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Fire detection and alarm systems —

Part 10: Point-type flame detectors

Systèmes de détection et d'alarme d'incendie —

Partie 10: Détecteurs de flammes ponctuels

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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 7240-10 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 3, *Fire detection and fire alarm systems*.

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ISO 7240 consists of the following parts, under the general title *Fire detection and alarm systems*:

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— *Part 1: General and definitions*

— *Part 2: Control and indicating equipment*

— *Part 4: Power supply equipment*

— *Part 5: Point-type heat detectors*

— *Part 6: Carbon monoxide fire detectors using electro-chemical cells*

— *Part 7: Point-type smoke detectors using scattered light, transmitted light or ionization*

— *Part 8: Carbon monoxide fire detectors using an electro-chemical cell in combination with a heat sensor*

— *Part 9: Test fires for fire detectors* [Technical Specification]

— *Part 10: Point-type flame detectors*

— *Part 11: Manual call points*

— *Part 12: Line type smoke detectors using a transmitted light beam*

— *Part 13: Compatibility assessment of system components*

— *Part 14: Guidelines for drafting codes of practice for design, installation and use of fire detection and fire alarm systems in and around buildings* [Technical Report]

— *Part 15: Point type fire detectors using scattered light, transmitted light or ionization sensors in combination with a heat sensor*

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— *Part 16: Sound system control and indication equipment*

— *Part 19: Design, installation, commissioning and service of sound systems for emergency purposes*

— *Part 21: Routing equipment*

— *Part 22: Smoke detection equipment for ducts*

The following parts are under preparation:

— *Part 26* dealing with oil mist detectors

— *Part 27* dealing with carbon fire detectors using optical or ionization smoke sensors, electrochemical cell carbon monoxide sensors and heat sensors

— *Part 28* dealing with fire protection control equipment

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Introduction

This part of ISO 7240 is based on a European Standard EN 54-10, prepared by the European Committee for Standardization CEN/TC 72 "*Fire detection and fire alarm systems*", together with ISO/DIS 19292, prepared by Technical Committee ISO/TC 8, *Ships and marine technology,* Subcommittee SC 1, *Lifesaving and fire protection.*

A fire detection and fire alarm system is required to function satisfactorily, not only in the event of a fire, but also during and after exposure to conditions likely to be met in practice, such as corrosion, vibration, direct impact, indirect shock and electromagnetic interference. Some tests specified are intended to assess the performance of the fire detectors under such conditions.

The performance of flame detectors is assessed from results obtained in specific tests. This part of ISO 7240 is not intended to place any other restrictions on the design and construction of such flame detectors.

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Fire detection and alarm systems —

Part 10: Point-type flame detectors

1 Scope

This part of ISO 7240 specifies requirements, test methods and performance criteria for point-type, resettable flame detectors that operate using radiation from a flame for use in fire detection systems installed in buildings. Additional requirements for flame detectors for use in marine applications are specified in Annex A.

This part of ISO 7240 does not cover flame detectors working on different principles from those described in this document (although this part of ISO 7240 can be used as guidance in assessing such products).

2 Normative references

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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.

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ISO 209-1, *Wrought aluminium and aluminium alloys — Chemical composition and forms of products — Part 1: Chemical composition*

ISO 7240-1, *Fire detection and alarm systems — Part 1: General and definitions*

IEC 60064, *Tungsten filament lamps for domestic and similar general lighting purposes — Performance requirements*

IEC 60068-1, *Environmental testing — Part 1: General and guidance*

IEC 60068-2-1, *Environmental testing — Part 2: Tests. Tests A: Cold*

IEC 60068-2-2, *Environmental testing — Part 2: Tests: Tests B: Dry heat*

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

IEC 60068-2-27, *Environmental testing — Part 2: Tests. Test Ea and guidance: Shock*

IEC 60068-2-30, *Environmental testing — Part 2: Tests. Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*

IEC 60068-2-42, *Environmental testing — Part 2: Tests. Test Kc: Sulphur dioxide test for contacts and connections*

IEC 60068-2-52, *Environmental testing — Part 2: Tests — Test Kb: Salt mist, cyclic (sodium, chloride solution)*

