards Association, is reprinted below for clarification of the concepts involved.²

This standard was initiated through industry effort in order to uphold and improve the level of electrical safety and safety-oriented performance of combustible gas detection instruments.

Throughout the development of the Standard the basic Subcommittee was augmented at several of its meetings by a substantial number of expert representatives from the oil and gas producing and transporting industries, the oil refining industry, the petro-chemical industry, the mining industry and other similar interests, representing "users" of this type of equipment. This included people responsible for the selection, application, installation, and maintenance of combustible gas detection instruments in this Standard have been designed to answer many of the expressed needs of such "users" based on their collective experience in the application and use of such instruments in actual service in the Canadian industrial environment.

This Standard establishes a minimum level of safety-oriented performance capability by requiring that:

- a) All such equipment pass certain tests, devised to measure the instrument's capability to properly respond to a variety of exposures simulating conditions and occurrences which may reasonably be expected to occur in actual service;
- b) All such equipment be provided with certain minimum features of construction deemed necessary to permit proper safe operation, ease of necessary adjustments and reliability;
- c) Each unit be provided with a comprehensive set of installation and operating instructions to permit the user to properly install, operate, and adjust the equipment, and to properly acquaint him with the capabilities and limitations of the equipment.

Moreover, this Standard provides that, if claims are made for performance levels or construction features in excess of the minimum levels in the Standard's basic requirements, the testing procedures and requirements be modified to verify all such superior claims. This is intended to encourage further advancements in the state of the art, and to give free rein to natural competitive development in this field, while still ensuring that any instrument he obtains is capable of performing at least to this minimum level.

Instrument capability alone cannot ensure that the use of these instruments will properly safeguard areas or locations where combustible gases or vapors may be

¹This standard was revised in 1984. See [Annex A](#) for reference information.

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or are present. The level of safety obtained depends heavily not only upon the user having a full knowledge of the limitations of the instrument, but also upon proper selection for the particular situation, proper installation and especially upon frequent periodic maintenance and adjustment.

To properly safeguard any particular area, the user must also have a basic knowledge of gas/vapor properties and phenomena (how gases and vapors propagate, whether the gases are heavier or lighter than air, etc.), and the conditions which may prevail in the areas being protected (direction and velocity of gas movement, humidity and temperature variation, presence of particulates or detrimental contaminants, ease of gaining access for periodic maintenance and adjustment, etc.), in order to select an instrument suitable for these conditions and locate it where it will be effective for its intended function.

Anyone using this Standard as an aid in selecting or applying combustible gas detection instruments should review the conditions described for the various tests (both in the body of the Standard and in the Appendix A³) and compare them to the actual conditions which may prevail in the locations to be protected. If actual conditions are likely to be more severe than the minimum test conditions in any respect, the user should seek an instrument having superior properties.

It is stressed that the final and long-term effectiveness of any combustible gas detection equipment depends heavily upon the user himself, who must be responsible for its proper application, installation, proper use and regular maintenance.

The reader's attention is particularly directed to the fact that, in developing the test requirements and acceptance criteria contained in this Standard, the Subcommittee which took part in its preparation had in mind the specific test apparatus and test technique then in use or being developed by one specific testing agency, as described in Appendix A³ of this Standard.

It is most important, therefore, in relating the test requirements of this Standard to conditions likely to arise in actual service, or in attempting to establish correlations with tests performed by different testing agencies, to realize and appreciate that the significance of the test results obtained is subject to interpretation based on the actual test apparatus and technique used. To ensure that the original intent of this Standard is met, therefore, the test technique and apparatus used must be as nearly as possible identical to that described in Appendix A.³

³ The following ISA Standard does not include the appendix from the Canadian document; therefore, references to Appendix A are not applicable.

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1 Scope

1.1 This standard addresses the details of construction, performance, and testing of portable, mobile, and stationary electrical instruments used for sensing the presence of combustible gas or vapor concentrations in ambient air. Parts of such instruments may be installed or operated in Class I hazardous (classified) locations and gaseous mines in accordance with codes and standards specified by authorities having jurisdiction. (See [Annex A](#).)

1.2 This standard applies to line-voltage operated instruments rated at 600 V nominal or less, and to portable, mobile, or stationary-type instruments utilizing a battery of a nonrechargeable (primary) type or a rechargeable (secondary) type.

1.3 This standard addresses combustible gas detection instruments intended to provide an indication or alarm, the purpose of which is to give a warning of potential hazard.

1.4 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.

1.5 This standard is written for gas detection instruments that are intended to measure gas concentrations in air in the range from zero up to the lower flammable (explosive) limit.

1.6 For instruments used for sensing the presence of multiple gases, this standard applies only to the portion sensing the presence of combustible gas or vapor.

2 Purpose

2.1 Part I of this standard provides minimum requirements for the performance of combustible gas detection instruments and thereby enhances the safety of operations employing these instruments.

2.2 Part II of this standard* establishes user criteria for the installation, operation, and maintenance of combustible gas detection instruments.

*[ISA-RP12.13, Part II, 1987](#), "*Installation, Operation, and Maintenance of Combustible Gas Detection Instruments*"

3 Definitions

3.1 alarm set point: The selected gas concentration level(s) at which an indication, alarm, or other output function is initiated.

3.2 calibration: The act of adjusting an instrument to "zero" and setting the desired "span."

3.3 clean air: Air that is free of combustible gases and contaminating substances.

3.4 combustible gas: Any substance that exists in the gaseous or vapor state at normal atmospheric temperature and pressure and that is capable of being ignited and rapidly oxidizing when mixed with proper proportions of air or oxygen.

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" within this standard.

3.5 control unit: That portion of a multipart gas detection instrument that is not directly responsive to the combustible gas, but that responds to the electrical signal obtained from one or more detector heads to produce an indication, alarm, or other output function if gas is present at the detector head location.

3.6 detector head: That gas-responsive portion of a multipart gas detection instrument that is located in the area where sensing the presence of combustible gases is desired. Its location may be integral with or remote from its control unit.

NOTE—The detector head may incorporate additional circuitry such as signal-processing or signal-amplifying components or circuits in addition to the gas-sensing element in the same housing.

3.7 diffusion: A method by which the atmosphere being monitored gains access to the gas-sensing element by natural molecular movement.

3.8 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—For purposes of this standard, the terms "lower flammable limit (LFL)" and "lower explosive limit (LEL)" are deemed to be synonymous, and likewise 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" may be used hereafter to denote these two sets of terms. It should be recognized that particular authorities having jurisdiction may have overriding requirements that dictate the use of one of these sets of terms and not the other.

3.9 full-scale gas concentration: 100 percent of the actual marked full-scale concentration value.

NOTE—For purposes of this standard, the actual gas concentration corresponding to the lower and upper flammable limits shall be the values shown in the latest edition of nationally recognized documents. See [Annex A](#).