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English Version

Alarm systems - Intrusion and hold-up systems - Part 2-4: Requirements for combined passive infrared and microwave detectors

Systèmes d'alarme - Systèmes d'alarme contre l'intrusion et les hold-up - Partie 2-4: Exigences pour détecteurs combinés à infrarouges passifs et à hyperfréquences

Alarmanlagen - Einbruch- und Überfallmeldeanlagen - Teil 2-4: Anforderungen an Passiv-Infrarotdualmelder und Mikrowellenmelder

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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European foreword

This document (EN 50131-2-4:2020) has been prepared by CLC/TC 79, “Alarm systems”.

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2021-06-30
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2023-06-30

This document supersedes EN 50131-2-4:2008 and all of its amendments and corrigenda (if any).

EN 50131-2-4:2020 includes the following significant technical changes with respect to EN 50131-2-4:2008:

— editorial changes and refinement of wording;

— clarification to significant reduction of range requirements;

— clarification to the Electrical requirements section and certain environmental conditions;

— addition of requirements, tests and corresponding Annexes throughout the overall standard, to support ceiling mounted detectors;

— improvement of the requirements of the supplied documentation;

— improvement of the standard conditions for testing;

— addition of chapter which defines the condition for the mounting height while the tests are performed;

— refinement of the standard requirements for the Testing procedures;

— refinement of the Immunity to air flow test to allow for better repeatability of the test results;

— verifying and clarifying of the wording of the test for resistance to or detection of re-orientation of adjustable mountings;

— updating of the test magnet specification for resistance to magnetic field interference;

— verifying and clarifying of the wording for the detection of detector masking in regards to the conditions and the test material;

— review and optimization of the methods for temperature adjustments for the test environment;

— review of Sample Testmatrix;

— review and verifying of references to other standards.

EN 50131 consists of the following parts, under the general title *Alarm systems - Intrusion and hold-up systems*:

— *Part 1: System requirements*

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— *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*

— *Part 2–7–1: Intrusion detectors – Glass break detectors – Acoustic*

— *Part 2–7–2: Intrusion detectors – Glass break detectors – Passive*

— *Part 2–7–3: Intrusion detectors – Glass break detectors – Active*

— *Part 3: Control and indicating equipment*

— *Part 4: Warning devices*

— *Part 5–3: Requirements for interconnections equipment using radio frequency techniques*

— *Part 6: Power supplies*

— *Part 7: Application guidelines*

— *Part 8: Security fog devices*

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Introduction

This document deals with combined passive infrared and microwave detectors (to be referred to as the detector) used as part of intrusion alarm systems installed in buildings. It includes four security grades and four environmental classes.

The purpose of the detector is to detect the broad spectrum infrared radiation emitted by an intruder, to emit microwave signals and analyse the signals that are returned and to provide the necessary range of signals or messages to be used by the rest of the intrusion alarm system.

The number and scope of these signals or messages will be more comprehensive for systems that are specified at the higher grades.

This version of the standard contains limited requirements for Grade 4 detectors. Future revisions of the standard are expected to include enhanced requirements for Grade 4 detectors.

This document is only concerned with the requirements and tests for the detector. Other types of detector are covered by other documents identified as in the EN 50131-2 series.

NOTE Each country has certain regulations in regards to which part of the microwave spectrum is allowed to be used in this application. This information can be found in ERC recommendation 70-03.

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1 Scope

This document is for combined passive infrared and microwave detectors installed in buildings and provides for security grades 1 to 4 (see EN 50131-1), specific or non-specific wired or wire-free detectors, and uses environmental classes I to IV (see EN 50130-5). This document does not include requirements for detectors intended for use outdoors.

The purpose of the detector is to detect the broad spectrum infrared radiation emitted by an intruder, to emit microwave signals and analyse the signals that are returned and to provide the necessary range of signals or messages to be used by the rest of the intrusion alarm system.

For a combined detector where both detection technologies need to be in their activated state in order to generate an alarm condition, the grade-dependent requirements of this document apply. For combined detectors which can be configured or operated such that each detection technology can generate an alarm condition independently, the grade-dependant requirements as defined in EN 50131-2-2 and EN 50131-2-3 apply, when configured accordingly. Otherwise, it is the responsibility of the manufacturer to clearly state that the detector does not comply to this document and not to EN 50131-2-2 and EN 50131-2-3 when put into such a configuration.

It is essential that a detector fulfils all the requirements of the specified grade.

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

Requirements for system interconnections are not included in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

EN 50130-5, *Alarm systems — Part 5: Environmental test methods*

EN 50131-1, *Alarm systems — Intrusion and hold-up systems — Part 1: System requirements*

EN 50131-6, *Alarm systems — Intrusion and hold-up systems — Part 6: Power supplies*

EN 60404-5, *Magnetic materials — Part 5: Permanent magnet (magnetically hard) materials — Methods of measurement of magnetic properties (IEC 60404-5)*

EN 60404-8-1, *Magnetic materials — Part 8-1: Specifications for individual materials — Magnetically hard materials (IEC 60404-8-1)*

EN 60404-14, *Magnetic materials — Part 14: Methods of measurement of the magnetic dipole moment of a ferromagnetic material specimen by the withdrawal or rotation method (IEC 60404-14)*

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3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions and abbreviations given in EN 50131-1 and the following apply.

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

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

3.1 Terms and definitions

3.1.1
activated state
condition where a detection technology participates in the generation of an alarm signal or message

3.1.2
basic detection target
heat source and/or microwave reflector designed to verify the operation of a detector

3.1.3
coverage angle
width of field of view in degrees provided by the detector when measured in the horizontal plane

3.1.4
combined passive infrared and microwave detector
device used to determine the presence of human intruders by sensing the broad-spectrum infrared emitted by a human being and differences between emitted and reflected microwave signals due to the associated movement

Note 1 to entry: The infrared and microwave detection technology are housed within the same enclosure.

3.1.5
detection settings
adjustments which influence the performance of the detector (e.g. pulse count settings, gain settings)

3.1.6
detector reference axis
virtual line determined by the detector manufacturer projecting from the point of origin of the detection coverage pattern

3.1.7
incorrect operation
physical condition that causes an inappropriate signal from a detector in the context of this document

3.1.8
masking
interference with the ability to detect human intruders by the introduction of a physical obstruction such as metal, plastic, paper or sprayed paints or lacquers on or in close proximity to the detector

3.1.9
microwave detector
device used to determine the presence of human intruders by sensing the differences between emitted and reflected microwave signals due to movement

3.1.10
passive infrared detector
device used to determine the presence of human intruders by sensing the broad-spectrum infrared emitted by a human being

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3.1.11
simulated walk test target
non-human or synthetic heat source or microwave reflector designed to simulate the standard walk test target

3.1.12
standard walk test target
human being of defined weight and height clothed in close fitting garments

3.1.13
walk test
operational test to demonstrate detection performance during which a detector is stimulated by the standard walk test target in a controlled environment

3.1.14
walk test attitude, crawling
orientation of the standard walk test target moving with hands and knees in contact with the floor

3.1.15
walk test attitude, upright
orientation of the standard walk test target standing and walking with arms held at the sides of the body

3.2 Abbreviations

HDPE	High Density PolyEthylene
PIR	Passive InfraRed
EMC	Electromagnetic Compatibility
SWT	Standard Walk-test Target
BDT	Basic Detection Target
FOV	Field Of View

4 Functional requirements

4.1 Event Processing

Detectors shall process the events shown in Table 1.

Table 1 — Events to be processed by grade

Event	Grade			
	1	2	3	4
Intrusion Detection	M	M	M	M
Tamper Detection	Op	M	M	M
Masking Detection	Op	Op	M	M
Low Supply Voltage	Op	Op	M	M
Total Loss of Power Supply	Op	M	M	M
Local Self-Test	Op	Op	M	M
Remote Self-Test	Op	Op	Op	M
M = Mandatory Op = Optional				

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Detectors shall generate signals or messages as shown in Table 2.

Table 2 — Generation of Signals or Messages

Event	Signals or Messages		
	Intrusion	Tamper	Fault
No Event	NP	NP	NP
Intrusion	M	NP	NP
Tamper	NP	M	NP
Masking [a]	M	Op	M
Low Supply Voltage	Op	Op	M
Total Loss of Power Supply [b]	M	Op	Op
Local Self-Test Pass [a]	NP	NP	NP
Local Self-Test Fail	NP	NP	M
Remote Self-Test Pass [a]	M	NP	NP
Remote Self-Test Fail	NP	NP	M
M = Mandatory NP = Not Permitted Op = Optional			
This permits two methods of signalling a masking: either by the intrusion signal and fault signal, or by a dedicated masking or message. 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 prioritize 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.			
[a] An independent signal or message may be provided instead. [b] Total loss of Power Supply does not apply for message based detectors.			

4.2 Detection

4.2.1 Detection performance

Both detection technologies shall be in an activated state, before the alarm condition shall be generated.

The detector shall generate an intrusion signal or message when the standard or simulated walk-test target moves at velocities and attitudes specified in Table 3. For detection across the boundary the walk-test distance shall be 1,5 m either side of the boundary. For test "Detection within the boundary" the walk-test distance shall be 3,0 m.

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Table 3 — General walk test velocity and attitude requirements

Test	Grade 1	Grade 2	Grade 3	Grade 4
Detection across the boundary	Required	Required	Required	Required
Velocity	1,0 ms^{-1}	1,0 ms^{-1}	1,0 ms^{-1}	1,0 ms^{-1}
Attitude	Upright	Upright	Upright	Upright
Detection within the boundary	Required	Required	Required	Required
Velocity	0,3 ms^{-1}	0,3 ms^{-1}	0,2 ms^{-1}	0,1 ms^{-1}
Attitude	Upright	Upright	Upright	Upright
Detection at high velocity	Not required	Required	Required	Required
Velocity	N/A	2,0 ms^{-1}	2,5 ms^{-1}	3,0 ms^{-1}
Attitude	N/A	Upright	Upright	Upright
Close-in detection performance (For coverage angles less than or equal to 180°)	Required	Required	Required	Required
Distance	2,0 m	2,0 m	0,5 m	0,5 m
Velocity	0,5 ms^{-1}	0,4 ms^{-1}	0,3 ms^{-1}	0,2 ms^{-1}
Attitude	Upright	Upright	Crawling	Crawling
Detection of radial movement (For coverage angles of 360°)	Required	Required	Required	Required
Velocity	0,5 ms^{-1}	0,4 ms^{-1}	0,3 ms^{-1}	0,2 ms^{-1}
Attitude	Upright	Upright	Upright	Upright
Intermittent movement detection performance [a]	Not required	Not required	Required	Required
Velocity	N/A	N/A	1,0 ms^{-1}	1,0 ms^{-1}
Attitude	N/A	N/A	Upright	Upright

[a] For grade 3 and 4 detectors, the intermittent movement shall consist of the SWT walking 1 m at a velocity of 1,0 ms^{-1} then pausing for 5 s before continuing. The sequence shall be maintained until the SWT has traversed through the entire detection area. This constitutes one walk test. The test shall be repeated in each of the directions shown in Figure C.3.

The detection performance tests required for a detector will depend on the coverage angle claimed. Therefore this document differentiates between detectors with coverage angles less than or equal to 180°, such as those typically used for wall mounted applications, and detectors with coverage angles of 360° detectors intended for ceiling mounting.

