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Alarm systems – Intrusion and hold-up systems

Part 4: Warning devices

bsi.

National foreword

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European foreword

This document (EN 50131-4:2019) has been prepared by CLC/TC 79, “Alarm systems”.

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2019-12-31
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2021-12-31

This document supersedes EN 50131-4:2009.

This revision includes changes:

— to remove technology specific terminology from requirements;

— to clarify the scope and detail of requirements;

— to clarify the application and methodology of tests;

— to align requirements and testing for tamper security with other parts of the EN 50131-x suite of product standards;

— to align requirements for environmental testing with other parts of the EN 50131-x suite of product standards;

— to improve editorial presentation.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

1 Scope

This document includes requirements for warning devices used for notification in intrusion and hold up alarm systems installed in buildings. Four grades of warning device are described corresponding to each of the four security grades given in EN 50131-1. Requirements are also given for four environmental classes covering applications in indoor and outdoor locations as specified in EN 50130-5.

This document does not deal with requirements for compliance with EC regulatory Directives, such as the EMC Directive, Low Voltage Directive, etc. except that it specifies the equipment operating conditions for EMC susceptibility testing as required by EN 50130-4.

2 Normative references

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

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

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

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

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

EN 60068-2-75, *Environmental testing — Part 2-75: Tests — Test Eh: Hammer tests (IEC 60068-2-75)*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

EN 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications (IEC 61672-1)*

EN 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code) (IEC 62262)*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
audible alarm
distinctive sound generated in response to an alarm condition

3.1.2
warning device
device that gives an audible alarm in response to a notification

Note 1 to entry: A warning device may also provide alert indications.

3.1.3
external warning device
warning device designed to be located outside the supervised premises which gives an external audible alarm in response to a notification

3.1.4
internal warning device
warning device designed to be located within the supervised premises which gives an internal audible alarm in response to a notification

3.1.5
enclosure
housing that contains the warning device components, normally comprises a backplate and a cover

3.1.6
external power source
energy supply external to the I&HAS which may be non-continuous, e.g. mains supply

3.1.7
reference point
centroid of the mounting face of the warning device enclosure projected onto the mounting surface

3.1.8
remote power source
electrical supply, which is not a part of the warning device, meeting the requirements of EN 50131-6

3.1.9
remotely powered warning device
warning device that does not incorporate its own power source

3.1.10
self-powered warning device
warning device that incorporates its own power source

3.1.11
standby condition
operational mode of a self-powered warning device during which it is powered from its internal storage device, whilst not notifying an alarm condition

3.1.12
storage device – failure
condition of the storage device where it is no longer able to power the warning device

3.1.13
storage device – low residual energy
condition specified by the warning device manufacturer which indicates that the storage device is nearly discharged

3.1.14
trigger command
notification signal or message passed to the warning device

3.1.15
visible damage
damage that would be visible to a person of normal eyesight viewing at a distance of 2 m under an illumination level of 2 000 lx

3.2 Abbreviations

For the purposes of this document, the following abbreviations are used:

CIE - Control and indicating Equipment

I&HAS - Intrusion and Hold-up Alarm System(s)

WD - Warning Device

4 General considerations

This European Standard considers two different categories of warning device, remotely powered and self-powered devices.

Self-powered warning devices are classified into one of four types, dependent upon the recharge characteristics of the storage device and the source of recharge power. These four types are defined in Table 9.

5 Requirements

5.1 Functional

5.1.1 Response

Depending upon the grade, warning devices shall have the functionality as defined in Table 1. Where a function is provided, the warning device shall operate in accordance with the requirements of Table 2.

NOTE Requirements for the interconnections are given in the specific interconnection standard(s).

Table 1 — Warning device functionality

Function	Self-powered				Remotely powered			
	Grade				Grade			
	1	2	3	4	1	2	3	4
Trigger command	M	M	M	M	M	M	M	M
Tamper signal or message output	M	M	M	M	M	M	M	M
Fault signal or message output	Op [b]	Op [b]	M	M	Op	Op	Op	Op
Monitor of remote power [a]	M	M	M	M	Op	Op	Op	Op
Monitor integrity of trigger command interconnection	Op	Op	M	M	Op	Op	Op	Op
Local self test	Op [b]	Op [b]	M	M	Op	Op	Op	Op
Remote test input	Op	Op	Op	M	Op	Op	Op	Op

Key
Op Optional
M Mandatory

[a] Remote power monitoring only applies to warning devices with a remote power source and an internal storage device, see types X and Z as defined in Table 9.

[b] Mandatory for type W devices as defined in Table 9.

Table 2 — Warning device responses

Event	Self-powered WD			Remote powered WD		
	Audible alarm	Tamper signal or message	Fault signal or message	Audible alarm	Tamper signal or message	Fault signal or message [a]
Trigger command	M	NP	NP	M	NP	NP
Tamper event at the WD	Op	M	NP	Op	M	NP
Loss of remote power source	Op [b]	Op [b]	Op [b]	N/A	Op	Op
Loss of trigger command interconnection integrity	Op [c]	Op [c]	Op [c]	Op	Op	Op
Local self test pass	NP	NP	NP	NP	NP	NP
Local self test fail	NP	NP	M [a]	NP	NP	M
Remote self test pass	NP	NP	M [d]	NP	NP	M [d]
Remote self test fail	NP	NP	M [d]	NP	NP	M [d]

Key
M Mandatory
Op Optional
NP Not Permitted
N/A Not applicable

[a] The provision of a fault signal or message is not mandatory for all grades, see Table 1.

