

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Workplace atmospheres –  
Part 1: Gas detectors – Performance requirements of detectors for toxic gases**

**Atmosphères des lieux de travail –  
Partie 1: Détecteurs de gaz – Exigences d'aptitude à la fonction des détecteurs  
de gaz toxiques**

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**Partie 1: Détecteurs de gaz – Exigences d'aptitude à la fonction des détecteurs de gaz toxiques**

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**WORKPLACE ATMOSPHERES –****Part 1: Gas detectors –  
Performance requirements of detectors for toxic gases**

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International Standard IEC 62990-1 has been prepared by Joint Working Group (JWG) 45 of IEC technical committee 31: Equipment for explosive atmospheres in cooperation with ISO technical committee 146: Air quality, sub-committee 2: Workplace atmospheres.

It is published as a dual logo standard.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
31/1463/FDIS	31/1480/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62990 series, published under the general title *Workplace atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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- withdrawn,
- replaced by a revised edition, or
- amended.

The contents of the corrigendum of December 2019 have been included in this copy.

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## INTRODUCTION

This part of IEC 62990 specifies general requirements for construction, testing and performance of equipment intended to measure the concentration of toxic gas and vapour in workplace atmospheres and other industrial and commercial applications. The performance requirements are intended to apply under environmental conditions present at the site of operation. However, because a wide range of environmental conditions are encountered in practise, this document specifies requirements that have to be fulfilled by equipment when tested under prescribed laboratory conditions.

This document applies to the following types of equipment: Health Monitoring (HM) and Safety Monitoring (SM). For a given measurement task of Type HM equipment the range over which the requirements must be met depends on the occupational exposure limit value. However, for most toxic gases and vapours the occupational exposure limit values have not been harmonized at the international level. Therefore, it was decided to use a reference value instead of the occupational exposure limit value for the performance tests. The list of reference values is given in Annex A. The reference values chosen are equal to or close to the occupational exposure limit values used in different countries but are intended to be used only for type testing equipment without any legal implications.

Electrical equipment used for the direct detection and direct concentration measurement of toxic gases and vapours generate readings in clean air (nominally zero), which vary with environmental conditions and time. This document therefore includes test methods and requirements for acceptable variations in measured values at application of zero gas and of defined test gases.

For gas detection equipment (including additional function for detecting flammable gas and/or oxygen, consideration should be given to the relevant standards.

General requirements for construction, testing and performance of gas detectors for flammable gases and vapours are set out in IEC 60079-29-1, *Explosive atmospheres – Part 29-1: Gas detectors – Performance requirements of detectors for flammable gases*.

General requirements for construction, testing and performance of open path detectors for flammable gases are set out in IEC 60079-29-4, *Explosive atmospheres – Part 29-4: Gas detectors – Performance requirements of open path detectors for flammable gases*.

Guidance for the selection, installation, use and maintenance of gas detecting equipment is set out in IEC 60079-29-2: *Explosive atmospheres – Part 29-2, Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen*.

Guidance for functional safety of fixed gas detection systems is set out in IEC 60079-29-3: *Explosive atmospheres – Part 29-3, Gas detectors – Guidance on functional safety of fixed gas detection systems*.



## WORKPLACE ATMOSPHERES –

### Part 1: Gas detectors – Performance requirements of detectors for toxic gases

#### 1 Scope

This part of IEC 62990 specifies general requirements for design, function and performance, and describes the test methods that apply to portable, transportable, and fixed equipment for the detection and concentration measurement of toxic gases and vapours in workplace atmospheres and other industrial and commercial applications.

This document is applicable to continuously sensing equipment whose primary purpose is to provide an indication, alarm and/or other output function the purpose of which is to indicate the presence of a toxic gas or vapour in the atmosphere and in some cases to initiate automatic or manual protective action(s). It is applicable to equipment in which the sensor generates an electrical signal when gas is present.

This document applies to two types of equipment:

- Type HM (Health Monitoring) ‘occupational exposure’ equipment:  
For occupational exposure measurement, the performance requirements are focused on uncertainty of measurement of gas concentrations in the region of Occupational Exposure Limit Values (OELV). The upper limit of measurement will be defined by the manufacturer in accordance with 4.2.1.
- Type SM (Safety Monitoring) ‘general gas detection’ equipment:  
For general gas detection applications (e.g. safety warning, leak detection), the performance requirements are focused on alarm signalling. The upper limit of measurement will be defined by the manufacturer according to the intended use of the equipment.

In general, the requirements for accuracy will be higher for Type HM equipment than for Type SM equipment. The same equipment may meet the requirements of both Type HM and Type SM.

For equipment used for sensing the presence of multiple gases this document applies only to the detection of toxic gas or vapour.