4.2.2 Indication of detection

An indicator shall be provided at the detector to indicate when an intrusion signal or message has been generated. At grades 1 and 2 this indicator shall be capable of being enabled and disabled either remotely at Access Level 2 and/or locally enabled/disabled after removal of a cover which provides tamper detection as described in Tables 1 and 4. At grades 3 and 4 this indicator shall be capable of being enabled and disabled remotely at Access Level 2.

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4.3 Operational requirements

4.3.1 Time interval between intrusion signals or messages

Detectors using wired interconnections 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.

Detectors using wire free interconnections 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

4.3.2 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.

4.3.3 Self-tests

4.3.3.1 General

Self-tests shall detect failures of a critical function (e.g. unable to detect temperature differences) and signal these situations according to Table 2. As a minimum the self-tests shall detect failures of the output of each sensing technology.

4.3.3.2 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.

4.3.3.3 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.

4.4 Immunity of the individual technologies to incorrect operation

4.4.1 General

The detector shall be considered to have sufficient immunity to incorrect operation if the following requirements have been met. No intrusion signal or message shall be generated during the tests.

4.4.2 Immunity to turbulent warm air flow

The PIR component of the detector shall not initiate the generation of any signals or messages when turbulent warm air is blown over the face of the detector.

4.4.3 Immunity to visible & near infrared radiation

The PIR component of the detector shall not initiate the generation of any signals or messages when a beam of visible light is swept across the front window or lens through two panes of glass.

4.4.4 Immunity to microwave signal interference by fluorescent lights

The microwave component of the detector shall not initiate the generation of any signals or messages due to the operation of a fluorescent light source mounted nearby.

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4.5 Tamper security

4.5.1 General

Tamper security requirements for each grade of 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	Required	Required	Required	Required
Detection of access to the inside of the detector	Not Required	Required	Required	Required
Removal from the mounting surface wired detectors	Not required	Not Required	Required	Required
Removal from the mounting surface wirefree detectors	Not required	Required	Required	Required
Resistance to, or detection of, re-orientation Applied torque	Not required	Required 2 Nm	Required 5 Nm	Required 10 Nm
Magnetic field immunity Magnet Type defined in Annex A	Not required	Required Type 1	Required Type 2	Required Type 2
Masking Detection	Not required	Not required	Required	Required

4.5.2 Resistance to and detection of unauthorised access to components and means of adjustment

All components, means of adjustment and access to mounting screws, 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 such 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 for each claimed mounting type (e.g. wall, ceiling, corner, brackets) in accordance with Table 4.

The tamper detection mechanism shall not be defeated by the use of small tools as per the examples in Annex I.

4.5.4 Resistance to, or detection of, re-orientation

Detectors mounted on adjustable mountings, shall resist or detect reorientation.

After the torque given in Table 4 has been applied and then removed from the detector it shall not have rotated more than 5° from its original position. Alternatively, when the torque given in Table 4 has been applied, a tamper signal or message shall be generated if the detector rotates by more than 5°.

4.5.5 Immunity to magnetic field interference

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

4.5.6 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.

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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 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.

No masking signal or message shall be generated by normal human movement according to Figure C.5.

For detectors where detection of masking may be remotely disabled the detection of masking shall operate when the I&HAS is unset; it is not required to operate when the I&HAS is set.

4.6 Electrical requirements

4.6.1 General

The grade-dependencies appear in Table 5. These requirements do not apply to detectors having internal Type C power supplies. For these detectors, refer to EN 50131-6.

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 change 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 manufacturer's stated values if greater. When the supply voltage is lowered slowly, the detector shall function normally at the specified range limits.

The detector shall generate a fault signal or message according to Table 1 and 2, prior to the situation where the detector is unable to function correctly due to low supply voltage.

4.6.4 Input voltage ripple

The detector shall meet all functional requirements during the modulation of the input voltage by a peak to peak voltage of 10 % of the nominal value, 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 nominal and maximum and between nominal and minimum.

4.7 Environmental classification and conditions

4.7.1 Environmental classification

The environmental classification is described in EN 50131-1 and shall be specified by the manufacturer.

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4.7.2 Immunity to environmental conditions

Detectors shall meet the requirements of the environmental tests described in Tables 7 and 8. These tests shall be performed in accordance with EN 50130-4 and EN 50130-5.

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.

Impact tests shall not be carried out on delicate detector components such as LEDs, optical windows or lenses.

For endurance tests, the detector shall continue to meet the requirements of this document 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 EN 50131-1.

5.2 Documentation

The product shall be accompanied with clear and concise documentation conforming to the main systems document EN 50131-1. The documentation shall additionally state:

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

b) the manufacturer's diagram as scaled drawing of the detector and its claimed detection boundary showing top and side elevations at the claimed nominal mounting height, superimposed upon a scaled 2,0 m squared grid. The size of the grid shall be directly related to the size of the claimed detection boundary;

c) the claimed nominal mounting height, and the effect of changes to it on the claimed detection boundary;

d) the effect of adjustable controls on the detector's performance or on the claimed detection boundary including at least the minimum and maximum settings;

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

f) any specific settings needed to meet the requirements of this document at the claimed grade;

g) any non-compliant detection settings shall be identified;

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

i) a warning to the user not to obscure partially or completely the detector's field of view;

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

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

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tolerance of ± 10 % unless otherwise stated. A list of tests appears as a general test matrix in Annex B, Table B.1.

6.2 General test conditions

6.2.1 Standard conditions for testing

The general atmospheric conditions in the measurement and tests laboratory shall be, unless stated otherwise:

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

All values are “inclusive values”.

6.2.2 General detection testing environment and procedures

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

6.2.3 Testing environment

The detection tests require an enclosed, unobstructed and draught-free area that enables testing of the manufacturer’s claimed coverage pattern. The test area shall be large enough so as not to significantly affect the microwave coverage pattern due to reflections.

The test area walls and floor shall have a recommended emissivity of at least 80 % between 8 µm and 14 µm wavelength, at least directly behind the SWT.

The temperature of the background surface immediately behind the SWT shall be in the range 15 °C to 25 °C, and shall be horizontally uniform over that area to ± 2 °C. Over the whole background area it shall be measured at ten points spread evenly throughout the coverage pattern. The average background temperature is the linear average of the ten points.

Annex C provides example diagrams for the range of walk tests for one format of detection pattern and similarly a 360° detection pattern. Many others are possible.

6.2.4 Mounting height

If the manufacturer claims different detection patterns for different mounting heights, each pattern shall be tested at the specified height.

If the manufacturer claims one pattern for a range of mounting heights, the full pattern shall be tested at the claimed nominal height. If no nominal is specified, the full pattern shall be tested at the midpoint of the height range. For detectors with coverage angles less than or equal to 180° at the maximum mounting height all test points closer than 4,0 m from the detector shall be tested and all test points at maximum claimed range shall be tested. For detectors with a coverage angle of 360° all test points at maximum claimed range shall be tested. At the minimum mounting height all test points at maximum claimed range shall be tested.

The mounting heights apply to walk tests only and not for any other tests, e.g. EMC and environmental.

6.2.5 Standard walk test target

6.2.5.1 General

The SWT shall have the physical dimensions of 1,60 m to 1,85 m in height, shall weigh 70 kg ± 10 kg and shall wear close-fitting clothing having a recommended emissivity of at least 80 % between 8 µm and 14 µm wavelength. No metallic objects shall be worn or carried by the SWT or incorrect microwave reflection will result.

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6.2.5.2 Standard walk test target temperature

Temperatures shall be measured at the following five points on the surfaces of the SWT that are facing the detector at the time of the walk test for a given test point:

1. Head
2. Chest
3. Back of hand
4. Knee
5. Feet

Temperatures shall be measured using a non-contact thermometer or equivalent equipment.

The temperature differential at each body point is measured, then weighted and averaged as detailed in Annex D, D.1.

There shall be a means of calibration and control of the desired velocity at which the SWT is required to move.

The use of a simulator/robot in place of the SWT is permitted, provided that it meets the specification of the SWT with regard to temperature and microwave reflectivity. It is known as the simulated target. In case of conflict, a human walk test shall be the primary reference.

6.2.5.3 Standard walk test target temperature differential

The walk tests shall be performed either with an average temperature differential Dtr (as calculated in Annex D, D.1) of 3,5 °C ± 20 %, or if the temperature differential is larger than 3,5 °C + 20 % (4,2 °C), it may be adjusted by one of the means specified in Annex D, D.2.

6.2.6 Testing procedures

The detector shall be connected to the nominal supply voltage, and connected to equipment with a means of monitoring intrusion signals or messages. The detector shall be allowed to stabilise for 180 s.

Any non-compliant detection settings shall be identified by the manufacturer and not subject to testing.

All tests will be performed at the most sensitive setting (e.g. minimum pulse count) unless otherwise stated.

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 a detector. The basic detection test is performed using the BDT(s).

The manufacturer shall provide, for testing purposes only, methods for placing either technology permanently in an activated state where the other technology may cause an intrusion signal or message.

6.3.2 Basic detection targets (BDT)

The BDT is a human hand, alternatively the BDT consists of a heat source with heat emission equivalent to that of a human hand, which can be moved across the field of view of the detector. An informative description is given in Annex E. The temperature of the source shall be between 3,5 °C and 10,0 °C above the background.

A short range walk test may be carried out as an alternative to using the BDT.

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6.3.3 Basic Detection Test procedure

A stimulus that is similar to that produced by the SWT using the BDT is applied to the detector. Move the BDT perpendicularly across the centre line of the detection field at a distance of not more than 1 m, and at a height where the manufacturer claims detection will occur.

Move the BDT along a distance of 1 m at a velocity of 0,5 ms^{-1} to 1,0 ms^{-1}. The detector 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.

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

6.4 Walk testing

6.4.1 General walk test method

Walk testing is accomplished by the controlled movement of a SWT across the field of view of the detector. The grade dependent velocities and attitudes to be used by the SWT are specified in Table 3. The tolerance of these velocities shall be better than ± 10 %. The SWT begins and ends a walk with feet together. Annex F is an informative description of two systems that may be used to control and monitor the desired velocity.

The detector shall be mounted at a height according to 6.2.4. The orientation shall be as specified by the manufacturer with unobstructed view of the walk test to be performed.

When the detector is walk tested, it shall be set to the least sensitive setting required to achieve the claimed compliant detection coverage (e.g. maximum pulse count).

Before commencing and after completing each walk test, the SWT shall stand still for at least 20 s.

The walk test attitude, crawling, is a crawling attitude which shall consist of the standard walk test target moving with hands and knees in contact with the floor.

The walk test attitude, upright, is an upright attitude which shall consist of the standard walk test target standing and walking with arms held at the sides of the body.

6.4.2 Verification of detection performance

The general test conditions of 6.2 shall apply to all tests in this series.

Detection performance shall be tested against the manufacturer's documented claims. The manufacturer shall provide the test laboratory with scaled drawings of the claimed detection boundary superimposed on a 2,0 m grid, see Annex C, Figure C.6. The manufacturer shall declare the detector reference axis.

Care should be taken when defining the claimed detection boundary as inaccuracy in the boundary may result in test failure.

Example walk test diagrams are shown in Annex C.

It is recommended that the test laboratory mark on the scaled drawings, the locations of the test points as determined by the following procedures for reference during the walk testing. Detection settings shall be set to the values recommended by the manufacturer to achieve the claimed performance.

Preferably the detection coverage will be tested as a whole, however if the dimensions of the detection pattern exceed the available test space, it is permitted to test the detection performance in sections, provided the performance of the microware technology is not influenced by the close proximity to walls or other objects.

