

INTERNATIONAL STANDARD

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First edition
1998-04

Electrical apparatus for the detection and measurement of flammable gases – Part 1: General requirements and test methods

*Appareils électriques de détection et de mesure
des gaz combustibles –*

*Partie 1:
Règles générales et méthodes d'essai*

IEC 61779-1:1998

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Commission Electrotechnique Internationale
International Electrotechnical Commission
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICAL APPARATUS FOR THE DETECTION
AND MEASUREMENT OF FLAMMABLE GASES –****Part 1: General requirements and test methods**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61779-1 has been prepared by subcommittee 31L: Electrical apparatus for the detection of flammable gases, of IEC technical committee 31: Electrical apparatus for explosive atmospheres.

The text of this standard is based on the following documents:

FDIS	Report on voting
31L/47/FDIS	31L/52/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

Annex A forms an integral part of this standard.

Annexes B and C are for information only.

A bilingual version of this standard may be issued at a later date.

INTRODUCTION

Guidance for the selection, installation, use and maintenance of gas detecting apparatus are set out in IEC 61779-6: Electrical apparatus for the detection and measurement of flammable gases – Part 6: Guidelines for the selection, installation, use and maintenance¹⁾.

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1) To be published.

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 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) and in mines susceptible to firedamp. This standard is supplemented by the following standards, concerning the specific requirements for the performance of the various types of apparatus:

IEC 61779-2: *Performance requirements for group I apparatus indicating up to a volume fraction of 5 % methane in air*

IEC 61779-3: *Performance requirements for group I apparatus indicating up to a volume fraction of 100 % methane in air*

IEC 61779-4: *Performance requirements for group II apparatus indicating up to a volume fraction of 100 % lower explosive limit*

IEC 61779-5: *Performance requirements for group II apparatus indicating up to a volume fraction of 100 % gas*

NOTE 1 – IEC 61779-1, in association with the standards 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 the 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, 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 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 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.

1.1.2 This standard 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.

1.1.3 This standard is applicable to flammable gas detection apparatus intended to provide an indication, alarm or other output function, the purpose of which is to give a warning of a potential explosion hazard and, in some cases, to initiate automatic or manual protective action(s).

1.1.4 This standard is applicable to apparatus, including the integral sampling systems of aspirated apparatus, intended to be used for commercial and industrial safety applications.

1.1.5 This standard does not apply to external sampling systems, or to apparatus of laboratory or scientific type, or to apparatus used only for process control purposes.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61779. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 61779 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(351):1975, *International Electrotechnical Vocabulary (IEV) – Chapter 351: Automatic control*

IEC 60079-0:1983, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*

IEC 60079-1:1990, *Electrical apparatus for explosive gas atmospheres – Part 1: Construction and verification test of flameproof enclosures of electrical apparatus*

IEC 60079-2:1983, *Electrical apparatus for explosive gas atmospheres – Part 2: Electrical apparatus – type of protection "p"*

IEC 60079-5:1967, *Electrical apparatus for explosive gas atmospheres – Part 5: Sand-filled apparatus*

IEC 60079-6:1995, *Electrical apparatus for explosive gas atmospheres – Part 6: Oil immersion "o"*

IEC 60079-7:1990, *Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety "e"*

IEC 60079-10:1986, *Electrical apparatus for explosive gas atmospheres – Part 10: Classification of hazardous areas*

IEC 60079-11:1991, *Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety "i"*

IEC 60079-13:1982, *Electrical apparatus for explosive gas atmospheres – Part 13: Construction and use of rooms or buildings protected by pressurization*

IEC 60079-14:1984, *Electrical apparatus for explosive gas atmospheres – Part 14: Electrical installations in explosive gas atmospheres (other than mines)*

IEC 60079-15:1987, *Electrical apparatus for explosive gas atmospheres – Part 15: Electrical apparatus, with type of protection "n"*

IEC 60079-18:1992, *Electrical apparatus for explosive gas atmospheres – Part 18: Encapsulation "m"*

IEC 60079-19:1993, *Electrical apparatus for explosive gas atmospheres – Part 19: Repair and overhaul for apparatus used in explosive atmospheres (other than mines or explosives)*

IEC 60079-20:1996, *Electrical apparatus for explosive gas atmospheres – Part 20: Data for flammable gases and vapours, relating to the use of electrical apparatus*

IEC 61000-4-1:1992, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 1: Overview of immunity tests – Basic EMC publication*

IEC 61000-4-3:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test – Basic EMC publication*

ISO 2738:1987, *Permeable sintered metal materials – Determination of density, oil content, and open porosity*

ISO 4003:1977, *Permeable sintered metal materials – Determination of bubble test pore size*

ISO 4022:1987, *Permeable sintered metal materials – Determination of fluid permeability*

ISO 6142:1981, *Gas analysis – Preparation of calibration gas mixtures – Weighing methods*

ISO 6145-1:1986, *Gas analysis – Preparation of calibration gas mixtures – Dynamic volumetric methods – Part 1: Methods of calibration*

