BRITISH STANDARD

BS EN 50131-2-4:2008

# Alarm systems — Intrusion and hold-up systems —

## Part 2-4: Requirements for combined passive infrared and microwave detectors

ICS 13.310



British Standards

# National foreword

This British Standard is the UK implementation of EN 50131-2-4:2008. It supersedes DD CLC/TS 50131-2-4:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GW/1, Electronic security systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

**Compliance with a British Standard cannot confer immunity from legal obligations.**

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# EUROPEAN STANDARD

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January 2008

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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

This European Standard was approved by CENELEC on 2007-12-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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# Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 79, Alarm systems.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50131-2-4 on 2007-12-01.

This European Standard supersedes CLC/TS 50131-2-4:2004.

The following dates were fixed:

| | | |
|---|---|---|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2008-12-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2010-12-01 |

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

| | |
|---|---|
| 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 2–7–1 | 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 standard 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 radiation and analyse 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 European Standard is only concerned with the requirements and tests for the detector. Other types of detector are covered by other documents identified as in EN 50131-2 series.

If a combined detector can be operated in each technology individually, it shall also meet the grade-dependant requirements of the standards having relevance to those technologies.

## 1 Scope

This standard 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 standard does not include requirements for detectors intended for use outdoors.

A detector shall fulfil 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 influence the correct operation of the mandatory functions.

This European Standard does not apply to system interconnections.

## 2 Normative references

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

| | |
|---|---|
| EN 50130-4 | Alarm systems - Part 4: Electromagnetic compatibility - Product family standard: Immunity requirements for components of fire, intruder 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 systems - Part 6: Power supplies |
| EN 60068-1 | Environmental testing – Part 1: General and guidance (IEC 60068-1) |
| EN 60068-2-52 | Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution) (IEC 60068-2-52) |
| EN 60529 | Degrees of protection provided by enclosures (IP code) (IEC 60529) |

## 3 Definitions and abbreviations

For the purpose of this European Standard the following definitions and abbreviations apply in addition to those given in EN 50131-1.

### 3.1 Definitions

**3.1.1**
**basic detection target**
heat source and/or microwave reflector designed to verify the operation of a detector

**3.1.2**
**combined passive infrared and microwave detector**
detector of the broad-spectrum infrared emitted by a human being, with an active microwave emitter and detector installed in the same casing

**3.1.3**
**incorrect operation**
physical condition that causes an inappropriate signal from a detector

**3.1.4**
**masking**
interference with the detector input capability by the introduction of a physical barrier such as metal, plastic, paper or sprayed paints or lacquers in close proximity to the detector

**3.1.5**
**microwave detector**
detector having an active microwave emitter and receiver installed in the same casing

**3.1.6**
**passive infrared detector**
detector of the broad-spectrum infrared radiation emitted by a human being

**3.1.7**
**simulated walk test target**
non-human or synthetic heat source or microwave reflector designed to simulate the standard walk test target

**3.1.8**
**standard walk test target**
human being of standard weight and height clothed in close fitting clothing appropriate to the simulation of an intruder

**3.1.9**
**walk test**
operational test during which a detector is stimulated by the standard walk test target in a controlled environment

**3.1.10**
**walk test attitude, crawling**
crawling attitude shall consist of the standard walk test target moving with hands and knees in contact with the floor

**3.1.11**
**walk test attitude, upright**
upright attitude shall consist of the standard walk test target standing and walking with arms held at the sides of the body. The standard walk test target begins and ends a traverse with feet together

## 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 Indication signals or messages

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 detection | M | M | M | M |
| Tamper detection | Op | M | M | M |
| Masking detection | Op | Op | M | M |
| Significant reduction of range | Op | Op | Op | 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

**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 |
| Significant reduction of range [a] | M | Op | M |
| 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 signal or message may be provided instead.

[b] Alternatively Total loss of Power Supply shall be determined by loss of communication with the detector.

NOTE 1 This permits two methods of signalling a masking or reduction of range event: either by the intrusion signal and fault signal, or by a dedicated masking or reduction of range signal 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 prioritise signals, eg 1 Intrusion, 2 Fault, 3 Masking.

NOTE 2 When, in Table 1, an event may optionally generate signals or messages, they shall be as shown in this table.

## 4.2 Detection

### 4.2.1 Detection performance

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 detection within the boundary the walk-test distance shall be 3,0 m.

**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** | 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 |
| **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 |
| **Significant reduction of specified range** [b] | Not required | Not required | Not required | Required |
| Velocity | N/A | N/A | N/A | 1,0 $ms^{-1}$ |
| Attitude | N/A | N/A | N/A | 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.

b The means to detect a significant reduction in range may be met either by detectors having the appropriate function (4.2.3) or by suitable system design. Two or more devices (eg a detector in conjunction with a camera, active transmitter or additional detector), may cooperate and interconnect with the system to provide means to detect a significant reduction of range.

### 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 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.

#### 4.2.3 Significant reduction of specified range

Grade 4 detectors shall detect significant reduction of range or coverage area due, for example, to deliberate or accidental introduction of objects or obstructions into the coverage area.

Range reduction along the principal axis of detection of more than 50 % shall generate a signal or message within 180 s, according to the requirements of Table 2 and Table 3.

If additional equipment is required to detect significant reduction of range, reference shall be made to this equipment and its operation in the manufacturer's documentation.

### 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 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.

##### 4.3.3.2 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.

### 4.4 Immunity of the individual technologies to incorrect operation

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.

#### 4.4.1 Immunity to air flow

The PIR component of the detector shall not generate any signals or messages when air is blown over the face of the detector.

#### 4.4.2 Immunity to visible & near infrared radiation

The PIR component of the detector shall not generate any signal or message when a car headlamp is swept across the front window or lens through two panes of glass.

#### 4.4.3 Immunity to microwave signal interference by fluorescent lights

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

## 4.5 Tamper security

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

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

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.