For example, detectors with a coverage angle of 360° can be tested in sections where it is permitted to rotate the detector in order to test the complete coverage pattern as described in the corresponding procedures for the tests. If this method is used, sufficient clearance shall be provided when mounting close to a wall or other structure, to allow adequate space for the tests to be performed unimpeded.

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If a detector has been tested in sections, the method shall be described in the test report.

The SWT or a suitable simulated target, with its temperature difference with the background adjusted according to Annex D, shall be used. Grade dependent velocities and attitudes are specified in Table 3.

6.4.3 Detection across and within the detection boundary

6.4.3.1 General

The tests assess the ability to detect intruders moving within and across the boundaries of the detection area.

6.4.3.2 Verify detection across the boundary for detectors with coverage angles less than or equal to 180°

Figure C.1 a) shows an example of a manufacturer's claimed detection boundary for a detector with a coverage angle less than 180°.

Place test points at 2,0 m intervals (measured in straight line distances) around the claimed detection boundary of the detector, starting from the detector, and finishing where the claimed detection boundary crosses the detector reference axis. Repeat for the opposite side of the detection pattern. If the gap between the final point on each side is greater than 2,0 m, place a test point where the claimed detection boundary crosses the detector axis. For Grade 1 detectors it is only necessary to test alternate test points.

Each test point is connected to the detector by a radial line. At each test point, two test directions into the detection coverage pattern are available at +45° and -45° to the radial line. Both directions shall be tested beginning at a distance of 1,5 m from the test point, and finish 1,5 m after it. If the placement of the test point results in one of the test directions being outside the claimed detection boundary, this direction shall be rotated 180° such that the SWT enters the coverage pattern. An example of a test point direction that must be rotated is shown at the location labelled A of Figure C.1 a). Similarly, the directions of the next three adjacent test points are also rotated.

A walk test is a walk in one direction through a test point.

A walk test that generates an intrusion signal or message is a passed walk test.

Pass / Fail Criteria: An intrusion signal or message shall be generated in response to the first walk test. Alternatively if the first walk test attempt does not generate an intrusion signal or message then four further attempts shall be carried out. All of these further attempts shall generate an intrusion signal or message to constitute a passed walk test.

6.4.3.3 Verify detection across the boundary for detectors with a coverage angle of greater than 180°

Figure C.1 b) shows an example of a manufacturer's claimed detection boundary for a detector with 360° coverage angle. Place test points at 2,0 m intervals (measured in straight line distances) around the claimed detection boundary of the coverage pattern, starting from the point where the claimed detection boundary crosses the detector reference axis and working in a clockwise direction until either the detector or the first test point is reached. For Grade 1 detectors it is only necessary to test alternate test points.

At each test point, two test directions into the detection coverage pattern are available at +45° and -45° to the radial line. Both directions shall be tested beginning at a distance of 1,5 m from the test point, and finish 1,5 m after it.

A walk test is a walk in one direction through a test point.

If the detection performance is tested in sections (e.g. four sections of 90°), this shall be equivalent to the detection performance when tested in one section. The test points must fall on the same points around the circumference as if the test was done in 360°.

Pass / Fail Criteria: An intrusion signal or message shall be generated in response to the first walk test. Alternatively, if the first walk test attempt does not generate an intrusion signal or message then four further attempts shall be carried out. All of these further attempts shall generate an intrusion signal or message to constitute a passed walk test.

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6.4.3.4 Verify detection within the boundary for detectors with coverage angles less than or equal to 180°

Figure C.2 a) shows an example of a manufacturer's claimed detection boundary for a detector with a coverage angle less than 180°.

Starting at the detector, place the first test point at 4,0 m along the detector reference axis. Using the 2,0 m squared grid, place further test points at alternate grid intersections within the claimed detection boundary as shown in the Figure C.2 a). Test points located 1 m or less from a claimed detection boundary test point (as determined in 6.4.3.2) can be omitted.

Each test point is connected to the detector by a radial line. At each test point, two test directions are available, at +45° and -45° to the radial line. Both directions shall be tested beginning at a distance of 1,5 m from the test point, and finish 1,5 m after it.

A walk test is a walk in one direction through a test point

Pass / Fail Criteria: An intrusion signal or message shall be generated in response to the first walk test. Alternatively, if the first walk test attempt does not generate an intrusion signal or message then four further attempts shall be carried out. All of these further attempts shall generate an intrusion signal or message to constitute a passed walk test.

6.4.3.5 Verify detection within the boundary for detectors with coverage angle of greater than 180°

Figure C.2 b) shows an example of a manufacturer's claimed detection boundary for a detector with 360° coverage angle.

Starting at the detector, place the first two test points at 2,0 m along the detector reference axis on both sides of the detector. Refer to 1 and 2 of Figure C.2 b). Draw lines from each initial test point with an angle of +45° and -45° from the detectors reference axis. Where the lines intersect, two more test points will be placed. Refer to 3 and 4 of Figure C.2 b).

Using the 2,0 m squared grid, place further test points at alternate grid intersections within the claimed detection boundary. Test points that fall outside of the claimed detection boundary or are located 1 m or less from a claimed detection boundary test point (as determined in 6.4.3.3) can be omitted.

Each test point is connected to the detector by a radial line. At each test point, two test directions are available, at + 45° and – 45° to the radial line. Both directions shall be tested beginning at a distance of 1,5 m from the test point, and finish 1,5 m after it.

A walk test is a walk in one direction through a test point.

If the detection performance is tested in sections (e.g. four sections of 90°), this shall be equivalent to the detection performance when tested in one section. The test points must fall on the same points as if the test was done in 360°.

Pass / Fail Criteria: An intrusion signal or message shall be generated in response to the first walk test. Alternatively, if the first walk test attempt does not generate an intrusion signal or message then four further attempts shall be carried out. All of these further attempts shall generate an intrusion signal or message to constitute a passed walk test.

6.4.4 Verify the high-velocity detection performance for detectors with a coverage angle less than or equal to 180°

Four walk tests are performed. Initially two walk tests begin outside the claimed detection boundary, from opposite sides, and pass through the detector reference axis mid-range point at +45° and -45° to the detector reference axis, and moving towards the detector. The third and fourth walk tests pass in opposite directions at right angles to the detector reference axis at a distance of 2 m in front of the detector. Examples are shown in Figure C.3 a).

The SWT shall cross all of the specified detection area, coming to rest after clearing the other claimed detection boundary.

Pass / Fail Criteria: An intrusion signal or message shall be generated for each of the four walk tests.

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6.4.5 Verify the high-velocity detection performance for detectors with a coverage angle of greater than 180°

Figures C.3 b) and c) show examples of a manufacturer's claimed detection boundary for a detector with a 360° coverage angle.

To determine the orientation of the walk tests, place two initial test points half way between the detector and the claimed detection boundary along the detector reference axis in either direction. Draw lines from each initial test point with an angle of +45° and -45° from the detectors reference axis. Where the lines intersect, two more test points will be placed.

Eight walk tests are made, refer to arrows labelled 1 to 8 of Figure C.3 b). The SWT shall begin each walk test outside of the claimed detection boundary and pass through the test point at an angle of +70° and –70° to a radial line extending from the detector to the test point.

The SWT shall traverse the entire detection area, coming to rest after clearing the claimed detection boundary

A walk test that generates an intrusion signal or message is a passed walk test.

Place a further two test points 2 m from the detector along the detector reference axis in either direction. Draw lines from each of these test points with an angle of +45° and -45° from the detectors reference axis. Where the lines intersect, two more test points will be placed.

Another eight walk tests are made, refer to arrows labelled 9 to 16 of Figure C.3 c). The SWT shall begin each walk test outside of the claimed detection boundary and pass through the test point at an angle of +90° and –90° to a radial line extending from the detector to the test point.

The SWT shall traverse the entire detection area, coming to rest after clearing the claimed detection boundary.

If it is necessary to test the detection performance in sections, rotate the detector by increments of 90° and repeat the procedure until the complete detection coverage has been tested. Figure C.3 d) provides examples.

Pass/Fail criteria: An intrusion signal or message shall be generated for every walk test in both directions.

6.4.6 Verify the intermittent movement detection performance for detectors with a coverage angle less than or equal to 180°

Applicable to grade 3 and 4 detectors.

With reference to Figure C.3 a), two walk tests are performed, crossing the entire detection area.

The tests begin outside the claimed detection boundary, from opposite sides, and pass through the detector axis mid-range point at +45° and -45° to the detector reference axis, moving towards the detector.

The intermittent movement shall consist of the SWT walking 1 m at a velocity of 1,0 ms^{-1}, then pausing for 5 s before continuing. The sequence shall be maintained until the SWT has traversed the entire detection area.

Pass / Fail Criteria: An intrusion signal or message shall be generated for both walk tests.

6.4.7 Verify the intermittent movement detection performance for detectors with a coverage angle of greater than 180°

Applicable to grade 3 and 4 detectors.

With reference to Figure C.3 b) place two initial test points half way between the detector and the claimed detection boundary along the detector reference axis in either direction. Draw lines from each initial test point with an angle of +45° and -45° from the detectors reference axis. Where the lines intersect, two more test points will be placed.

Eight walk tests are made. The SWT shall begin each walk test outside of the claimed detection boundary and pass through the test point at an angle of +70° and –70° to the corresponding the radial line. Refer to arrows 1 to 8 of Figure C.3 b).

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The intermittent movement shall consist of the SWT walking 1 m at a velocity of 1,0 ms^{-1}, then pausing for 5 s before continuing. The sequence shall be maintained until the SWT has traversed the entire detection area

If it is necessary to test the detection performance in sections, rotate the detector by increments of 90° and repeat the procedure until the complete detection coverage has been tested. Figure C.3 d) provides examples. Refer to arrows labelled 1 to 8.

Pass/Fail criteria: An intrusion signal or message shall be generated for every walk test in both directions.

6.4.8 Verify the close-in detection performance for detectors with a coverage angle less than or equal to 180°

Two walk tests are performed beginning and ending outside the claimed detection boundary of the detection area as shown in Figure C.4 a). The tests begin outside the claimed detection boundary with the centre of the SWT at a distance of 2,0 m ± 0,2 m for grades 1 and 2 (or at a distance of 0,5 m ± 0,05 m for grades 3 and 4) from the vertical axis of the detector. If the manufacturer claims close-in detection performance at distances closer than those specified for the detector grade, then the test shall be conducted at the claimed distance.

The SWT shall traverse the entire detection area, coming to rest after clearing the other side of the claimed detection boundary

Pass / Fail Criteria: An intrusion signal or message shall be generated for every walk test in both directions.

6.4.9 Detection of radial movement for detectors with a coverage angle of greater than 180°

Figure C.4 b) shows an example of a manufacturer's claimed detection boundary for a detector with a 360° coverage angle.

Two walk tests are performed, crossing the entire detection area. The tests begin outside the claimed detection boundary, moving along the detector reference axis towards and passing directly beneath the detector, ending outside the claimed detection boundary. Repeat in the opposite direction. Refer to arrows labelled 1 and 2 of Figure C.4 b).

Two further walk tests are performed but at right angles to the detector reference axis. The tests begin outside the claimed detection boundary, moving towards and passing directly beneath the detector crossing the entire detection area and ending outside the claimed detection boundary of the detection area. Repeat in the opposite direction. Refer to arrows labelled 3 and 4 of Figure C.4 b).

If it is necessary to test the detection performance in sections, rotate the detector by 90° and repeat the same procedure until the complete detection coverage has been tested. Figure C.4 c) provides examples.

