
**Hydrogen detection apparatus —
Stationary applications**

Détecteurs d'hydrogène — Applications fixes

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 26142 was prepared by Technical Committee ISO/TC 197, *Hydrogen technologies*.

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Introduction

Over the course of several years, international efforts have been initiated for the development of necessary regulations, codes and standards required for the introduction of hydrogen energy systems in consumer environments. Such codes and standards usually require a safety system to detect hydrogen concentrations before a fraction of the flammable or explosive limit is reached, in order to allow for purging, shut-off, and similar safety operations.

This International Standard provides requirements for stationary hydrogen detection apparatus, covering both performance requirements and test methods. This International Standard is intended to cover situations where the user desires the ability to detect hydrogen leaks and monitor hydrogen concentrations relevant to safety. This International Standard is primarily intended for hydrogen detection apparatus at vehicle refuelling stations, where a high level of safety management is required. This sector has an immediate need for this standard and is expected to be the main application for such apparatus, but this standard can also be applied to other stationary installations where the detection of hydrogen is required.

This International Standard is not intended to exclude any specific technologies that meet the performance requirements herein.

This International Standard contains the important quantitative and technical specifications against the danger of hydrogen leakage. This standard will promote international cooperation under easy-to-understand requirements, by leading to widespread use of hydrogen energy.

Benefits to be gained by the implementation of this International Standard include using the performance requirements in the standard to overcome safety concerns and aiding in development of the hydrogen fuel infrastructure.

In this International Standard, attention is concentrated on specific requirements related to performance and testing of hydrogen detection apparatus, such as a specific detection range for single and multiple safety systems, selectivity, poisoning, fast response time, and hydrogen-specific test methods needed by the hydrogen energy industry. This International Standard focuses primarily on stationary hydrogen technologies whose main purpose is to produce, store and handle hydrogen, and not on systems that might generate hydrogen as an undesirable by-product. The purpose of a hydrogen detection apparatus according to this standard is to mitigate risk from unintended hydrogen releases within a wide range of hydrogen concentrations including those exceeding the lower flammability limit.

Hydrogen-related facilities might be required to have the ability to detect hydrogen concentrations before a specified concentration of hydrogen or fraction of flammable limit is reached, in order to allow for single and/or multilevel safety operations, such as nitrogen purging or ventilation and/or system shut-off; or there might be a desire to detect hydrogen concentrations above the lower flammability limit, in order to monitor concentrations following a release. The hydrogen detection apparatus described in this International Standard can detect the hydrogen leak concentration at multiple points determined by users to realize such multilevel safety operations.

Hydrogen detection apparatus — Stationary applications

1 Scope

This International Standard defines the performance requirements and test methods of hydrogen detection apparatus that is designed to measure and monitor hydrogen concentrations in stationary applications. The provisions in this International Standard cover the hydrogen detection apparatus used to achieve the single and/or multilevel safety operations, such as nitrogen purging or ventilation and/or system shut-off corresponding to the hydrogen concentration. The requirements applicable to the overall safety system, as well as the installation requirements of such apparatus, are excluded. This International Standard sets out only the requirements applicable to a product standard for hydrogen detection apparatus, such as precision, response time, stability, measuring range, selectivity and poisoning.

This International Standard is intended to be used for certification purposes.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14687-1:1999, *Hydrogen fuel — Product specification — Part 1: All applications except proton exchange membrane (PEM) fuel cell for road vehicles*

ISO 14687-1:1999/Cor.2:2008, *Hydrogen fuel — Product specification — Part 1: All applications except proton exchange membrane (PEM) fuel cell for road vehicles — Technical Corrigendum 2*

IEC 61000-4-1, *Electromagnetic compatibility (EMC) — Part 4-1: Testing and measurement techniques — Overview of IEC 61000-4 series*

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

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

IEC 60079-0:2008, *Explosive atmospheres — Part 0: Equipment — General requirements*