This document is not applicable to equipment:

- with samplers and concentrators such as sorbents or paper tape having an irreversible indication;
- used for the measurement of gases and vapours related to the risk of explosion;
- used for the measurement of oxygen;
- used only in laboratories for analysis or measurement;
- used only for process measurement purposes;
- used in the domestic environment;
- used in environmental air pollution monitoring;
- used for open-path (line of sight) area gas measurement;
- used for ventilation control in car parks or tunnels.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

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

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61000-4-29, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61326-1, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

## 3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

### 3.1 gas properties

#### 3.1.1 ambient air

normal atmosphere surrounding the equipment

#### 3.1.2 clean air

air that is free of gases or vapours which the sensor is sensitive to or which influence the performance of the sensor

#### 3.1.3 occupational exposure limit value OELV

limit of the time-weighted average of the concentration of a chemical agent in the air within the breathing zone of a worker in relation to a specified reference period

Note 1 to entry: The term “limit value” is often used as a synonym for “occupational exposure limit value”, but the term “occupational exposure limit value” is preferred because there is more than one limit value (e.g., biological limit value and occupational exposure limit value).

Note 2 to entry: Occupational exposure limit values (OELVs) are often set for reference periods of 8 h, but can also be set for shorter periods or concentration excursions.

[SOURCE: ISO 18158:2016, 2.1.5.4, modified (Note 2 to entry is shortened)]

#### **3.1.4**

##### **reference value**

<for type HM equipment> value used as the basis to specify requirements such as measuring range, resolution and alarm set point

Note 1 to entry: The term reference value is used in this document because for most toxic gases and vapours the occupational exposure limit values have not been harmonized at the International level.

#### **3.1.5**

##### **poisons**

<for sensing elements> substances that lead to temporary or permanent change of performance, particularly loss of sensitivity of the sensing element

#### **3.1.6**

##### **toxic gas**

gas or vapour that can be harmful to human health and/or the performance of persons due to its physical or physico-chemical properties

Note 1 to entry: For the purpose of this document, the term “toxic gas” includes “toxic vapours”.

#### **3.1.7**

##### **volume fraction**

quotient of the volume of a specified component and the sum of the volumes of all components of a gas mixture before mixing, all volumes referring to the pressure and the temperature of the gas mixture

Note 1 to entry: The volume fraction and volume concentration take the same value if, at the same state conditions, the sum of the component volumes before mixing and the volume of the mixture are equal. However, because the mixing of two or more gases at the same state conditions is usually accompanied by a slight contraction or, less frequently, a slight expansion, this is not generally the case.

#### **3.1.8**

##### **zero gas**

gas recommended by the manufacturer, which is free of toxic gases and interfering and contaminating substances, the purpose of which is calibration or adjustment of the equipment zero

#### **3.1.9**

##### **standard test gas**

test gas with a composition specified for each item of equipment and gas and/or vapour to be used for all tests unless otherwise stated

#### **3.1.10**

##### **time-weighted average concentration**

##### **TWA concentration**

concentration of gas in air averaged over a reference period

#### **3.1.11**

##### **reference period**

specified period of time for which the occupational exposure limit value of a chemical agent applies

Note 1 to entry: The reference period is usually 8 h for long-term measurements and 15 min for short-term measurements.

[SOURCE: ISO 18158:2016, 2.1.5.7, modified (term “biological agent” deleted as not relevant to the current document)]

## **3.2 types of equipment**

### **3.2.1**

#### **alarm-only equipment**

equipment with an alarm but not having an indication of measured value

### **3.2.2**

#### **aspirated equipment**

equipment that samples the gas by drawing it to the gas sensor

Note 1 to entry: A hand operated or electric pump is often used to draw gas to the sensor.

### **3.2.3**

#### **automatically aspirated equipment**

aspirated equipment with an integral pump or separate pump, which is connected directly to the equipment

### **3.2.4**

#### **continuous duty equipment**

equipment that is powered for long periods of time, but may have either continuous or intermittent sensing

Note 1 to entry: Within this document, all equipment is regarded as continuous duty.

### **3.2.5**

#### **diffusion equipment**

equipment in which the transfer of gas from the atmosphere to the sensor takes place without aspirated flow

### **3.2.6**

#### **fixed equipment**

equipment fastened to a support, or otherwise secured in a specific location when energized

### **3.2.7**

#### **portable equipment**

equipment intended to be carried by a person during its operation

Note 1 to entry: Portable equipment is battery powered and includes, but is not limited to

- a) hand-held equipment, typically less than 1 kg, which requires use of only one hand to operate,
- b) personal monitors, similar in size and mass to the hand-held equipment, that are continuously operating while they are attached to the user, and
- c) larger equipment that can be operated by the user while it is carried either by hand, by a shoulder strap or carrying harness and which may or may not have a hand directed probe.