[b] At least one of these actions shall occur at the warning device. For grade 3 and grade 4 warning devices, if the loss of remote power source can be shown to be caused by a fault then a fault signal shall be generated, otherwise a tamper signal shall be generated.

[c] At least one of these actions shall occur at the warning device. For grade 3 and grade 4 warning devices, if the loss of trigger command integrity can be shown to be caused by a fault then a fault signal shall be generated, otherwise a tamper signal shall be generated.

[d] The response to a remote test pass shall be different from the response to a remote test fail.

5.1.2 Acoustic

A warning device shall produce a varying sound output, which is distinctive and likely to attract attention with a mean acoustic output of no less than that defined in Table 3 at 1 m from the mounting surface of the warning device throughout the manufacturer's specified operating voltage range. Acoustic output levels as measured in accordance with Annex A, taken at 30° intervals in the horizontal plane, shall not be below the minimum individual level defined in Table 3 at 1 m from the mounting surface. The mean acoustic output shall be calculated by the arithmetic sum of these values divided by the number of measurements. For surface mounted devices (e.g. wall mounted devices) this is required at angles between 15° and 165° to the surface, and for pole mounted devices it is for the full 360°.

Table 3 — Acoustic output levels

	Internal warning device	External warning device
Minimum mean acoustic output level	80 dB(A)	100 dB(A)
Minimum individual acoustic output level	75 dB(A)	95 dB(A)

NOTE 1 It is considered restrictive to define exact waveforms of acceptable alarm tones, therefore the only tests that can be applied are on the acoustic output level and that the tone is varying.

NOTE 2 Voice alarms are deemed to meet the requirements of a varying sound output.

NOTE 3 A warning device may also provide audible alert indications providing such indications are easily distinguishable from an alarm.

NOTE 4 The acoustic output (sound level and/or frequency) of a warning device may be subject to variation depending on local or national requirements.

5.1.3 Timing

A trigger command exceeding 400 ms shall be processed by the warning device.

A warning device shall commence its audible alarm within 1 s of receiving a valid trigger command to do so. It shall cease its audible alarm within 1 s of receiving a valid cancellation of the trigger command.

The warning device shall sound between these signals.

The maximum time for which an audible warning device shall sound continuously is 15 min.

NOTE 1 For remote powered warning device, where applicable, this requirement may be achieved by the CIE.

NOTE 2 The duration of the operational period of a warning device may be subject to variation depending on local or national requirements

A tamper signal or message shall be generated within 1 s of a tamper condition occurring.

There shall be a response to loss of remote power source or loss of trigger command interconnection integrity according to Tables 1 and 2, within 10 s of the fault occurring.

A response to local test fail according to Tables 1 and 2 shall occur within 10 s of detection of the fault.

5.2 Tamper

5.2.1 Protection

All component parts shall be housed in an enclosure meeting the impact requirements of the appropriate grade given in Table 4.

Provision shall be made to allow adequate fixing of the enclosure to the mounting surface.

Table 4 — Enclosure construction

Grade	Internal warning device				External warning device			
	1	2	3	4	1	2	3	4
Resistance to impact (IK rating according to EN 62262)	06	06	07	08	07	07	08	08

The cover of the enclosure shall be secured with one or more screws or bolts or alternatively by a mechanical lock. The cover of the enclosure shall be opened only with the use of one or more keys or suitable tools.

It shall not be possible, without causing visible damage, to gain access to any electrical connections, or elements providing adjustment, without first generating a tamper signal or message.

When the unit is mounted normally it shall not be possible, without causing visible damage, to introduce a tool, as defined in Table 5, such that the operation of the warning device could be adversely affected.

Table 5 — Tool dimension for tamper protection

Dimensions in millimetres

	Grade 1	Grade 2	Grade 3	Grade 4
Steel rod as specified in EN 60529, with diameter	2,5	2,5	1	1
Flat bar dimensions (±0,05 mm)	10 × 1 × 300	10 × 1 × 300	5 × 0,5 × 300	5 × 0,5 × 300

5.2.2 Detection

The tamper detection requirements for warning devices relative to the security grade are given in Table 7.

Opening the warning device enclosure by normal means shall generate a tamper signal or message. The enclosure shall not permit the introduction of a tool of dimension as specified in Table 5 and Table 6, to defeat the tamper detection.

Table 6 — Tool dimension for tamper detection

Dimensions in millimetres

	Grade 1	Grade 2	Grade 3	Grade 4
Steel wire of tensile strength 650 MPa - 825 MPa and dimensions [a]	NA	NA	Ø 1 × 300	Ø 1 × 300
[a] for example, welding rod wire meeting this specification is commonly available.				

