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Ships and marine technology — Specifications for gas detectors intended for use on board ships —

Part 1: Portable gas detectors for atmosphere testing of enclosed spaces

Navires et technologie maritime — Spécifications pour les détecteurs de gaz destinés à être utilisés à bord des navires —

Partie 1: Détecteurs de gaz portables pour les essais atmosphériques des espaces clos

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Foreword

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The committee responsible for this document is ISO/TC 8, *Ships and marine technology*, Subcommittee SC 1, *Lifesaving and fire protection*.

ISO 19891 consists of the following parts, under the general title *Ships and marine technology — Specifications for gas detectors intended for use on board ships*:

— *Part 1: Portable gas detectors for atmosphere testing of enclosed spaces* [Publicly Available Specification]

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Introduction

This part of ISO/PAS 19891 specifies performance, gases to be measured, tolerances for gas measurement, and testing requirements of portable gas detectors used for testing of the atmosphere in enclosed spaces on board ships prior to entry into those spaces, as required by SOLAS regulation XI-1/7 “Atmosphere testing instrument for enclosed spaces”.

This part of ISO/PAS 19891 specifies the characteristics that portable gas detectors should be assessed against for items such as: which gases can be measured, sensitivities, indications, alarm levels, protection against shock, temperature and water ingress, and additional requirements for spaces or areas where a risk of explosion exists.

This part of ISO/PAS 19891 specifies the marine environmental conditions in which portable gas detectors are expected to be used.

This part of ISO/PAS 19891 does not define differences between gases and vapours, nor does it give technical detail on calculations and methodology for explosive limits or operational exposure levels. The intent of this part of ISO/PAS 19891 is to simplify the subject to the essentials and use references for the actual scientific standards if more detailed explanations are required.

This part of ISO/PAS 19891 does not provide a specification on how to use portable gas detectors, or how to enter enclosed spaces.

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Ships and marine technology — Specifications for gas detectors intended for use on board ships —

Part 1:
Portable gas detectors for atmosphere testing of enclosed spaces

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1 Scope

This part of ISO/PAS 19891 provides specifications in performance, gases to be measured, sensitivities, indications, alarm levels, protection against shock, temperature and water ingress, and testing requirements of portable gas detectors used for atmosphere testing of enclosed spaces on board ships prior to entry into those spaces.

This part of ISO/PAS 19891 specifies suitable portable gas detectors for compliance with SOLAS regulation XI-1/7 "Atmosphere testing instrument for enclosed spaces", and can be used for deciding whether portable gas detectors available on the market are suitable for compliance with these SOLAS requirements.

NOTE 1 SOLAS regulation XI-1/7 requires appropriate portable atmosphere testing instrument or instruments to be carried on board ships by 1 July 2016. The SOLAS regulation states that, as a minimum, the appropriate portable atmosphere testing instrument or instruments be capable of measuring concentrations of oxygen, flammable gases or vapours, hydrogen sulphide and carbon monoxide prior to entry into enclosed spaces.

For the purpose of measurement of concentrations of flammable gases or vapours, this part of ISO/PAS 19891 specifies the flammable gas as either "methane" or "propane and butane", and requires clear marking of types of flammable gases which can be measured by the portable gas detectors. For an optimal use of ISO/PAS 19891, it should be noted that flammable vapours/gases which are not marked, cannot be measured, or detected by the portable gas detector.

NOTE 2 Iso-butane can be used as calibration gas of portable gas detectors measuring propane and butane.

This part of ISO/PAS 19891 does not give any indication of the toxicity of the flammable gases.