IEC 60068-2-78, *Environmental testing — Part 2-78 — Tests — Test Cab: Damp heat, steady state*

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IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 2: Electrostatic discharge immunity test*

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) — Part 4-4: Testing and measurement techniques — Electrical fast transient/burst immunity test*

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) — Part 4-5: Testing and measurement techniques — Surge immunity test*

IEC 61000-4-6:2006, *Electromagnetic compatibility (EMC) — Part 4-6: Testing and measurement techniques — Immunity to conducted disturbances, induced by radio-frequency fields*

EN 50130-4, *Alarm systems — Part 4: Electromagnetic compatibility — Product family standard: Immunity requirements for components of fire, intruder and social alarm systems*

3 Terms and definitions

For the purposes of this document, the terms, definitions and symbols given in ISO 7240-1 and the following apply.

3.1
detector classification
classification of flame detectors to indicate their relative sensitivity to fire

NOTE Class 1 indicates the highest sensitivity and Class 3 the lowest sensitivity acceptable within this part of ISO 7240, except Class 4 where the sensitivity is nominated by the manufacturer.

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3.2
infrared (IR) detector
flame detector responding only to radiation having wavelengths greater than 850 nm

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3.3
multiband detector
flame detector having two or more sensing elements, each responding to radiation in a distinct wavelength range and each of whose outputs may contribute to the alarm decision

NOTE The alarm decision may be based on any arithmetic or logical combination of the individual signals.

3.4
response point
distance, D, measured in accordance with 5.1.5, at which the individual flame detector under test gives an alarm signal

3.5
sensitivity
measure of the ability of a flame detector to detect fires

NOTE Sensitivity is not necessarily directly related to the response point.

3.6
sensitivity adjustment
any adjustment of the detector or of the alarm criteria within the supply and monitoring equipment that leads to a change in sensitivity

See 5.1.2.

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3.7
ultra-violet (UV) detector
flame detector responding only to radiation having wavelengths less than 300 nm

4 General requirements

4.1 Compliance

In order to comply with this part of ISO 7240, the detector shall meet the requirements of this clause, which shall be verified by visual inspection or engineering assessment, shall be tested as described in Clause 5 and shall meet the requirements of the tests.

4.2 Classification

Detectors shall conform to one or more of the following classifications: class 1, class 2, class 3 or class 4 according to the requirements of the tests specified in 5.5.

Detectors suitable for use in marine environments shall conform to the additional requirements specified in Annex A.

4.3 Individual alarm indication

Each detector shall be provided with an integral red visual indicator, by which the individual detector that released an alarm can be identified, until the alarm condition is reset. Where other conditions of the detector are visually indicated, they shall be clearly distinguishable from the alarm indication, except when the detector is switched into a service mode. For detachable detector, the indicator may be integral with the base or the detector head.

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The visual indicator shall be visible from a distance of 6 m in an ambient light intensity up to 500 lx at an angle of up to

a) 5° from the axis of the detector in any direction, and

b) 45° from the axis of the detector in at least one direction.

4.4 Connection of ancillary devices

The detector may provide for connections to ancillary devices (remote indicators, control relays, etc.), but open- or short-circuit failures of these connections shall not prevent the correct operation of the detector.

4.5 Monitoring of detachable detectors

For detachable detectors, a means shall be provided for a remote monitoring system (e.g. the control and indicating equipment) to detect the removal of the head from the base, in order to give a fault signal.

4.6 Manufacturer's adjustments

It shall not be possible to change the manufacturer's settings except by special means (e.g. the use of a special code or tool) or by breaking or removing a seal.

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4.7 On-site sensitivity adjustment

If there is provision for on-site sensitivity adjustment of the detector, then

a) for all settings at which the manufacturer claims compliance, the detector shall comply with the requirements of this part of ISO 7240 and shall achieve a classification corresponding to that marked on the detector for that setting;

b) for each setting in a), access to the adjustment means shall only be possible by the use of a code or special tool or by removing the detector from its base or mounting;

c) any setting or settings at which the manufacturer does not claim compliance with this part of ISO 7240 shall only be accessible by the use of a code or special tool, and it shall be clearly marked on the detector or in the associated data that if these setting or settings are used, the detector does not comply with this part of ISO 7240.

