IEC 62642-2-72

Edition 1.0 2015-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Alarm systems – Intrusion and hold-up systems – Part 2-72: Intrusion detectors – Glass break detectors (passive)

Systèmes d'alarme – Systèmes d'alarme contre l'intrusion et les hold-up – Partie 2-72: Détecteurs d'intrusion – Détecteurs de bris de glace (passifs)

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ALARM SYSTEMS – INTRUSION AND HOLD-UP SYSTEMS –

Part 2-72: Intrusion detectors – Glass break detectors (passive)

FOREWORD

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International Standard IEC 62642-2-72 has been prepared by IEC technical committee 79: Alarm and electronic security systems.

This standard is based on EN 50131-2-7-2 (2012) and its IS1 (2014).

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

FDIS	Report on voting
79/512/FDIS	79/528/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.

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

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A list of all parts in the IEC 62642 series, published under the general title *Alarm systems – Intrusion and hold-up systems*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

This part 2-72 of the IEC 62642 series concerns of intrusion and hold-up alarm systems (I&HAS) installed in buildings. It includes devices that are installed inside or outside of the supervised premises and mounted in indoor or outdoor environments. The other parts of this series of standards are as follows:

Part 1	System requirements
Part 2-2	Intrusion detectors – Passive infrared detectors
Part 2-3	Intrusion detectors – Microwave detectors
Part 2-4	Intrusion detectors – Combined passive infrared / Microwave detectors
Part 2-5	Intrusion detectors – Combined passive infrared / Ultrasonic detectors
Part 2-6	Intrusion detectors – Opening contacts (magnetic)
Part 2-71	Intrusion detectors – Glass break detectors (acoustic)
Part 2-72	Intrusion detectors – Glass break detectors (passive)
Part 2-73	Intrusion detectors – Glass break detectors (active)
Part 3	Control and indicating equipment
Part 4	Warning devices
Part 5-3	Interconnections – Requirements for equipment using radio frequency techniques
Part 6	Power supplies
Part 7	Application guidelines
Part 8	Security fog devices/systems

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ALARM SYSTEMS – INTRUSION AND HOLD-UP SYSTEMS –

Part 2-72: Intrusion detectors – Glass break detectors (passive)

1 Scope

This part of IEC 62642 defines passive surface mounted glass break detectors installed in buildings and provides for security grades 1 to 4 (see IEC 62642-1), specific or non-specific wired or wire-free detectors, and uses environmental classes I to IV (see IEC 62599-1). This International Standard does not include requirements for passive surface mounted glass break detectors intended for use outdoors.

A detector complies with all the requirements of the specified grade.

Functions additional to the mandatory functions specified in this standard may be included in the detector, providing they do not adversely influence the correct operation of the mandatory functions.

This International Standard does not apply to system interconnections.

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.

IEC 60068-2-52:1984, *Basic environmental testing procedures – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium, chloride solution)*[1]

IEC 62599-1, *Alarm systems – Part 1: Environmental test methods*

IEC 62599-2, *Alarm systems – Part 2: Electromagnetic compatibility – Immunity requirements for components of fire and security alarm systems*

IEC 62642-1, *Alarm systems – Intrusion and hold-up systems – Part 1: System requirements*

3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions and abbreviations given in IEC 62642-1, as well as the following apply.

3.1 Terms, definitions and abbreviations

3.1.1
glass breakage
physical destruction of a glass pane, which allows intrusion to the monitored area, for example in doors, windows or enclosures

[1] First edition. This edition has been replaced in 1996 by IEC 60068-2-52:1996, *Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium, chloride solution)*.

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3.1.2
passive surface mounted glass break detector
detector that is mounted on a glass pane, which detects the energy emitted by a glass breakage of the pane the detector is mounted on

3.1.3
basic test source
signal simulator designed to verify the basic function of the detector

3.1.4
incorrect operation
physical condition that causes an inappropriate signal or message from a detector

3.1.5
basic detection test
test whose purpose is to verify the operation of a detector after conditioning

3.1.6
masking
interference with the detector input capability such as an introduction of a physical barrier (e.g. metal, plastic, paper or sprayed paints or lacquers in close proximity to the detector) or changing the characteristics of the monitored area (e.g. placing wet newspapers on the outside of the monitored glass pane)

3.1.7
standard immunity glass pane
glass pane to be used for all immunity tests, where a glass pane is needed, according to Annex A

3.1.8
simultaneous installation
installation of more then one detector or sensor pair of one detector type (e.g. sender and receiver) for one or more detector´s processing units

3.2 Abbreviations

BTS Basic test source

EMC Electromagnetic compatibility

4 Functional requirements

4.1 Event processing

Detectors shall process the events shown in Table 1. Detectors shall generate signals or messages as shown in Table 2.