### 4.5.2 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.

### 4.5.3 Resistance to, or detection of, re-orientation

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°.

### 4.5.4 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 A.

### 4.5.5 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.

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 at 1 $ms^{-1}$ at a distance equal to or greater than 1 m.

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.

**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 - for detectors mounted on brackets only | Not required | Required | Required | Required |
| Applied torque | | 2 Nm | 5 Nm | 10 Nm |
| Magnetic field immunity | Not required | Required | Required | Required |
| Magnet type defined in Annex A | | Type 1 | Type 2 | Type 2 |
| Masking detection | Not required | Not required | Required | Required |

## 4.6 Electrical requirements

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 |

### 4.6.1 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.

### 4.6.2 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 raised slowly, the detector shall function normally at the specified range limits.

### 4.6.3 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.

### 4.6.4 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.

#### 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 50130-5 and EN 50130-4.

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 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 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 of the detector and its claimed detection boundary showing top and side elevations at 2,0 m mounting height or at a height specified by the manufacturer, superimposed upon a scaled 2 m squared grid. The size of the grid shall be directly related to the size of the claimed detection boundary;

c) the recommended 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 European Standard at the claimed grade;

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

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

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

j) any special requirements needed for detecting a significant reduction in range, where provided.

# 6 Testing

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 B.

## 6.1 General test conditions

### 6.1.1 Standard conditions for testing

The general atmospheric conditions in the measurement and tests laboratory shall be those specified in EN 60068-1, 5.3.1, unless stated otherwise.

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

### 6.1.2 General detection testing environment and procedures

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

### 6.1.3 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. Many others are possible.

### 6.1.4 Standard walk test target

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.

#### 6.1.4.1 Standard walk test target temperature

Temperatures shall be measured at the following five points on the front of the body of the SWT:

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 D.1.

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

NOTE 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.

#### 6.1.4.2 Standard walk test target temperature differential

The walk tests shall be performed either with an average temperature differential $Dt_r$ (as calculated in 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 to achieve an equivalent temperature differential Dte within this range by one of the means specified in D.2.

If $Dt_r$ is less than 3,5 °C – 20 % (2,8 °C), no valid test is possible.

If $Dt_r$ is between 2,8 °C and 4,2 °C, no adjustment is required.

### 6.1.5 Testing procedures

The detector shall be mounted at a height of 2,0 m unless otherwise specified by the manufacturer. The orientation shall be as specified by the manufacturer with unobstructed view of the walk test to be performed. 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. If multiple sensitivity modes such as pulse counting are available, any non-compliant modes shall be identified by the manufacturer. All compliant modes shall be tested.

## 6.2 Basic detection test

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).

### 6.2.1 Basic detection targets (BDT)

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

The passive infrared 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.

The microwave BDT shall be a metal plate having equivalent microwave reflectivity to that of the human hand, which can be moved across the field of view of the detector.

BDTs may be used separately or together.

A close-in walk test may be carried out as an alternative to using the BDT.

### 6.2.2 PIR basic detection test

Activate the microwave technology; the unit shall not generate an intrusion signal or message.

A stimulus that is similar to that produced by the SWT is applied to the detector, using the PIR BDT. Move the PIR 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 PIR BDT 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.

### 6.2.3 Microwave basic detection test

Activate the passive infrared technology; the unit shall not generate an intrusion signal or message. A stimulus that is similar to that produced by the SWT is applied to the detector using the microwave BDT. Move the microwave BDT along the centre line of the detection field from a distance of 2 m to a distance of 1 m from the detector, at a height where the manufacturer claims detection will occur.

The microwave BDT is to be moved 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 the stimulus both before and after being subjected to any test that may adversely affect its performance.

## 6.3 Walk testing

### 6.3.1 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.

### 6.3.2 Verification of detection performance

The general test conditions of 6.1.1, 6.1.2 and 6.1.3 shall apply to all tests in this series.

Detection performance shall be tested against the manufacturer's documented claims. Example walk test diagrams are shown in Annex C.

Any variable controls shall be set to the values recommended by the manufacturer to achieve the claimed performance.

If the dimensions of the detection pattern exceed the available test space, it may be tested in sections rather than as a whole.

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.

### 6.3.3 Detection across and within the detection boundary.

The tests assess detection of intruders moving within and across the boundaries of the detection area. The diagrams in Annex C show an example of the detection boundary, superimposed where appropriate on a scaled 2 m squared grid. A variety of boundary formats are possible and can be tested.

#### 6.3.3.1 Verify detection across the boundary

Figure C.1 shows an example of a manufacturer's claimed detection boundary.

Place test points at 2 m intervals around the boundary of the detection pattern, starting from the detector, and finishing where the boundary crosses the detector axis. Repeat for the opposite side of the detection pattern. If the gap between the final point on each side is greater than 2 m, place a test point where the 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.

A walk test is a walk in one direction through a test point. Before commencing and after completing each walk test the SWT shall stand still for at least 20 s.

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

Pass/Fail criteria: There shall be a passed walk test in both directions for every test point.

#### 6.3.3.2 Verify detection within the boundary

Figure C.2 shows an example of a manufacturer's claimed detection boundary superimposed upon a scaled 2 m squared grid.

Starting at the detector, place the first test point at 4 m along the detector axis. Using the 2 m squared grid, place further test points at every alternate grid intersection, on both sides of the detector axis. No test point shall be less than 1 m from, or lie outside, the claimed boundary.

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

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

Pass/Fail criteria: There shall be a passed walk test in both directions for every test point

### 6.3.4 Verify the high-velocity detection performance

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

The SWT shall cross all of the specified detection area, coming to rest after clearing the other detection boundary. Before commencing and after completing each walk test the SWT shall stand still for at least 20 s.

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

### 6.3.5 Verify the intermittent movement detection performance

Two walk tests are performed, crossing the entire detection area. Before commencing and after completing each walk test the SWT shall stand still for at least 20 s.

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

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 the entire detection area.