NOTE These adjustments can be carried out at the detector or at the control and indicating equipment.

4.8 Marking

Each detector shall be clearly marked with, or supplied with, the following information:

a) number of this part of ISO 7240 (i.e. ISO 7240-10);

b) name or trademark of the manufacturer or supplier;

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c) model designation (type or number);

d) classification of the detector, e.g. class 1 and, where the detector is classified as class 4, the distance as determined by 5.5.2.3;

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e) where the detector complies with the marine application requirements as specified in Annex A, the word “marine”, the symbol “M” or similar indication;

f) some mark(s) or code(s), (e.g. a serial number or batch code) by which the manufacturer can identify, at least, the date or batch and place of manufacture and the version number(s) of any software contained within the detector;

g) wiring terminal designations;

h) angle of reception as determined in 5.4;

i) operating wavelength band(s) e.g. UV, IR.

For detachable detectors, the detector head shall be marked with at least a), b), c), d), e) and f), and the base shall be marked with at least b), c) (i.e. its own model designation) and g).

Where any marking on the device uses symbols or abbreviations not in common use, these shall be explained in the data supplied with the device.

The marking shall be visible during installation of the detector and shall be accessible during maintenance.

The markings shall not be placed on screws or other easily removable parts.

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4.9 Data

Detectors shall either be supplied with sufficient technical, installation and maintenance data to enable their correct installation and operation or, if all of these data are not supplied with each detector, reference to the appropriate data sheet shall be given on, or with, each detector.

To enable correct operation of the detectors, these data should describe the requirements for the correct processing of the signals from the detector. This may be in the form of a full technical specification of these signals, a reference to the appropriate signalling protocol or a reference to suitable types of control and indicating equipment, etc.

Installation and maintenance data shall include reference to an *in situ* test method to ensure that detectors operate correctly when installed.

NOTE Additional information can be required by organizations certifying that detectors produced by a manufacturer conform to the requirements of this part of ISO 7240.

4.10 Requirements for software-controlled detectors

4.10.1 General

The requirements of 4.10.2, 4.10.3 and 4.10.4 shall be met for detectors that rely on software control in order to fulfil the requirements of this part of ISO 7240.

4.10.2 Software documentation

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4.10.2.1 The manufacturer shall submit documentation which gives an overview of the software design. This documentation shall be in sufficient detail for the design to be inspected for compliance with this part of ISO 7240 and shall include at least the following:

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a) functional description of the main program flow (e.g. as a flow diagram or structogram), including

   1) a brief description of the modules and the functions that they perform,

   2) the way in which the modules interact,

   3) the overall hierarchy of the program,

   4) the way in which the software interacts with the hardware of the detector,

   5) the way in which the modules are called, including any interrupt processing;

b) description of those areas of memory used for the various purposes (e.g. the program, site-specific data and running data);

c) designation by which the software and its version can be uniquely identified.

4.10.2.2 The manufacturer shall have available detailed design documentation, but which is provided to the testing authority only when required by that authority. It shall comprise at least the following:

a) overview of the whole system configuration, including all software and hardware components;

b) description of each module of the program, containing at least

   1) the name of the module,

   2) a description of the tasks performed,

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3) a description of the interfaces, including the type of data transfer, the valid data range and the checking for valid data;

c) full source code listings, as hard copy or in machine-readable form (e.g. ASCII-code), including all global and local variables, constants and labels used, and sufficient comment for the program flow to be recognized;

d) details of any software tools used in the design and implementation phase (CASE-Tools, Compilers, etc.).

4.10.3 Software design

In order to ensure the reliability of the detector, the following requirements for software design apply.

a) The software shall have a modular structure.

b) The design of the interfaces for manually and automatically generated data shall not permit invalid data to cause error in the program operation.

c) The software shall be designed to avoid the occurrence of deadlock of the program flow.