Table 1 – Events to be processed by grade

Event	Grade			
	1	2	3	4
Intrusion	M	M	M	M
No stimulus [a]	M	M	M	M
Masking	Op	Op	M	M
Tamper	Op	M	M	M
Low supply voltage – wire free devices	M	M	M	M
Low supply voltage – wired devices	Op	Op	Op	M

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Event	Grade			
	1	2	3	4
Total loss of power supply [b]	Op	M	M	M
Local self test [c]	Op	Op	M	M
Remote self test	Op	Op	Op	M

Key

M = Mandatory

Op = Optional

[a] 'No Stimulus' is considered to be the quiet condition, while no alarm generating stimulus for a detector at that time applies to the detector input capabilities

[b] Mandatory for wire-free at all grades. Only required if power is for normal local operation, e.g. purely switch based solutions do not fall under this requirement; however if signal processing (except if it is the CIE itself) is required to process the output of the sensor, such an event shall be generated alternatively no generation of a message or signal is required when the condition is detected by the CIE due to system design

[c] Mandatory for all grade 4 devices. For grade 3 devices only required in case of MCU based solutions based on software / firmware sensor input analysis and signal processing.

Table 2 – Generation of Indication signals or messages

Event	Signals or messages		
	Intrusion	Tamper	Fault
Intrusion	M	NP	NP
No stimulus	NP	NP	NP
Masking [a]	M	Op	M
Tamper	NP	M	NP
Low supply voltage	Op	Op	M
Total loss of power supply [b]	M	Op	Op
Local self test pass	NP	NP	NP
Local self test fail	NP	NP	M
Remote self test pass	M	NP	NP
Remote self test fail	NP	NP	M

M = mandatory

NP = Not permitted

Op = Optional

[a] An independent masking signal or message may be provided instead.

[b] Alternatively total loss of power supply shall be determined by loss of communication with the detector.

This permits two methods of signalling a masking event: either by the intrusion signal and fault signal, or by a dedicated output. Use of the intrusion signal and fault signal is preferable, as this requires fewer connections between CIE and detector. If multiple events overlap there will be some signal combinations that may be ambiguous. To overcome this ambiguity it is suggested that detectors should not signal 'intrusion' and 'fault' at the same time except to indicate masking. This implies that the detector should prioritise signals, e.g. 1 Intrusion, 2 Fault, 3 Masking.

When, in Table 1, an event may optionally generate signals or messages, they shall be as shown in this table.

4.2 Operational requirements

4.2.1 Time interval between intrusion signals or messages

Wired detectors shall be able to provide an intrusion signal or message not more than 15 s after the end of the preceding intrusion signal or message.

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Wire free detectors shall be able to provide an intrusion signal or message after the end of the preceding intrusion signal or message within the following times:

Grade 1	300 s
Grade 2	180 s
Grade 3	30 s
Grade 4	15 s

4.2.2 Switch on delay

The detector shall meet all functional requirements within 180 s of the power supply reaching its nominal voltage as specified by the manufacturer.

4.2.3 Self tests

4.2.3.1 Local self test

The detector shall automatically test itself at least once every 24 h according to the requirements of Tables 1 and 2. If normal operation of the detector is inhibited during a local self-test, the detector inhibition time shall be limited to a maximum of 30 s in any period of 2 h.

4.2.3.2 Remote self test

A detector shall process remote self tests and generate signals or messages in accordance with Tables 1 and 2 within 10 s of the remote self test signal being received, and shall return to normal operation within 30 s of the remote test signal being received.

4.3 Detection

4.3.1 Detection performance

4.3.1.1 General

The detector shall generate an intrusion signal or message when a simulated or real glass breakage according to the corresponding requirements of Table 3 is performed.

Table 3 – Performance test requirements

Requirement	Grade 1	Grade 2	Grade 3	Grade 4
Verification of detection performance	M	M	M	M
Performance test: hole drilling with diamond hole saw	Op	Op	Op	M
Performance test: glass cutting	Op	Op	Op	M
M = Mandatory Op = Optional				

4.3.1.2 Verification of detection performance

This test will verify the detection performance for sensitivity and a break through the glass according to the supported conditions claimed by the manufacturer. It will verify the maximum covering range (sensitivity performance test) and the break through detection (breakage performance test), according to Annex A for different glass types and sizes claimed to be supported (types and dimensions) by the manufacturer. A number of standard glass types and sizes need to be passed by this test according to the corresponding test section.

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4.3.1.3 Performance test for hole drilling with a diamond hole saw

This test will verify the detection performance by drilling a hole using a diamond hole saw on different glass types and dimensions according to the supported conditions claimed by the manufacturer and Annex A. It will verify if the detector is able to identify and signal the change of the integrity of the monitored side of the glass pane.

4.3.1.4 Performance test for glass cutting

This test will verify the detection performance by cutting the glass using a standard glass cutter on different glass types and dimensions according to the supported conditions claimed by the manufacturer and Annex A. It will verify if the detector is able to identify and signal the change of the integrity of the monitored side of the glass pane.

4.3.2 Indication of detection

Powered detectors at grades 3 and 4 that include processing capabilities shall provide an indicator at the detector to indicate when an intrusion signal or message has been generated. Self-powered detectors (e.g. detectors which rely on the energy resulting from the glass breakage) do not require such an indicator.

At grades 3 and 4 this indicator shall be capable of being enabled and disabled remotely at access level 2.

4.4 Immunity to false alarm sources

4.4.1 General

The detector shall have sufficient immunity to false alarm sources if the following requirements have been met. No intrusion signal or message shall be generated as a result of the false alarm sources according to each individual test clause.

The tests for this clause will be performed on the standard immunity test glass pane as defined in 3.1.7, wherever a glass pane is required.