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

### 6.3.6 Verify the close-in detection performance.

Two walk tests are performed beginning and ending outside the boundary of the detection area as detailed in Figure C.4. The tests begin outside the detection boundary with the centre of the SWT at a distance (for Grades 1 and 2) of 2,0 m ± 0,2 m from, and (for Grades 3 and 4) of 0,5 m ± 0,05 m from the vertical axis of the detector.

The SWT shall cross all of the specified detection area, coming to rest after clearing the other detection boundary. Before commencing and after completing each walk test the SWT shall stand still for at least 20 s.

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

### 6.3.7 Verify the significant reduction of specified range

Select a test point on the detector axis at a distance of 55 % of the manufacturer's claimed detection range. Erect a barrier which blocks infrared and microwave radiation across the axis and perpendicular to it, at a distance of 45 % of the manufacturer's claimed detection range, covering a horizontal distance of ± 2,5 m on either side of the detector axis, and a vertical height of 3 m as detailed in Figure C.5.

At the test point, two test directions are used, beginning at a distance of 1,5 m before the test point, and finishing 1,5 m after it, moving perpendicularly to the detector axis.

The SWT shall move along each path from start to finish. At the end of each walk test, the SWT shall pause for at least 20 s before carrying out any further test.

Pass/Fail criteria: A masking signal or message shall be generated when the barrier is present.

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

Switch on the detector power with the indicator enabled 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. 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 shall both respond. For the third basic detection test there shall be no indication.

## 6.5 Self tests

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.

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

Short the PIR 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 PIR 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.

Short the microwave sensor signal output to ground or carry out an equivalent action as recommended by the manufacturer and repeat the test(s). For detectors with more than one microwave 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.

## 6.6 Immunity of individual technologies to incorrect operation

### 6.6.1 Immunity to airflow

Place the microwave technology in a state where the PIR technology may cause an intrusion signal or message.

From a point 1,0 m below the detector, direct the airflow from a heater over the face of the detector, raising the air temperature at the detector window by 20 °C from ambient at a rate of 5 °C $min^{-1}$. The warm air shall flow at a mean velocity of 0,7 $ms^{-1} \pm 0{,}1$ $ms^{-1}$, measured at the detector window. Do not allow the detector a direct view of the heating elements.

Stabilise for 4 min at ambient + 20 °C. Switch off the heat and allow the temperature to ramp down for 1 min or until ambient is reached. Stabilise at ambient for 2 min. Repeat the cycle 5 times.

Pass/Fail criteria: There shall be no change of status of the detector.

### 6.6.2 Immunity to visible and near infrared radiation

Place the microwave technology in a state where the PIR technology may cause an intrusion signal or message.

A white light source (a 12 V halogen car headlamp, VW H4 bulb or equivalent, without front reflector and lens) connected to a 13,5 V d.c. 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.

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: There shall be no change of status of the detector.

### 6.6.3 Immunity to microwave signal interference by fluorescent lights

Place the passive infrared technology in a state where the microwave technology may cause an intrusion signal or message.

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).

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: There shall be no change of status of the detector.

## 6.7 Tamper security

The general test conditions of 6.1.1 shall apply.

### 6.7.1 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.

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.

### 6.7.2 Detection of removal from the mounting surface

Confirm the operation of the back tamper device by removing the detector from the mounting surface. Replace the unit on the mounting surface without the fixing screws, unless they form a part of the tamper detection device.

Slowly prise 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.

### 6.7.3 Resistance to re-orientation of adjustable mountings

Mount the detector with the bracket 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.

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°.

### 6.7.4 Resistance 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 and verify correct generation of tamper and fault signals or messages. Repeat the test with the other pole.

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

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

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

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

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

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.

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.

**Table 6 — Range of materials for masking tests**

| Material number | Material |
|---|---|
| 1 | Matt black paper sheet |
| 2 | 2 mm thick aluminium sheet |
| 3 | 3 mm thick clear gloss acrylic sheet |
| 4 | White polystyrene foam sheet |
| 5 | Self adhesive clear vinyl sheet [a] |
| 6 | Colourless plastic skin, spray Polyurethane [a] |
| 7 | Clear gloss lacquer, brush applied [a] |
| [a] Applied only from the front. | |

All sheet samples shall be large enough to inhibit detection.

### 6.7.6 Immunity to false masking signals

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

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

### 6.8 Electrical tests

Ensure that there is no human movement in the coverage area of the detector during the tests.

Table 5 specifies grade dependency.

### 6.8.1 Detector current consumption

This test is not applicable to detectors with internal 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.

### 6.8.2 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 $Vs^{-1}$ 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. 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 Grade 3 and 4 detectors, 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: For Grade 3 and 4 detectors, 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.

### 6.8.3 Input voltage ripple

This test is not applicable to detectors with internal 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 basic detection test.

### 6.8.4 Input voltage step change

This test is not applicable to detectors with internal 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.

### 6.8.5 Total loss of power supply

This test is not applicable to detectors with internal 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 for bus based system total loss of power supply may be determined by loss of communication with the detector.

## 6.9 Environmental classification and conditions

Unless stated otherwise the general test conditions of 6.1.1 shall apply.

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.

After the $SO_2$ test, detectors shall be washed and dried in accordance with the procedure prescribed in EN 60068-2-52. The basic detection test shall be performed immediately after drying. Carry out the access to interior test (6.7.1) and the detection of detector masking test (6.7.5) 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 |

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.

**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 |
| $SO_2$ 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.

## 6.10 Marking, identification and documentation

### 6.10.1 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.

### 6.10.2 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 EN 50131-1, and the manufacturer’s claimed performance data.