IEC 60079 (all parts), *Explosive atmospheres*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

alarm set point

fixed or adjustable setting of the hydrogen detection apparatus that is intended to select the hydrogen volume fraction at which an indication, an alarm or another output function will automatically be activated

- 3.2**
ambient air
normal atmosphere surrounding the hydrogen detection apparatus
- 3.3**
aspirated hydrogen detection apparatus
hydrogen detection apparatus that samples the gas to be detected by introducing it to the hydrogen sensor(s) in a forced manner (e.g. use of a gas sampling pump or induction of a flow through a pressure differential)
- 3.4**
clean air
air that is free of flammable gases, interfering or contaminating substances, and dust
- 3.5**
control unit
part of hydrogen detection apparatus that is commonly referred to as the apparatus body and which excludes its remote sensor(s) and connections, if any
- 3.6**
data collecting interval
time interval between the time when an indication data is collected and the time when the next indication data is corrected
- 3.7**
diffusion chamber
chamber that can be sealed with controlled conditions of temperature, humidity and test-gas volume fraction, used for performing the test on the hydrogen detection apparatus
- 3.8**
fault signal
audible, visible or other type of signal different from the alarm signal, providing, directly or indirectly, a warning or an indication that the hydrogen detection apparatus is not working satisfactorily
- 3.9**
final indication
indication given by the hydrogen detection apparatus after stabilization
- 3.10**
hydrogen detection apparatus
assembly with an integrated or a remote hydrogen sensor that is intended to detect and measure the hydrogen volume fraction over a declared measuring range
- NOTE 1 The hydrogen detection apparatus may be provided with a single or multiple alarm set points.
- NOTE 2 The hydrogen detection apparatus may include one or more built-in alarm indications, output contacts for alarm and/or electrical signals for alarm.
- 3.11**
hydrogen sensing element
component that provides a measurable, continuously changing physical quantity in correlation to the surrounding hydrogen volume fraction
- 3.12**
hydrogen sensor
assembly, which contains one or more hydrogen sensing elements and may also contain circuit components associated with the hydrogen sensing elements, that provides a continuously changing physical quantity or signal in correlation to the physical quantity provided by the hydrogen sensing element(s)

3.13**hydrogen volume fraction**

hydrogen content expressed as the ratio of the volume of hydrogen to the total volume of all components in the gas mixture under standard conditions of temperature and pressure of 20 °C and 101,325 kPa

3.14**interferant**

any substance that affects the sensitivity of a hydrogen sensing element by contacting or adhering to it

3.15**latching alarm**

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

3.16**measuring range**

range, defined by the lowest and highest hydrogen volume fractions, within which a hydrogen detection apparatus can measure hydrogen volume fractions within the specified accuracy

3.17**multi-level detection**

continuous detection and monitoring of hydrogen volume fraction with multiple alarm set points

3.18**nominal supply voltage**

voltage corresponding to the manufacturer-recommended operating voltage for the hydrogen detection apparatus

3.19**poisoning**

phenomenon caused by any interferant that permanently affects the sensitivity of a hydrogen sensing element

3.20**remote hydrogen sensor**

hydrogen sensor that is remotely connected to a hydrogen detection apparatus

3.21**selectivity**

response of the hydrogen detection apparatus to hydrogen compared with the response to other gases

NOTE If there is high selectivity to hydrogen, the results will be less ambiguous and the cross-sensitivity to other gases will be low.

3.22**sensitivity**

ratio of change produced in the apparatus by a known volume fraction of hydrogen

NOTE 1 Depending on the context, this can refer to the minimum change in the volume fraction of hydrogen that the apparatus will detect.

NOTE 2 High sensitivity implies that low volume fractions can be measured.

3.23**special state**

state of the hydrogen detection apparatus other than those in which monitoring of hydrogen volume fractions takes place, for example, warm-up, calibration mode or fault condition

3.24**stabilization**

state in which three successive readings of a hydrogen detection apparatus, taken at 30 s intervals, indicate no changes greater than 5 % of the volume fraction of the test gas