4.10.4 Storage of programs and data

The program necessary to comply with this part of ISO 7240 and any preset data, such as manufacturer's settings, shall be held in non-volatile memory. Writing to areas of memory containing this program and data shall be possible only by the use of some special tool or code and shall not be possible during normal operation of the detector.

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Site-specific data shall be held in memory which retains data for at least two weeks without external power to the detector, unless provision is made for the automatic renewal of such data, following loss of power, within 1 h of power being restored.

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5 Tests

5.1 General

5.1.1 Atmospheric conditions for tests

Unless otherwise stated in a test procedure, carry out the testing after the test specimen has been allowed to stabilize in the standard atmospheric conditions for testing as specified in IEC 60068-1 as follows.

— temperature: (15 to 35) °C

— relative humidity: (25 to 75) %

— air pressure: (86 to 106) kPa

The temperature and humidity shall be substantially constant for each environmental test where the standard atmospheric conditions are applied.

5.1.2 Operating conditions for tests

If a test method requires a specimen to be operational, then connect the specimen to suitable supply and monitoring equipment having the characteristics required by the manufacturer's data. Unless otherwise specified in the test method, the supply parameters applied to the specimen shall be set within the manufacturer's specified range(s) and shall remain substantially constant throughout the tests. The value chosen for each parameter shall normally be the nominal value, or the mean of the specified range. If a test

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procedure requires a specimen to be monitored to detect any alarm or fault signals, then connections shall be made to any necessary ancillary devices [e.g. through wiring to an end-of-line device for collective (conventional) detectors] to allow a fault signal to be recognized.

Unless otherwise specified in the test method, detectors having adjustable sensitivity shall be set to their highest sensitivity for the conditioning.

The details of the supply and monitoring equipment and the alarm criteria used shall be given in the test report (see Clause 6).

5.1.3 Mounting arrangements

The specimen shall be mounted by its normal means of attachment in accordance with the manufacturer's instructions. If these instructions describe more than one method of mounting, then the method considered to be most unfavourable shall be chosen for each test.

5.1.4 Tolerances

Unless otherwise stated, the tolerances for the environmental test parameters shall be as given in the basic reference standards for the test (e.g. the relevant part of IEC 60068).

If a specific tolerance or deviation limit is not specified in a requirement or test procedure, then a tolerance of ± 5 % shall be applied.

5.1.5 Determination of response point

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5.1.5.1 Principle

The response point shall be measured by exposing the detector to the radiation from a suitable flame source and determining the greatest distance at which the detector reliably produces an alarm condition within 30 s of being exposed to the radiation from the flame.

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5.1.5.2 Test apparatus

The test apparatus shall be as described in Annex B.

The design and construction of the apparatus and the surfaces surrounding the test area shall be such that no significant radiation from the source reaches the detector apart from that which has passed through the aperture. (This means for example that there shall be no reflection of radiation from the walls or other parts of the apparatus and no spurious radiation from hot flue gases or hot surfaces around the burner.)

Throughout this test method, the detector shall be aligned relative to its optical axis and the distances relative to the plane of the detector sensing elements shall be measured. If the detector does not have a well-defined optical axis, then the manufacturer shall nominate an optical axis for the purposes of this test method. The position of this axis relative to an easily identifiable plane on the detector shall be noted in the test report (see Clause 6).

Similarly, if the detector sensing elements do not lie in a well-defined plane, then the manufacturer shall nominate a plane for the purposes of this test method. The position of this plane relative to an easily identifiable plane on the detector shall be noted in the test report (see Clause 6).

5.1.5.3 Initial determination

A suitable area for the aperture shall be determined experimentally before the commencement of the test program such that the response point of one detector, chosen at random from the specimens submitted for test, lies within the range 1 300 mm to 1 700 mm. The size and shape of the aperture used shall be recorded and shall be kept constant throughout the test program. For detectors having adjustable sensitivity and whose adjustment range covers more than one sensitivity class, the appropriate aperture size for each sensitivity class of detector shall be determined.