ISO 6145-3:1986, *Gas analysis – Preparation of calibration gas mixtures – Dynamic volumetric methods – Part 3: Periodic injections into a flowing gas stream*

ISO 6145-4:1986, *Gas analysis – Preparation of calibration gas mixtures – Dynamic volumetric methods – Part 4: Continuous injection method*

ISO 6145-6:1986, *Gas analysis – Preparation of calibration gas mixtures – Dynamic volumetric methods – Part 6: Sonic orifices*

ISO 6147:1979, *Gas analysis – Preparation of calibration gas mixtures – Saturation method*

2 Definitions

For the purpose of this part of IEC 61779, and of the standards listed in 1.1.1, the following definitions apply:

2.1 Gas properties

2.1.1

ambient air

normal atmosphere surrounding the apparatus

2.1.2

clean air

air that is free of flammable gases and interfering or contaminating substances

2.1.3

explosive gas atmosphere

mixture with air, under normal atmospheric conditions, of flammable material in the form of gas or vapour, in which, after ignition, combustion spreads throughout the unconsumed mixture

NOTE 1 – This definition specifically excludes dusts and fibres in suspension in air. Mists are not covered by this standard.

NOTE 2 – Although a mixture that has a concentration above the upper flammable limit (see 2.1.9) is not an explosive atmosphere, in certain cases for area classification purposes, it is advisable to consider it as an explosive gas atmosphere.

NOTE 3 – Normal atmospheric conditions include variations above and below the reference levels of 101,3 kPa and 20 °C provided the variations have a negligible effect on the explosive properties of the flammable materials.

2.1.4

firedamp

flammable gas, consisting mainly of methane, found naturally in mines

2.1.5

flammable gas

gas or vapour which, when mixed with air in a certain proportion, will form an explosive atmosphere

NOTE – For the purpose of this standard the term "flammable gas" includes flammable vapours.

2.1.6

lower flammable limit (LFL)

volume ratio of flammable gas or vapour in air below which an explosive gas atmosphere will not be formed

2.1.7

poisons (of sensors)

substances which lead to temporary or permanent loss of sensitivity of the sensors

2.1.8

potentially explosive atmosphere

atmosphere that could become explosive (The danger is a potential one.)

2.1.9

upper flammable limit (UFL)

volume ratio of flammable gas or vapour in air above which an explosive gas atmosphere will not be formed (see also note 2 to 2.1.3)

2.1.10

volume ratio (v/v)

ratio of the volume of a component gas to the volume of the gas mixture under specified conditions of temperature and pressure

2.1.11

zero gas

gas which is free of flammable gases, and interfering and contaminating substances, the purpose of which is calibration/adjustment of the apparatus zero

2.2 Types of instruments

2.2.1

alarm-only apparatus

apparatus having an alarm but not having a meter or other indicating device that would allow measurement of the deviations permitted by the requirements of the appropriate standards listed in 1.1.1

2.2.2

aspirated apparatus

combustible gas detecting apparatus that obtains the gas by drawing it to the gas sensor – for example, by means of a hand-operated or electric pump

2.2.3

continuous duty apparatus

combustible gas detecting apparatus that is powered for long periods of time, but may have either continuous or intermittent sensing

2.2.4

diffusion apparatus

apparatus in which the transfer of gas from the atmosphere to the gas sensor takes place by random molecular movement, i.e. under conditions in which there is no aspirated flow

2.2.5

fixed apparatus

apparatus that is intended to have all parts permanently installed at a given location

2.2.6

group I apparatus

electrical apparatus for mines susceptible to firedamp

2.2.7

group II apparatus

electrical apparatus for places with a potentially explosive atmosphere, other than mines susceptible to firedamp

2.2.8

portable apparatus

spot-reading or continuous duty apparatus that has been designed to be carried readily from place to place and to be used while it is being carried. A portable apparatus is battery powered and includes, but is not limited to

- a) a hand-held apparatus, typically less than 1 kg, suitable for one-handed operation without accessories (such as sampling probes, sample lines), fitted,
- b) personal monitors, similar in size and mass to the hand-held apparatus, that are continuously operating (but not necessarily continuously sensing) while they are attached to the user, and
- c) another apparatus that can be operated by the user while it is carried either by hand, or by means of a shoulder strap or carrying harness, and which may or may not have a hand-directed probe.