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

# Annex A
(normative)

## Dimensions & requirements of the standardised test magnets

The following standards will form the base for the selection of the test magnets:

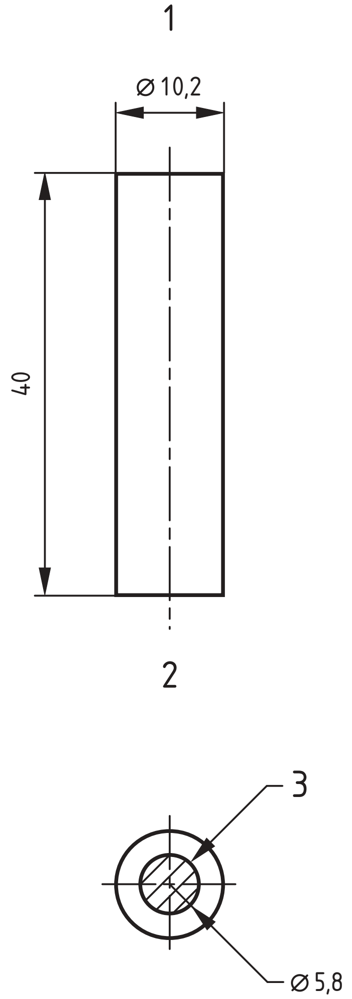
EN 60404-5, Magnetic materials - Part 5: Permanent magnet (magnetically hard) materials - Methods of measurement of magnetic properties (IEC 60404-5)

IEC 60404-8-1, Magnetic materials - Part 8-1: Specifications for individual materials - Magnetically hard materials

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)

The field strength of the magnet determined by the magnetic material, by remanence (Br) in mT, the product of energy (BH) max in $kJm^{-3}$ and the polarisation of the working point in mT.

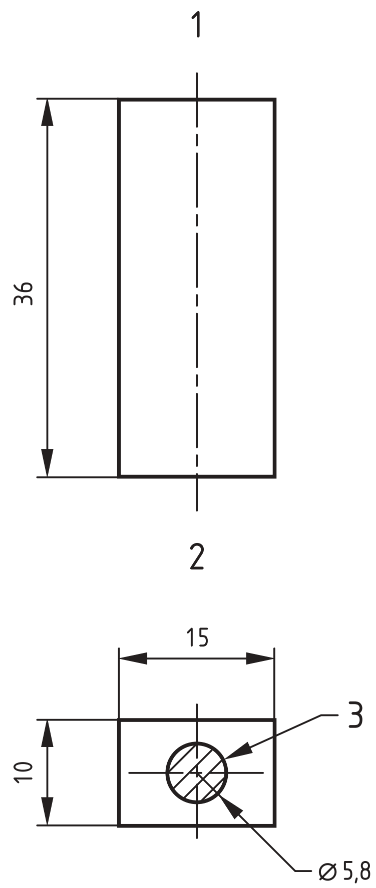
The relevant values, dimensions and measurement points for the test magnet can be found in the following drawings and tables. For calculations, measurements and calibrating the test magnets refer to the above standards.




**Key**
1 North pole
2 South pole
3 North pole (shaded)

| | |
|---|---|
| **Material** | ALNiCo 34/5 (Code number R1-1-10) |
| **Remanence $B_r$ min.** | 1 120 mT |
| **Product of energy $(BH)_{max.}$** | 34 kJ/$m^3$ |
| **Polarization of working point** | 0,835 T +/– 2 % |

**Figure A.1 — Test magnet - Magnet Type 1**




**Key**
1 North pole
2 South pole
3 North pole (shaded)

| | |
|---|---|
| **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**

# Annex B
(normative)

## 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 | 6.3.3.1 | None | 1 |
| Verify detection within the boundary | None | 6.3.3.2 | None | 1 |
| Verify the high velocity detection performance | None | 6.3.4 | None | 1 |
| Verify the intermittent movement detection performance | None | 6.3.5 | None | 1 |
| Verify the close-in detection performance | None | 6.3.6 | None | 1 |
| Verify the significant reduction of specified range | None | 6.3.7 | None | 1 |
| Switch-on delay, time interval between signals and indication of detection | None | 6.4 | None | 1 |
| Self tests | None | 6.5 | None | 2 |
| Immunity to air flow | None | 6.6.1 | None | 1 |
| Immunity to visible and near infrared radiation | None | 6.6.2 | None | 1 |
| Immunity to microwave signal interference by fluorescent lights | None | 6.6.3 | None | 1 |
| Resistance to and detection of unauthorised access to the inside of the detector through covers and existing holes | None | 6.7.1 | None | 10 |
| Detection of removal from the mounting surface | None | 6.7.2 | None | 10 |
| Resistance to or detection of re-orientation of adjustable mountings | None | 6.7.3 | None | 10 |
| Resistance to magnetic field interference | None | 6.7.4 | None | 10 |
| Detection of detector masking | 6.2.2 + 6.2.3 | 6.7.5 | 6.2.2 + 6.2.3 | 10, 11 [a] |
| Immunity to false masking signals | None | 6.7.6 | None | 1 |
| Detector current consumption | None | 6.8.1 | None | 1 |
| Slow input voltage change and input voltage range limits | None | 6.8.2 | None | 1 |
| Input voltage ripple | None | 6.8.3 | None | 1 |
| Input voltage step change | None | 6.8.4 | None | 1 |
| Total loss of power supply | None | 6.8.5 | None | 1 |
| Dry heat | 6.2.2 | 6.9 | 6.2.2 | 3 |

| Main test title | Task to be performed in conjunction with main test | | | Sample no. |
|---|---|---|---|---|
| | Before main test | During main test | After main test | |
| Cold | 6.2.2 | 6.9 | 6.2.2 | 3 |
| Damp heat (steady state) | 6.2.2 | 6.9 | 6.2.2 | 4 |
| Damp heat (cyclic) | 6.2.2 | 6.9 | 6.2.2 | 4 |
| Water ingress | 6.2.2 | 6.9 | 6.2.2 | 5 |
| Mechanical shock | 6.2.2 | 6.9 | 6.2.2 | 6 |
| Vibration | 6.2.2 | 6.9 | 6.2.2 | 7 |
| Impact | 6.2.2 | 6.9 | 6.2.2 | 6 |
| EMC | 6.2.2 | 6.9 | 6.2.2 | 8 |
| Damp heat (steady state) | 6.2.2 | 6.9 | 6.2.2 | 4 |
| Damp heat (cyclic) | 6.2.2 | 6.9 | 6.2.2 | 4 |
| $SO_2$ corrosion | 6.2.2 | 6.9 | 6.2.2 | 9 |
| Vibration (sinusoidal) | 6.2.2 | 6.9 | 6.2.2 | 7 |
| Marking and/or identification | None | 6.10.1 | None | 1 |
| Documentation | None | 6.10.2 | None | 1 |

[a] For masking tests more samples may be required.

