TECHNICAL SPECIFICATION **CLC/TS 50131-2-2**

SPECIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION August 2004

ICS 13.310

English version

Alarm systems - Intrusion systems
Part 2-2: Requirements for passive infrared detectors

Systèmes d'alarme -
Systèmes de détection d'intrusion
Partie 2-2: Exigences pour détecteurs infrarouges passifs

Alarmanlagen -
Einbruchmeldeanlagen
Teil 2-2: Anforderungen an Passiv-Infrarotmelder

This Technical Specification was approved by CENELEC on 2004-05-04.

CENELEC members are required to announce the existence of this TS in the same way as for an EN and to make the TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. CLC/TS 50131-2-2:2004 E

Foreword

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

The text of the draft was submitted to the vote at the meeting of TC 79 in Madrid and was approved by CENELEC as CLC/TS 50131-2-2 on 2004-05-04. Standstill is maintained.

The following date was fixed:

- latest date by which the existence of the TS has to be announced at national level	(doa)	2004-11-04

NOTE Latest date by which the TS has to be voted as EN: 2 years maximum after dav of TS.

Contents

Introduction

This Technical Specification is a specification for passive infrared detectors (to be referred to as the detector) used as part of intrusion detection systems installed in buildings. It includes four security grades and the first three environmental classes.

The purpose of a detector is to detect the broad spectrum infrared radiation emitted by an intruder and to provide the necessary range of signals or messages to be used by the rest of the intruder 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 specification is only concerned with the requirements and tests for the detector. Other types of detector are covered by other documents identified as CLC/TS 50131-2-x.

The requirement in EN 50131-1 that detectors in grade 3 and 4 systems shall include a 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.

1 Scope

This Technical Specification 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 III (see EN 50130-5).

A function designated in the specification as not required for a particular grade may be provided by the manufacturer. If provided, it will be tested, and shall meet all relevant requirements of any higher grade. If it passes, the manufacturer may claim it as an extra feature, which does not alter the overall grading of the detector.

The specification 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 50130-4:1995	Alarm systems - Part 4: Electromagnetic compatibility - Product family standard: Immunity requirements for components of fire, intruder and social alarm systems
EN 50130-5:1998	Alarm systems - Part 5: Environmental test methods
EN 50131-1:1997	Alarm Systems - Intrusion systems - Part 1: General requirements
EN 50131-6:1997	Alarm systems - Intrusion systems - Part 6: Power supplies
EN 60529:1991	Degree of protection provided by enclosures (IP code)

3 Definitions and abbreviations

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

3.1
alert/set mode
state of operation in which a detector shall generate an intrusion signal or message in response to stimulation by a human being or the standard walk test target

3.2
basic detection target
heat source designed to verify the operation of a detector

3.3
ceiling mount detector
detector capable of sensing human movement from a mounting position on the ceiling

3.4
curtain detector
detector capable of sensing human movement through a continuous layer of detection zones

3.5
incorrect operation
physical condition that causes an inappropriate signal or message from a detector

3.6
local memory
storage medium situated on board the detector, having the capability to record signals or messages generated by the detector

3.7
long range detector
detector capable of sensing human movement in an extended field of view with horizontal angular coverage less than 10°

3.8
masking
interference with the detector input capability by the introduction of a physical barrier such as metal, plastics, paper or sprayed paints or lacquers in close proximity to the detector

3.9
passive infrared detector
detector of the broad-spectrum infrared radiation emitted by a human being

3.10
simulated walk test target
non-human or synthetic heat source designed to simulate the standard walk test target

3.11
standard walk test target
human being of standard weight and height clothed in close fitting clothing appropriate to the simulation of an intruder

3.12
standby/unset mode
state of operation in which a detector is not required to generate an alarm signal or message in response to stimulation by a human being or a standard walk test target

3.13
test mode
state of operation in which a detector will activate an intrusion indicator in response to stimulation by a human being or the standard walk test target

3.14
volumetric detector
detector capable of sensing human movement in a volume such as a room with a field of view with horizontal angular coverage greater than 45°

3.15
walk test
operational test during which a detector is stimulated by the standard walk test target in a controlled environment

3.16
walk test attitude, crawling
crawling attitude shall consist of the standard walk test target moving with hands and knees in contact with the floor

3.17
walk test attitude, upright
upright attitude shall consist of the standard walk test target standing and walking with arms by the sides of the body. The standard walk test target begins and ends a traverse with feet together

3.18
wire free detector
detector connected to the control and indicating equipment by interconnection such as radio frequency signals

3.19 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

All detectors shall have an alert/set mode. Grades 3 and 4 shall have an unset mode. If a detector has only one mode of operation, then it shall always be in the alert/set mode. Tamper detection shall be active in all modes.

Each possible mode of operation is determined by the status of the intrusion detection system with which the detector communicates. The detector signals or messages in these modes of operation shall function in accordance with Table 1. All signals or messages apply to all modes of operation unless stated otherwise. Where a memory display or intrusion indicator is provided on board the detector, it shall not function in the alert/set mode.

Table 1 - Indication signals or messages

Event	Grades	Intrusion signal or message	Tamper signal or message	Fault signal or message
Intrusion	1 – 4	Required *	Not permitted	Not permitted
No stimulus	1 – 4	Not permitted	Not permitted	Not permitted
Masking	1 – 2	Not required	Not required	Not required
	3 – 4	Required **	Not required	Required **
Tamper	1 – 4	Not required	Required	Not required
Low supply voltage (external)	1 – 2	Not required	Not required	Not required
	3 – 4	Not required	Not required	Required
Total loss of external power supply	1	Not required	Not required	Not required
	2 – 4 ***	Required	Not required	Not required
Local self-test pass	1 – 4	Not permitted	Not permitted	Not permitted
Local self-test fail	1 – 2	Not permitted	Not permitted	Not required
	3 – 4	Not permitted	Not permitted	Required
Remote self-test pass	1 – 2	Not required	Not permitted	Not permitted
	3 – 4	Required	Not permitted	Not permitted
Remote self-test fail	1 – 2	Not permitted	Not permitted	Not required
	3 – 4	Not permitted	Not permitted	Required

* Not required in unset/standby mode: required in test mode.
** An independent masking signal or message may be provided instead.
*** Not required for bus systems.

NOTE For internal power supplies, see EN 50131-6.

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 within the boundary for a distance of 3 m. The detector shall also generate an intrusion signal or message when the standard or simulated walk test target moves across the manufacturer's claimed boundary of detection.

The velocities and attitudes are as specified in Table 2.

Table 2 - 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	(m/s)	1,0	1,0	1,0	1,0
Attitude		Upright	Upright	Upright	Upright
Detection within the boundary		Required	Required	Required	Required
Velocity	(m/s)	0,3	0,3	0,2	0,1
Attitude		Upright	Upright	Upright	Upright
Detection at high velocity		Not required	Required	Required	Required
Velocity	(m/s)	#	2,0	2,5	3,0
Attitude		#	Upright	Upright	Upright
Close-in detection performance	(dist, m)	2,0	2,0	0,5	0,5
Velocity	(m/s)	0,5	0,4	0,3	0,2
Attitude		Upright	Upright	Crawling	Crawling
Intermittent movement detection performance *		Not required	Not required	Required	Required
Velocity	(m/s)	#	#	0,2 (1,0)	0,1 (1,0)
Attitude		#	#	Upright	Upright
Effect of control adjustments **		Not required	Required	Required	Required
Velocity	(m/s)	#	0,3	0,2	0,1
Attitude		#	Upright	Upright	Crawling
Significant reduction of specified range		Not required	Not required	Not required ***	Not required ***
Velocity	(m/s)	#	#	# (1,0)	1,0
Attitude		#	#	# Upright	Upright

* The intermittent movement shall consist of the SWT moving a distance of 1 m by taking two 0,2 (5) m steps (at 1,0 m/s), pausing for 5 s then continuing until the SWT has left the area for a further 1 s.

