



Automatic fire detection and alarm systems

Part 17: Warning equipment for people with hearing impairment



AS 1603.17:2020

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- Deafness Forum of Australia
- Engineers Australia
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Part 17: Warning equipment for people with hearing impairment

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Preface

This Standard was prepared by the Standards Australia Committee FP-002, Fire Detection, Warning, Control and Intercom Systems, to supersede AS 1603.17—2011, *Automatic fire detection and alarm systems, Part 17: Warning equipment for people with hearing impairment*.

The objective of this document is to provide design and performance requirements for warning equipment that acts in conjunction with smoke alarms or other emergency detection systems to alert people with hearing impairment to potential danger.

The major changes in this edition are as follows:

- (a) Terminology aligned with the AS 1670 series and BS 5446-3.
- (b) Normative references updated.
- (c) Power supply requirements clarified.
- (d) Conformance of VAD to AS ISO 7240.23.
- (e) Conformance of AAD to AS ISO 7240.3 or AS 3786.
- (f) Fault response timings aligned with the AS 7240 series.
- (g) Component assessment requirements clarified.

Contents

Preface	ii
Introduction	v
Section 1 Scope and general	1
1.1 Scope	1
1.2 Normative references	1
1.3 Terms and definitions	2
1.4 Abbreviated terms	3
Section 2 Warning systems	4
Section 3 Components	5
3.1 General	5
3.2 Control panel	5
3.2.1 General	5
3.2.2 Wired component connectors	5
3.2.3 Transmission path fault supervision	5
3.2.4 Enclosure protection	5
3.3 Display of functional conditions	6
3.4 Control panel indications	6
3.4.1 General	6
3.4.2 Indication of power	6
3.4.3 Indication of an alarm condition	6
3.4.4 Indication of a fault	6
3.4.5 Display of indications	6
3.4.6 Audible indication of fire alarm — Optional function	6
3.4.7 Additional indications	7
3.4.8 Quiescent condition	7
3.5 Alarm condition	7
3.5.1 Reception and processing of alarm signals	7
3.5.2 Silence warning system facility — Optional function	7
3.5.3 Alarm condition test facility — Optional function	7
3.6 Fault warning condition	8
3.6.1 Reception and processing of fault signals	8
3.6.2 Indication of faults	8
3.6.3 Audible fault indication — Optional function	8
3.7 Control panel power supply	8
3.8 Visual alarm device	9
3.9 Vibrating pad (option with requirements)	9
3.10 Vibrating alerter (option with requirements)	9
3.11 Radio-transmission path for warning system components	9
3.11.1 General	9
3.11.2 Operating range	10
3.11.3 Fault monitoring	10
3.12 Audible alarm device (option with requirements)	10
3.13 Labelling	10
3.14 Software	10
3.15 Component conformance	10
Section 4 Testing	12
4.1 General	12
4.2 Functional test	12
4.3 Environmental tests	12
4.4 Shock test	12
4.4.1 Test procedure	12
4.4.2 Test requirements	13
4.5 Drop test	13

4.5.1	Test procedure	13
4.5.2	Test requirements	14
Section 5	Marking and data	15
5.1	Individual component marking	15
5.2	Point of sale packaging	15
5.2.1	Kits	15
5.2.2	Individual components	15
5.3	Hardware documentation	16
5.4	Test report	16

Introduction

Smoke alarm systems and smoke detection systems for use in residential applications are intended to warn of the presence of fire by emitting an audible warning. However, people with hearing impairment may be unable to hear the audible alarm that is normally produced.

There are recognized methods of alerting people with hearing impairment: the use of vibro-tactile, low-frequency sounds and visual alarm devices. To provide a fire warning for people with hearing impairment, it has become common practice for such devices to be coupled to smoke alarms or smoke detection systems. For example, vibrating pads can be used to awaken sleeping people and visual alarms to alert those already awake. This part of the AS 1603 series specifies the requirements for supplementary warning devices for use in residential accommodation to warn people with hearing impairment of fire. This document does not claim to provide an exclusive or definitive solution to the problem of providing reliable fire safety protection to people with hearing impairment.

This document provides tests and requirements for vibro-tactile devices, visual alarm devices, and any control equipment required for the connection of these components to smoke alarm or smoke detection systems.

Reference is made to international and national Standards throughout this document and in the component conformance table to increase the options for conformance and to reduce the time and cost in demonstrating conformance. Conformance refers to fulfilling the requirements of a Standard or document.