Pass/Fail criteria: An intrusion signal or message shall be generated for every walk test in both directions.

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

To demonstrate compliance with the operational requirements of 4.3.1 and 4.3.2 and the requirement of 4.2.2, apply the following procedure;

a) Switch on the detector power with the indicator enabled and allow 180 s for stabilisation after which perform the basic detection test and note the response.

b) After the time interval specified in 4.3.1, repeat the basic detection test and note the response.

c) Disable the intrusion detector indicator locally using the method described in the operating instructions and again repeat the basic detection test whilst monitoring the intrusion indicator and note the response.

d) Enable the intrusion detector indicator using the method described in the operating instructions and repeat the basic detection test whilst monitoring the intrusion indicator and note the response.

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Where the feature exists to remotely enable/disable the intrusion detector indicator apply the following;

e) Disable the intrusion detector indicator remotely using the method described in the operating instructions and again repeat the basic detection test whilst monitoring the intrusion indicator and note the response.

f) Enable the intrusion detector indicator using the method described in the operating instructions and repeat the basic detection test whilst monitoring the intrusion indicator and note the response.

Pass/Fail Criteria:

The detector shall have met the requirements of the basic detection test for steps a) and b).

The observations made during the procedure of steps c) and d) shall have confirmed that the detection indicator can be disabled/enabled locally at the detector. Similarly, the observations made during the procedure of steps e) and f) shall have confirmed that the detection indicator can be disabled/enabled under remote control.

6.6 Self-tests

6.6.1 General

To demonstrate compliance with the operational requirements of 4.3.3.2 and 4.3.3.3, the procedure for verifying these self-test requirements consists of applying or removing a fault condition to each of the detection technologies in combination with the Self-test.

6.6.2 Application of the fault conditions

1) Short the PIR sensor signal output to ground or carry out an equivalent action as recommended by the manufacturer. For detectors with more than one PIR sensor signal output, the test(s) shall be repeated for each output individually.

2) Short the microwave sensor signal output to ground or carry out an equivalent action as recommended by the manufacturer. For detectors with more than one microwave sensor signal output, the test(s) shall be repeated for each output individually.

6.6.3 Local self-test procedure

a) Perform the basic detection test, note the response.

b) Apply a fault condition to the PIR sensor (see Application of the fault conditions 1)).

c) Note when the response occurs.

d) Remove the fault condition, reset the detector and then perform the basic detection test and note the response.

e) Apply a fault condition to the Microwave sensor (see Application of the fault conditions 2)).

f) Note when the response occurs.

g) Check the manufacturer's technical documentation to confirm that the time the detector remains inhibited during the local self-test is stated.

Local self-test pass/fail criteria:

For steps a) and d), the detector shall have met the requirements of the basic detection test.

For steps c) and f), the detector shall have generated a fault signal or message (Local Self-Test Fail) within 24hrs as specified in 4.3.3.2.

For step g), the maximum inhibition time as stated in the manufacturer's technical documentation shall not exceed the timings specified in 4.3.3.2.

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6.6.4 Remote self-test procedure

a) Perform the basic detection test, note the response.

b) Apply a fault condition to the PIR sensor (see Application of the fault conditions 1)).

c) Initiate a Remote Self-test, note the response.

d) Remove the fault condition.

e) Initiate a Remote Self-test, note the response.

f) Perform the basic detection test 30s after the initiation of the Remote Self-test of e), note the response.

g) Reset the detector, perform a basic detection test and note the response.

h) Apply a fault condition to the Microwave sensor (see Application of the fault conditions 2)).

i) Initiate a Remote Self-test, note the response.

j) Remove the fault condition.

k) Initiate a Remote Self-test, note the response.

l) Perform the basic detection test 30s after the initiation of the Remote Self-test of k), note the response.

Remote self-test pass/fail criteria:

For steps a), f), g) and l), the detector shall have met the requirements of the basic detection test.

For steps c) and i), the detector shall have generated a fault signal or message (Remote Self-Test Fail) within 10s as specified in 4.3.3.3.

For steps e) and k), the detector shall have generated an intruder signal or message (Remote Self-Test Pass) within 10s as specified in 4.3.3.3.

6.7 Immunity of individual technologies to incorrect operation

6.7.1 Immunity to turbulent warm air flow

Place the microwave technology in an activated state where the PIR technology may cause an intrusion signal or message. The manufacturer shall propose a method to put the microwave technology in an activated state, which shall be applied to the detector. From a point 1,0 m ± 0,5 m below the detector, direct the airflow from a fan heater over the face of the detector (see example setup in Annex L, Figure L.1), raising the air temperature at the detector window by 15 °C from ambient at a rate of 3 °C min^{-1}. The warm air shall flow at a mean velocity of 0,7 ms^{-1} ± 0,2 ms^{-1}, measured at the detector window. Do not allow the detector a direct view of the heat source.

Stabilise for 4 minutes at ambient + 15 °C. Switch off the heat and allow the temperature to ramp down for 1 minute or until ambient is reached. Stabilise at ambient for 2 min. Repeat the cycle 5 times.

Pass/Fail Criteria: No signals or messages shall be generated.

6.7.2 Immunity to visible & near infrared radiation

Place the microwave technology in an activated state where the PIR technology may cause an intrusion signal or message. The manufacturer shall propose a method to put the microwave technology in an activated state, which shall be applied to the detector.

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A white light source (a 12 V halogen car headlamp, VW H4 bulb or equivalent, without front reflector and lens) apply 13,5 V d.c. to the bulb from suitably rated power supply, capable of generating at least 2 000 lx at 3 m range is used to illuminate the detector.

The lamp shall be burned in for 10 h and shall be discarded after 100 h use.

The light from the source shall fall on the detector through two clean 4 mm thick panes of glass, separated by a 10 mm air gap, and placed at 0,5 m in front of the detector.

Measure the light intensity at the detector with a calibrated visible light meter. Calibration is described in Annex G.

Mount the detector in a darkened room at an initial range of 5 m from the source. The source shall be mounted in the main axial detection zone of the detector that is sensitive to infrared radiation in the 8 µm to 14 µm wavelength band. Mount the visible light meter at the chosen position of the detector, and move the light source towards and away from it until a reading in the visible band of 2 000 lx ± 10 % is obtained. Tilting may be required to align the detector to the main axial detection zone with the source.

The light source is scanned about a vertical axis such that the emitted light crosses the detector at a rate of 0,5 ms^{-1}, and clears the outer edge of the detector housing. A total of ten scans shall be made across the front of the detector.

Pass/Fail Criteria: No signals or messages shall be generated.

6.7.3 Immunity to microwave signal interference by fluorescent lights

Place the PIR technology in an activated state where the microwave technology may cause an intrusion signal or message. The manufacturer shall propose a method to put the PIR technology in an activated state, which shall be applied to the detector

A 1,20 m x 25 mm diameter 36 W / 40 W magnetically ballasted fluorescent tube of between 100 h and 1 000 h usage having no metal reflectors or extraneous decoration is mounted on the ceiling 0,5 m above, 2,0 m in front of, and parallel to the detector axis. For ceiling mounted detectors, the tube shall be mounted 1,0 m below the detector and 0,5 m in front of it (see Annex H, Figure H.1).

The tube shall be switched on for 60 s and off for 30 s. The test is repeated 5 times.

Repeat the test with the fluorescent tube rotated through 90° relative to the detector axis.

Pass/Fail Criteria: No signals or messages shall be generated.

6.8 Tamper security

6.8.1 Resistance to and detection 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 I and by attempting to distort the housing attempt to gain access to all components, means of adjustment and mounting screws, which, when interfered with, could adversely affect the operation of the detector.

NOTE The detector can be mounted on a test fixture so that the test can be performed at a safe working height.

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 and mounting screws, which, when interfered with could adversely affect the operation of the detector, without generating a tamper signal or message or causing visible damage.

6.8.2 Detection of removal from the mounting surface

To confirm the operation of the tamper device, mount the detector according to the manufacturer's installation instruction on a substantial wooden block.

By hand and / or by using small tools as per the examples in Annex I, remove the detector from the mounting surface.

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Pass/Fail Criteria: A tamper signal or message shall be generated upon removal from the surface.

To confirm that the tamper device cannot easily be defeated, mount the detector according to the manufacturer's installation instruction on a substantial wooden block.

Using small tools as per the examples in Annex I, attempt to prevent the operation of the tamper detection, while removing it from the mounting surface.

Pass/Fail Criteria: A tamper signal or message shall be generated upon removal from the surface.

In order to limit the samples required and taking into account the technology type of the tamper device, exploratory testing with the detector un-mounted is recommended.

6.8.3 Resistance to re-orientation of adjustable mountings

Mount the detector with the adjustable mounting so that it may be turned on the adjustable mount by a measured torque and the resultant angular displacement assessed both during and after the test, as shown in Annex J. The levels of grade dependent torque required are given in Table 4. Care should be taken that no extra torque is applied by the test fixture itself (e.g. ensuring that the mounting block is supported with minimum friction).

Apply the required torque. Remove the torque. Measure the angle of twist of the detector relative to the mounting.

Pass/Fail Criteria: When the torque given in Table 4 is applied to the detector it shall not rotate more than 5°. Alternatively, when the torque given in Table 4 is applied, a tamper signal or message shall be generated before the detector has rotated by 5°.

6.8.4 Immunity to magnetic field interference.

Connect power to the detector and wait 180 s. Attempt to prevent intrusion, tamper and fault signals or messages by placing a single pole of a magnet of type according to Table 4 on each surface of the detector housing in sequence. For each placement carry out the basic detection test, apply stimulus for tamper, fault, and masking and verify the correct generation of the signals or messages. Repeat the test with the other pole.

Pass/Fail Criteria: The presence of the magnet shall not prevent the correct generation of any signal or message.

In order to identify critical positions and taking into account the technology type of signalling, exploratory testing with the detector is recommended.

6.8.5 Detection of detector masking

For each test, the detector shall be powered, the materials applied and its signals or messages monitored for changes of status.

Apply each of the sheet material samples number 1 to 4 as specified in Table 6:

a) slid across in 1 s and held in front of the face of the detector from one side, at a distance of 0 mm;

b) slid across in 1 s and held in front of the face of the detector from one side, at a distance of 50 mm;

c) slid across in 10 s and held in front of the face of the detector from one side, at a distance of 0 mm;

d) slid across in 10 s and held in front of the face of the detector from one side, at a distance of 50 mm.

Repeat tests a), b), c) and d) with material number 2 slid across and held in front of only that part of the face of the detector that is directly in front of the microwave transmitter/receiver unit.

Material no. 5 shall be applied directly to the front of the detector.

Apply the materials numbers 6 and 7 as specified in Table 6 directly to the front face of the detector.

Material 6 shall be sprayed using intermittent passes lasting no longer than 2 s each.

Material 7 shall be applied using single passes of the brush.

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For materials 6 and 7 repeat the applications until the detector no longer responds or the masking signal is generated.

After each individual material application, wait 180 s for the system to stabilise and carry out a basic detection test.

Pass/Fail Criteria: If either the PIR or microwave technology is inhibited then a masking signal or message as described in Table 2 shall be generated within 180 s of the masking material being applied, and shall continue to be generated for at least as long as the material is in place. Alternatively, both the PIR and the microwave technologies of the detector shall continue to operate normally.

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

All materials tested shall be passed.

Operate normally in the context of this specific test would allow for the reduction of the manufacturer declared coverage by a maximum of 50 %.