Attempts to remove the warning device from its mounting surface for a distance defined in Table 8 in a perpendicular direction shall generate a tamper signal or message according to Table 7.

It shall not be possible to defeat the removal from mounting detection by sliding a 25 mm × 1 mm × 300 mm blade, or by use of pliers (of thickness 5 mm and reach 150 mm), between the mounting surface and the warning device.

The warning device shall include means to detect penetration of the enclosure, which could cause mis-operation of the warning device, as specified in Table 7, when a hole of 4 mm is made in the enclosure.

Table 7 — Tamper detection

Security grade	Internal warning device				External warning device			
	1	2	3	4	1	2	3	4
Opening by normal means	M	M	M	M	M	M	M	M
Removal from mounting – Wire free WD	Op	M	M	M	Op	M	M	M
Removal from mounting – Wired WD	Op	Op	M	M	Op	Op	M	M
Detection of penetration of enclosure	Op	Op	Op	Op	Op	Op	Op	M
Key Op Optional M Mandatory								

Table 8 — Removal from mounting

	Grade 1	Grade 2	Grade 3	Grade 4
Maximum distance before tamper detection	10 mm [a]	10 mm [a]	5 mm	5 mm
[a] If removal from mounting detection is provided.				

5.3 Environmental

The environmental classification shall be as 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.

The warning device shall meet the requirements of the relevant environmental class as specified by the manufacturer.

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

For endurance tests, the warning device shall continue to meet the requirements of this European Standard after being subjected to the specified range of environmental conditions.

See 6.10 for the relevant tests and severity.

5.4 EMC Susceptibility

For all grades the warning device shall meet the performance requirements of this European Standard when subject to the EMC conditions and severity levels defined in EN 50130-4.

NOTE EMC emissions are covered by EC regulatory Directives.

5.5 Safety

NOTE Safety requirements are covered by EC regulatory Directives.

5.6 Electrical

5.6.1 Connections

The means of electrical connection shall be appropriate for the physical size and current carrying capacity of the required conductors. The method of termination shall not damage the conductors.

Terminal blocks and other components utilized for connections shall be identifiable with numbers or other marks specified in the documentation

If external metal enclosures are used with a facility to connect to the equi-potential bonding, e.g. for the purpose of protection from lightning strikes, then there shall be the provision to clamp wires with a cross sectional area of 4 mm^2 to 16 mm^2.

5.6.2 Operating parameters

5.6.2.1 Voltage range

The warning device shall meet all the functional requirements when the supply voltage range lies between the manufacturer's stated values.

5.6.2.2 Slow remote power source voltage rise

When the warning device is subject to a slow input voltage rise from zero of 1 Vs^{-1}, then it shall function normally when the supply voltage reaches the minimum operating voltage.

5.6.2.3 Remote power source voltage step change

When the warning device is subject to a step in the input voltage between maximum and minimum, and vice versa, there shall be no change in the status of the warning device, and no signals or messages shall be generated.

5.6.2.4 Current consumption

The warning device's quiescent and peak current consumption on each connection shall not exceed those specified by the manufacturer in the alarm sounding and non alarm sounding states, at the nominal supply voltage.

5.6.3 Self-powered

5.6.3.1 General

Where a self-powered warning device's own power source is not used to power other I&HAS components, then the requirements of EN 50131-6 do not apply to that power source.

Where a self-powered warning device incorporates its own storage device, the following additional requirements apply:

5.6.3.2 Storage device operating time

The storage device shall have sufficient capacity for at least 10 consecutive maximum sound duration periods, or at least 30 min; whichever is the shorter. At the end of this time, the individual acoustic output 1 m from the warning device at, at least, one of the measurement points specified in 5.1.2, shall meet the requirements of Table 3.

5.6.3.3 Storage device standby time

The storage device shall have sufficient capacity to maintain the warning device in its standby condition for the periods specified in Table 9.

Table 9 — Storage device standby duration

Type	Remote power source	Storage device type	Integral recharge capability	Grade 1	Grade 2	Grade 3	Grade 4
W	None	Non rechargeable	Not applicable	1 year	1 year	1 year	1 year
X	Yes	Non rechargeable	Not applicable	24 h	24 h	120 h	120 h
Y	None	Rechargeable	Yes	24 h	24 h	120 h	120 h
Z	Yes	Rechargeable	Yes, from remote power source	12 h	12 h	60 h	60 h

NOTE 1 A type W warning device could, for example, have a dry cell as its only means of power. This storage device has no means of recharge and will need replacing before it is completely exhausted.

NOTE 2 A type X warning device could, for example, be remotely powered from the I&HAS and with a dry cell as its storage device. This storage device has no means of recharge and will need replacing before it is completely exhausted.

NOTE 3 A type Y warning device could, for example, recharge its storage device by means of a solar cell, or connection to an external power source (e.g. mains supply).

NOTE 4 A type Z warning device could, for example, be normally powered from the I&HAS, and this power source is also used to recharge its storage device.

At the end of the standby period, the storage device shall meet the operating time requirements of 5.6.3.2.