NOTES

Australian Standard®

Automatic fire detection and alarm systems

Part 17: Warning equipment for people with hearing impairment

Section 1 Scope and general

1.1 Scope

This document specifies the requirements for individual components used to form a fire warning system appropriate to the individual requirements or needs of people with hearing impairment.

This warning equipment is intended to alert people with hearing impairment and, in particular, to arouse sleeping occupants on detection of a fire.

1.2 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.

AS 1670.1, *Fire detection, warning, control and intercom systems—System design, installation and commissioning, Part 1: Fire*

AS 1670.4, *Fire detection, warning, control and intercom systems—System design, installation and commissioning, Part 4: Emergency warning and intercom systems*

AS 3786, *Smoke alarms using scattered light, transmitted light or ionization*

AS ISO 7240.1, *Fire detection and alarm systems, Part 1: General and definitions*

AS 7240.2, *Fire detection and alarm systems, Part 2: Fire detection control and indicating equipment (ISO 7240-2:2017, MOD)*

AS ISO 7240.3, *Fire detection and alarm systems, Part 3: Audible alarm devices*

AS 7240.4, *Fire detection and alarm systems, Part 4: Power supply equipment (ISO 7240-4:2017, MOD)*

AS ISO 7240.23, *Fire detection and alarm systems, Part 23: Visual alarm devices*

AS ISO 7240.25, *Fire detection and fire alarm systems, Part 25: Components using radio transmission paths*

AS/NZS 3100, *Approval and test specification—General requirements for electrical equipment*

AS/NZS 60335.1, *Household and similar electrical appliances—Safety, Part 1: General requirements*

AS/NZS 62368.1, *Audio/video, information and communication technology equipment, Part 1: Safety requirements (IEC 62368-1:2014 (ED. 2.0), MOD)*

AS/ACIF S008, *Requirements for customer cabling products*

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

IEC 60068-2-27, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

IEC 60068-2-31, *Environmental testing — Part 2-31: Tests — Test Ec: Rough handling shocks, primarily for equipment-type specimens*

BS 5446-3, *Detection and alarm devices for dwellings. Specification for fire alarm and carbon monoxide alarm systems for deaf and hard of hearing people*

1.3 Terms and definitions

For the purposes of this document, the terms and definitions given in AS ISO 7240.1 and the following apply.

1.3.1

audible alarm device

AAD

device to warn of a fire alarm condition using an audible signal

1.3.2

control panel

equipment which provides functions such as the monitoring, supervision, indication and controls for system components

1.3.3

enclosure

housing(s) in which parts and sub-assemblies are mechanically secured

1.3.4

fault warning condition

fault indicated at the control panel

1.3.5

fire detection and alarm system

FDAS

equipment, including control and indication equipment, which when arranged in a specified configuration is capable of detecting and indicating a fire and signalling for appropriate action

1.3.6

hearing-impairment

condition where a person is unable to rely on hearing alarm signals with or without the use of a hearing aid or cochlear implant

1.3.7

initiating device

smoke or heat alarm or fire detection alarm system

1.3.8

may

indicates the existence of an option

1.3.9

shall

indicates that a statement is mandatory

1.3.10

should

indicates a recommendation

1.3.11

smoke alarm system

SAS

one or more smoke alarms providing occupant warning

Note 1 to entry: Smoke alarms shall conform to AS 3786.

1.3.12**vibrating alerter**

device intended to alert a person while awake by vibration

Note 1 to entry: If a separate charging unit is supplied for this device, it is considered to be part of the device.

1.3.13**vibrating pad**

device intended to waken a person from sleep by vibration

1.3.14**warning system**

combination of devices and control equipment intended to warn occupants of an emergency condition such as fire

1.4 Abbreviated terms

AAD	audible alarm device
CIE	control and indicating equipment
ELV	extra low voltage
EWCIE	emergency warning control and indicating equipment
FDAS	fire detection and alarm system
FDCIE	fire detection control and indicating equipment
PSE	power supply equipment
VAD	visual alarm device

Section 2 Warning systems

The warning system shall meet the following requirements:

- (a) The warning system shall incorporate a control panel in accordance with [Clause 3.2](#). The control panel shall be connected to an initiating device in accordance with [Clause 3.5.1](#)
- (b) Power supply shall be in accordance with [Clause 3.7](#).
- (c) Visual alarm device shall be in accordance with [Clause 3.8](#).
- (d) One or more of the following options shall be included:
 - (i) Vibrating pad in accordance with [Clause 3.9](#).
 - (ii) Vibrating alerter, in accordance with [Clause 3.10](#).
 - (iii) Audible alarm device in accordance with [Clause 3.12](#).

NOTE The sole use of an audible alarm device is not recommended.