4.4.2 Immunity to small objects hitting the glass

The detector shall not generate an intrusion signal or message when small objects such as hail, sand, gravel etc. hit the outside of the monitored glass. The tests are described in 6.7.2.

4.4.3 Immunity to soft objects hitting the glass

The detector shall not generate an intrusion signal or message when soft objects (e.g. a human fist) hit the outside of the monitored glass. The tests are described in 6.7.3.

4.4.4 Immunity to hard objects hitting the glass

The detector shall not generate an intrusion signal or message when hard objects (e.g. handlebars of a bicycle) hit the outside of the monitored glass. The tests are described in 6.7.4.

4.4.5 Immunity to static pressure

The detector shall not generate an intrusion signal or message when permanent pressure changes applied to the monitored glass. The tests are described in 6.7.5.

4.4.6 Immunity to dynamic pressure

The detector shall not generate an intrusion signal or message when dynamic pressure changes (due to wind, etc.) applied to the monitored glass. The tests are described in 6.7.6.

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4.4.7 Immunity to wide band noise

The detector shall not generate an intrusion signal or message when a wide band of frequencies at the same time, which are close to the frequency of a glass breakage (e.g. branches of a tree moving against the window) are applied to the detector. The tests are described in 6.7.7.

4.5 Tamper security

4.5.1 General

Tamper security requirements for each grade of a detector are shown in Table 4.

Table 4 – Tamper security requirements

Requirement	Grade 1	Grade 2	Grade 3	Grade 4
Resistance to access to the inside of the detector	M	M	M	M
Detection of access to the inside of the detector [a]	Op	M	M	M
Removal from the mounting surface [b]	Op	M [c]	M	M
Detection of masking	Op	Op	M	M
Magnetic field Immunity	Op	M	M	M
Magnet type defined in Annex C		Type 1	Type 2	Type 2

M = Mandatory

Op = Optional

[a] Not required for wired detectors which are fully potted and where it is not possible to get access to any adjustments or components.

[b] At grade 2 and grade 3 not required if the detector is mounted properly according to the manufacturers instructions with a two-component / epoxy glue (adhesive and activator), which supports the requested environmental conditions when mounted and fixed.

[c] At grade 2 required for wire free detectors only, if the wire free detectors do not use a two-component / epoxy glue (adhesive and activator) for fixing.

4.5.2 Resistance to and detection of unauthorised access to the inside of the detector through covers and existing holes

All components and means of adjustment which, when interfered with, could adversely affect the operation of the detector, shall be located within the detector housing. Such access shall require the use of an appropriate tool and depending on the grade as specified in Table 4 shall generate a tamper signal or message before access can be gained.

It shall not be possible to gain access without generating a tamper signal or message or causing visible damage.

4.5.3 Detection of removal from the mounting surface

A tamper signal or message shall be generated if the detector is removed from its mounting surface, in accordance with Table 4.

4.5.4 Detection of masking

Means shall be provided to detect inhibition of the operation of the detector by masking according to the requirements of Table 4. Alternatively, the detector shall continue to operate normally.

The maximum response time for the masking detection device shall be 180 s. Masking shall be signalled according to the requirements of Table 2. The signals or messages shall remain

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for at least as long as the masking condition is present. A masking signal or message shall not be reset while the masking condition is still present. Alternatively the masking signal or message shall be generated again within 180 s of being reset if the masking condition is still present.

NOTE From a system design point of view it would be preferable for masked detectors to automatically reset after the masking condition is removed.

The detection of masking shall operate when the I&HAS is both set and unset.

4.5.5 Immunity to magnetic field interference

It shall not be possible to inhibit any signals or messages with a magnet of grade dependence according to Table 4. The magnet types shall be as described in Annex C.

4.6 Electrical requirements

4.6.1 General

These requirements do not apply to detectors having Type C power supplies. For these detectors refer to IEC 62642-6. For detectors having an external power supply, the requirements appear in Table 5.

Table 5 – Electrical requirements

Test	Grade 1	Grade 2	Grade 3	Grade 4
Detector current consumption	Required	Required	Required	Required
Input voltage range	Required	Required	Required	Required
Slow input voltage rise	Not required	Required	Required	Required
Input voltage ripple	Not required	Required	Required	Required
Input voltage step change	Not required	Required	Required	Required

4.6.2 Detector current consumption

The detector's quiescent and maximum current consumption shall not exceed the figures claimed by the manufacturer at the nominal input voltage.

4.6.3 Slow input voltage rise and voltage range limits

The detector shall meet all functional requirements when the input voltage lies between ±25 % of the nominal value, or between the manufacturers range limits if greater. When the supply voltage is raised slowly, the detector shall function normally at the specified range limits.

4.6.4 Input voltage ripple

The detector shall meet all functional requirements during the sinusoidal variation of the input voltage by ±10 % of nominal, at a frequency of 100 Hz.

4.6.5 Input voltage step change

No signals or messages shall be caused by a step in the input voltage between maximum or minimum and nominal values of the input voltage.

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4.7 Environmental classification and conditions

4.7.1 Environmental classification

The environmental classification is described in see IEC 62642-1 and shall be specified by the manufacturer.