Table 6 — Range of materials for masking tests

Material number	Material
1	Black paper sheet shall have a matte finish with the following characteristics : • Diffuse Reflectance in the NIR shall be between 3 % and 7 % when tested perpendicular to the paper surface. • Black paper shall be 0,15 mm thick minimum • The paper shall be coloured throughout the thickness (not surface coloured)
2	2 mm thick aluminium sheet, unpainted and untreated
3	3 mm thick clear gloss acrylic sheet
4	White polystyrene foam sheet of the following dimensions : • 30 mm thickness with a tolerance of ± 50 %
5 [a]	Self-adhesive clear vinyl sheet of the following dimensions : • 0,1 mm thickness with a tolerance of ± 40 %
6 [a]	Colourless medical plastic skin spray, polyurethane polymer based
7 [a]	Clear gloss lacquer, brush applied
[a] Applied only from the front.	

All sheet samples shall be large enough to inhibit detection.

6.8.6 Immunity to False Masking Signals

The SWT shall walk across the detector coverage pattern at a distance of 1 m at 1 ms^{-1}.

Examples are shown in Annex C, Figure C.5 a) for detectors with a coverage angle less than or equal to 180°and Figure C.5 b) for detectors with a coverage angle of 360°.

Pass/Fail Criteria: The detector shall not generate masking signals or messages.

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6.9 Electrical tests

6.9.1 General

Ensure that no human movement is able to trigger an alarm of the detector during the tests.

Table 5 specifies grade dependency.

The electrical tests are not applicable to detectors with internal type C power supplies.

6.9.2 Detector current consumption

Connect the detector to a suitable variable, stabilized 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 stabilize 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.

Set the supply voltage to the nominal V +25 % and then allow the detector to stabilise for 180 s. Monitor the intrusion and fault signals or messages and carry out a basic detection test. Decrement the voltage at a rate of 0,1 Vs^{-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. Monitor the intrusion and fault signals or messages and carry out a basic detection test.

Pass/Fail Criteria: There shall be no unintentional signals or messages generated by the detector during the slow input voltage test and the detector shall continue to meet the requirements of the basic detection test.

The following test is grade dependent as defined in Table 1.

Lower the supply voltage at a rate of 0,1 Vs^{-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: The detector shall generate a fault signal or message prior to the situation where no intrusion signal or message is generated when the basic detection test is carried out.

6.9.4 Input voltage ripple

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 % peak to peak 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 and the detector shall continue to meet the requirements of the basic detection test.

6.9.5 Input voltage step change

Connect the detector to a suitable variable, stabilised power supply 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 pulses from nominal supply

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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

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.

6.10 Environmental classification and conditions

Detectors shall be subjected to the environmental conditioning described in EN 50130-5 according to the requirements of Tables 7 and 8 and the EMC product family standard EN 50130-4.

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

Special conditions:

During testing ensure that the detector is shielded from rapid changes of surface temperature or air movement within the field of view due to unwanted effects of the tests. This may be achieved by covering the receiving aperture of the detector with a material unable to pass infrared or microwave energy, which shall not interfere with the intended conditioning. It is necessary to consider the effect on any anti-masking sensors when selecting a suitable material or method.

Monitor the detector for unintentional signals or messages. No functional test is required during the tests.

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. Water penetration of the enclosure is permitted provided that the functionality of the detector is unaffected

After the SO_2 test, detectors shall be dried in accordance with the procedure prescribed in EN 50130-5. The basic detection test shall be performed immediately after the recovery period. Carry out the access to interior test (6.8.1) and the detection of detector masking test (6.8.5) with material number 1 only.

Table 7 — Operational tests

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

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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. It is permissible for the detector to generate an intrusion signal or message during the impact test. During the shock test a detector shall not alarm on the first shock in any axis but may alarm on subsequent shocks in that axis.

Table 8 — Endurance tests

Test	Environmental classification			
	Class I	Class II	Class III	Class IV
Damp heat (steady state)	Required	Required	Required	Required
Damp heat (cyclic)	Not required	Not required	Required	Required
SO2 corrosion	Not required	Required	Required	Required
Vibration (sinusoidal)	Required	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 EN 50131-1).

Pass/Fail Criteria: All specified markings shall be present.

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 document and in EN 50131-1, and the manufacturer's claimed performance data.

Pass/Fail Criteria: All information specified shall be present.

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Annex A
(normative)

Dimensions & requirements of the standardized test magnets

A.1 Introduction

The following standards form the basis for the selection of the independent test magnets:

EN 60404-5, *Magnetic materials — Part 5: Permanent magnet (magnetically hard) materials — Methods of measurement of magnetic properties (IEC 60404-5)*

EN 60404-14, *Magnetic materials — Part 14: Methods of measurement of the magnetic dipole moment of a ferromagnetic material specimen by the withdrawal or rotation method (IEC 60404-14)*

EN 60404-8-1, *Magnetic materials — Part 8-1: Specifications for individual materials — Magnetically hard materials (IEC 60404-8-1)*

A.2 Requirements

The field strength of the magnet is determined by the magnetic material, by remanence (Br) in mT and the product of energy (BH)max in kJ/m^3. These values describe a certain level of saturation of the magnetic material, and shall be measured before any calibration takes place.

The actual field strength of the test magnet needs to be adjusted at the polarization of the working point in mT as defined in Figures A.1 and A.2.

The relevant value, dimensions and measurement point for the test magnets can be found in Figures A.1 and A.2. For calculations, measurements and calibration of the test magnets, the standards cited above shall be used.

NOTE To get the magnets adjusted to the proper values and calibrated (e.g. polarization in working point), it is strongly suggested to have the adjustments of the magnetic values performed by an accredited test house for magnetic fields.

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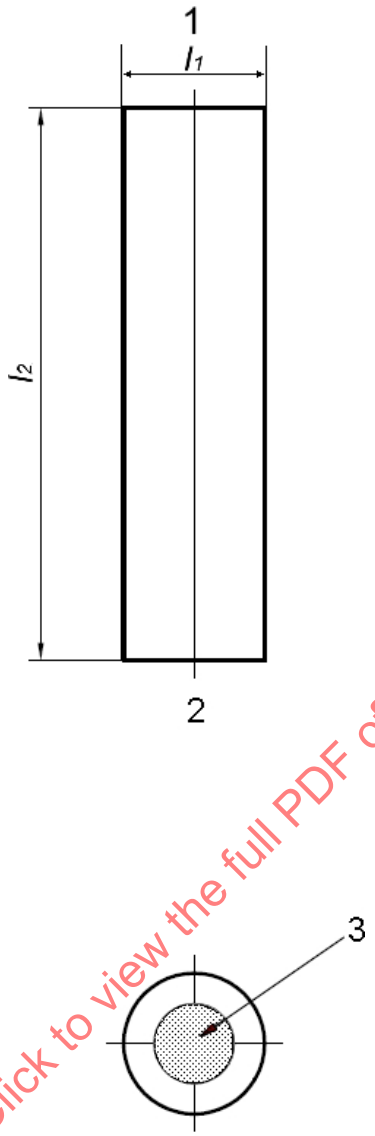

Key

1 north pole
2 south pole
3 marking of north pole
l_1 ø 10,2 mm diameter
l_2 40 mm total length

Material	NdFeB N40 (REFeB 310/130 - Code number R5-1-11)
Remanence B_r min	1 275 mT ± 2 %
Product of energy $(BH)_{max}$	310 kJ/m^3 ± 3 %
Polarization of working point	0,835 T ± 2 %

Figure A.1 — Test magnet - Magnet Type 1

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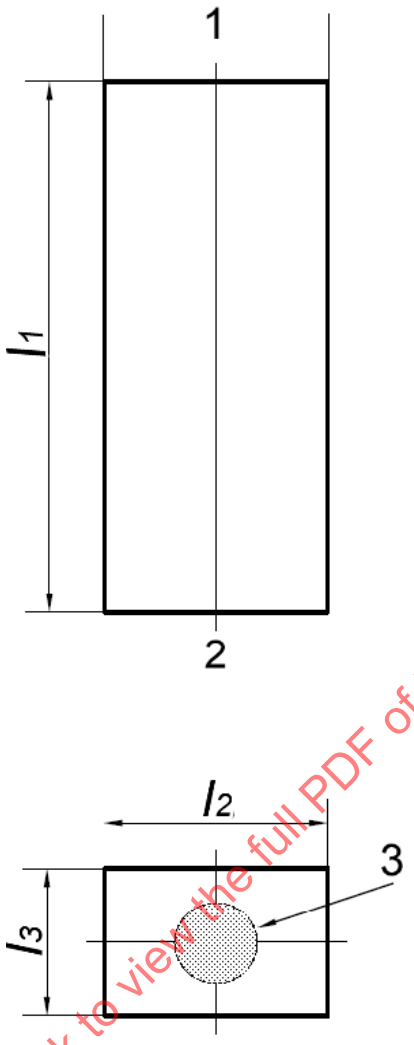

Key

1	north pole
2	south pole
3	marking of north pole
l_1	36 mm total length
l_2	15 mm width
l_3	10 mm height

Material	NdFeB N38 (REFeB 280/120 - Code number R5-1-7) nickeled
Remanence B_r min.	1 240 mT
Product of energy (BH) max.	280 kJ/m^3
Polarization of working point	Remanence B_r - 5%

Figure A.2 — Test magnet - Magnet Type 2

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Annex B
(normative)

General testing matrix

Table B.1 — General testing matrix

Main test title	Task to be performed in conjunction with main test			Sample no.
	Before main test	During main test	After main test	
Verify detection across the boundary	None	6.4.3.2, 6.4.3.3	None	1
Verify detection within the boundary	None	6.4.3.4, 6.4.3.5	None	1
Verify the high velocity detection performance	None	6.4.4, 6.4.5	None	1
Verify the intermittent movement detection performance	None	6.4.6, 6.4.7	None	1
Verify the close-in detection performance	None	6.4.8, 6.4.9	None	1
Switch-on delay, time interval between signals and indication of detection	None	6.5	None	1
Self-tests	None	6.6	None	2
Immunity to turbulent warm air flow	None	6.7.1	None	1
Immunity to visible and near-infrared radiation	None	6.7.2	None	1
Immunity to microwave signal interference by fluorescent lights	None	6.7.3	None	1
Resistance to and detection of unauthorised access to the inside of the detector through covers and existing holes	None	6.8.1	None	10
Detection of removal from the mounting surface	None	6.8.2	None	10
Resistance to or detection of re-orientation of adjustable mountings	None	6.8.3	None	10
Immunity to magnetic field interference	None	6.8.4	None	10
Detection of detector masking	6.3.3	6.8.5	6.3.3	10 [a]
Immunity to false masking signals	None	6.8.6	None	1
Detector current consumption	None	6.9.1	None	1
Slow input voltage change and input voltage range limits	None	6.9.2	None	1

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Main test title	Task to be performed in conjunction with main test			Sample no.
	Before main test	During main test	After main test	
Input voltage ripple	None	6.9.3	None	1
Input voltage step change	None	6.9.4	None	1
Total loss of power supply	None	6.9.5	None	1
Dry heat (operational)	6.3.3	None	6.3.3	3
Cold (operational)	6.3.3	None	6.3.3	3
Damp heat (steady state, operational)	6.3.3	None	6.3.3	4
Damp heat (cyclic, operational)	6.3.3	None	6.3.3	4
Water ingress (operational)	6.3.3	None	6.3.3	5
Mechanical shock (operational)	6.3.3	None	6.3.3	6
Vibration (operational)	6.3.3	None	6.3.3	7
Impact (operational)	6.3.3	None	6.3.3	6
EMC (operational)	6.3.3	None	6.3.3	8
Damp heat (steady state, endurance)	6.3.3	None	6.3.3	4
Damp heat (cyclic, endurance)	6.3.3	None	6.3.3	4
SO_2 corrosion (endurance)	6.3.3	None	6.3.3	9
Vibration (sinusoidal, endurance)	6.3.3	None	6.3.3	7
Marking and/or identification	None	6.11.1	None	1
Documentation	None	6.11.2	None	1
[a] For masking tests more samples may be required.				

