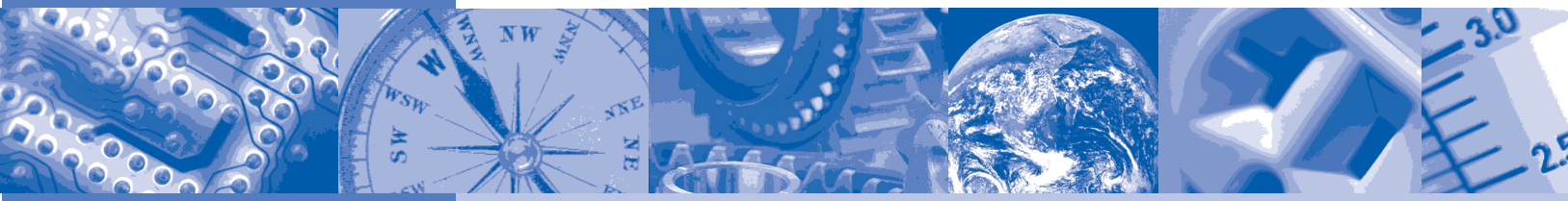
ANSI/ISA–12.13.01–2003
(IEC 61779-1 through 5 Mod)



Performance Requirements for Combustible Gas Detectors

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ISA–The Instrumentation, Systems, and Automation Society

ANSI/ISA-12.13.01 (IEC 61779-1 through 5 Mod)
Performance Requirements for Combustible Gas Detectors

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Preface

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Foreword

All text of IEC 61779-1 through IEC 61779-5 is included in this document. U.S. National Deviations are shown by ~~strikeout~~ through deleted text and underline under added text. Tables or portions of tables that are to be deleted are shown as shaded; figures to be deleted are marked with the overlay “Figure X Deleted.” All added tables are numbered by a table number corresponding to the applicable subclause for improved clarity and are NOT underlined. Notes appear in the table titles showing the tables as added material.

For Part 1, there are four annexes and an introduction. Annex A is normative and Annexes B, C, D and the introduction are informative and are not considered part of this document. For Part 2 through 5, Annex A for each part is informative and is not considered part of this document.

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Introduction

This section provides an informative historical perspective on the development of combustible gas detection performance standards.

Need for Gas Detection Standards

From the early 1920's to the mid 1970's, gas detection requirements were mostly limited to the detection of combustible gases to warn of explosion hazards. This need created an industry aimed at providing portable and fixed apparatus that intermittently or continuously sample potentially hazardous areas and provide alarms and indications.

The Mine Safety and Health Administration (formerly known as the U.S. Bureau of Mines) has been certifying apparatus for use in mines since the late 1930's.

Since the mid 1970's, detectors submitted to some of the independent nationally recognized test laboratories (or NRTL's) for general hazardous area certifications also had to be tested to the lab's own performance standard.

Several standards organizations have provided standards and recommended practices to help users in the selection and application of these apparatus.

Existing Gas Detector Standards

Parts 22 and 27 of Title 30 of the U.S. Code of Federal Regulations provided some of the earliest requirements for apparatus that detect methane in mines. Part 22 - issued in 1935, applied to Portable Methane Detectors and part 27 - issued in 1966, applied to Methane Monitoring Systems. These two documents do still exist, but are fairly general in nature. They are each about 4 to 6 pages long and provide brief instructions on construction and performance requirements, but also include instructions on submitting apparatus for evaluation and notification of design changes after approval. No new work on these documents is in process at this time.

The Canadian standard - C22.2 No 152 - Combustible Gas Detection Instruments - was first issued in 1976 and last revised in 1988. The revision added an exclusion of open path detectors, revised the step change response test so that the acceptance criteria will now be to reach 90% of applied concentration (100% LFL gas), and Temperature Variation test was changed to include portables.

Factory Mutual issued its Combustible Gas Detectors Approval Standard 6310/6320 in 1982 and updated it in 1989 and 2001.

The American National Standards Institute (ANSI) adopted the ISA's S12.13, part 1 - titled Performance Requirements, Combustible Gas Detectors which was issued in 1986 and part 2 - Installation, Operation, and Maintenance of Combustible Gas Detection Instruments - issued in 1987.

The ANSI/ISA S12.13 part I performance standard - originally issued in 1975 - was based on the CSA document. It was revised slightly and released in October 1995 while work continued on issues that were balloted and released in 2000.

The document is cited in two sections of the U.S. federal regulations pertaining to offshore and loading platforms and preliminary discussions have proposed that it be adopted in other areas such as Parts 22 and 27 of Title 30 of the Code of Federal Regulations for mines and the parts of the National Electrical Code pertaining to equipment in hazardous locations.

The British Standards Institute issued EN50054 - Electrical Apparatus for the Detection and Measurement of Combustible Gases general requirements and test methods - in 1991 which supersedes the withdrawn BS 6020 which was issued in 1981. The associated documents EN50055 and EN50056 cover performance requirements for mines products indicating up to 5% by volume and 100% by volume methane. EN50057 and EN50058 document performance requirements for group II (non-mines) apparatus indicating up to 100% LEL and 100% by volume respectively.