4.7.2 Immunity to environmental conditions

All detectors shall meet the requirements of the relevant environmental class and equipment class as specified by the manufacturer of the environmental tests described in Table 6 and Table 7. These tests shall be performed in accordance with IEC 62599-1 and IEC 62599-2.

Impact tests shall not be carried out on delicate detector components such as LEDs or microphones.

Unless specified otherwise for operational tests, the detector shall not generate unintentional intrusion, tamper, fault or other signals or messages when subjected to the specified range of environmental conditions.

For endurance tests, the detector shall continue to meet the requirements of this standard after being subjected to the specified range of environmental conditions.

5 Marking, identification and documentation

5.1 Marking and/or identification

Marking and/or identification shall be applied to the product in accordance with the requirements of IEC 62642-1.

5.2 Documentation

The product shall be accompanied with clear and concise documentation conforming to the main systems document IEC 62642-1. The documentation shall additionally state:

a) a list of all options, functions, inputs, signals or messages, indications and their relevant characteristics;

b) any disallowed field adjustable control settings or combinations of these;

c) where alignment adjustments are provided, these shall be labelled as to their function;

d) the manufacturer's quoted nominal operating voltage and the maximum and quiescent current consumption at that voltage;

e) the detection range (minimum and maximum) and coverage diagram. The installation instructions shall be clear and concise that the maximum range will include the farthest point from the sensor input to any point of the monitored glass;

f) all types, maximum size, minimum and maximum thickness of glass for which the detector is claimed to detect;

g) any restrictions according to the mounting location of the detector, or any other restrictions which apply to the performance of the detector;

h) any specific settings needed to meet the requirements of this document at the claimed grade.

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6 Testing

6.1 General

The tests are intended to be primarily concerned with verifying the correct operation of the detector to the specification provided by the manufacturer. All the test parameters specified shall carry a general tolerance of ±10 % unless otherwise stated. A list of tests appears as a general test matrix in Annex I.

6.2 General test conditions

6.2.1 Standard laboratory conditions for testing

The general atmospheric conditions in the measurement and tests laboratory shall be those specified below, unless stated otherwise.

Temperature	15 °C to 35 °C
Relative humidity	25 % RH to 75 % RH
Air pressure	86 kPa to 106 kPa

6.2.2 General detection testing environment and procedures

6.2.2.1 General

Manufacturer's documented instructions regarding mounting and operation shall be read and applied to all tests.

6.2.2.2 Testing environment

The detectors or sensor elements will be mounted according to the manufacturer's description on the monitored object (glass window or door glass pane). Some tests will be performed on the monitored object, others will be performed on panes (unframed window), where the detectors are mounted directly on.

6.2.2.3 Test procedures

The tests will be performed with the types of glass claimed by the manufacturer. These tests will be performed with the sizes and thicknesses of glass as specified in Annex A.

Additionally, tests will be performed with the maximum size claimed by the manufacturer if this is greater than the maximum size specified in Annex A.

Additional tests will be performed with the thinnest glass claimed by the manufacturer, if this is thinner than the minimum thickness specified in Annex A.

The detector shall be connected to the nominal supply voltage and connected to the monitoring system that is appropriate to the test. The detector shall be allowed to stabilise for 180 s. The intrusion signal or message output shall be monitored. If multiple sensitivity modes are available, any non-compliant modes shall be identified by the manufacturer. All compliant modes shall be tested.

6.3 Basic detection test

6.3.1 General

The purpose of the basic detection test is to verify that a detector is still operational after a test or tests has/have been carried out. The basic detection test verifies only the qualitative performance of the detector. The basic detection test is performed using the BTS.

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6.3.2 Basic test source

For functional verification there shall be a device available which will simulate a glass breakage or destruction, without breaking the glass (BTS), alternatively a pane of standard sized glass (see Annex A) can be broken to verify the detection. The Basic Test Source (BTS) which is specified by the manufacturer simulates the breaking of a standard glass window by the low energy attack test.

This device should be a test device, which is specified for testing through simulation of a glass break from or recommended by the manufacturer.

This device should simulate a glass breakage or destruction, by pressing the device onto the monitored glass and simulating a sound, frequency or condition, which needs to be detected.

6.3.3 Basic detection test method

The detector shall generate an intrusion signal or message when a test device (BTS) is used to simulate a glass breakage. The test will be performed according to the manufacturer's instructions after the first installation, to verify, that all detectors are installed properly. It will be performed again, after or / and during the environmental tests under the same conditions the tests had been performed the first time, to verify that the detectors will still function the way, the manufacturer claims to support (e.g. detection range) and to compare this results with the results of the initial test.

If the test is not compatible with the detector, use the manufacturer's information to generate the correct algorithm.

The detector(s) shall produce an intrusion signal or message when exposed to an alarm stimulus both before and after being subjected to any test that may adversely affect its performance.

6.4 Performance tests

6.4.1 General

The general test conditions of 6.2.2 shall apply to all tests in this series.

Detection performance shall be tested against the manufacturer's documented claims. Any variable controls shall be set to the values recommended by the manufacturer to achieve the claimed performance.

The detectors shall be assessed in the specified test environment.