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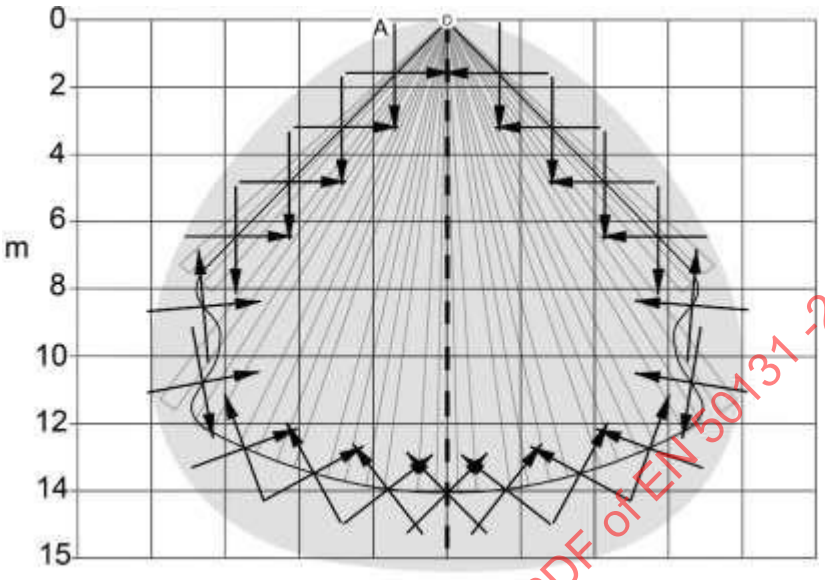
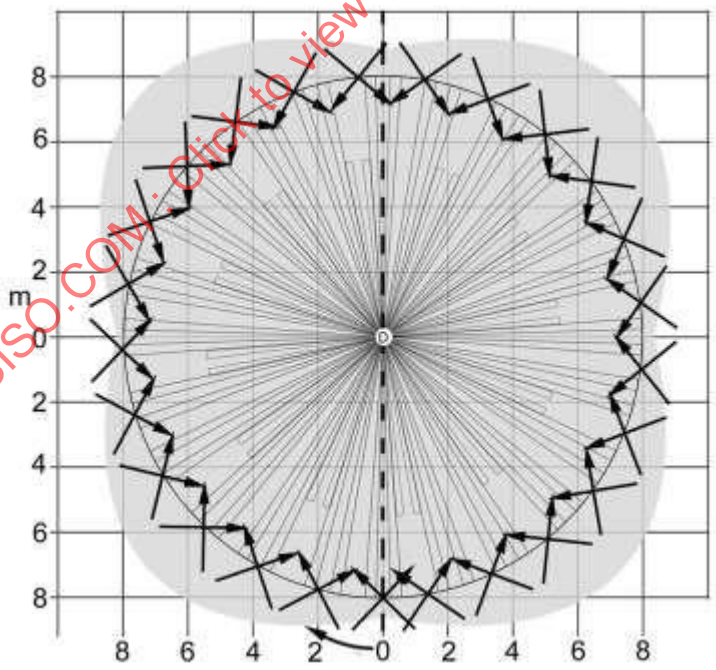
Annex C
(normative)

Walk test diagrams



a) Detection across the claimed detection boundary for detectors with a coverage angle less than or equal to 180° (6.4.3.2)



b) Detection across the claimed detection boundary for detectors with a coverage angle greater than 180° (6.4.3.3)

Key

D detector

- - - detector reference axis

Figure C.1

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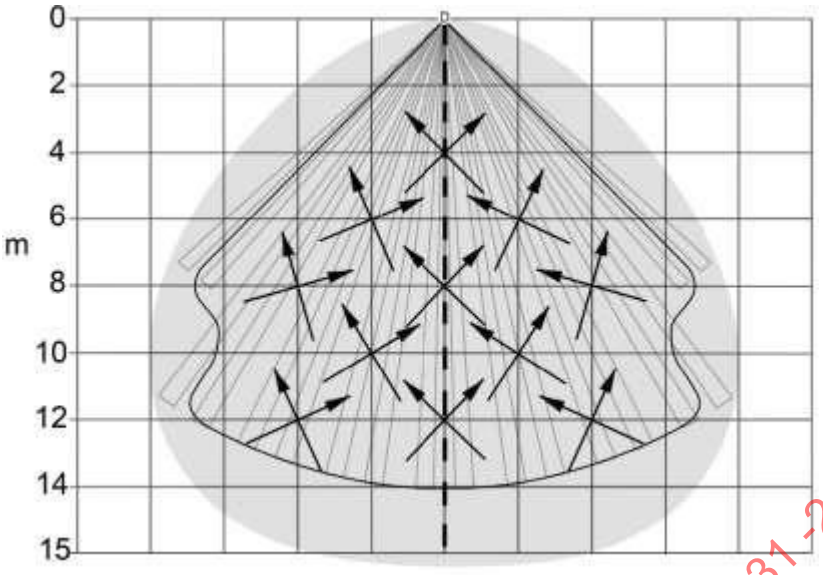
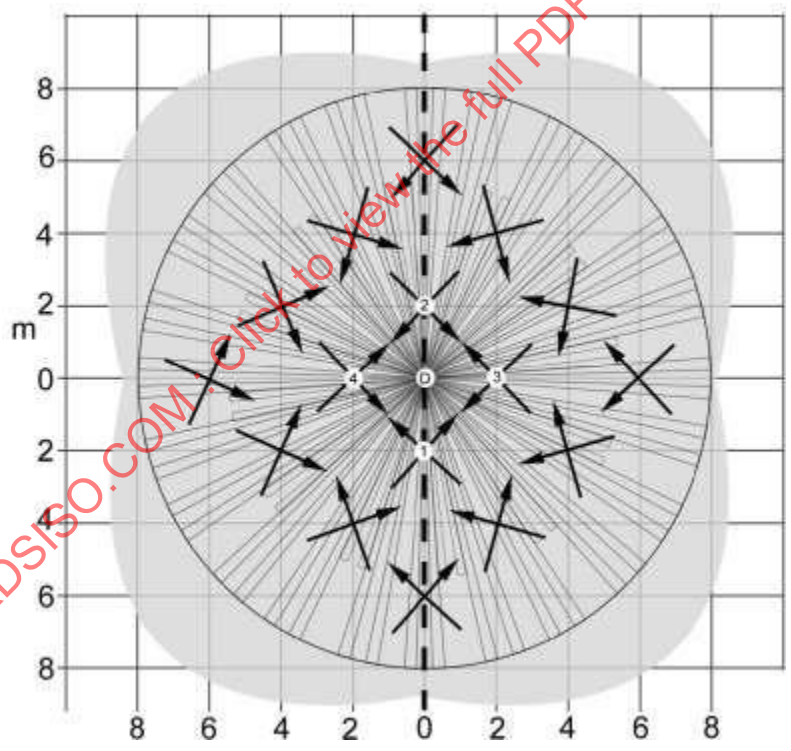


a) **Detection within the claimed detection boundary for detectors with a coverage angle less than or equal 180˚ (6.4.3.4)**



b) **Detection within the claimed detection boundary for detectors with a coverage angle greater than 180˚ (6.4.3.5)**

Key

D detector

- - - detector reference axis

Figure C.2

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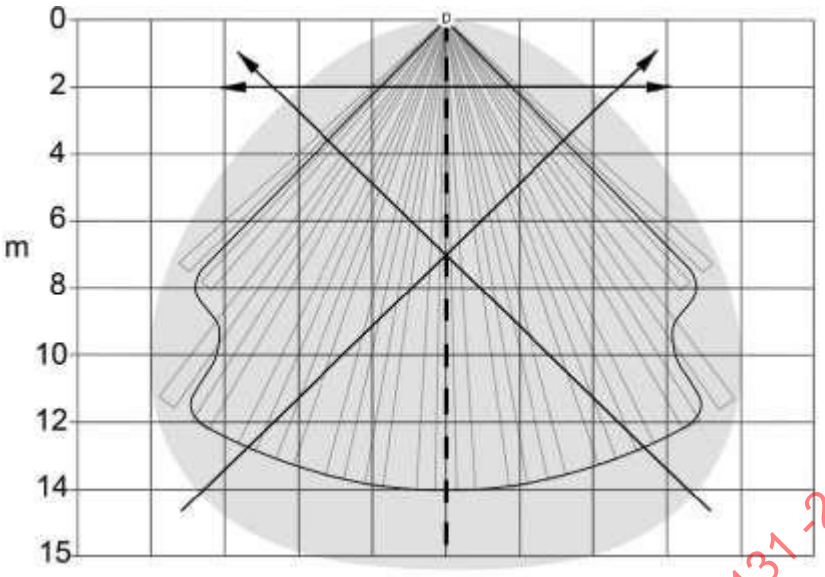
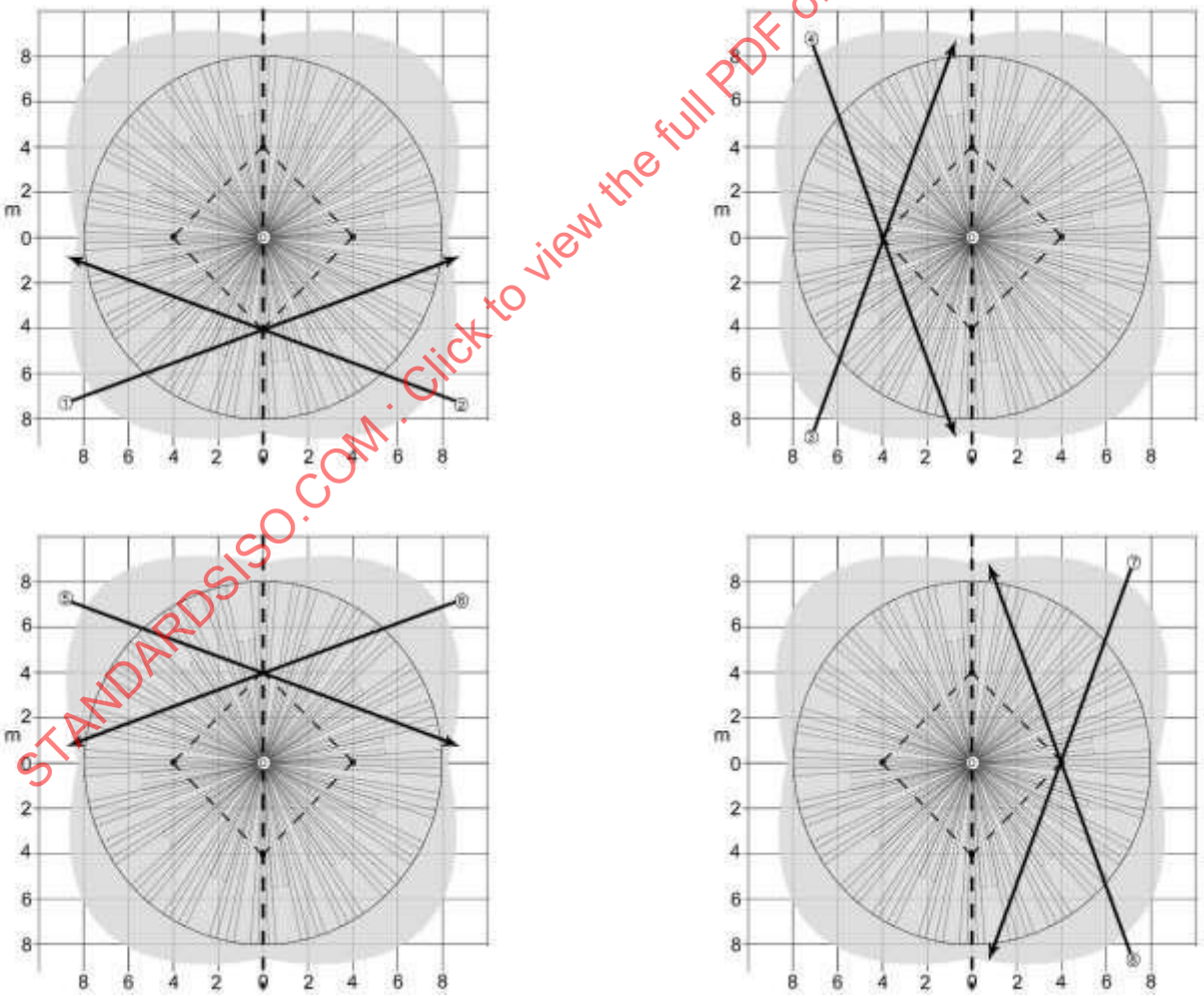