The Australian Standard 2275 is titled Electrical Equipment for Explosive Atmospheres - Combustible Gas Detection Instruments. Part 1 is General Requirements for Explosion Protection of Electrical Apparatus and Systems. Part 2 is Performance Requirements. UL 1484 and BS 7348 are residential combustible gas detector standards and BS 6959 is a recommended practice for non-mines combustible gas detector applications. These documents are slightly outside the main focus of the SP12.13 subcommittee.

U.S. efforts in support of combustible gas detection applications

In the United States, a subcommittee of the ISA (the Instrumentation, Systems and Automation Society - formerly known as the Instrument Society of America) is working to support users and manufacturers of combustible gas detectors. The SP12.13 (Performance Requirements for Combustible Gas Detectors) subcommittee is a subcommittee of ISA's SP12 (Electrical Equipment for Hazardous Locations) committee. In turn, the ISA is accredited by the American National Standards Institute (ANSI) as a standard writing body and provides technical advisory groups to ANSI. Also, ANSI established the United States National Committee of the IEC, which serves as the ANSI sponsored, U.S. electrotechnical industry supported and staffed, interface with its international parent organization the International Electrotechnical Commission - IEC. The USNC also serves as the U.S. electrotechnical industry interface with the European Committee for Electrotechnical Standardization - CENELEC, the Pacific Area Standards Congress – PASC, the Pan American Standards Commission - COPANT, and the Council for Harmonization of Electrotechnical Standardization of North America - CANENA. For those not familiar with the IEC, it could be considered the sister organization to ISO. Based in Geneva, Switzerland, the IEC handles all topics pertaining to electrotechnical devices and ISO handles everything else. In short, the SP12.13 subcommittee serves as the technical advisory group (TAG) to the U.S. National Committee of the IEC. Other organizations throughout the world include subcommittees similar to SP12.13 (for example CENELEC TC 31-9 in Europe and subcommittees in Australia, South Africa and others).

The purpose of the SP12.13 subcommittee is "to actively monitor applications, be a source for technical information, and prepare documents as needed to improve minimum performance of combustible gas detection instruments." The scope of the subcommittee includes:

Preparing standards and recommended practices for performance, installation, operation, and maintenance of combustion gas detection instruments.

Promoting current technology for proper use and maintenance to enhance safety of hazardous areas.

Serving as a source of technical information.

Supporting efforts to obtain international standards for these instruments.

The types of instruments and applications that the subcommittee is involved with are those involving industrial safety and do not include residential monitors or process analysis equipment.

The subcommittee maintains a balance between users, manufacturers, and others (government agencies, third party test labs, etc.) in accordance with ISA and ANSI requirements, although this is not necessary at the subcommittee level. The group meets formally twice a year in conjunction with SP12 meetings.

The ISA SP92 subcommittee is involved with detectors of oxygen and toxic gases.

The SP12.13 subcommittee is currently involved in the support of four documents:

The ANSI/ISA S12.13 part I performance standard as mentioned earlier in this text.

The document is cited in two sections of the U.S. federal regulations pertaining to offshore and loading platforms and preliminary discussions have been started to propose that it be adopted in other areas such as Parts 22 and 27 of Title 30 of the Code of Federal Regulations for mines and the parts of the National Electrical code pertaining to equipment in hazardous locations.

The RP 12.13 part II recommended practice was last issued in 1987 and should have been reaffirmed in 1997, but recommended practices are not as firm as standards on review rules. The first section had been placed into electronic media in preparation for editing, but we decided that we would adopt the IEC guide when it issues. The remainder of the document (Bureau of Mines 627) and Bureau of Mines 680 were released as technical reports as they contain very useful information pertaining to flame and explosion hazards.

Edition 1 of the IEC 31L performance standard (61779-1 through 5) was approved and published in 1998. Work to generate the U.S. version has been completed with National Deviations in ANSI/ISA-12.13.01-2002.

The IEC 61779-6 guide was released in 1999.

Some of the technical issues related to existing and new technologies continue to be debated by SP12.13 for clarifications or adjustment of testing procedures, but several more significant issues are worth mention.

EMI

By subjecting some gas detectors to radio or electromagnetic interference or electrostatic discharge, one could cause the apparatus to go into alarm or stop functioning all together. Many older standards either do not include requirements, or the requirements are considered to be inadequate. The present version of ANSI/ISA-12.13.01-2002 requires only that the apparatus indication not vary by more than 10% when a 5-watt radio is transmitting 1 meter away at two frequencies. Most committee members agree that the requirements should include a sweep of frequencies and that the field strength should be specified rather than the power rating of a radio because the resulting field depends on the efficiency of the last stage and antenna of the radio. Also, with the introduction of more communications products, wider frequencies need to be considered. Because more stringent requirements are likely to add cost to the products, care is being taken to propose only minimum EMI requirements that will satisfy most applications.