** If means for continuous adjustment of detection sensitivity is provided, the effect of any setting shall be indicated with a tolerance of less than 25 % of the maximum reading.

*** 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.

To test features that are not required in a particular grade, parameters from a higher grade shall be specified.

4.2.2 Indication of detection

An indicator, if provided at the detector, shall indicate when detection causes an intrusion signal or message. This indicator shall be capable of being enabled/disabled. This operation shall only be performed locally after removal of the cover or remotely at the control and indicating equipment.

4.2.3 Significant reduction of specified range

If the facility to detect reduction in specified range is provided, then range reduction along the principal axis of detection of more than 50 % shall generate an alarm or fault signal or message within a maximum period of 180 s, according to the requirements given in Table 2. The requirements of 4.3.5 (self test) and 4.5.5 (resistance to masking) can provide range reduction detection.

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

4.3 Operational requirements

4.3.1 Time interval between intrusion signals or messages

Wired detectors shall be able to provide an intrusion signal or message not more than 15 s after the end of the preceding intrusion signal or message. Wire free detectors shall perform the same function in a time as follows:

Grade 1: 300 s,
Grade 2: 300 s,
Grade 3: 30 s,
Grade 4: 15 s (see EN 50131-1 for amendment).

4.3.2 Switch on delay

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

4.3.3 Fault condition signalling

When a detector suffers a fault, a fault signal or message shall be generated in accordance with the manufacturer's specification, and the provisions of Table 1.

4.3.4 Power supply faults

Detectors of all grades shall signal complete power failure according to the provisions of Table 1. Additionally, detectors of grades 3 and 4 shall signal when the supply voltage moves below the manufacturer’s specified range according to the provisions of Table 1.

4.3.5 Self tests

Grade 3 and grade 4 detectors shall monitor the function of the sensor and associated on-board signal processing circuitry. A self-test shall be performed under the control of the detector.

When a remote self-test is initiated, a signal or message shall be generated between 1 s and 5 s later, and shall be signalled within 5 s of that initiation. The test duration shall not exceed 10 s. After the test is completed, the detector shall resume its previous state within 5 s. Fault indication requirements appear in Table 1.

Where normal operation of the detector is inhibited during a local test of function monitoring the detector inhibition time shall be limited to a maximum of 15 s in a period of 1 h.

4.4 Immunity 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 detector shall not generate any signal or message when air is blown over the face of the detector.

4.4.2 Immunity to visible and near infrared radiation

The detector shall not generate any signal or message when visible and near Infrared radiation from a light source such as a car headlamp is directed on to the front window or lens through a pane of glass.

4.5 Tamper security

Tamper security requirements for each grade of detector are shown in Table 3.

4.5.1 Prevention of unauthorized access to the inside of the detector through covers and existing holes

Access holes shall not allow interference with the operation of the detector by probing with commonly available tools. Damage shall not be caused that would be visible to a person with normal eyesight viewing from a distance of 1 m with the detector illuminated at a level of 2 000 lux.

A tool shall be required to open the unit. All covers giving access to components which could affect adversely the operation of the detector shall be fitted with a tamper detection device in accordance with Table 3. A tamper signal or message shall be generated before access is gained with any tool.

4.5.2 Detection of removal from the mounting surface

A tamper detection device shall be fitted which signals a tamper if the detector is removed from the mounting surface, in accordance with Table 3. Mounting screws shall only be accessible from within the unit. Operation of the device shall not be preventable by external means. This device shall activate before access can be gained to it.

4.5.3 Resistance to re-orientation

Where the orientation of a detector can be adjusted, resistance to re-orientation shall be provided in accordance with Table 3.

The alignment of the boundary of detection shall not have changed by more than 5° due to a grade dependent applied torque. Alternatively a tamper detection device shall signal before the alignment of the boundary of detection has moved by 5°. One test arrangement is described in Annex L.

If a detector provides a means to adjust the orientation of its coverage pattern, the access to this means shall be protected by a tamper device.

4.5.4 Immunity to magnetic field interference

It shall not be possible to inhibit any output or signalling devices with a magnet of grade dependent remanence, according to Table 3. The form of standard magnets shall be as described in Annex A.

4.5.5 Resistance to masking

Means shall be provided to detect inhibition of the operation of the detector by covering its sensing area and sensor, in the unset mode. The maximum response time for the masking detection device shall be 180 s. Intrusion and fault signals or messages or a dedicated anti-masking signal or message shall be generated. The signals or messages shall remain latched until restored. Grade dependency appears in Table 3.

No anti-masking signal or message shall be generated by normal human movement at 1 m/s at a distance greater than 1 m in the unset condition.

Table 3 - 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
Removal from the mounting surface*	Not required	Required *	Required	Required
Resistance to re-orientation:	Not required	Required	Required	Required
Applied torque (Nm)		2	5	10
Magnetic field immunity:	Not required	Required	Required	Required
Remanence (T)		0,15	0,3	1,2
Anti-masking: capability	Not required	Not required	Required	Required
* Required for wire free detectors only.				

4.6 Electrical requirements

These requirements do not apply to detectors having internal power supplies. For these detectors refer to EN 50131-6. For detectors having an external power supply, the requirements appear in Table 4.

Table 4 - Electrical requirements

Test	Grade 1	Grade 2	Grade 3	Grade 4
Detector current consumption	Required	Required	Required	Required
Input voltage range & 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
Total loss of supply	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 (rise) and voltage range limits

The detector shall meet all functional requirements when the input voltage lies between ± 25 % of the nominal value, or between the manufacturer's stated values (range limits 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 maximum or minimum and nominal values of the input voltage.

4.6.5 Total loss of supply

An intrusion signal or message shall be caused by the total loss of the supply voltage.

4.7 Environmental classification and conditions

4.7.1 Environmental classification

The environmental classification is described in EN 50131-1. All the relevant environmental tests shall be carried out at the appropriate level for all security grades, as given in EN 50130-5.

4.7.2 Immunity to environmental conditions

All detectors shall meet the requirements of the relevant environmental class and equipment class as specified by the manufacturer.

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

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

For endurance tests, the detector shall continue to meet the requirements of this specification 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 (including any from higher grades), 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 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;

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

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

g) a warning to the user not to obscure partially or completely the detector's field of view with large objects such as furniture;

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

i) the method of detecting a 50 % 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 laboratory conditions for testing

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

6.1.2.1 Testing environment

The detection tests require an enclosed, unobstructed and draught-free area at least 25 % larger in the three dimensions than the manufacturer’s claimed field of view, with the detector mounted in the as-used position on a wall or ceiling, or on a free-standing test rig.