For types X and Z, where loss of the remote power supply causes the warning device to activate (see Table 2) a standby condition is not required, the requirements of Table 9 do not apply, and the storage device shall only meet the operating time requirements of 5.6.3.2.

5.6.3.4 Recharge rate

Type Y and Z warning devices shall be capable of supplying current at the appropriate voltage to recharge the storage device equivalent to 80 % of that supplied by the storage device in meeting the requirements of 5.6.3.2 and 5.6.3.3 within the periods as specified in Table 10.

Table 10 — Recharge periods

	Grade 1	Grade 2	Grade 3	Grade 4
Maximum time to recharge	72 h	72 h	24 h	24 h

5.6.3.5 Remote power monitoring

Where the warning device has a remote power source and this power source is lost, then the warning device shall respond according to Table 2.

5.6.3.6 Remote power short circuit protection

Where the warning device has a remote power source it shall not be possible to discharge the storage device through a short circuit applied to the remote power source connections.

5.7 Self test requirements

5.7.1 Local self test

5.7.1.1 General

A local self test shall be performed under the control of the warning device.

A fault signal or message shall be generated within 10 s of detection of any of the conditions in Table 11.

Table 11 — Self test monitoring

	Grade 1	Grade 2	Grade 3	Grade 4
Storage device - low residual energy	Op [a]	Op [a]	M	M
Storage device - failure	Op	Op	M	M
Key Op Optional M Mandatory				
[a] Mandatory for type W devices as defined in Table 9.				

5.7.1.2 Storage device monitoring

5.7.1.2.1 Storage device monitoring – Low residual energy

The residual energy in the storage device shall be monitored in accordance with Table 11.

A storage device low residual energy fault occurs when the residual energy of the storage device falls below that specified by the warning device manufacturer. This residual energy shall be greater than the minimum energy required to operate the warning device.

Non rechargeable storage devices shall be monitored continuously. Rechargeable storage devices shall only be monitored when the warning device is in its standby condition.

For type X warning devices without a standby condition, the requirements of 5.7.1.2.1 shall only apply when the remote power source is available.

For type Z warning devices without a standby condition, the requirements of 5.7.1.2.1 do not apply.

The warning device manufacturer shall declare in their documentation the monitored condition of the storage device that will generate this fault signal or message.

5.7.1.2.2 Storage device monitoring – Failure

Where the storage device is rechargeable and in accordance with Table 11, means shall be provided to determine whether the storage device is no longer able to power the warning device e.g. by applying a load to the storage device and monitoring the terminal voltage. These means shall not be achieved by monitoring terminal voltage alone.

The maximum time period for detection of a storage device failure shall be 24 h.

For type Y and Z warning devices the requirements of 5.7.1.2.2 shall only apply when the storage device recharge source is available.

5.7.2 Remote self test

Any remote test sequence shall not prevent the warning device from operating in accordance with Table 2.

If a remote test is initiated, the warning device shall not remain in test mode for a period in excess of 60 s.

An audible alarm or a tamper signal or message shall not be used to communicate the pass or fail of a remote test request. One possible test sequence is shown in Annex B.

5.8 Marking

The warning device shall be marked in accordance with EN 50131-1.

5.9 Documentation

The warning device shall be accompanied by documentation in accordance with EN 50131-1.

Additionally, the documentation shall contain the following information:

a) brief description of operation;

b) type of warning device (i.e. internal or external, remote or self-powered);

c) installation requirements, (e.g. wall or pole mounting);

d) method of adjustment/configuration;

e) operating instructions;

f) connection details, including sufficient detail to enable effective interface and operation as part of the I&HAS;

g) supply voltage range and nominal supply voltage(s);

h) quiescent and peak current consumption on each connection in the alarm sounding and non alarm sounding states, at the nominal supply voltage;

i) suitable storage device type, capacity and low residual energy condition (where applicable);

j) response of the warning device to loss of remote power, and trigger command interconnection integrity (where applicable);

k) for type Y devices the conditions required to guarantee the storage device recharge time;

l) type of acoustic output, (e.g. tone, voice etc.);

m) maximum sound duration time (where applicable).

6 Test section

6.1 General

All the test parameters specified shall carry a general tolerance of ± 10 % unless otherwise stated.

All tests shall be performed at the manufacturer's specified nominal supply voltage, unless otherwise stated.

6.2 Functional

6.2.1 General conditions

The general atmospheric conditions in the measurement and tests laboratory shall follow the requirements below, unless stated otherwise.

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

6.2.2 General mounting

The warning device shall be mounted in accordance with the manufacturer's instructions.

6.2.3 General testing procedures

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

6.3 Reduced functional test

6.3.1 Purpose

To check that the warning device is operational before undergoing other tests and that it continues to function after these tests, e.g. impact, environmental etc.

6.3.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.3.3 Mounting

The mounting conditions shall be sufficient to conduct a reduced functional test, and the requirements of 6.2.2 do not necessarily apply.

6.3.4 Stimuli

Apply a trigger command. Once the warning device has activated, remove the trigger command.

Open the warning device by normal means.

6.3.5 Measurement

Monitor the acoustic output in response to the input stimuli.

Monitor the tamper signal or message output.