# Annex C
(normative)

## Walk test diagrams

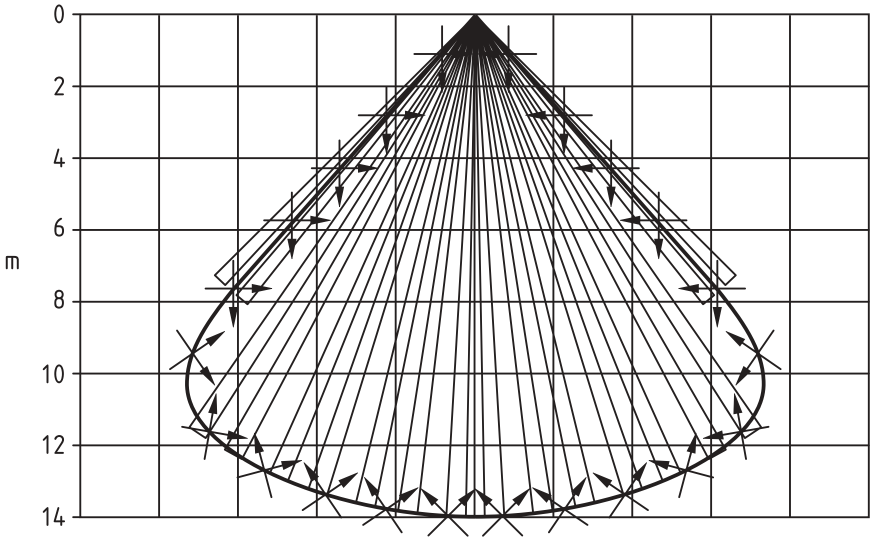
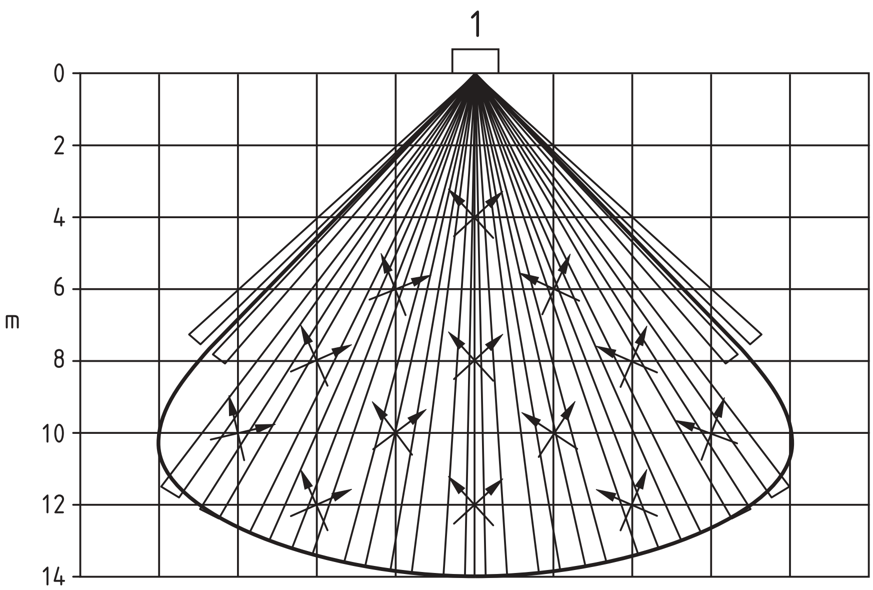