### **3.2.8**

#### **transportable equipment**

equipment not intended to be carried by a person during operation, nor intended for fixed installation

### **3.2.9**

#### **gas detection transmitter**

fixed gas detection equipment that provide a conditioned electronic signal or output indication to a generally accepted industry standard (such as 4-20 mA), intended to be utilized with separate gas detection control units or signal processing data acquisition, central monitoring and similar systems, which typically process information from various locations and sources including, but not limited to gas detection equipment

**3.2.10****gas detection control unit**

equipment intended to provide display indication, alarm functions, output contacts or alarm signal outputs or any combination when operated with remote sensor(s)

**3.2.11****separate gas detection control unit**

equipment intended to provide display indication, alarm functions, output contacts or alarm signal outputs or any combination when operated with gas detection transmitter(s)

**3.2.12****equipment with integral sensor(s)**

equipment that provides display indication, alarm functions, output contacts and/or alarm signal outputs using a sensor which is within or directly assembled to the equipment housing

**3.2.13****accessory**

component which can be fitted to the equipment for special purpose

EXAMPLE: External gas pump, sampling probe, hoses, collecting cone, weather protection device.

**3.3****sensors****3.3.1****sensing element**

part of the sensor which is sensitive to the gas/vapour to be measured

**3.3.2****sensor**

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

**3.3.3****integral sensor**

sensor which is within or directly assembled to the equipment housing

**3.3.4****remote sensor**

sensor which is installed separately, but is connected to a gas detection control unit, gas detection transmitter, or to transportable or portable equipment

**3.4****supply of gas to equipment****3.4.1****sample line**

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

Note 1 to entry: Accessories such as filter or water trap are often included in the sample line.

**3.4.2****sampling probe**

separate accessory sample line which is optionally attached to the equipment

Note 1 to entry: It is usually short (e.g. of the order of 1 m) and rigid, although it can be telescopic. In some cases, it is connected by a flexible tube to the equipment.

### **3.4.3 adjustment**

procedure carried out to minimize the deviation of the measured value from the test gas concentration

Note 1 to entry: When the equipment is adjusted to give an indication of zero in clean air, the procedure is called 'zero adjustment'.

### **3.4.4 calibration**

procedure which establishes the relationship between a measured value and the concentration of a test gas

Note 1 to entry: If the deviation at calibration is too high, usually an adjustment will be carried out subsequently.

### **3.4.5 field calibration kit**

means of presenting test gas to the equipment for the purpose of calibrating, adjusting or verifying the operation of the equipment

Note 1 to entry: The field calibration kit can be used for verifying the operation of the alarms if the concentration of the test gas is above the alarm set-point.

Note 2 to entry: A mask for calibration and test is an example of a field calibration kit.

### **3.4.6 mask for calibration and test**

device that can be attached to the equipment to present a test gas to the sensor in a reproducible manner

## **3.5 signals and alarms**

### **3.5.1 alarm set point**

setting of the equipment at which the measured concentration will cause the equipment to initiate an indication, alarm or other output function

### **3.5.2 TWA alarm set point**

setting of the equipment at which the measured time weighted average concentration will cause the equipment to initiate an indication, alarm or other output function

### **3.5.3 indication**

representation of the measured value on an output or display

Note 1 to entry: The indication may be affected by suppression of indication, filtering or averaging.

### **3.5.4 fault signal**

audible, visible or other type of output, different from the alarm signal, permitting, directly or indirectly, a warning or indication that the equipment is not working satisfactorily

### **3.5.5 latching alarm**

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

### **3.5.6 measured value**

calculated concentration of gas and/or vapour that results from processing sensor signal

Note 1 to entry: The measured value may be further processed before indication on output or display (e.g. time-weighted average, suppression of indication, etc.).

### 3.5.7

#### **measuring principle**

type of physical or physico-chemical detection principle and the measurement procedure to determine the measured value

### 3.5.8

#### **special state**

any state of the equipment other than those in which monitoring of gas concentration and/or alarming is the intent

Note 1 to entry: Special state includes warm-up, calibration mode or fault condition.

### 3.5.9

#### **indication range**

range of measured values of gas concentration over which the equipment is capable of indicating (see Figure 1).

### 3.5.10

#### **lower limit of indication**

smallest measured value within the indication range

SEE Figure 1)

### 3.5.11

#### **upper limit of indication**

largest measured value within the indication range

SEE Figure 1.

### 3.5.12

#### **measuring range**

range of measured values of gas concentration over which the accuracy of the equipment lies within specified limits

SEE Figure 1.

### 3.5.13

#### **lower limit of measurement**

smallest measured value within the measuring range

SEE Figure 1.

Note 1 to entry: The lower limit of measurement is always zero for type SM equipment.

### 3.5.14

#### **upper limit of measurement**

largest measured value within the measuring range

SEE Figure 1.

Note 1 to entry: Indications below the lower limit of measurement or above the upper limit of measurement will not necessarily meet the requirements of this document.