6.4.2 Verification of detection performance

6.4.2.1 General

All performance tests are based on physical destruction characteristics (e.g. the sound of breakage) of the size, thickness and types of glass claimed to be supported by the manufacturer including the standard glass types listed in Annex A, if claimed to be supported by the manufacturer.

6.4.2.2 Sensitivity performance test

The test will be performed for each glass type claimed to be supported by the manufacturer. Each glass pane will be positioned on on top of the support / distance pieces, to ensure that the glass break signal can reach the detectors undampened.

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Three detectors shall be mounted according to the manufacturer's installation instructions on the monitored glass (if a simultaneous installation is not supported, the test shall be performed for each detector separately), at the maximum distance of the planned glass breakage claimed to be supported by the manufacturer. The maximum distance claimed to be supported, will determine the size of the glass pane. This actually means that one detector will be mounted at the maximum distance and the rest of the detectors will be mounted adjacent to these detectors along the far edge of the glass according to Annex K, within the range claimed to be supported

To verify the sensitivity, the edge of the glass will be broken with a pair of pliers at the far distance end relative to the position of one detector, given that the other two detectors are still in the claimed to be supported area. The pliers shall be placed in a way, that they will hold 100 mm^2 to 150 mm^2 of the glass, when the breakage is performed. The output of the detectors will be monitored for detection of the glass breakage. This will be performed 3 times for each glass type; it is allowed to repeat the test on the same pane, if the pane will support it.

Pass/fail criteria: 8 out of 9 attempts shall be detected for each glass type.

6.4.2.3 Breakage performance test

These tests shall use the physical destruction characteristics (e.g. the sound of breakage), thickness and types of glass claimed to be supported by the manufacturer including the standard glass types listed in Table A.1, if claimed to be supported by the manufacturer:

For each glass type claimed to be supported by the manufacturer, 2 panes with nominal thickness of Annex A and standard size of Annex A will be tested by dropping a steel ball according to the test set up of Annex J (Tables J.1 and J.2). 8 samples shall be used to measure the detection performance (if a simultaneous installation is not supported, the test shall be performed for each detector separately and may require one pane per detector).

Pass/fail criteria: At least 7 out of 8 attempts shall be detected for each glass type.

The detectors shall be mounted at different positions according to the installation instructions of the manufacturer.

6.4.3 Hole drilling with a diamond hole saw

This test will be performed according to the grading listed in Table 3.

The drilling of a hole using a diamond hole saw will be performed. It will be verified, if the detector is able to identify and signal the change of the integrity of the monitored side of the glass pane. Three detectors will be mounted according to the installation instructions of the manufacturer (if a simultaneous installation is not supported the test shall be repeated three times one by one). A diamond hole saw with a diameter of 20 mm (±1 mm) will be used to drill a hole into the glass pane opposite to the monitored side. This will be performed once in the most distant position to the detector or its sensors and four times on randomly chosen positions within the coverage range claimed to be supported by the manufacturer.

Pass/fail criteria: The test is passed successfully, if the detector(s) has indicated the change of the integrity of the glass pane for the most distant position and detected at least three out of the four attempts on the randomly chosen positions. In case the change of integrity for the most distant position was not indicated, it is allowed to carry out three more tests in the most distant position, whereas all of them need to be indicated by the detector.

A change of integrity of a glass pane can be either a successful hole drilling or a destruction of the glass, complete or in parts, which allows access to the side where the detector or the sensor(s) are mounted.

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These tests need to be repeated for each glass type with the maximum size and minimum thickness claimed to be supported by the manufacturer.

6.4.4 Glass cutting

This test will be performed according to the grading listed in Table 3.

Three detectors will be mounted according to the manufacturer's installation instructions (if a simultaneous installation is supported, otherwise the test shall be repeated three times one by one). A standard glass cutter will be used to cut a piece of glass on the opposite side where the detector or its sensor element is mounted and the cut piece will be carefully broken. This will be performed once in the most distance position to the detector and four times on randomly chosen positions. At one location there will be a circle created, with a diameter of 100 mm ± 10 mm and carefully removed out of the glass pane.

Pass/fail criteria: The test is passed successfully, if the detector(s) has indicated the change of the integrity of the glass pane for the most distant position and detected at least three out of the four attempts on the randomly chosen positions. In case the change of integrity for the most distant position was not indicated, it is allowed to carry out three more tests in the most distant position, whereas all of them need to be indicated by the detector.

A change of integrity of a glass pane can be either a successful glass cutting or a destruction of the glass, complete or in parts, which allows access to the side where the detector or the sensor(s) are mounted.

All of the tests need to be repeated for each glass type with the maximum size and minimum thickness claimed to be supported by the manufacturer.

6.5 Switch-on delay, time interval between signals, and indication of detection

The general test conditions of 6.2 shall apply.

Switch on the detector power with the indicator enabled (if provided) and allow 180 s for stabilisation. Carry out the basic detection test. Note the response. After the specified time interval between signals carry out the basic detection test. Note the response. Disable the intrusion indicator (if provided). After the specified time interval between signals carry out the basic detection test. Note the response.

Pass/fail criteria: The detector shall generate an intrusion signal or message in response to each of the three basic detection tests. For the first and second basic detection tests, the intrusion signal or message and the intrusion indicator (if provided) shall both respond. For the third basic detection test there shall be no indication.