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5.1.5.4 Source stability

After determining a suitable aperture size and before any determination of response points, the irradiance on the optical axis of the source shall be measured using the radiometer in accordance with Clause B.5. This measurement shall be carried out with no modulation of the source and with the aperture unobstructed. The measured value of irradiance shall be recorded and used as a reference throughout the test program to verify that the source radiance has not varied by more than 5 %.

5.1.6 Test procedure

Connect the specimen to its supply and indicating equipment and allow it to stabilize for a period of 15 min or for a time specified by the manufacturer. During this stabilization period, shield the specimen using the shutter in accordance with Clause B.3 from all sources of radiation which can affect the determination of the response point.

Before commencing any measurement of the response point, allow the burner to reach a stable working condition.

Vary the distance of the specimen from the source and expose the detector to the source at each distance for 30 s using the shutter. The response point, D, is the greatest distance, measured between the aperture and the plane of the specimen sensing element(s), at which the detector reliably produces an alarm response within each 30 s exposure. If the detector response is known to be dependent on previous exposure to radiation, then allow sufficient time before each exposure to ensure that previous exposures do not substantially affect the measurement of the response point.

For detectors having stochastic response behaviour, each value of D shall be the mean value of at least six repetitions of each measurement. Continue repetitions until an additional value changes the average value of D by less than 5 %.

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5.1.7 Reduced functional tests

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Where the test procedure calls for a reduced functional test, the detector shall be exposed to a source of radiation that is sufficient to cause an alarm response from the detector. The nature of the source used and the duration of the exposure shall be appropriate to the product in question.

5.1.8 Provision for tests

The following shall be provided for testing compliance with this part of ISO 7240:

a) for detachable detectors, eight heads and eight bases; for non-detachable detectors, eight specimens

b) the data required in 4.9.

The specimens submitted shall be deemed representative of the manufacturer's normal production with regard to their construction and calibration. This implies that the mean response point of the eight specimens found in the reproducibility test (5.2) should also represent the production mean and that the limits specified in the reproducibility test should also be applicable to the manufacturer's production.

5.1.9 Test schedule

The detectors shall be tested according to the test schedule given in Table 1. After the reproducibility test, the four specimens having the largest value of response point (at the highest sensitivity setting) shall be numbered 1 to 4 and the remainder shall be numbered 5 to 8.

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Table 1 — Test schedule

Test	Subclause	Specimen number(s)
Reproducibility	5.2	all specimens
Repeatability	5.3	1
Directional dependence	5.4	1
Fire sensitivity	5.5	all specimens
Dazzling (operational)	5.6	1
Dry heat (operational)	5.7	2
Cold (operational)	5.8	2
Damp heat, cyclic (operational)	5.9	6
Damp heat, steady state (endurance)	5.10	6
Sulphur dioxide SO_2 corrosion (endurance)	5.11	5
Shock (operational)	5.12	8
Impact (operational)	5.13	7
Vibration, sinusoidal (operational)	5.14	4
Vibration, sinusoidal (endurance)	5.15	4
Variation in supply parameters (operational)	5.16	1
Electromagnetic compatibility (EMC) immunity tests (operational)	5.17	
Electrostatic discharge		1 [a]
Radiated electromagnetic fields		3 [a]
Conducted disturbance induced by electromagnetic fields		3 [a]
Fast transient bursts		3 [a]
Slow high-energy voltage surges		2 [a]

[a] In the interest of test economy, it is permitted to use the same specimen for more than one EMC test. In that case, intermediate functional test(s) on the specimen(s) used for more than one test can be deleted and the full functional test conducted at the end of the sequence of tests. However, it should be noted that in the event of a failure, it might not be possible to identify which test exposure caused the failure.

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5.1.10 Test report

The test results shall be reported in accordance with Clause 6.

5.2 Reproducibility

5.2.1 Object of test

To show that the sensitivity of the specimen does not vary unduly from specimen to specimen and to establish response point data for comparison with the response points measured after the environmental tests.

5.2.2 Test procedure

Measure the response point of each of the test specimens as specified in 5.1.6 and record each value of D. For detectors having adjustable sensitivity and whose range of adjustment covers more than one sensitivity class, repeat the measurement for each marked class.

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