To standardize the test area walls and floor for IR tests, they shall each be covered with uniform materials having an infrared emissivity of at least 80 % in the 8 µm to 14 µm wavelength band, at least directly behind the SWT, and in the FOV of the detector.

Volumetric, curtain, and long-range detectors shall be mounted on the centre line of the vertical surface constituting the back wall of the test area, or on a free-standing test rig, at a height of 2,0 m unless otherwise specified by the manufacturer. Ceiling mounted detectors shall be mounted in an appropriate orientation permitting at least half the field of view to be verified.

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

6.1.2.2 Testing procedures

The detector shall be connected to the nominal supply voltage, placed in the alert/set mode, and connected to the monitoring system that is appropriate to the test. The detector shall be allowed to stabilize for 180 s. The intrusion signal or message output shall be monitored. 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.

The following SWT temperature conditions shall apply during the test and shall be recorded at intervals sufficient to ensure consistent measurement:

a) 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 during calibration of the SWT. Over the whole background area it shall be measured at ten points.

b) The averaged temperature difference between the background temperature and the SWT temperature shall be 3 °C +/- 10 %. If it is greater, attenuation filters shall be placed directly over the detector lens or window to reduce proportionally the energy received by the detector. The procedure is described in Annex D.

6.2 Basic detection test

6.2.1 Basic detection target

The purpose of the BDT is to verify that a detector is still operational after a test or tests has/have been carried out. The BDT verifies only the qualitative performance of a detector. It consists of a heat source equivalent to the human hand that 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 not less than 3 °C above the background.

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

6.2.2 Basic test of detection capability

A stimulus that is similar to that produced by the SWT is applied to the detector, using the BDT. 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 a distance of 1 m at a velocity of 0,5 m/s to 1,0 m/s. 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.

6.3 Walk testing

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 2.

Walk tests shall not be repeated before a time interval of at least 20 s (or greater if specified by the manufacturer) has elapsed.

An intrusion signal or message shall be generated during a (each) walk test to register a pass. If an individual walk test is failed, it shall be repeated twice more. Two passes out of the three tests shall constitute a passed test.

General pass/fail criteria for all tests

For a complete test series, 95 % or more of the tests shall be passed.

6.3.1 Standard walk test target (SWT)

The SWT shall have the physical dimensions of 160 cm to 185 cm in height, shall weigh 70 kg ± 10 kg and shall wear close-fitting clothing having an emissivity of greater than 80 % between 8 µm to 14 µm wavelength band.

The averaged temperature difference between the SWT and the background shall be established.

Temperatures shall be measured at five points on the body of the SWT, on the surface facing perpendicularly to the axis of the detector, and the background temperature close to each point measured at the same time.

1. Head.
2. Upper torso side.
3. Hand at body side.
4. Legs at knee.
5. Feet.

Temperatures shall be measured using a non-contact thermometer or equivalent equipment, which shall be verified against the calibration heat source (6.3.3.1). The test house shall measure and calibrate at intervals that ensure conformance with the specified limits.

The temperature differences at each body point are calculated, weighted and averaged. The informative detail calculation of the SWT temperature difference is given in Annex D.

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. It is known as the simulated target. In case of conflict, a human walk test shall be the primary reference.

6.3.2 Standard walk test target calibration

6.3.2.1 A calibration heat source

A heat source that has an absolutely constant temperature close to that of the human body is described in Annex F.

6.3.2.2 Standard walk test target temperature difference

The equivalent average temperature difference Dt_e between the background temperature and the SWT temperature shall be 3 °C +/- 10 %.

Since the SWT is variable in the amount of heat emitted in the 8 µm to 14 µm wavelength band, it may be necessary to adjust the energy received from the SWT to achieve the required equivalent average temperature difference.

The real average temperature difference Dt_r shall be greater than 2,7 °C (3,0 °C – 10 %). As is described in Annex D, attenuation filters shall be used to reduce the thermal radiation from the SWT by a factor Dt_e/Dt_r (± 10 %). If Dt_r is less than 3,3 °C, no filter will be required.

6.3.2.3 Control of the standard walk test target velocity

This equipment provides a means whereby the SWT can move at a desired velocity. The system produces an apparent movement or audible signal, which may be matched by the SWT. The SWT begins and ends a traverse with feet together, matching movement with the velocity control system. The system can employ any desired means provided that the SWT velocity can be monitored to a tolerance of better than ± 10 %.

The informative description of two such systems appears in Annex H.

6.4 Verification of detection performance

The general test conditions of 6.1.2 shall apply to all tests in this series.

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

PIR detectors of all types shall be assessed in the specified test environment.

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

Lay out the test area according to the provisions of the diagrams in Annex C, and the manufacturer’s performance claims.

Figure C.2 shows an example of the detection boundary. A detector reference line is drawn through the detector, at right angles to the detector axis.

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 2.

6.4.1 Detection within and across 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 upon a scaled 2 m squared grid. A variety of boundary formats are possible and can be tested.

6.4.1.1 Verify detection across the boundary

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

Select test points on the boundary as detailed in Figure C.1:

Place test points at 2 m intervals around the entire boundary of the detection pattern, starting from the detector, and finishing with a final test point where the boundary crosses the detector axis, if omission of this point would leave a gap greater than 2 m wide. Repeat for the opposite side of the detection pattern.

Each test point is connected to the detector by a radial line. At each test point, two alternative test directions are available, beginning at a distance of 1,5 m from the test point, and finishing 1,5 m after it. The SWT shall move at either +45° or - 45° to the radial line.

6.4.1.2 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.

Select test points within the detection boundary, as detailed in Figure C.2:

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 defined, at +45° and -45° to that line. The SWT shall start at a distance of 1,5 m before the test point, and finish 1,5 m after it.

6.4.2 Detection at high velocity and with intermittent movement

The tests assess detection of intruders moving at high velocity, and moving intermittently across the protected area.

6.4.2.1 Verify the high-velocity detection performance

Three walk tests are performed, crossing the entire detection area as detailed in Figure C.3.

Two walk tests begin outside the boundary of the area, from opposite sides, and pass through the detector axis mid-range point at 45°. The third walk test passes at right angles to the detector axis at a distance of 1 m in front of, and parallel to the detector reference line.

The SWT shall cross all of the specified detection area, coming to rest after clearing the other detection boundary. At the end of each path, the SWT shall pause for at least 20 s, then return to the starting point.

6.4.2.2 Verify the intermittent movement detection performance

Two walk tests are performed, crossing the entire detection area as detailed in Figure C.3.

The tests begin outside the boundary of the area, from opposite sides, and pass through the detector axis mid-range point at 45°.

The intermittent movement starts with the SWT standing with feet together, moving 2 x 0,2 (5) m steps and stopping with the feet together. After 5 s at rest the cycle is repeated until the SWT has left the area.

The SWT shall cross all of the specified detection area, coming to rest after clearing the other detection boundary. At the end of each path, the SWT shall pause for at least 20 s, then return to the starting point.

6.4.3 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 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 detector reference line or the nearest claimed detection boundary.

The SWT shall cross all of the specified detection area, coming to rest after clearing the other detection boundary. At the end of each path, the SWT shall pause for at least 20 s, then return to the starting point.