6.6 Fault condition signals or messages: self tests

The general test conditions of 6.2 shall apply.

Carry out the basic detection test to verify that the detector is operating.

Pass/fail criteria: The detector shall generate an intrusion signal or message and shall not generate tamper or fault signals or messages.

For grade 3 and 4 detectors, monitor the detector during a local self test.

Pass/fail criteria: The detector shall not generate any intrusion, tamper or fault signals or messages.

For grade 4 detectors, monitor the detector during a remote self test. Note the response.

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Pass/fail criteria: The detector shall generate an intrusion signal or message and shall not generate tamper or fault signals or messages.

Short the sensor signal output to ground or carry out an equivalent action as recommended by the manufacturer. For grade 3 and 4 detectors, monitor the detector during a local self test. For grade 4 detectors, also monitor the detector during a remote self test. For detectors with more than one sensor signal output, the test(s) shall be repeated for each output individually.

Pass/fail criteria: (local self test): The detector shall generate a fault signal or message and shall not generate intrusion or tamper signals or messages.

Pass/fail criteria: (remote self test): The detector shall generate a fault signal or message and shall not generate intrusion or tamper signals or messages.

It might be necessary to consult the detector manufacturer regarding the most appropriate method for initiating the specified faults.

6.7 Tests of immunity to false alarm sources

6.7.1 General

The general test conditions of 6.2 shall apply.

The purpose of this test section is to verify that impacts which will not result in a breakage of the monitored glass do not generate any type of signal or message to the CIE.

Before and after each of the following tests a basic functional test (6.3) will be performed, to verify that each detector is still in a valid working and detection condition.

The mounting positions of the detectors shall comply with the manufacturer's instructions.

Pass/fail criteria: There shall be no change of status of the detector during each of the following tests. After each performed test a basic functional test shall generate an alarm signal or message.

6.7.2 Immunity to small objects hitting the glass

This test will simulate hail hitting the window.

Whereas 6 detectors will be mounted on the opposite ('inner') side of the standard immunity glass pane, 3 kg hail consisting out of Polyoxymethylene according the below specification will be dropped at the other ('out') side of a glass pane running through a plastic tube with a length of 1,80 m, which is mounted at a distance of 50 mm and where at the end the hail will hit the centre of the monitored standard immunity glass pane.

Polyoxymethylene (Delrin®)[2] ball specification:

Material	Delrin 500 or 100 (or equivalent)
Density	1 390 kg·m^{-3} to 1 420 kg·m^{-3} (ISO 1183)
Diameter	12 mm ± 1 mm
Quantity per kg	790 pieces to 800 pieces
Tensile strength	57 MPa to 59 MPa (ISO 527-1/ ISO 527-2)
Rockwell Hardness	115 HRR to 122 HRR (ISO 2039-2)

[2] This information is given for the convenience of users of this standard and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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The test set up shall be according to the schematic drawing in Figure D.1.

The general pass/fail criteria in 6.7.1 shall apply.

6.7.3 Immunity to soft objects hitting the glass

This test will simulate soft objects hitting the centre of the glass pane (e.g. a human fist).

Whereas 6 detectors will be mounted on the opposite ('inner') side of the standard immunity glass pane, a pendulum test with rubber ball with the following characteristics will be performed:

Pendulum object (A)	Rubber ball
Diameter	80 mm ± 5 mm
Weight	0,38 kg ± 0,05 kg
Angle α	60° ± 5°
Number of tests	5
Minimum pause between each test:	5 s

The connection between the steel ball and the upper most point of the pendulum is a cotton string with a diameter of <3 mm. Each test will consist out of one hit, without repeated bouncing.

The test set up shall be according to Figure E.1.

The general pass/fail criteria in 6.7.1 shall apply.

6.7.4 Immunity to hard objects hitting the glass

This test will simulate hard objects hitting the centre of the glass pane (e.g. handlebars of a bicycle).

Whereas 6 detectors will be mounted on the opposite ('inner') side of the standard immunity glass pane, a pendulum test with a steel ball with the following characteristics will be performed:

Pendulum object (A)	Hardened steel ball
Diameter	40 mm ± 3 mm
Weight	0,26 kg ± 0,03 kg
Angle α	270° ± 1°
Number of tests	5
Minimum pause between each test	5 s

The connection between the steel ball and the upper most point of the pendulum is a cotton string with a diameter of <3 mm. Each test will consist of one hit, without repeated bouncing.

The test set up shall be according to Figure F.1.

The general pass/fail criteria in 6.7.1 shall apply.

6.7.5 Immunity to static pressure

This test will simulate a permanent pressure against the centre of the glass (e.g. change of the power of installation of the glass over time / tense glass over time, objects which are leaned against the glass, etc.).

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Whereas 6 detectors will be mounted on the opposite (“inner”) side of the standard immunity glass pane, a static pressure test with a pneumatic cylinder with the following characteristics will be performed:

Force with pressure object (F):	100 N ± 5 N tolerance
Exposure time:	5 s to 6 s
Number of tests:	5
Minimum pause between each test:	5 s

Description of pneumatic cylinder:

Type:	Pneumatic cylinder
Diameter of the touching surface element:	5 cm ± 0,2 cm
Type of surface of the touching surface element:	plain, PTFE

The test set up shall be according to Figure G.1.