- (e) Facilities for interconnection between components shall meet the requirements of [Clauses 3.2.2](#) and [3.2.3](#).
- (f) Set of instructions for connection and operation of the system components shall be in accordance with [Clause 5.3](#).

If an optional function with requirements is included, then all the corresponding requirements shall be met.

If functions other than those specified in this document are provided, those functions shall not jeopardize any requirements of this document.

Section 3 Components

3.1 General

Components may be supplied in two ways:

- (a) A standalone system containing the components, connections and instructions required for that installation; or
- (b) Individual components intended to be installed as part of another warning system.

Components shall be compatible when interconnected to form a system.

Leads connecting a component with the control panel shall be provided with a strain-relieving device.

The lead shall be subjected to a pulling force of 20 N without jerks for 1 min in any direction allowed by the design. The pull shall not be transmitted to the joints between the leads and terminal connectors or between the leads and circuit board.

3.2 Control panel

3.2.1 General

The control panel may be a standalone unit, conforming to this document, or it may be incorporated into the control and indicating equipment (CIE) as specified in either AS 1670.1 or AS 1670.4.

The indications and controls shall be designed so that they are easily accessible.

The control panel shall be able to function in the following conditions simultaneously:

- (i) Alarm condition.
- (ii) Fault warning condition.

All components, including flexible mains supply cord and cables, shall meet the relevant requirements of AS/ACIF S008, AS/NZS 60335.1 and AS/NZS 62368.1.

3.2.2 Wired component connectors

Wired connections between system components shall be via mechanically latching connectors or screw terminals.

Where mechanically latching connectors are used, it shall not be possible to make these connections incorrectly.

3.2.3 Transmission path fault supervision

External transmission paths between the warning system components shall be supervised for faults that may prevent the transmission of an emergency warning signal.

Where the transmission path is by means of physical connections (e.g. cabled), a transmission path fault shall be indicated at the control panel within 300 s.

Where the transmission path is by means of wire-free connections, a transmission path fault shall be indicated at the control panel within 60 min.

3.2.4 Enclosure protection

The enclosure ingress protection shall meet at least classification IP 21C as given in IEC 60529.

3.3 Display of functional conditions

The control panel shall be capable of unambiguously indicating at least the following functional conditions by means of light-emitting indicators or alphanumeric display or both, as described in [Clause 3.4.1](#):

- (a) Alarm condition.
- (b) Fault warning condition.

3.4 Control panel indications

3.4.1 General

The control panel indicators shall meet the requirements of AS 7240.2:2018 Clause 4.11.

3.4.2 Indication of power

The presence of power shall be indicated without prior manual intervention. This indication of power shall —

- (a) consist of a dedicated green light-emitting indicator or an alphanumeric display or both; and
- (b) meet the requirements of [Clause 3.4.1](#).

Components that are not powered by the control panel shall incorporate a power on indicator unless the provision of power is supervised by the control panel.

3.4.3 Indication of an alarm condition

An alarm condition shall be visually indicated without prior manual intervention. This indication of an alarm condition shall —

- (a) consist of a dedicated red light-emitting indicator or an alphanumeric display or both; and
- (b) meet the requirements of [Clause 3.4.1](#).

NOTE This visual indicator is not the visual alarm device.

The control panel shall respond to the alarm signal from an initiating device and activate the warning equipment within 15 s.

3.4.4 Indication of a fault

A visual indication shall be given on the control panel of any of the fault conditions listed in [Clause 3.6.2](#). The indication of a fault shall —

- (a) consist of a general fault indicator or individual indicator(s) for each fault. The indicator shall consist of a yellow light-emitting indicator or alphanumeric display; and
- (b) meet the requirements of [Clause 3.4.1](#).

3.4.5 Display of indications

All required indications shall be clearly identifiable.

3.4.6 Audible indication of fire alarm — Optional function

The audible indication may be the same for the alarm condition as for the fault warning condition. If they are different, the audible alarm indication shall have priority.

The audible indication for the control panel shall meet the requirements of AS 7240.2:2018 Clause 4.12.2.

3.4.7 Additional indications

The system may also be used for non-emergency purposes (e.g. paging, alarm clock, telephone or doorbell). In such cases, distinct indications shall be provided to identify the source of activation. Under fire alarm conditions, the alarm indication shall have priority.

Where indications are used in addition to required indications, these shall not result in contradiction or confusion.