2.2.9

spot-reading apparatus

apparatus intended to operate for periods of only a few minutes for irregular intervals

2.2.10

transportable apparatus

apparatus not intended to be portable, but which can be moved readily from one place to another

2.3 Sensors

2.3.1

remote sensor

sensor that is not integral to the main body of the apparatus

2.3.2

sensor

assembly in which the sensing element is housed and which may also contain associated circuit components

2.4 Supply of gas to instrument

2.4.1

sample line

pipeline by means of which the gas being sampled is conveyed to the sensor

2.4.2

sampling probe

separate sample line which is attached to the apparatus as required, that may or may not be supplied with the apparatus. It is usually short (e.g. in the order of 1 m) and rigid (although it may be telescopic), but it may be connected by a flexible tube to the apparatus

2.5 Signals and alarms

2.5.1

alarm set point

fixed or adjustable setting of the apparatus that is intended to preset the level of concentration at which the apparatus will automatically initiate an indication, alarm or other output function

2.5.2

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

2.5.3

latching alarm

alarm that, once activated, requires deliberate action to be deactivated

2.6 Times

2.6.1

drift

variation in the apparatus indication with time, at any fixed gas concentration level (including clean air)

2.6.2

final indication

indication given by the apparatus after stabilization

2.6.3

minimum time of operation (spot-reading apparatus)

time interval between the initiation of a measurement procedure and the time when the apparatus indication reaches a stated percentage of the final indication

2.6.4

measuring span

algebraic difference between the upper and lower limits of the measuring range [IEV 351-05-39 modified]

2.6.5

stabilization

state when three successive readings of an apparatus, taken at two minute intervals, indicates no changes greater than ± 1 % of the measuring range

2.6.6**time of response $t(x)$ (not applicable to spot-reading apparatus)**

time interval, with the apparatus in a warmed-up condition, between the time when an instantaneous variation in volume ratio is produced at the apparatus inlet and the time when the response reaches a stated percentage (x) of the final indication

2.6.7**warm-up time (not applicable to spot-reading apparatus)**

time interval, with the apparatus in a stated atmosphere, between the time when the apparatus is switched on and the time when the indication reaches and remains within the stated tolerances (see figures 1 and 2)

2.7 Miscellaneous**2.7.1****nominal supply voltage**

voltage that is given by manufacturers as the recommended operating voltage of their gas detection apparatus

2.7.2**special tool**

tool required to gain access to, or to adjust, controls. The design of the tool is intended to discourage unauthorized interference with the apparatus

2.7.3**type of protection**

measures applied in the construction of electrical apparatus to prevent ignition of the surrounding explosive atmosphere by such apparatus (see 3.1.2)

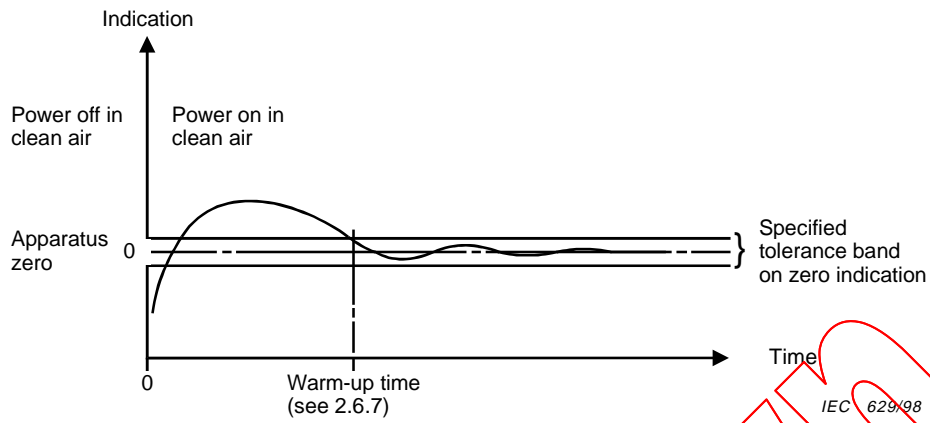


Figure 1 – Warm-up time in clean air (typical)

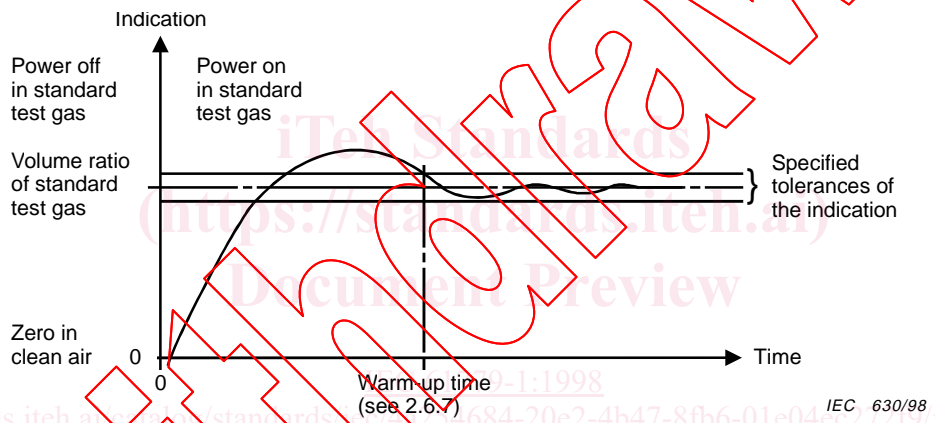


Figure 2 – Warm-up time in standard test gas (typical)