6.3.6 Pass/Fail criteria

The warning device shall generate a sound output in response to the trigger command. There is no requirement to measure this, unless there is concern that the sound output is inadequate, in which case the full sound output shall be measured in accordance with 6.5.1.

A tamper signal or message shall be generated when the warning device is opened by normal means.

6.4 Response to events

6.4.1 Response to trigger command

6.4.1.1 Purpose

To verify that after application of a stimulus as indicated by the manufacturer the warning device responds within the correct time frame.

6.4.1.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.4.1.3 Mounting

The general mounting conditions of 6.2.2 shall apply.

6.4.1.4 Stimuli

Apply a trigger command, of greater than 400 ms where appropriate. Wait for a period greater than 10 s but less than 1 min, and cancel the trigger command, in accordance with the manufacturer's instructions.

6.4.1.5 Measurement

Monitor the acoustic output in response to the input stimuli, and the time from the initial application of the trigger command.

6.4.1.6 Pass/Fail criteria

The warning device shall activate within 1 s of the application of the trigger command. The warning device shall continue to sound until no more than 1 s after the cancellation of the trigger command.

6.4.2 Response to loss of trigger command interconnection integrity

6.4.2.1 Purpose

To verify the correct response, according to Table 2 and as specified by the manufacturer, to a loss of trigger command interconnection integrity.

6.4.2.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.4.2.3 Mounting

The general mounting conditions of 6.2.2 shall apply.

6.4.2.4 Stimuli

Effect a loss of trigger command interconnection integrity.

6.4.2.5 Measurement

Monitor the performance of the warning device.

6.4.2.6 Pass/Fail criteria

Ensure that the warning device responds correctly to the loss of trigger command interconnection integrity as defined in Table 2 within 10 s of the removal of the trigger command interconnection, and that this response is in accordance with the supplied documentation.

6.4.3 Maximum sound duration limit

6.4.3.1 Purpose

To verify the maximum time for which the warning device sounder operates, and that the time limiting device resets correctly.

NOTE This section is not applicable for warning devices without an integral time limiting device.

6.4.3.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.4.3.3 Mounting

The general mounting conditions of 6.2.2 shall apply.

6.4.3.4 Stimuli

Activate the warning device using all methods identified in Table 2 which are applicable to the warning device. Remove these stimuli after the warning device sound output ceases.

Then reapply one or all of the above stimuli.

6.4.3.5 Measurement

Monitor the acoustic output in response to the input stimuli. Record the time for which it operates.

6.4.3.6 Pass/Fail criteria

Ensure that the warning device sounds after the application of the stimuli for the time specified in the supplied documentation, and for no longer than the time defined in 5.1.3.

Reapplication of one or all of the stimuli shall cause the warning device to sound.

6.5 Acoustic output level

6.5.1 Purpose

To verify that the warning device sound level meets the minimum requirements as defined in 5.1.2.

6.5.2 Conditions

The general test conditions of 6.2.1 shall apply. The test shall be carried out at the minimum and maximum rated supply voltage, as specified by the manufacturer.

6.5.3 Mounting

The mounting conditions as defined in Annex A shall apply.

6.5.4 Stimuli

Apply a trigger command, and wait for the sound output to stabilize before starting to take any readings.

6.5.5 Measurement

Measure the sound pressure level of the device under test, at 30° intervals on a horizontal plane, over the range as defined in 5.1.2. See Annex A.

6.5.6 Pass/Fail criteria

Each individual reading shall not be less than the minimum individual acoustic output level of Table 3. The arithmetic mean output of all readings taken shall not be less than that in Table 3.

6.6 Tamper

6.6.1 Opening by normal means

6.6.1.1 Purpose

To verify that a tool or key is required for normal access.

6.6.1.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.6.1.3 Mounting

The general mounting conditions of 6.2.2 shall apply.

6.6.1.4 Stimuli

Attempt to open the cover of the warning device without the use of a tool or key.

6.6.1.5 Measurement

Record whether it has been possible to open the cover.

6.6.1.6 Pass/Fail criteria

Opening the cover of the warning device without the use of a tool or key shall not be achieved.

6.6.2 Protection

6.6.2.1 Purpose

To demonstrate that it is not possible to insert a metal rod into the warning device in its normal mounting position and prevent its normal operation, or defeat the operation of the tamper detection circuitry.

6.6.2.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.6.2.3 Mounting

The general mounting conditions of 6.2.2 shall apply.

6.6.2.4 Stimuli

For each tool specified in Table 5, individually attempt to insert the tool into the warning device without causing physical damage. If the tool is inserted, the tool should be manoeuvred to try to interfere with any of the components inside the warning device.

Perform a reduced functional test of the warning device.

NOTE There is no requirement to remove the tool before performing the reduced functional test.

6.6.2.5 Measurement

Record any mis-operation of the warning device, and the results of the reduced functional test.

6.6.2.6 Pass/Fail criteria

It shall not have been possible to defeat the operation of the tamper detection device by inserting the tool. Additionally, no mis-operation of the warning device shall have been noted.

The warning device shall successfully pass the reduced functional test.