The general pass/fail criteria in 6.7.1 shall apply

6.7.6 Immunity to dynamic pressure

This test will simulate dynamic changing pressures against the centre of the glass (e.g. change of air pressure, wind etc.).

Whereas 6 detectors will be mounted on the opposite (“inner”) side of the standard immunity glass pane, a dynamic pressure test with a pneumatic cylinder with the following characteristics will be performed:

Force with pressure object (F):	50 N ± 2,5 N tolerance
Exposure time:	1 s to 2 s
Number of tests:	5
Minimum pause between each test:	1 s

Description of pneumatic cylinder:

Type:	Pneumatic cylinder
Diameter of the touching surface element:	5 cm ± 0,2 cm
Type of surface of the touching surface element:	plain, PTFE

The test set up shall be according to Figure H.1.

The general pass/fail criteria in 6.7.1 shall apply.

6.7.7 Immunity to wide band noise based using IC’s

This test will simulate a wide band of frequencies, which is close to the sound of a glass breakage.

As a test tool there will be an Integrated Circuit (IC) with hardened legs / pins DIP40 PIN ICs or equivalent used. The standard immunity glass pane shall be used. The scratching will happen on the opposite side of the glass pane where the detectors are mounted.

Whereas 6 detectors will be mounted on the one (‘inner’) side of the standard immunity glass pane it will be scratched on the opposite (‘outer’) side, the maximum test time should last 2 min.

The general pass/fail criteria in 6.7.1 shall apply.

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6.8 Tamper security

6.8.1 General

The general test conditions of 6.2.1 shall apply.

6.8.2 Prevention of unauthorised access to the inside of the detector through covers and existing holes

Mount the detector according to the manufacturer's recommendations. Using commonly available small tools such as those specified in Annex B and by attempting to distort the housing attempt to gain access to all components and means of adjustment which, when interfered with, could adversely affect the operation of the detector.

Pass/fail criteria: Normal access shall require the use of an appropriate tool. For the grades specified in Table 4, it shall not be possible to gain access to any components, means of adjustment which, when interfered with, could adversely affect the operation of the detector, without generating a tamper signal or message or causing visible damage.

6.8.3 Detection of removal from the mounting surface

Confirm the operation of the back tamper device by removing the detector from the mounting surface. Place the unit on the mounting surface without permanently mounting it. Slowly lift the detector away from the mounting surface and attempt to prevent the tamper device from operating by inserting a strip of steel between 100 mm and 200 mm long by 10 mm to 20 mm wide, and 1 mm thick, between the rear of the detector and its mounting surface.

Pass/fail criteria: A tamper signal or message shall be generated before the tamper device can be inhibited.

6.8.4 Resistance to magnetic field interference

Connect power to the detector and wait 180 s. A magnet of nominal remanence in accordance with Annex C and Table 4 shall be placed on each surface of the detector housing in sequence whilst the basic detection test is performed. The magnet shall be applied in a manner that ensures that a single magnetic pole contacts the surface, to maximise flux penetration. Record the response of the detector.

Then interrogate each tamper detection device and record any change of state, including the state of the relay. The magnets shall be as specified in Annex C.

Pass/fail criteria: A tamper signal or message shall be produced, according to Table 4 or the detector shall continue to work normally without a signal or message being generated. The presence of the magnet shall not prevent correct generation of any signal or message.

6.8.5 Detection of masking

A wet newspaper shall be placed on the opposite to the monitored side of the standard immunity glass pane, covering the overall surface of the pane. After the material had been applied to the pane wait 180 s for the system to stabilise and perform a breakage of the glass pane according to J.1.

Pass/fail criteria: Either an intrusion or / and a fault signal or message or an independent anti-masking signal or message shall be generated within 180 s of the masking material being applied, and shall continue to be generated as long as the material is in place. Alternatively, the detector shall continue to operate normally.

If the test failed, it shall be repeated twice more. Two passes out of the three tests shall constitute a passed test.

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6.9 Electrical tests

6.9.1 General

The BTS given in 6.3 shall be used where appropriate for verification. Connect the detector to a variable, stabilised power supply and allow it to stabilise for at least 180 s.

Table 5 specifies grade dependency.

6.9.2 Detector current consumption

This test is not applicable to detectors with Type C power supplies.

Connect the detector to a suitable variable, stabilised power supply with a current measuring meter in series. Connect a voltmeter across the power input terminals of the detector. Set the voltage to the nominal supply voltage and allow the detector to stabilise for at least 180 s.

Place the detector in the mode which draws the maximum current as described by the manufacturer and measure the current drawn.

Place the detector in the mode which draws quiescent current as described by the manufacturer and measure the current drawn.

Pass/fail criteria: The current shall not exceed the manufacturer's stated values by more than 20 % in either mode.

6.9.3 Slow input voltage change and input voltage range limits

Connect the detector to a suitable variable, stabilised power supply.

Raise the supply voltage from zero at a rate of 0,1 $V \cdot s^{-1}$ in steps not greater than 10 mV until the nominal supply voltage V –25 % is reached, or the minimum supply voltage specified by the manufacturer, whichever is lower. Allow the detector to stabilise for 180 s.