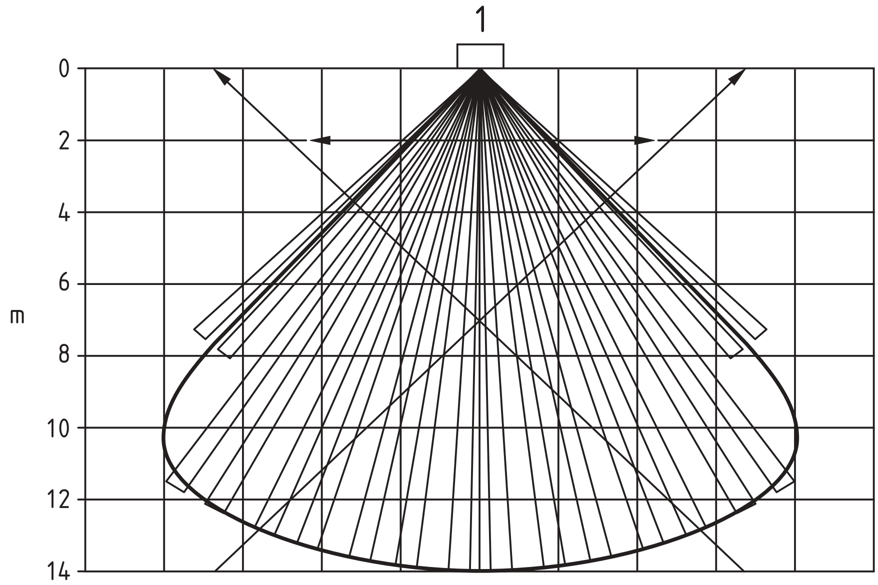

**Figure C.1 — Detection across the boundary**




**Key**

1 Detector

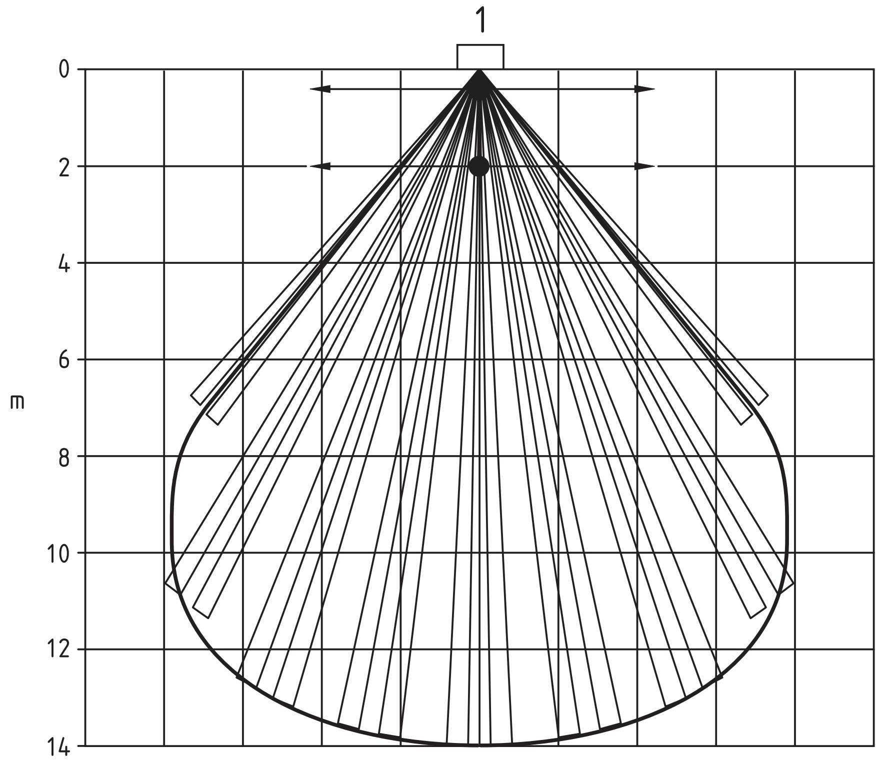
**Figure C.2 — Detection within the boundary**




**Key**

1 Detector

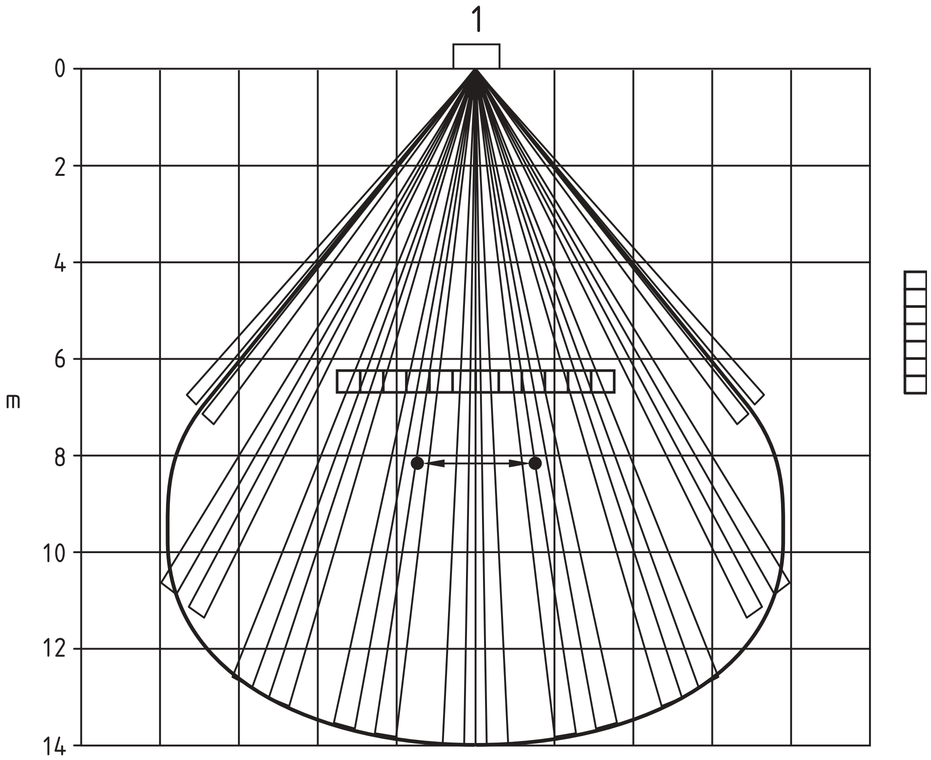
**Figure C.3 — High velocity and intermittent movement**




**Key**

1 Detector

**Figure C.4 — Close-in detection**




**Key**

1 Detector

**Figure C.5 — Significant range reduction**

# Annex D
(normative)

# Procedure for calculation of the average temperature difference between the standard target and the background

## D.1 Measurement and calculation of the real average temperature difference between the SWT and the background

The calculation of real average temperature difference $Dt_r$ of the selected SWT requires non-contact temperature measurement of the body and of the immediately adjacent background and averaging of the differences between these. The thermometer shall have a wavelength sensitivity range of 6 µm to 18 µm, a collection angle no larger than 3°, and its emissivity setting shall be 95 %.