a) High velocity and intermittent movement for detectors with a coverage angle less than or equal 180˚ (6.4.4 and 6.4.6)



b) High velocity and intermittent movement for detectors with a coverage angle greater than 180˚ (6.4.5 and 6.4.7)

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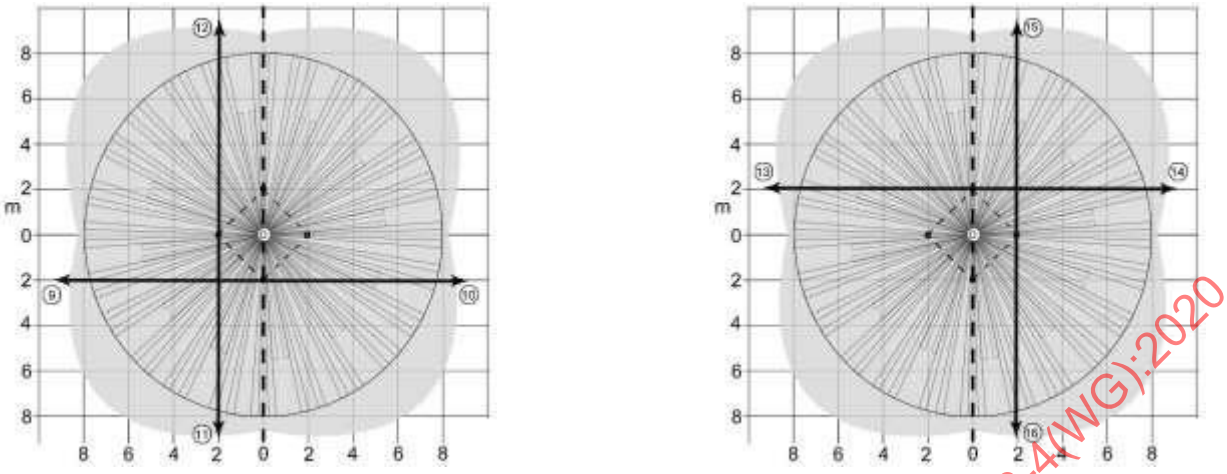
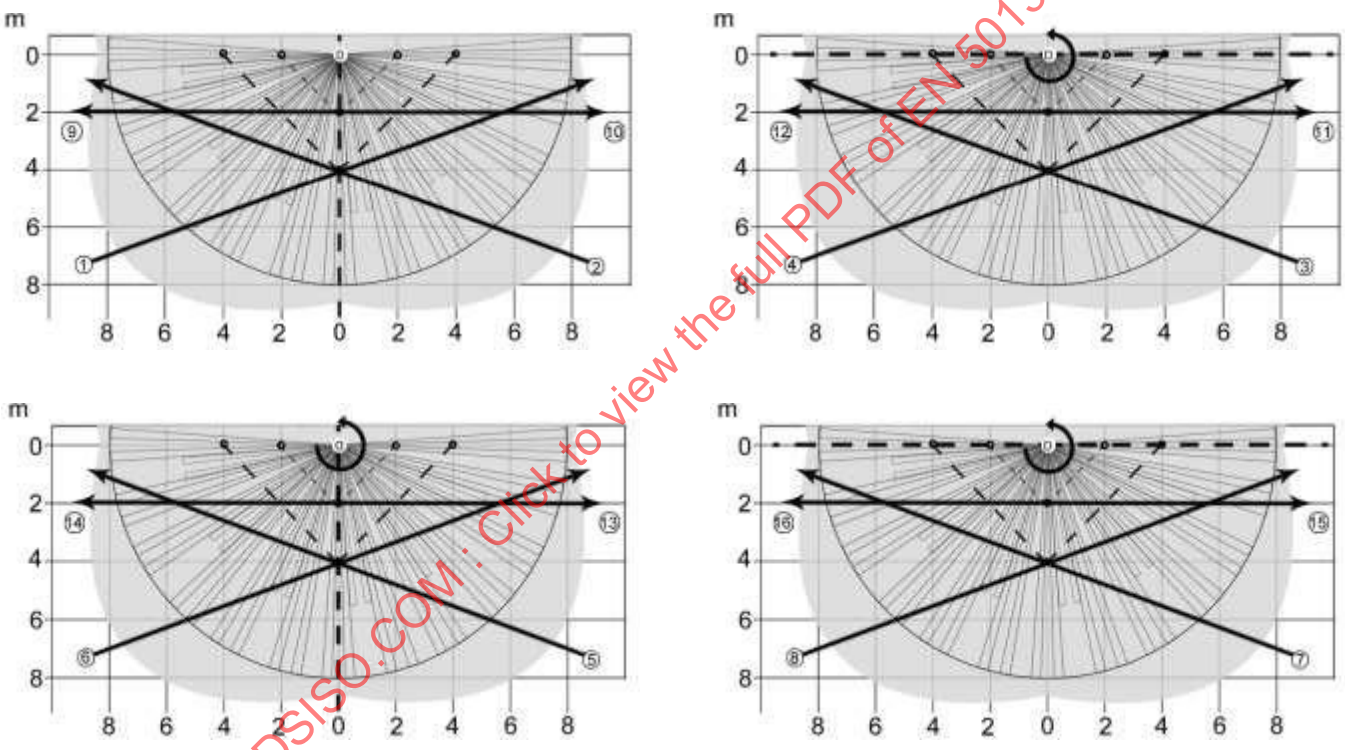


c) High velocity movement for detectors with a coverage angle greater than 180˚ (6.4.5)



d) High velocity (and intermittent movement) for detectors with a coverage angle greater than 180˚ alternative test setup for testing in sections (6.4.5 and 6.4.7)

Key

D detector

- - - detector reference axis

The examples of Figure C.3 d) show a detector with 360° detection coverage tested in sections by rotating the detector through 90° until the high velocity and where applicable, the intermittent tests for the entire detection coverage pattern are complete.

Figure C.3

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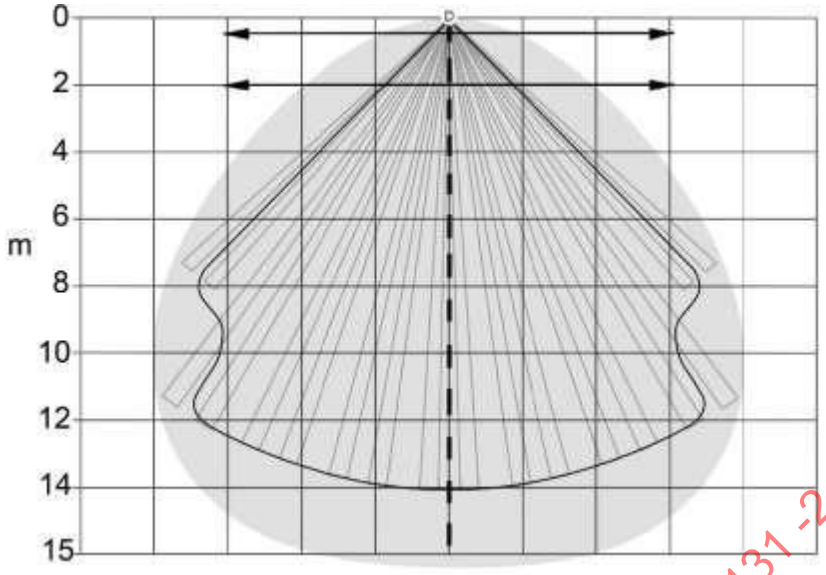
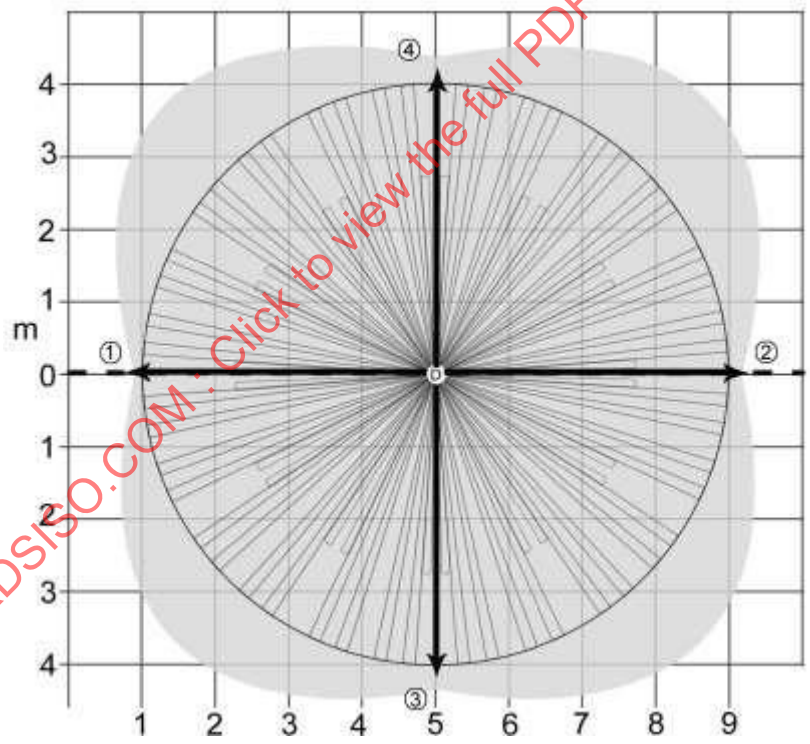


a) Close-in detection for detectors with a coverage angle less than or equal to 180° Wall mounted detectors (6.4.8)



b) Detection of radial movement for grade 3 and 4 detectors with a 360° coverage angle (6.4.9)