6.4.4 Verify the effect of control adjustments on detection

Select test points on the manufacturer's claimed detection boundary, as detailed in Figure C.1 and 6.4.1.1, and within the manufacturer's claimed detection boundary, as detailed in Figure C.2 and 6.4.1.2. Use only the manufacturer's claimed values for maximum and minimum settings of control adjustments and the consequent range and angular coverage.

Each test point on the boundary is connected to the detector by a radial line. At each test point, two alternative test directions are available, beginning at a distance of 1,5 m before the test point, and finishing 1,5 m after it. The SWT shall move at both + 45° or - 45° to the radial line.

The SWT shall move along each path from start to finish. At the end of each path, the SWT shall pause for at least 20 s, then return to the start of that path.

6.4.5 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 of cardboard boxes 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: An alarm or fault signal or message shall be generated when the barrier is present.

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

The general test conditions of 6.1 shall apply.

Switch on the detector power with the indicator enabled (if provided) and allow 180 s for stabilisation. Carry out the BDT. Note the response. Carry out the BDT again, after the specified time interval between signals. Note the response again. Disable the intrusion indicator, if provided. Repeat the BDT.

Pass/fail criteria: The detector shall generate an intrusion signal or message in response to the BDT. The intrusion signal or message and the intrusion indicator shall respond at the same time and shall do so after 180 s have elapsed. A second intrusion signal or message shall be generated after the specified time interval has elapsed. With the indicator disabled the detector shall still generate an intrusion signal or message.

6.6 Fault condition signals or messages: self tests

The general test conditions of 6.1 shall apply.

Verify that the detector is operating with the BDT by monitoring the intrusion and fault signals or messages. Remove the BDT and verify that no intrusion and fault signal or message is generated.

Short one or both of the sensor signal leads to earth (or carry out an equivalent action as recommended by the manufacturer) during the period when the detector carries out its own internal test, or during remote operation of the internal test if the detector is provided with this facility.

Repeat both self tests with the one or both of the sensor leads in an open circuit condition (or carry out an equivalent action as recommended by the manufacturer).

Pass/fail criteria, local self test: When a fault is initiated during the self-test period specified by the manufacturer, a fault signal or message shall be generated for grades 3 and 4 only, and no intrusion signal or message. The local memory shall not be set.

Pass/fail criteria, remote self test: When a fault is initiated during the self-test period specified by the manufacturer, an intrusion signal or message shall be generated for grades 3 and 4 only, and no fault signal or message. The local memory shall not be set.

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

6.7 Immunity to incorrect operation

The general test conditions of 6.1.1 shall apply.

Pass/fail criteria: There shall be no change of status of the detector during each of the following tests.

6.7.1 Immunity to air flow

From a point 1,0 m from the detector, direct the airflow from a fan heater over the face of the detector, raising the air temperature from ambient (20 °C) by 5 °C/min, to 40 °C within 4 min at the detector window. Do not allow the detector a direct view of the heating elements.

Stabilize for 4 min at 40 °C. Switch off the heat and allow the temperature to ramp down for one minute or until ambient is reached. Stabilize at ambient for 2 min. Repeat the cycle 5 times.

The warm air shall flow at a mean velocity of 0,7 $ms^{-1} \pm 0,1 ms^{-1}$, measured with an anemometer (range 0 to 1 ms^{-1}) at the detector window.

6.7.2 Immunity to visible and near infrared radiation

A white light source (a 12 V halogen car headlamp, VW H4 or equivalent, without front glass (bulb) capable of generating at least 2 000 lux at 3 m range is used to illuminate the detector.

The lamp shall be burned in for 10 h, shall be run at constant current, 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 J.

Mount the detector in a darkened room, in the alert/set mode, on a stand 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 lux ± 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 10 scans shall be made across the front of the detector.

6.8 Tamper security

The general test conditions of 6.1.1 shall apply.

6.8.1 Prevention of unauthorized access to the inside of the detector through covers and existing holes

Attempt to overcome the tamper detection device without the use of the tool specified by the manufacturer, by deliberate attack with normally available objects (of minimum thickness 0,5 mm) as listed in Annex K, or by distorting the housing without creating damage.

Pass/fail criteria: Only the tool specified by the manufacturer for servicing purposes shall open the access cover(s) to the inside of the detector. The tamper detection device shall operate before access is gained to any circuit connection or control that can adjust performance or alignment of the detector.

6.8.2 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.

6.8.3 Resistance to re-orientation of adjustable mountings

Mount the detector 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 L. The levels of grade dependent torque required are given in Table 3.

Connect power to the detector and place it in the set/alert mode. Apply the required torque. Remove the torque. Measure the angle of twist of the detector relative to the mounting.

Pass/fail criteria: If the angle of re-orientation at the required torque is less than 5°, the test is passed.

If a tamper device is provided, it shall activate before the angular displacement of 5° is reached.

6.8.4 Resistance to magnetic field interference

Connect power to the detector and place it in the set/alert mode. A magnet of nominal remanence in accordance with Table 3 shall be placed on each surface in sequence of the detector housing whilst the BDT is moved in front of the detector. The magnet shall be applied in a manner that ensures that a single magnetic pole contacts the surface, to maximize the flux penetration. Record the response of the detector. Then interrogate each tamper detection device and record any change of state, including the state of the relay. The magnets shall be as specified in Annex A.

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

6.8.5 Resistance to detector masking

For each test, the detector shall be in the unset mode, and its signals or messages shall be monitored for changes of status.

Apply the spray materials specified in Table 5 from an aerosol can, using intermittent passes of the spray lasting no longer than 2 s each. Apply the brushed lacquer in single passes of the brush. After each application, place the detector in the set mode, and carry out the BDT. Repeat the applications until the detector no longer responds.

Apply each of the sheet material samples specified in Table 5 directly to the whole front of the detector, cutting them to fit the detector window where necessary. Then apply the samples again by sliding them across the face of the detector from one side, at distances of 0 mm and 50 mm. Perform two series of tests, one taking 1 s to cover the detector lens/ window, and the other 10 s.

After each individual material application, wait 180 s for the system to stabilize.

Pass/fail criteria: Either an intrusion and a fault signal or message or an independent anti-masking signal or message (an anti masking and/ or tamper signal or message) shall be generated within 180 s of the masking material being applied, and shall continue to be generated as long as the material is in place. Alternatively, the detector shall continue to operate normally. 80 % of the materials tests shall be passed.

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

General pass/fail criteria for all tests

For a complete test series, 95 % or more of the tests shall be passed.

Table 5 - Range of materials for masking tests

Test no.	Material
1	Black paper sheet
2	2 mm thick aluminium sheet
3	3 mm thick acrylic sheet
4	White polystyrene foam
5	Self adhesive clear vinyl *
6	Plastic skin, spray P U *
7	Clear lacquer, brush applied *
* Applied only from the front.	

All plate/sheet samples shall be large enough to inhibit detection (a maximum of 150 mm²).

6.9 Electrical tests

The BDT given in 6.2 shall be used where appropriate for verification. Ensure that there is no human movement in the FOV of the detector during the tests. Connect the detector to a variable, stabilized power supply and allow it to stabilize for at least 180 s.

Table 4 specifies grade dependency.