Five separate zones of the human form shall be measured for surface temperature, and the differences between the zone and the background weighted and summed to give $Dt_r$:

| Body zone | Body-background: temperature difference | Significance: weighting factor | |
|---|---|---|---|
| Head | $Dt_{r1}$ | $W_1$ | 2 |
| Chest | $Dt_{r2}$ | $W_2$ | 4 |
| Back of Hand | $Dt_{r3}$ | $W_3$ | 4 |
| Knee | $Dt_{r4}$ | $W_4$ | 2 |
| Feet | $Dt_{r5}$ | $W_5$ | 1 |

$$Dt_r = \frac{\sum_{k=1}^{5} Dt_{rk} \times W_k}{\sum_{k=1}^{5} W_k}$$

## D.2 Adjustment of equivalent average temperature difference between the SWT and the background

The equivalent average temperature difference between the SWT temperature and the immediately adjacent background temperature shall not be less than 2,8 °C (3,5 °C – 20 %). If $Dt_r$ is greater than 4,2 °C (3,5 °C + 20 %), one or more attenuation filters shall be placed directly over the detector lens or window to reduce the radiation received by the detector to within 20 % of that which would result from a temperature difference of 3,5 °C.

Alternatively, if $Dt_r$ is greater than 4,2 °C (3,5 °C + 20 %), the SWT may wear an extra layer or layers of close fitting clothing, or the general background temperature may be raised. If $Dt_r$ is less than 2,8 °C (3,5 °C -20 %), the general background temperature will need to be lowered.

HDPE sheets may be used as filter material for SWT signal adjustment. The percentage reduction in radiation received by the detector obtainable with these materials is best established with a suitable infrared spectrograph.

Examples of material thicknesses are 100 µm and 200 µm. which may give the following approximate signal reductions:

| Material thickness | Approximate signal reduction |
|---|---|
| 100 µm | 20 % |
| 200 µm | 36 % |

# Annex E
(informative)

## Basic detection target for the basic test of detection capability

The purpose of this equipment is to verify that a detector is still operational after a test has been carried out. A heat source is required that, after stabilisation, has a surface temperature similar to that of an intruder. A stack of eight 120 Ω, 0,25 W resistors in series makes a 960 Ω resistor mounted on a copper clad board of height 120 mm and width 30 mm. Adjust the supply voltage until the BDT has an average stabilised surface temperature from 3,5 °C to 10 °C above the background temperature when measured with a non-contact thermometer. This, when mounted on a hand-held rod provided with sufficient cable from the power supply, can be moved by hand across the field of view of the detector. A suitable distance of movement would be about 1,0 m at a range of about 1,0 m from the detector.

# Annex F
(informative)

# Equipment for walk test velocity control

The SWT is required to move at a variety of velocities during walk tests as specified in Table 3. The required velocities range from 0,1 $ms^{-1}$ to 3,0 $ms^{-1}$ ± 10 %. A means of controlling these velocities is desirable.

## F.1 Moving light source guiding system

This equipment consists of a series of light emitting diodes (LEDs) mounted along the floor in the direction that the controlled walk test subject is desired to follow. They are driven by a variable time switch so that they flash in sequence across the floor, producing an apparent movement, which can be followed by the SWT.

## F.2 Metronome

The metronome gives an audible timing sound that can be used, in conjunction with a marked distance scale on the floor, to instruct the SWT to move from one mark to the next as each beat from the metronome sounds.

# Annex G
(informative)

## Immunity to visible and near Infrared radiation - Notes on calibration of the light source

The illumination source may be a round H4 type headlamp with 12 V, 60 W halogen bulb using only the main beam filament. It has been found that intrusion signals or messages produced by such lamps are caused not by visible radiation but by infrared wavelengths between 2 μm and 3 μm that are emitted in addition to the visible spectrum.

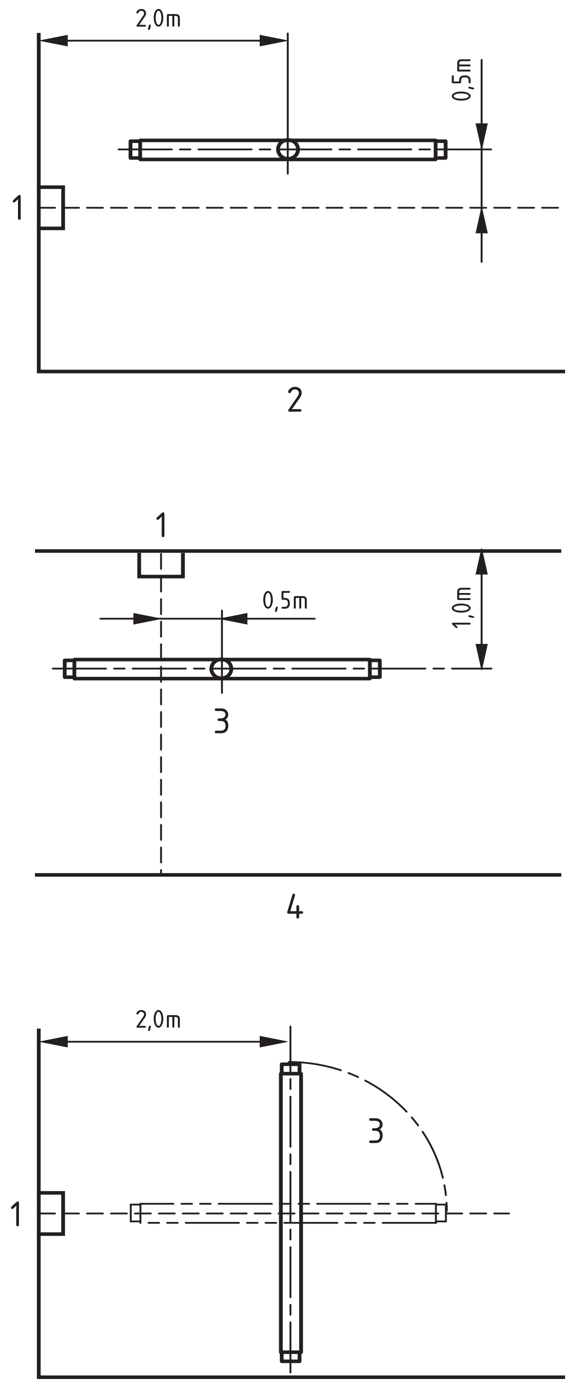
Not all headlamp and bulb combinations will emit the character of radiation needed.