2 Normative references

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

SOLAS regulation XI-1/7, *Atmosphere testing instrument for enclosed spaces*

IMO Resolution A.1050(27), *Revised recommendations for entering enclosed spaces aboard ships*, Annex, section 7, Testing the atmosphere

IEC 60079-0:2011, *Explosive atmospheres- Part 0: Equipment — General requirements*

IEC 60079-29-1:2007, *Explosive atmospheres — Part 29-1: Gas detectors — Performance requirements of detectors for flammable gases*

IEC 60079-29-2:2015, *Explosive atmospheres — Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen*

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IEC 60092-504:2001, *Electrical installations in ships — Part 504: Special features — Control and instrumentation*

IEC 60529:2013, *Degrees of protection provided by enclosures (IP Code)*

IEC 60533:1999, *Electrical and electronic installations in ships — Electromagnetic compatibility*

3 Terms and definitions

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

3.1
enclosed space
space which has any of the following characteristics:

1) limited openings for entry and exit;

2) inadequate ventilation; and

3) is not designed for continuous worker occupancy,

and includes, but is not limited to, cargo spaces, double bottoms, fuel tanks, ballast tanks, cargo pump-rooms, cargo compressor rooms, cofferdams, chain lockers, void spaces, duct keels, inter-barrier spaces, boilers, engine crankcases, engine scavenge air receivers, sewage tanks, and adjacent connected spaces

Note 1 to entry: See IMO resolution A.1050(27).

3.2
portable gas detector
device to measure gas or vapour concentrations in the atmosphere and which is portable to be carried on board in order to comply with SOLAS regulation XI-1/7

Note 1 to entry: This does not refer to a personal gas detector that is intended to be carried by an individual whilst inside the enclosed space.

Note 2 to entry: In this part of ISO/PAS 19891, portable gas detector means a “transportable gas detector” or a “portable gas detector” as specified in IEC 60079-29-1:2007.

3.3
external replaceable module
external plug-in sensor which can be directly plugged into a base or via short cable connection

Note 1 to entry: After sensor exchange, the manufacturer’s instructions are to be observed.

4 Specification of portable gas detectors for atmosphere testing of enclosed spaces

4.1 General requirements

4.1.1 Gases required to be measured

A portable gas detector shall clearly indicate gases which are measured by the detector.

A portable gas detector shall only measure gases which are calibrated or which are covered by the cross sensitivity.

Portable gas detectors and sensors shall be selected depending on measuring method and application in accordance with the requirements of IEC 60079-29-2:2015.

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In order to comply with SOLAS regulation XI-1/7, a portable gas detector or detectors shall be carried on board ships for measuring concentrations of oxygen, flammable gases or vapours, hydrogen sulphide and carbon monoxide in enclosed spaces without entry into the spaces.

Flammable gases or vapours are represented either by methane or propane/butane. Measurement of other flammable gases or vapours is not required, in general, for the purpose of SOLAS regulation XI-1/7, unless specifically required by a flag State Administration.

Measurement of toxic gases other than hydrogen sulphide and carbon monoxide may be required by a flag State Administration.

Measurement of other gases may be required based on results of risk assessments for entry into enclosed spaces according to IMO resolution A.1050 (27).

NOTE Detection of other gases may be required by the other SOLAS regulations and relevant codes, e.g. chapter II-2 of SOLAS, the IBC Code and/or the IMSBC Code.

4.1.2 Method of measurement

A portable gas detector shall be capable of sampling, detecting and measuring the gas or gases in enclosed spaces without entry into the spaces and without interference from the atmosphere or other characteristics of the intervening space(s).

When a suction hose or other means are used for the sampling from outside of enclosed spaces, the portable gas detector shall conform to the requirements for response time in IEC 60079-29-1:2015.

In practice, these specifications can be conformed to by a suitable suction hose or a suitable length of electric cables or wireless data transfer connecting head (sensor) and body (instrument). Other techniques such as light beams may be permitted provided they are not blocked or interfered with by the intervening spaces – either its atmosphere, environment or structure.

4.1.3 Basic performance

When a portable gas detector is designed for detecting and measuring multi gases, the detection and measurement of the gases shall be done by either permanently installed sensors for each gas or several gases, or by external replaceable modules for each gas, or by a combination of both.

In case external replaceable modules are used:

1) gas (es) measured by the replaceable module shall be clearly indicated on the module;

2) a clear description on the procedures for mounting and dismounting of the replaceable module shall be provided in the instruction manual;

3) unique identifiers of individual replaceable modules shall be included in the documentation.