Monitor the intrusion and fault signals or messages and carry out the basic detection test. This test is not applicable to detectors with Type C power supplies.

Pass/fail criteria: The basic detection test shall cause an intrusion signal or message and shall not cause a fault signal or message.

Reset the input voltage to the nominal V +25 % or the maximum level specified by the manufacturer, whichever is greater. Allow the detector to stabilise for 180 s. Monitor the intrusion and fault signals or messages and carry out the basic detection test. This test is not applicable to detectors with type C power supplies.

Pass/fail criteria: The basic detection test shall cause an intrusion signal or message and shall not cause a fault signal or message.

For detectors of the grade dependent requirements according to Table 1, lower the supply voltage at a rate of 0,1 $V \cdot s^{-1}$ in steps of not more than 10 mV until a fault signal or message is generated. Carry out the basic detection test.

Pass/fail criteria: For detectors of the grade dependent requirements according to Table 1, the detector shall generate a fault signal or message according to the requirements of Table 2 prior to the situation where no intrusion signal or message is generated when the basic detection test is carried out

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6.9.4 Input voltage ripple

This test is not applicable to detectors with Type C power supplies.

Set a signal generator to the nominal voltage V. Allow 180 s for the detector to stabilise. Modulate the detector supply voltage V by ±10 % at a frequency of 100 Hz for a further 180 s.

During the application of the ripple carry out a basic detection test. Observe whether any intrusion or fault signals or messages are generated.

Pass/fail criteria: There shall be no unintentional signals or messages generated by the detector during the voltage ripple test. There shall be an intrusion signal or message generated by the BTS.

6.9.5 Input voltage step change

This test is not applicable to detectors with Type C power supplies.

Connect the detector to a square wave generator limited to a maximum current of 1 A, capable of switching from the nominal supply voltage V to the nominal voltage V ±25 % in 1 ms.

Set the input voltage to the nominal supply voltage V and allow at least 180 s for the detector to stabilise. Monitor intrusion and fault signals or messages. Apply ten successive square wave pulses from nominal supply voltage V to V +25 %, of duration 5 s at intervals of 10 s. Repeat the step change test for the voltage range V to V –25 %.

Pass/fail criteria: There shall be no unintentional signals or messages generated by the detector during the test.

6.9.6 Total loss of power supply

This test is not applicable to detectors with Type C power supplies.

Connect the detector to a suitable variable, stabilised power supply. Set the voltage to the nominal supply voltage and allow the detector to stabilise for at least 180 s.

Monitor the intrusion and fault signals or messages and disconnect the detector from the power supply.

Pass/fail criteria: The detector shall either generate signals or messages according to the requirements of Table 2. Alternatively total loss of power supply may be determined by loss of communication with the detector by the CIE.

6.10 Environmental classification and conditions

Unless stated otherwise the general test conditions of 6.2.1 shall apply.

Detectors shall be subjected to the environmental conditioning described in IEC 62599-1 according to the requirements of Tables 6 and 7, and the tests of the EMC product family standard IEC 62599-2.

Detectors subjected to the operational tests are always powered. Detectors subjected to the endurance tests are always un-powered.

Monitor the detector for unintentional intrusion and (where applicable) tamper signals or messages. No functional test is required during the tests.

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After the tests and any recovery period prescribed by the environmental test standard carry out the basic detection test, and visually inspect the detector both internally and externally for signs of mechanical damage.

After the water ingress test, wipe any water droplets from the exterior of the enclosure, dry the detector, and carry out the basic detection test. Warm air shall not be used for drying.

After the SO_2 test, detectors shall be washed and dried in accordance with the procedure prescribed in IEC 60068-2-52:1984 (First edition). The basic detection test shall be performed immediately after drying.

Table 6 – Operational tests

Test	Environmental classification		
	Class I	Class II	Class III
Dry heat	Required	Required	Required
Cold	Required	Required	Required
Damp heat (steady state)	Required	Not required	Not required
Damp heat (cyclic)	Not required	Required	Required
Water ingress	Not required	Not required	Required
Mechanical shock	Required	Required	Required
Vibration	Required	Required	Required
Impact	Required	Required	Required
EMC	Required	Required	Required

Pass/fail criteria: No unintentional signals or messages shall occur during the tests. There shall be no signs of mechanical damage after the tests and the detector shall continue to meet the requirements of the basic detection test.

Table 7 – Endurance tests

Test	Environmental classification		
	Class I	Class II	Class III
Damp heat (steady state)	Required	Required	Required
Damp heat (cyclic)	Not required	Not required	Required
SO_2 corrosion	Not required	Required	Required
Vibration (sinusoidal)	Required	Required	Required

Pass/fail criteria: There shall be no signs of mechanical damage after the tests and the detector shall continue to meet the requirements of the basic detection test

6.11 Marking, identification and documentation

6.11.1 Marking and/or identification

Examine the detector visually to confirm that it is marked either internally or externally with the required marking and / or Identification (given in IEC 62642-1).

Pass/fail criteria: All specified markings shall be present.

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6.11.2 Documentation

By visual inspection ensure the detector has been supplied with clear and concise installation instructions and maintenance functions, all information specified in this standard and in IEC 62642-1, and the manufacturers claimed performance data.

Pass/fail criteria: All information specified shall be present.

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