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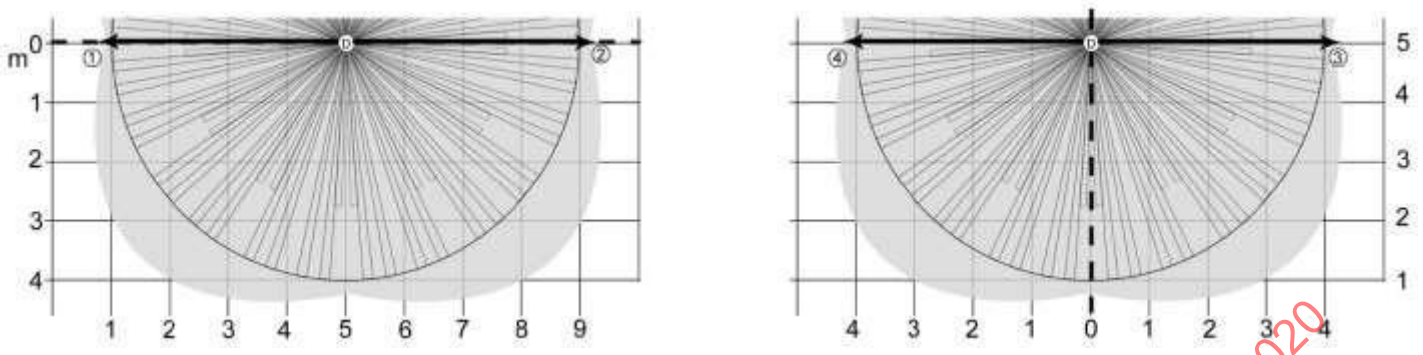


c) Detection of radial movement for grade 3 and 4 detectors with a 360° coverage angle, alternative test setup for testing in sections (6.4.9)

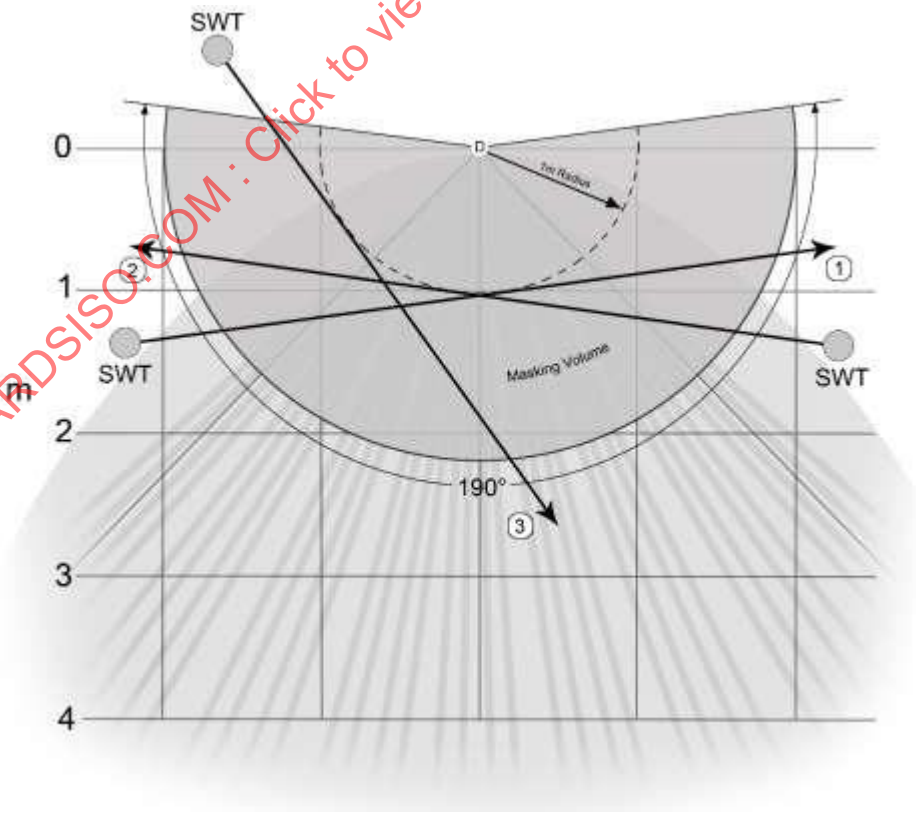
Key

D	detector
- - -	detector reference axis

Figure C.4 c) shows a detector with 360° detection coverage tested in sections by rotating the detector through 90°.

Sufficient clearance shall be provided when mounting the detector to allow adequate space for the SWT to pass beneath the detector unimpeded.

Figure C.4



a) Immunity to False Masking signals for detectors with a coverage angle less than or equal 180˚ (6.8.6)

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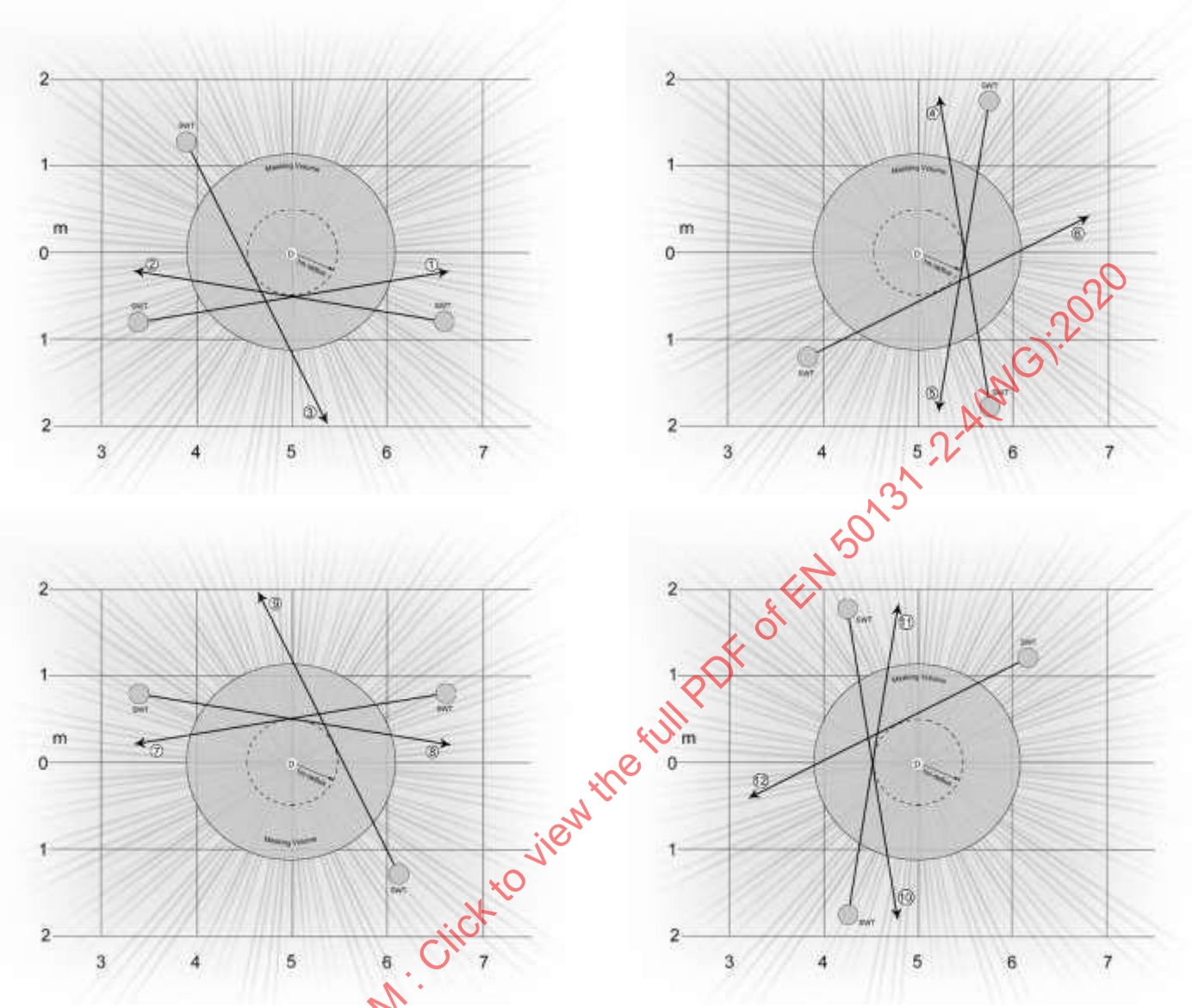

b) Immunity to False Masking signals for detectors with a 360° coverage angle (6.8.6)

Key

D detector

Figure C.5

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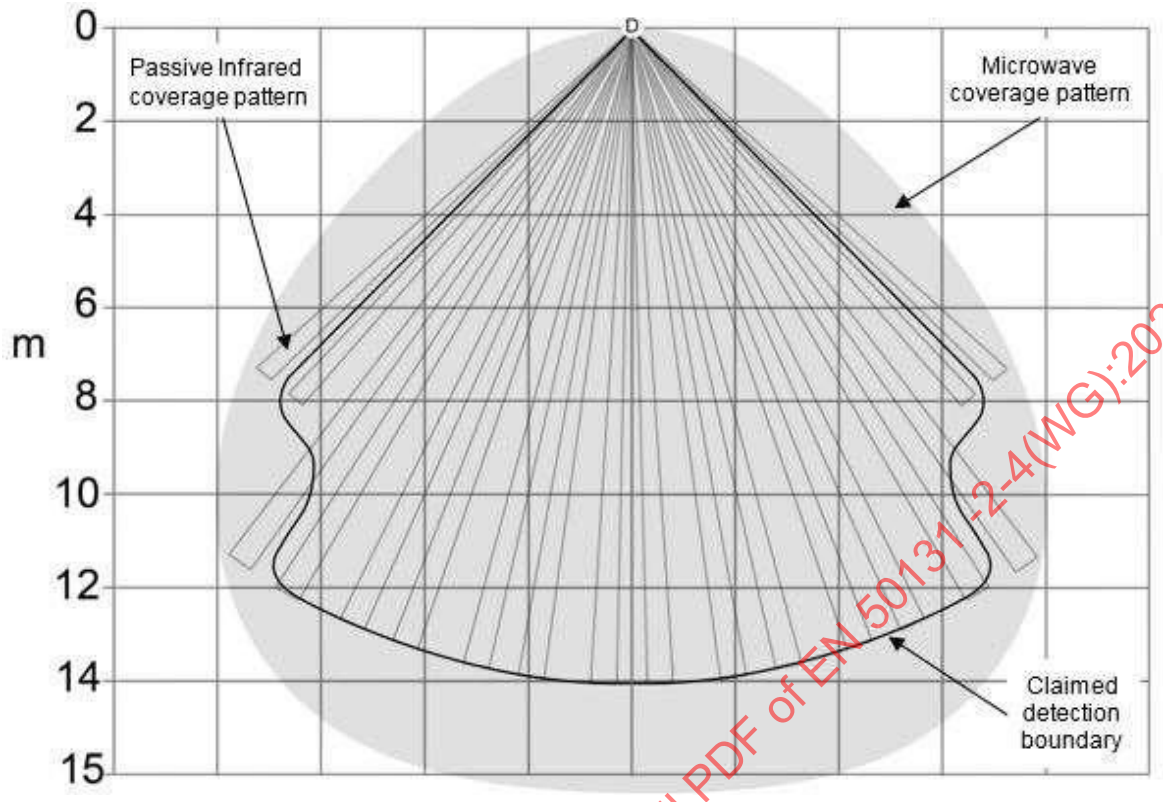

Key

D detector

Figure C.6 — Example of a scaled drawing of a manufacturer's claimed detection boundary

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