6.9.1 Detector current consumption

Connect the detector in series with a current measuring meter and connect a voltmeter across the power input terminals. Substitute a DC power supply for the Type C where used. Set the voltage to the nominal value. Place the detector in the unset/standby mode, if provided and enable the intrusion indicator. Measure current and voltage. Repeat the measurement in the alert/set mode.

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

6.9.2 Slow input voltage change (rise) and input voltage range limits

These tests are not applicable to detectors with internal power supplies.

Raise the supply voltage from zero by 100 mV every 1s until the nominal voltage V - 25 % is reached, or the minimum level specified by the manufacturer, whichever is less. Allow the detector to stabilize for 180 s, carry out the BDT, and monitor the intrusion and fault signals or messages.

Reset the input voltage to the nominal V. Raise the voltage from V by 100 mV every 1 s until the nominal voltage V + 25 % is reached, or the maximum level specified by the manufacturer, whichever is greater. Allow the detector to stabilize for 180 s, carry out the BDT, and monitor the intrusion and fault signals or messages.

Reset the input voltage to the nominal V. Lower the voltage by 100 mV every 1 s until the nominal voltage V - 25 % is reached, or the minimum level specified by the manufacturer, whichever is less. Allow the detector to stabilize for 180 s, carry out the BDT, and monitor the intrusion and fault signals or messages.

For grade 3 and 4 detectors, lower the voltage by 100 mV every 1 s from V - 25% until a fault signal is generated.

Pass/fail criteria, slow input voltage change (rise): There shall be no intrusion signal or message when a fault signal or message is generated, and there shall be no fault signal or message when an intrusion signal or message is generated.

Pass/fail criteria, voltage at the range limits: The detector shall generate an intrusion signal or message.

Pass/fail criteria, voltage below range limits: For grade 3 and 4 detectors, the detector shall signal a fault prior to the situation where no intrusion signal or message is generated when the BDT is carried out.

6.9.3 Input voltage ripple

This test is NOT applicable to detectors with internal power supplies.

Connect the detector to a signal generator with appropriate output impedance capable of generating a sinusoidal voltage of V ± 10 % superimposed on the detector nominal voltage V at a frequency of 100 Hz. Allow at least 180 s for the detector to stabilize. Apply the sinusoidal voltage for 180 s at 100 Hz.

Carry out the BDT. Observe whether any intrusion or fault signals or messages are generated.

Pass/fail criteria: There shall be no signals or messages generated by the detector during the test apart from that generated by the BDT.

6.9.4 Input voltage step change

This test is NOT applicable to detectors with internal 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.

Begin the test at the nominal voltage, and allow at least 180 s for the detector to stabilize. Carry out the BDT. 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. Observe whether any intrusion or fault signals or messages are generated. Repeat the BDT. Repeat the step change test for the voltage range V to V –25 %.

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

6.9.5 Total loss of power supply

This test is NOT applicable to detectors with internal power supplies or detectors in bus systems.

Disconnect the detector from the power supply. Observe whether any intrusion or other signals or messages are generated.

Pass/fail criteria: An intrusion signal or message shall be generated by the detector.

6.10 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 and the EMC product family standard EN 50130-4.

Specific requirements for PIR intrusion detectors are given in this specification. See Tables 6 and 7.

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

Special conditions:

During testing ensure that the PIR 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 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 intrusion and (where applicable) tamper 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 BDT, 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 BDT. 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 BDT shall be performed immediately after drying. Carry out the access to interior test and the anti-masking test with black paper only (4.5.1 and 4.5.5).

Table 6 - Operational tests

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

Pass/ fail criteria: No unintentional change of state 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 BDT.

Table 7 - Endurance tests

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

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

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

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

Annex A
(normative)

Format of standard test magnets

A.1 Lower strength magnet

The required remanence is 0,15 T ± 10 %.

A.2 Medium strength magnet

The required remanence is 0,30 T ± 10 %.

A.3 Higher strength magnet

The required remanence is 1,2 T ± 10 %.

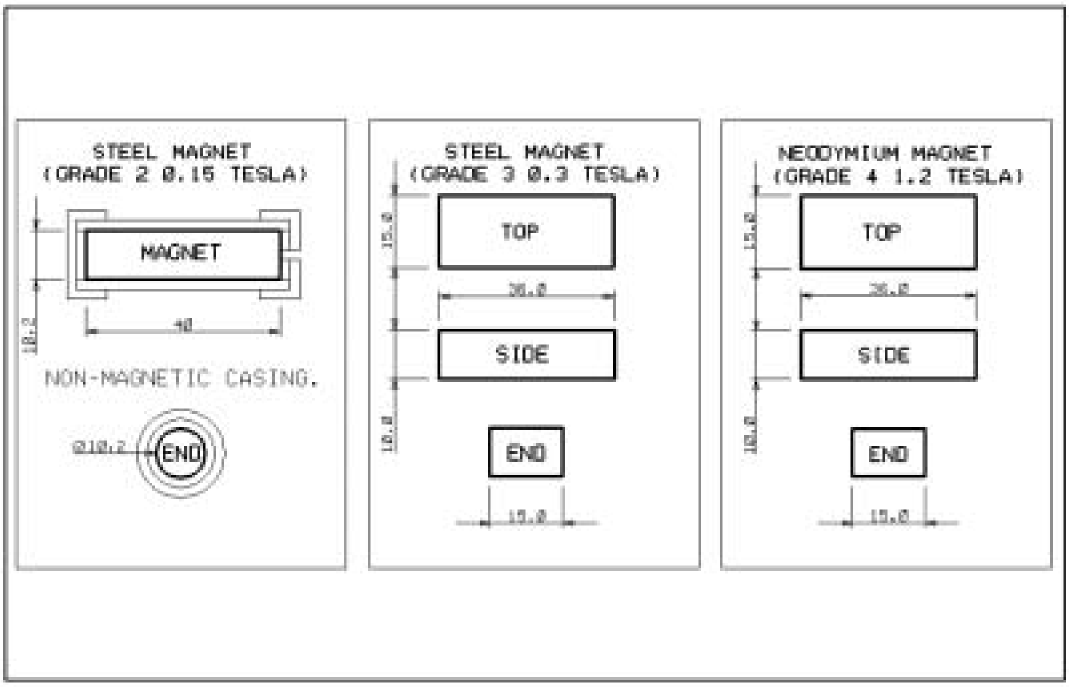

Figure A.1 - Format of standard test magnets

NOTE The names and addresses of suppliers of the magnets are held by the Certification Body and are available on request.