A conventional photographic light meter may be used to measure the intensity of light in the visible waveband produced by the headlamp, which will be set at a distance from the detector such that the intensity of light at the detector is 2 000 lx ± 10 %.

A conventional visible light meter will not measure the radiation emitted in the 2 μm to 3 μm wavelength band. The light meter should be calibrated against a standard light source. The headlamp is mounted at a distance which is adjusted so that the received visible radiation intensity is 2 000 lx ± 10 %, measured at the detector position with the light meter. Without moving the lamp, substitute a detector that operates in the 2 μm to 3 μm wavelength band (a PbS detector for example), and note the reading. Consistent test conditions can now be ensured by measurement of the received radiation in the 2 μm to 3 μm wavelength band, rather than relying totally on the visible light meter reading, which is an indirect measurement and may be inaccurate.

# Annex H
(informative)

## Immunity to microwave signal interference by fluorescent lights




**Key**
1 Detector
2 Side view
3 Rotate tube 90°
4 Ceiling mount
5 Top view

**Figure H.1 — Immunity to fluorescent lamp interference**

# Annex I
(informative)

## Example list of small tools

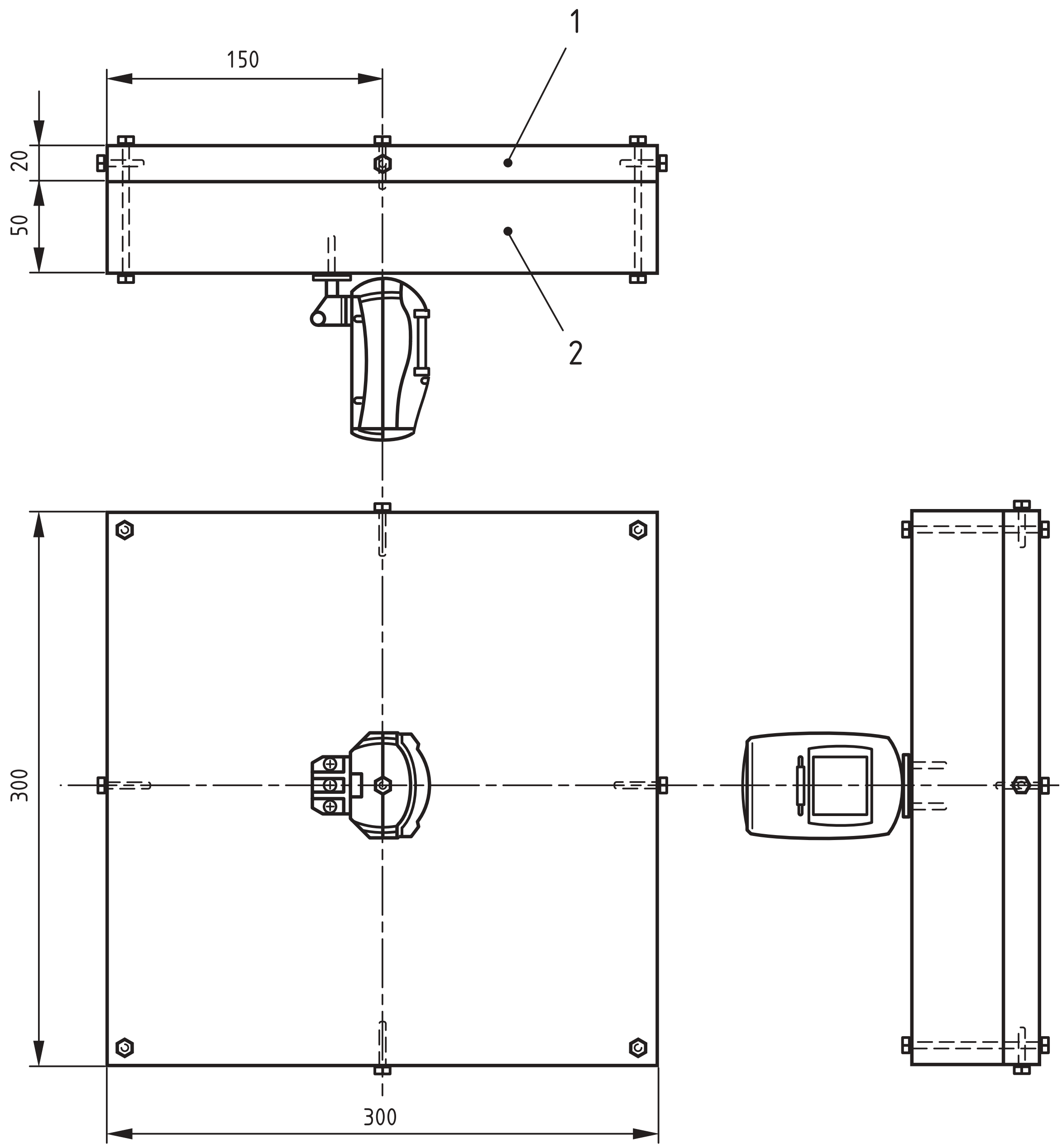
| | |
|---|---|
| Penknife | Magnets |
| Steel ruler | Paper |
| Wire | Pliers |
| Matches | Small screwdriver set |
| Paper clip | Stiff wire (1 mm ± 0,05 mm as EN 60529 IP4X) |
| Pen | |

# Annex J
(informative)

## Test for resistance to re-orientation of adjustable mountings

Mount the detector on a substantial wood block with a metal backing (see Figure J.1). Steel nuts fitted to the metal base are used to apply a torque wrench so a measured torque may be applied to the housing at the appropriate level for the measurement of re-orientation.

The test is performed by gripping the detector casing in a substantial soft-jawed vice and turning the metal base with the torque wrench. A line and protractor attached to the metal base allows assessment of the turning angle caused by the applied torque.




**Key**

1 Stainless steel

2 Hardwood

Dimensions in mm

NOTE All screws are M6 size.

**Figure J.1 — Re-orientation test**

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