With the tool withdrawn, there shall be no visible damage to the warning device.

6.6.3 Detection of opening by normal means

6.6.3.1 Purpose

To demonstrate that when opening the warning device by normal means it is not possible to insert a tool as specified in Table 5 and Table 6 into the warning device in its normal mounting position and defeat the operation of the tamper detection circuitry, before a tamper signal or message is generated.

To verify that after activation of tamper detection circuitry, the tamper signal or message is generated within the correct time frame.

6.6.3.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.6.3.3 Mounting

The general mounting conditions of 6.2.2 shall apply.

6.6.3.4 Stimuli

Open the warning device enclosure by normal means, and attempt to introduce each tool, individually, as specified in 5.2.2, into the warning device before the tamper detection device operates. If the tool is inserted, the tool should be manoeuvred to try to interfere with the tamper detection device.

Perform a reduced functional test of the warning device.

NOTE There is no requirement to remove the tool before performing the reduced functional test.

6.6.3.5 Measurement

Monitor the tamper signal or message output, and the results of the reduced functional test.

Record any mis-operation of the warning device.

Record the time from the tamper device operating to the tamper signal/message being transmitted.

6.6.3.6 Pass/Fail criteria

Opening the warning device by normal means shall generate a tamper signal or message.

It shall not have been possible to defeat the operation of the tamper detection device by inserting the tool whilst opening the warning device, without generation of a tamper signal or message.

The time between the tamper device operating and the generation of a tamper output signal or message shall be equal to or less than that specified in 5.1.3.

The warning device shall successfully complete the reduced functional test.

6.6.4 Detection of removal from mounting

6.6.4.1 Purpose

To demonstrate that a tamper signal or message is generated within the appropriate time period when the warning device is removed from the mounting surface, by a distance defined in Table 8.

6.6.4.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.6.4.3 Mounting

The sample shall be positioned on a horizontal flat surface.

6.6.4.4 Stimuli

Slowly lift the warning device from the flat surface in a perpendicular direction to the mounting surface, whilst monitoring the tamper signal or message output.

Attempt to slide a blade as defined in 5.2.2 to defeat the removal from mounting detection, before and during the above test. Repeat with the pliers as defined in 5.2.2.

6.6.4.5 Measurement

Record the distance from the mounting surface at which the tamper detection device operated and the time taken for the tamper signal/message to be generated.

Record whether it was possible to prevent the generation of a tamper signal or message.

6.6.4.6 Pass/Fail criteria

The tamper signal or message output shall have been generated before the sample is lifted by a distance exceeding that defined in Table 8.

The time between the tamper device operating and the tamper signal or message output being generated shall be equal or less than that specified in 5.1.3.

It shall not have been possible to prevent the generation of a tamper signal or message.

6.6.5 Detection of penetration

6.6.5.1 Purpose

To verify the performance of the penetration detection.

6.6.5.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.6.5.3 Mounting

The general mounting conditions of 6.2.2 shall apply.

6.6.5.4 Stimuli

Drill a hole of 4 mm diameter to provide access to the components within the warning device.

6.6.5.5 Measurement

Record any mis-operation of the warning device.

6.6.5.6 Pass/Fail criteria

The tamper detection shall operate if a hole of 4 mm or more can be created such that a tool (as defined in Table 5) could be used to cause mis-operation of the warning device.

6.7 Electrical tests

6.7.1 Operating voltage range and current consumption

6.7.1.1 Purpose

To verify that the warning device operates correctly at the minimum and maximum supply voltage, and that the current consumption is within the manufacturer's specification in both sounding and non-sounding conditions.

6.7.1.2 Conditions

The general test conditions of 6.2.1 shall apply. Additional functions, for example indicators, shall be enabled as specified by the manufacturer.

6.7.1.3 Mounting

The general mounting conditions of 6.2.2 shall apply or the sample shall be positioned on a horizontal flat surface.

6.7.1.4 Stimuli

A reduced functional test shall be carried out with the supply voltage at the manufacturer's stated minimum and maximum values.

6.7.1.5 Measurements

Record the operation of the warning device and the current consumption in both alarm sounding and non alarm sounding conditions.

6.7.1.6 Pass/Fail criteria

The warning device shall successfully pass the reduced functional test, and the current consumption shall not exceed the values specified by the manufacturer.

6.7.2 Slow rise of remote power source voltage

6.7.2.1 Purpose

To verify that when the warning device is subject to a slow input voltage rise it functions normally when the working voltage range is reached.

6.7.2.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.7.2.3 Mounting

The general mounting conditions of 6.2.2 shall apply or the sample shall be positioned on a horizontal flat surface.

6.7.2.4 Stimuli

Slowly increase remote power source voltage from zero at a rate of 1 Vs^{-1}.

When the supply voltage has reached the manufacturer's specified minimum operating voltage perform a reduced functional test.

NOTE For a bus powered warning device, a manufacturer may suggest alternative methods to demonstrate that the warning device meets the requirements of 5.6.2.2.

6.7.2.5 Measurements

Record the results of the reduced functional test.

6.7.2.6 Pass/Fail criteria

The warning device shall successfully pass the reduced functional test.