If a portable gas detector cannot measure, at once, all types of the gases to which the portable gas detector is approved, for instance, if it has three slots for continuously monitoring gas modules but is approved for more than three types of gases, the type of gases to be measured shall be clearly indicated on the portable gas detector and identified in the manual of the portable gas detector. Regardless of whether the portable gas detector uses permanently installed sensors, external replaceable modules, or by a combination of both, the detector, when in use, shall clearly indicate the types of gases for which it is set up to measure.

A portable gas detector shall, upon activation, perform a self-test which indicates that the portable gas detector is functioning correctly. Consideration shall be given to conduct a response check by using real test gases prior to use the portable gas detector.

A portable gas detector shall be provided with clearly defined re-calibration procedures which are carried out by the manufacturer. If the portable gas detector is fitted with an alarm or shutdown function that activates if the manufacture's calibration interval is exceeded, this should not stop the

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portable gas detector from functioning during actual use and the portable gas detector should not restart once the alarm or function has been activated.

4.1.4 Portability

A portable gas detector shall be easily carried by one person to enclosed spaces for atmosphere testing.

A portable gas detector shall be operated by batteries. A portable gas detector shall have an indicator which indicates the status of the energy source. An energy source of a portable gas detector shall be capable of operating the detector for at least 10 h.

4.2 Sensitivities, indications, and alarms

A portable gas detector shall indicate the measured concentrations. A portable gas detector shall provide visual and audible alarms if the measured value deviates from concentrations specified below.

A portable gas detector for multi gases shall clearly and unambiguously specify which gas is being measured by the detector. The indication may be switchable or menu accessible.

A portable gas detector for oxygen shall have accuracy at least plus/minus 1 % by volume in the air within temperature range of 0 ˚C to 40 ˚C. A portable gas detector for oxygen shall indicate concentration of oxygen and shall activate an alarm in case of low levels of oxygen determined by the flag State Administration. If the low level of oxygen is not determined by the Administration, 18 % by volume in the air may be used as the alarm level.

A portable gas detector for methane or propane/butane or both shall be capable of detecting these gases according to the criteria set by the flag State Administration, as appropriate. Such portable gas detectors shall indicate the concentration of the gases in percentages of the LFLs and shall activate an alarm at not higher than the levels to be determined by the flag State Administration. If the levels are not determined by the Administration, 30 % of LFLs of the gases may be used as the alarm levels.

A portable gas detector for hydrogen sulphide shall indicate the concentration of the gas in “ppm” and shall activate an alarm at not higher than the level to be determined by the flag State Administration. If the level is not determined by the Administration, 10 ppm may be used as the alarm level.

A portable gas detector for carbon monoxide shall indicate the concentration of the gas in “ppm” and shall activate an alarm at not higher than the level to be determined by the flag State Administration. If the level is not determined by the Administration, 50 ppm may be used as the alarm level.

NOTE LFL is also known as lower explosive limit (LEL).

4.3 Robustness and electrical safety

A portable gas detector shall have protection from the environment to which it is expected to be exposed or in which it is expected to operate. This includes protection against corrosion, shock, electrical interference, humidity and temperature. The portable gas detector shall be waterproof and dustproof to IP65 according to IEC 60529:2013.

A portable gas detector shall be explosion protected and approved for the full range of gases measured by the detector.

4.4 Marking and manual

4.4.1 Marking

A portable gas detector shall be permanently marked with the following items:

a) date of manufacture (month and year);

b) serial number;

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c) identification of manufacturer.

4.4.2 Instruction manual

A portable gas detector shall have a simple instruction manual which describes the basic features and alarm levels. The portable gas detector's instruction manual shall clearly define calibration requirements and response checks as appropriate.

5 Testing

A portable gas detector shall be tested to the following requirements, as applicable for the detector:

a) temperature according to IEC 60079-29-1:2007 and IEC 60092-504:2001;

b) humidity according to IEC 60079-29-1:2007 and IEC 60092-504:2001;

c) vibration according to IEC 60079-29-1:2007;

d) drop test for portable and transportable apparatus according to IEC 60079-29-1:2007;

e) battery capacity according to IEC 60079-29-1:2007;

f) electromagnetic compatibility according to IEC 60533:1999;

g) enclosure protection according to IEC 60529:2013;

h) equipment protection according to IEC 60079-0:2011.

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