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	
Verification of detection performance				
Detection within and across the boundary				
Verify detection across the boundary	None	6.4.2.1 + SWT	None	1
Verify detection within the boundary	None	6.4.2.2 + SWT	None	1
Effects of control adjustments on detection performance	None	6.4.4 + SWT	None	1
Verify significant reduction in range	None	6.4.5 + SWT	None	1
Detection at high velocity and with intermittent movement				
Verify the high velocity detection performance	None	6.4.3.1 + SWT	None	1
Verify the response to intermittent movement	None	6.4.3.2+ SWT	None	1
Detection close-in				
Verify the close-in detection performance	None	6.4.4 + SWT	None	1
Switch-on delay, time interval between signals and Indication of detection	None	6.5 + BDT	None	1
Fault condition signal or messages				
Self tests	None	6.6 + BDT	None	2
Immunity to incorrect operation				
Immunity to air flow	None	Monitor	None	1
Immunity to visible and near infrared	None	Monitor	None	1
Tamper security				
Access to detector interior through covers & holes	None	Monitor	None	10
Detection of removal from the mounting surface	None	Monitor	None	10
Resistance to re-orientation	None	Monitor	None	10
Resistance to magnetic field interference	None	6.8.5 + BDT	None	10
Resistance to detector masking	6.2.2 + BDT	Monitor	6.2.2 + BDT	10-15 *

Main test title	Task to be performed in conjunction with main test			Sample no.
	Before main test	**During main test**	**After main test**	
Electrical tests				
Detection power consumption	6.2.2 + BDT	Monitor	6.2.2 + BDT	1
Slow input voltage rise and input voltage range limits	6.2.2 + BDT	Monitor	6.2.2 + BDT	1
Input voltage ripple	6.2.2 + BDT	Monitor	6.2.2 + BDT	1
Input voltage step change	6.2.2 + BDT	Monitor	6.2.2 + BDT	1
Environmental test – Operational				
Dry heat	6.2.2 + BDT	Monitor	6.2.2 + BDT	3
Cold	6.2.2 + BDT	Monitor	6.2.2 + BDT	3
Damp heat (steady state)	6.2.2 + BDT	Monitor	6.2.2 + BDT	4
Damp heat (cyclic)	6.2.2 + BDT	Monitor	6.2.2 + BDT	4
Water ingress	6.2.2 + BDT	Monitor	6.2.2 + BDT	5
Mechanical shock	6.2.2 + BDT	Monitor	6.2.2 + BDT	6
Vibration	6.2.2 + BDT	Monitor	6.2.2 + BDT	7
Impact	6.2.2 + BDT	None	6.2.2 + BDT	6
EMC	6.2.2 + BDT	Monitor	6.2.2 + BDT	8
Environmental test – Endurance				
Damp heat (steady state)	6.2.2 + BDT	None	6.2.2 + BDT	4
Damp heat (cyclic)	6.2.2 + BDT	None	6.2.2 + BDT	4
SO_2 corrosion	6.2.2 + BDT	None	4.5.1 + 4.5.5 6.2.2 + BDT	9
Vibration	6.2.2 + BDT	None	6.2.2 + BDT	7
Marking, identification and documentation				
Marking	None	None	None	1
Documentation	None	None	None	1

Key to description:

None: no test or other operation is performed.
6.4.x + SWT: verify the detection performance using the "standard walk test target (SWT)".
Monitor: monitor the detector signal or message during the main test.
6.2.2 + BDT: basic test of detection capability using the "basic detection target (BDT)".
6.x + BDT: verify the requirements using the "basic detection target (BDT)".

* For masking tests more samples may be required.

Annex C
(normative)