6.7.3 Remote power source voltage step change

6.7.3.1 Purpose

To verify that the warning device operates correctly when subject to a step in the input voltage between maximum and minimum, and vice versa.

6.7.3.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.7.3.3 Mounting

The general mounting conditions of 6.2.2 shall apply or the sample shall be positioned on a horizontal flat surface.

6.7.3.4 Stimuli

Apply a step change between the manufacturer's specified minimum and maximum operating voltages and perform a reduced functional test.

Apply a step change between the manufacturer's specified maximum and minimum operating voltages and perform a reduced functional test.

6.7.3.5 Measurements

Record any mis-operation of the warning device, and the results of the reduced functional tests.

6.7.3.6 Pass/Fail criteria

No mis-operation of the warning device shall have been recorded.

The warning device shall successfully pass the reduced functional tests.

6.7.4 Storage device standby time

6.7.4.1 Purpose

To verify that the storage device shall have sufficient capacity to maintain the warning device in its standby condition for the periods as specified in Table 9.

6.7.4.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.7.4.3 Mounting

The general mounting conditions of 6.2.2 shall apply or the sample shall be positioned on a horizontal flat surface.

6.7.4.4 Stimuli

Apply a charged storage device as specified by the manufacturer, and ensure that the warning device is in its standby condition.

6.7.4.5 Measurements

Measure the current supplied by the storage device to the warning device.

6.7.4.6 Pass/Fail criteria

Calculate the capacity required to be supplied by the storage device to meet the standby condition times as specified in Table 9, and verify that this is less than the total storage device capacity.

6.7.5 Storage device operating time

6.7.5.1 Purpose

To verify that the storage device has sufficient capacity to operate the warning device as specified in 5.6.3.2.

6.7.5.2 Conditions

The general test conditions of 6.2.1 shall apply.

If the warning device has a standby condition, then discharge the storage device from its fully charged condition by holding the warning device in its standby condition for the grade dependant time given in Table 9.

Otherwise the storage device shall be in its fully charged condition.

Ensure that the remote power supply is disconnected.

NOTE For type W warning devices, the storage device may be subject to an accelerated discharge as described by the warning device manufacturer to achieve an equivalent state of discharge in an acceptable time period.

6.7.5.3 Mounting

The mounting conditions as defined in Annex A shall apply.

6.7.5.4 Stimuli

Activate the warning device, for example by application of a trigger command.

After the warning device has operated for the time specified in 5.6.3.2, activate the warning device again and measure the acoustic output in accordance with Annex A.

NOTE 1 Operating the warning device for the time specified may involve multiple applications of a trigger command.

NOTE 2 For warning device types X and Z where loss of remote power supply causes the warning device to immediately activate, it may be necessary to consult the warning device manufacturer for means to operate the warning device for the minimum operating time in 5.6.3.2.

6.7.5.5 Measurements

Measure and record the average current consumption whilst the warning device is sounding.

Measure the sound pressure level at 1 m away from the device under test.

6.7.5.6 Pass/Fail criteria

The individual acoustic reading shall not be less than the minimum individual acoustic output level of Table 3 at, at least, one of the 30° intervals on a horizontal plane as defined in 5.1.2. See Annex A.

6.7.6 Storage device recharge rate

6.7.6.1 Purpose

To verify that the warning device is able to recharge the storage device as specified in 5.6.3.4.

6.7.6.2 Conditions

The general test conditions of 6.2.1 shall apply.

The storage device shall be at the minimum discharge point as specified by the storage device manufacturer.

6.7.6.3 Mounting

The general mounting conditions of 6.2.2 shall apply or the sample shall be positioned on a horizontal flat surface.

6.7.6.4 Stimuli

Reconnect the remote power source at the manufacturer's specified minimum operating voltage (for type Z warning devices).

Activate the recharging source according to the warning device manufacturer's guidance (for type Y warning devices).

6.7.6.5 Measurements

Measure and record the charge current supplied to the storage device over the grade dependent recharge time as specified in Table 10.

6.7.6.6 Pass/Fail criteria

The warning device shall have supplied current at the appropriate voltage to the storage device equivalent to 80 % of that supplied by the storage device in tests 6.7.4 and 6.7.5.

6.7.7 Loss of remote power

6.7.7.1 Purpose

To verify that the warning device responds correctly to loss of the remote power source.

6.7.7.2 Conditions

The general test conditions of 6.2.1 shall apply. Ensure that the storage device is correctly connected.

6.7.7.3 Mounting

The general mounting conditions of 6.2.2 shall apply or the sample shall be positioned on a horizontal flat surface.

6.7.7.4 Stimuli

Remove the remote power source.

6.7.7.5 Measurements

Monitor and record the operation of the warning device outputs.

6.7.7.6 Pass/Fail criteria

The warning device shall respond as specified by Table 2, within the period specified in 5.1.3.

6.7.8 Remote power short circuit protection

6.7.8.1 Purpose

To verify that it is not possible to discharge the storage device through a short circuit applied to the remote power source connections.

6.7.8.2 Conditions

The general test conditions of 6.2.1 shall apply. Ensure that the storage device is correctly connected.