The subcommittee had developed a matrix of available EMI standards that could be cited, but this leaves the task of identifying the adequate test conditions and acceptance criteria. Another reference being considered is EN50270-1999. Manufacturers of communications equipment are being polled for information on expected field characteristics in the typical user's environment.

IR technology response

The introduction of infrared gas detectors brought with it improved long-term stability, but also slightly longer step recovery times on some models. This is because the sensor does not promote diffusion of the gas to the sensor surface as in catalytic sensors and because the sensor signal is non-linear. Some manufacturers propose that recovery time requirements should be relaxed in order to allow users to take advantage of lower maintenance costs and sensor poison resistance of IR sensors. Another important detail is that IR sensors do not detect hydrogen, but this is not a concern in most applications.

Open path

Open path monitors measure hydrocarbon concentrations over a fixed distance. The application of this technology for safety monitoring is debated because there could be a high concentration at one point on the path and none along the rest of the path, resulting in a low indication when in fact, a hazard exists. Others note that part of the open path question is similar to that of how many point detectors are needed to insure safety.

Entity concept & modular systems

The question being debated here is if it is wise to allow for approval of components of gas detection systems that could be matched with other components selected by the user. Detector heads might only contain the sensor, or could include additional electronics, which might require more testing. When the user matches these components with control units or data acquisition systems, the complete system is not guaranteed to perform within stated requirements.

Software quality requirements

With the increasing use of microprocessors and software in apparatus, subcommittee members have voiced concern that the gas detector standards should include requirements that will assure software quality. Also, should the standard prohibit connection of safety devices on same bus with non-safety components? Existing documents being considered include UL1998, prEN50271, ANSI/ISA-84.01-1996, and IEC 61508.

Harmonization

In many cases, harmonization and use of mutual recognition agreements between third party test labs will likely increase the amount of testing and cost associated with certifying a detector with one lab. However, because the one certificate would be accepted throughout the world, overall cost will be lower for those companies that address the world market. The users benefit because they can buy detectors from manufacturers anywhere in the world and be assured of product quality by citing the IEC standards.

Guidance for the selection, installation, use and maintenance of gas detecting apparatus are set out in ~~IEC~~ Publication ~~61779-6~~ ANSI/ISA-RP12.13.02 (IEC 61779-6 Mod).

Part 1 (IEC 61779-1 Mod)
Electrical apparatus for the detection and measurement of flammable gases — Part 1: General requirements and test methods

1 General

1.1 Scope

1.1.1 This part of ~~IEC 61779~~ ANSI/ISA-12.13.01 (IEC 61779-1 through 5 Mod) specifies general requirements for construction and testing and describes the test methods that apply to portable, transportable and fixed apparatus for the detection and measurement of flammable gas or vapour concentrations with air. The apparatus, or parts thereof, are intended for use in potentially explosive atmospheres (see ~~2.1.8~~ 2.1.3) ~~and in mines susceptible to firedamp~~. This document is supplemented by the following parts, concerning the specific requirements for performance of the various types of apparatus:

~~Part 2: Performance requirements for group I (mines) apparatus indicating up to a volume fraction of 5 % methane in air~~

~~Part 3: Performance requirements for group I (mines) apparatus indicating up to a volume fraction of 100 % methane in air~~

Part 4: Performance requirements for group II (non-mining) apparatus indicating up to a volume fraction of 100% lower explosive limit

Part 5: Performance requirements for group II (non-mining) apparatus indicating up to a volume fraction of 100% gas

NOTE 1 ~~IEC 61779-1~~ Part 1 of ANSI/ISA-12.13.01 (IEC 61779-1 through 5 Mod), in association with the parts referred to above, is intended to provide for the supply of apparatus giving a level of safety and performance suitable for general-purpose applications. However, for specific applications a prospective purchaser (or an appropriate authority) may additionally require apparatus to be submitted to particular tests or approval. For example, group I apparatus (i.e. apparatus to be used in mines susceptible to firedamp) may not be permitted to be used without the additional and prior approval of the relevant authority in mines under its jurisdiction. Such particular tests/approval are to be regarded as additional to and separate from the provisions of the standards referred to above and do not preclude certification to or compliance with these standards.

NOTE 2 ~~Group I and~~ Group II apparatus indicating up to a volume fraction of 100% methane and group II apparatus indicating up to a volume fraction of 100% gas are suitable for use only with the specific gases for which they have been calibrated.

NOTE 3 For the purpose of this document, 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 hereinafter 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.

NOTE 4 For the purpose of this document, the terms “explosive gas atmosphere” and “flammable gas atmosphere” are deemed to be synonymous.

1.1.2 This document is applicable when an apparatus manufacturer makes any claims regarding any special features of construction or superior performance that exceed these minimum requirements. All such claims shall be verified and the test procedures shall be extended or supplemented where necessary to verify the claimed performance. The additional tests shall be agreed between the manufacturer and test laboratory.