Walk test diagrams

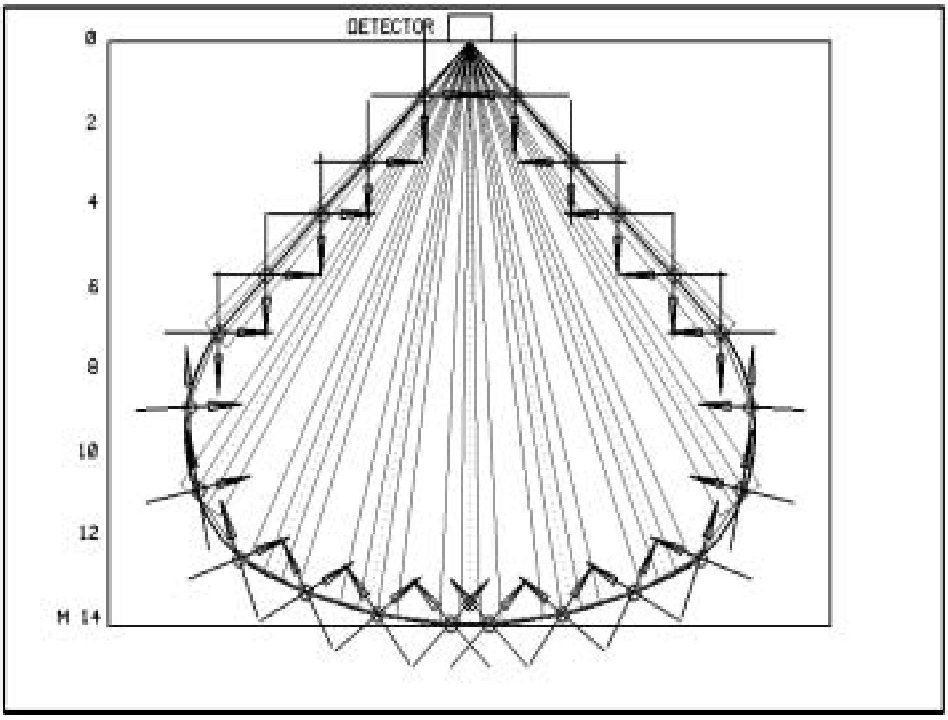

Figure C.1 – Detection across the boundary, & effect of control adjustments

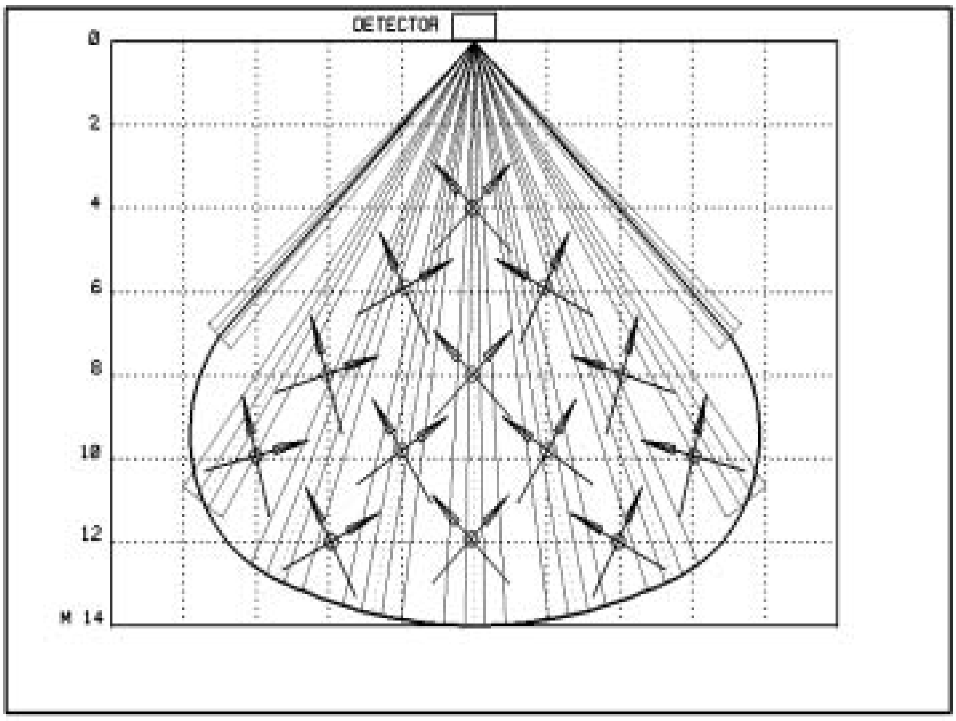

Figure C.2 – Detection within the boundary, & effect of control adjustments

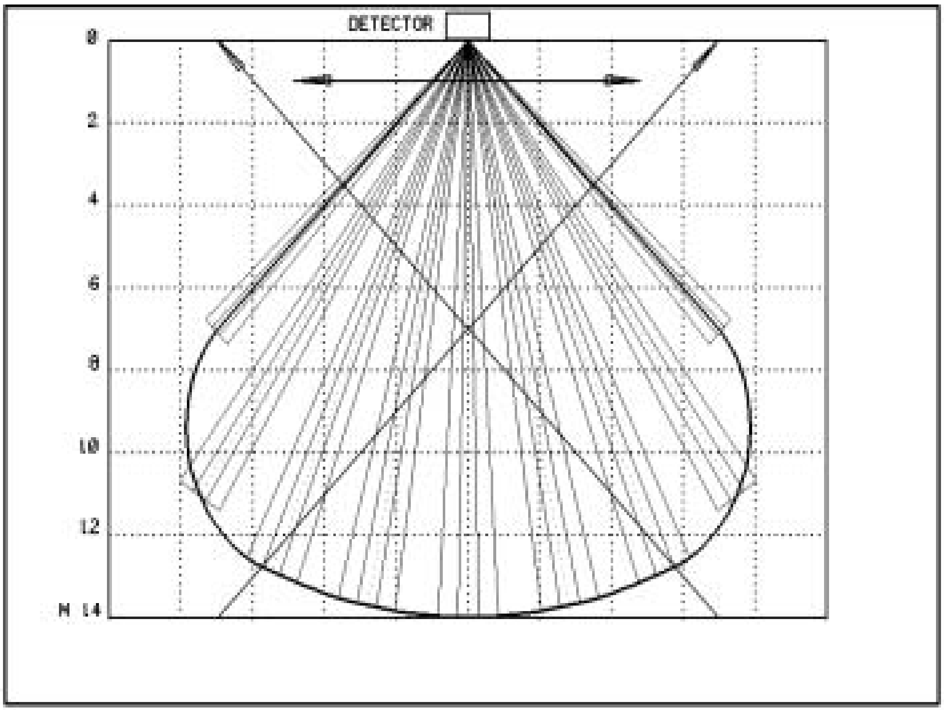

Figure C.3 - High velocity and intermittent movement

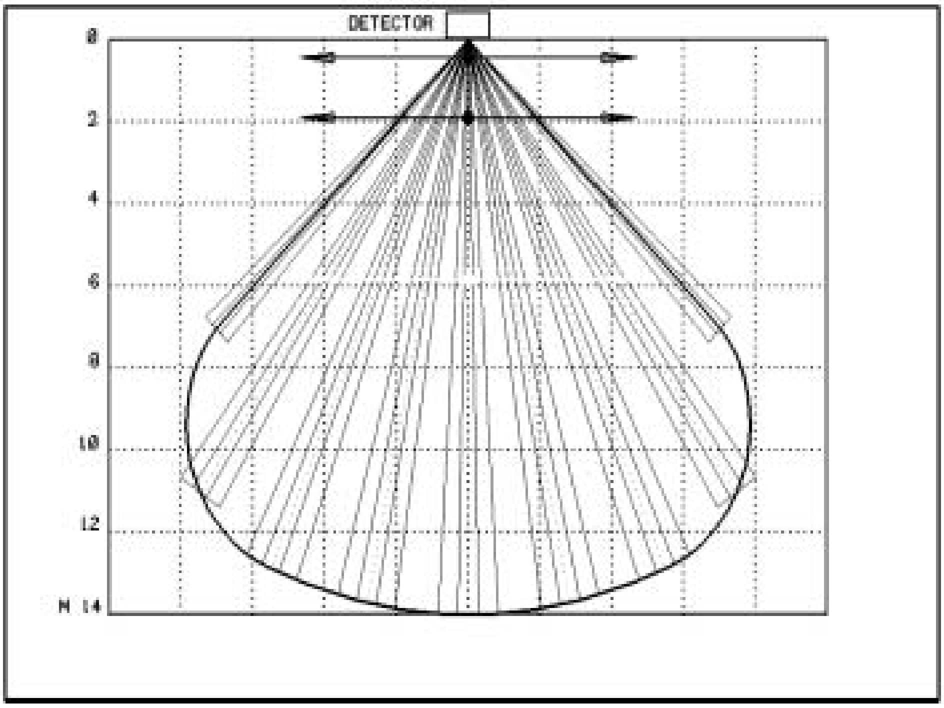

Figure C.4 - Close-in detection

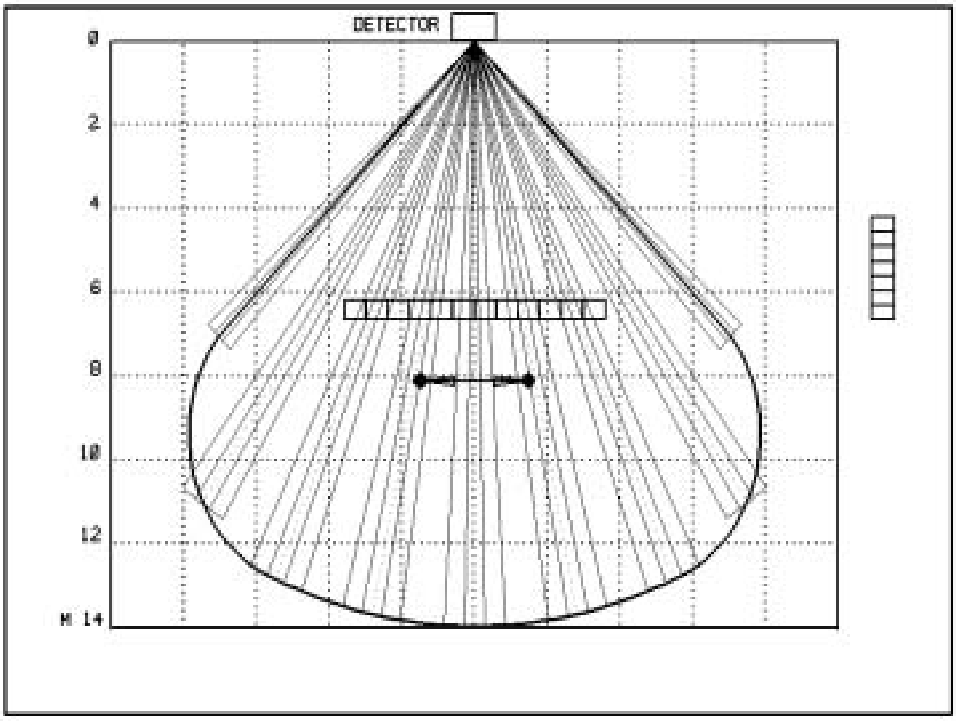

Figure C.5 - Significant range reduction

Annex D
(normative)

Procedure for calculation of average temperature difference

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 to 18 microns, 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: temp difference		Significance: weighting factor
Head	Dt_{r1}	W_1	2
Upper torso side	Dt_{r2}	W_2	4
Hand at body side	Dt_{r3}	W_3	4
Legs at 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 2,7 °C (3 °C –10 %). If Dt_r is greater than 3,3 °C (3 °C +10 %), attenuation filters shall be placed directly over the detector lens or window to reduce the radiation received by the detector to within 10 % of that which would result from a temperature difference of 3 °C. The procedure is detailed in Annex G.