6.7.8.3 Mounting

The general mounting conditions of 6.2.2 shall apply or the sample shall be positioned on a horizontal flat surface.

6.7.8.4 Stimuli

Disconnect the remote power source, and apply a short circuit across the remote power source connections.

6.7.8.5 Measurements

Monitor any current flow through the short circuit.

6.7.8.6 Pass/Fail criteria

There shall be no measured current flowing through the short circuit.

6.7.9 Storage device monitoring – Low residual energy

6.7.9.1 Purpose

To verify that the warning device can generate a fault signal or message when the storage device residual energy falls below the condition specified by the manufacturer.

6.7.9.2 Conditions

The general test conditions of 6.2.1 shall apply. Simulate a storage device by means advised by the warning device manufacturer, for example variable voltage power supply

Place the warning device into its standby condition, where applicable.

For type X warning device without a standby condition, connect the remote power source.

NOTE This test is not applicable to type z WD without a standby condition.

6.7.9.3 Mounting

The general mounting conditions of 6.2.2 shall apply or the sample shall be positioned on a horizontal flat surface.

6.7.9.4 Stimuli

Reduce the simulated SD energy to the level at which the warning device manufacturer has declared that a fault signal or message will be generated.

For type X warning device with a standby condition, repeat this test with the remote power source connected.

6.7.9.5 Measurements

Monitor the fault signal or message output. Record the time from the simulated SD energy level reaching the SD Failure - Low Residual Energy condition as specified by the warning device manufacturer to the fault signal or message being generated.

6.7.9.6 Pass/Fail criteria

The time between the simulated SD energy level reaching the SD Failure - Low Residual Energy condition as specified by the warning device manufacturer and a fault signal or message being generated shall not exceed that specified in 5.1.3.

6.7.10 Storage device monitoring – Failure

6.7.10.1 Purpose

To verify that the warning device generates a fault signal or message in the event that the storage device is no longer able to power the warning device.

6.7.10.2 Conditions

The general test conditions of 6.2.1 shall apply.

6.7.10.3 Mounting

The general mounting conditions of 6.2.2 shall apply or the sample shall be positioned on a horizontal flat surface.

6.7.10.4 Stimuli

The test should be devised following an inspection of a statement by the warning device manufacturer describing the storage device monitoring approach.

A failed storage device, or agreed simulation of a failed storage device shall be applied to the warning device.

6.7.10.5 Measurements

Monitor the fault signal or message output. Record the time from connection of the failed storage device to the fault signal or message being generated.

6.7.10.6 Pass/Fail criteria

The time between the connection of the failed storage device and a fault signal or message being generated shall not exceed the sum of the times specified in 5.1.3 and 5.7.1.2.2.

6.8 Marking

6.8.1 Purpose

To confirm that the warning device is marked in accordance with 5.8.

6.8.2 Conditions

Not applicable.

6.8.3 Mounting

Not applicable.

6.8.4 Stimuli

Not applicable.

6.8.5 Measurement

Examine the warning device visually.

6.8.6 Pass/Fail criteria

All specified markings shall be present.

6.9 Documentation

6.9.1 Purpose

To confirm that the warning device is accompanied by documentation in accordance with 5.9.

6.9.2 Conditions

Not applicable.

6.9.3 Mounting

Not applicable.

6.9.4 Stimuli

Not applicable.

6.9.5 Measurement

Examine the documentation visually.

6.9.6 Pass/Fail criteria

All information specified shall be present.

6.10 Environmental

6.10.1 Impact

6.10.1.1 Purpose

To demonstrate that the warning device will operate correctly during or after impact testing without significant mechanical damage or degradation of performance.

6.10.1.2 Conditions

The warning device shall be subject to impact testing using the methodology of EN 50130-5, with equipment meeting the requirements of EN 60068-2-75 at the severity levels specified in 5.2.1.

Impact testing to IK08, shall use the methodology of EN 60068-2-75, test EHa.

6.10.1.3 Mounting

As defined within EN 50130-5.

6.10.1.4 Stimuli

Apply the reduced functional test 6.3, before and after the environmental conditioning inclusive of any recovery period as specified in EN 50130-5, as defined in Table 12.

6.10.1.5 Measurement

In accordance with the reduced functional test, and by inspection for any mechanical failure. During the impact tests, monitor the outputs of the warning device for any unwanted activation during the conditioning process.

6.10.1.6 Pass/Fail criteria

No unintentional change of state shall occur during the impact tests.

The warning device shall continue to meet the requirements of the reduced functional test

There shall be no signs of mechanical damage except where such damage is sustained it does not prevent the warning device from satisfying the tests of 6.6.

6.10.2 Further environmental tests

6.10.2.1 Purpose

To demonstrate that the warning device will operate correctly during or after given environmental conditions without significant mechanical damage or degradation of performance.

6.10.2.2 Conditions

The warning device shall be subject to the environmental conditioning under the operating conditions as called up in Table 12 and described in EN 50130-5 and EMC product family standard EN 50130-4.

NOTE Impact testing is excluded from these tests as it has already been covered in 6.10.1.