Alternatively, if Dt_r is greater than 3,3 °C (3 °C +10 %), 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 2,7 °C (3 °C –10 %), the general background temperature will need to be lowered.

HDPE sheet shall be used as filter material for SWT signal adjustment. Two thicknesses of HDPE sheet have been identified as standard products. The available material thicknesses are 100 (A) and 200 (B) microns.

The percentage reduction in radiation received by the detector obtainable with these materials is best established with a suitable infrared spectrograph. A typical set of results is as follows:

Material combination:	**Signal reduced by:**
A	20 %
B	36 %
A + B	42 %
B + B	48 %
A + B + B	54 %

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 8 Ω x 125 Ω, 0,25 W resistors in series makes a 1 000 Ω resistor of height 120 mm and width 30 mm which, when run at 30 V, has a stabilized surface temperature in the required range. 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. This simulates to the detector the image of the SWT at 12 m range.

Measure the surface temperature of the resistor stack with the calibrated non-contact thermometer.

The temperature of the resistor stack should be at least 3 °C greater than that of the adjacent background. The applied voltage is altered to adjust the surface temperature of the resistor stack.

Annex F
(informative)

Calibration heat source

This heat source will produce a constant output of broad-spectrum near-infrared radiation at a constant temperature for a period of at least 1 h, and is useful for calibrating non-contact thermometers.

A cylindrical metal container 250 mm in height and of diameter 150 mm with a closed bottom and removable lid, painted matt black, is filled with sodium sulphate decahydrate ($Na_2.SO_4.10H_2O$).

The container is equipped with a thermocouple/ thermometer and is heated on an electric boiling ring so that all the contained salt can be melted and the melt temperature is at least 40 °C. The heat is then removed, and the temperature allowed to decline by radiation. At the melting point of the salt, the emission of latent heat will keep the temperature exactly constant at 37 °C until all the latent heat has been emitted.

Annex G
(normative)

Calibration of the standard walk test target

The SWT is a human subject, and the difference in temperature between the SWT and the background is required to be 3 °C ± 10 %. However, the SWT is variable in the amount of heat emitted in the 8 µm to 14 µm wavelength band.

The emission characteristics of the SWT are very difficult to alter, but the background temperature may be adjusted, or the SWT may wear extra clothing.

The third option is to use filters. These can be sheets of HDPE of different thickness, whose transmission can be measured with an infrared spectrograph. If the SWT has a temperature difference with the background greater than 3 °C and produces too large a signal, then placing one or more HDPE filters over the detector window will reduce the radiation received by the detector. The filters are mounted in a flat frame, looking down at 45° to the detection axis, and at 0 mm and 50 mm from the detector window. The adjusted level of received radiation shall be measured through the HDPE film(s). The range of signal adjustment available with HDPE films is detailed in Annex D.

If the SWT has a temperature difference with the background that is less than 3 °C –10 %, and therefore does not produce a large enough signal, then the background temperature will have to be lowered or the SWT adjusted, by altering the clothing. A measure of control over the test room temperature is therefore desirable

For an absolute temperature calibration, the calibration heat source described in Annex F can be mounted on an adjustable stand and moved across the field of view at a height where detection is expected to provide a simulation source with an absolutely known temperature.

Throughout the tests it is desirable that the background temperature of the area immediately behind the SWT is measured.

Annex H
(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 2. The required velocities range from 0,1 m/s to 3,0 m/s +/- 10 %. A means of controlling these velocities is desirable.

H.1 Moving light source guiding system

This equipment consists of a series of diodes 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.

H.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 J
(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 (see EN 60068). 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 microns and 3 microns 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 lux +/- 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 lux +/- 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 K
(informative)

Example list of small tools suitable for testing immunity of casing to attack

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

Annex L
(informative)

Test for resistance to re-orientation of adjustable mountings

Mount the detector on a substantial wood block with a metal backing (see Figure L.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 allows assessment of the turning angle caused by the applied torque.

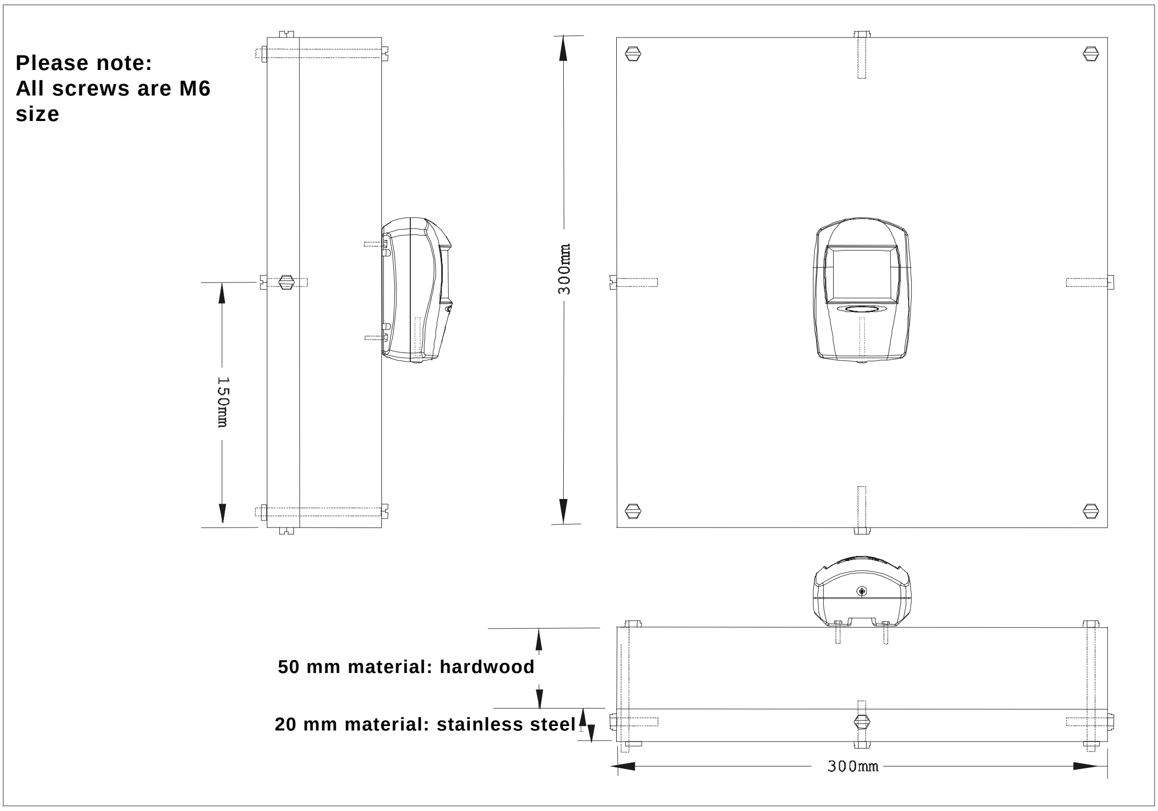

Figure L.1 - Re-orientation test