3.4.8 Quiescent condition

Any kind of system information may be displayed during the quiescent condition. No indications shall be given that could be confused with indications used in the —

- (a) alarm condition; or
- (b) fault warning condition

3.5 Alarm condition

3.5.1 Reception and processing of alarm signals

The control panel shall be capable of receiving and processing alarm signals from at least one of the following initiating devices:

- (a) Smoke alarms conforming to AS 3786.
- (b) FDAS.
- (c) EWCIE referenced in AS 1670.4.

The control panel shall automatically reset when the alarm signal clears.

3.5.2 Silence warning system facility — Optional function

This facility shall have a control, labelled with at least the word “Silence”.

The control shall silence the warning system and be —

- (a) indicated by a visual indication; and
- (b) automatically re-enabled after an interval not greater than 15 min.

3.5.3 Alarm condition test facility — Optional function

Where provided, the facility shall simulate an alarm signal and test the operation of the control panel and associated warning devices.

The test facility control shall meet one of the following requirements:

- (a) The alarm outputs shall be activated within 5 s and continue until the test control is released.
- (b) An automated test sequence for alarm outputs shall be initiated within 5 s and not continue for more than 20 s. This control shall be non-latching and labelled with at least the word “Test”.

3.6 Fault warning condition

3.6.1 Reception and processing of fault signals

The system shall enter the fault warning condition when signals are received which, after any necessary processing, are interpreted as a fault. The control panel shall be capable of simultaneously indicating all faults specified in [Clause 3.6.2](#) unless this is prevented by —

- (a) the presence of an alarm signal; or
- (b) the testing of any system component.

The system shall enter the fault warning condition within the periods specified in [Clause 3.2.3](#).

3.6.2 Indication of faults

The fault indications shall be indicated without prior manual intervention and automatically reset when the fault condition clears.

The following faults shall be indicated:

- (a) Any short circuit or interruption in a transmission path between components of the warning system.
- (b) Loss of a power source or low battery condition as applicable.

NOTE Separately powered components need not indicate a low battery on the control panel.

3.6.3 Audible fault indication — Optional function

The audible indication of faults shall be silenced by a manual control.

The manual control shall be labelled “sounder silence”.

The audible indication shall re-sound for each new fault condition.

The audible indication shall be automatically silenced if all fault conditions are cleared.

3.7 Control panel power supply

The control panel shall be supplied by two sources of power: main and standby.

When the power is available from either source, the power “on” indication shall operate in accordance with [Clause 3.4.2](#).

Each power source shall be capable of independently operating all components when the other power source is disconnected.

Components that are connected by a supervised transmission path to a dual power source are considered to be supplied by two power sources.

The main and standby power source shall meet the requirements of at least one of the following:

- (a) AS 3786; or
- (b) AS 7240.4.

Where the main power source is external and is using a voltage higher than extra low voltage (ELV), the unit shall conform to AS/NZS 3100.

Connection to the main power supply shall be by either fixed wiring, a socket outlet plug, or a power pack.

Where an a.c. power adaptor (plug pack or power pack) is used, it shall be supplied and labelled “WARNING — DO NOT REMOVE OR SWITCH OFF” in white lettering not less than 3 mm in height on a red background.

3.8 Visual alarm device

The visual alarm device (VAD) shall —

- (a) meet the requirements of AS ISO 7240.23 for Class C or W;
- (b) operate for a minimum of 4 min in alarm when powered from the main supply; and
- (c) operate for a minimum of 4 min in alarm when powered from standby power.

NOTE The VAD is intended to provide a general warning of an alarm condition and is not intended alone to arouse sleeping occupants.

3.9 Vibrating pad (option with requirements)

Vibrating pads shall be suitable for locating under the pillow of a bed.

NOTE 1 It is desirable that a means be provided to prevent the vibrating pad from slipping out of position under the pillow.

NOTE 2 Examples of typical principles of operation for a vibrating pad include:

- (a) Electric motor and mechanical cam/eccentric.
- (b) Solenoid or other coil/armature arrangement.

A connecting lead shall have a strain relief to prevent the lead being pushed into, or pulled out of, the pad. Vibrating pads shall be tested in accordance with BS 5446-3:2015 Annex G.

The operating voltage of vibrating pads shall —

- (a) not exceed ELV;
- (b) operate for a minimum of 1 min in alarm when powered from main power supply; and
- (c) operate for a minimum of 1 min in alarm when powered from standby power.

3.10 Vibrating alerter (option with requirements)

A vibrating alerter is intended to be worn or carried. When energized, vibrations should be of sufficient intensity to alert a non-sleeping person.

Vibrating alerters shall include both a vibrating function and a light-emitting indicator. They shall be tested in accordance with BS 5446-3:2015 Annex E.

3.11 Radio-transmission path for warning system components

3.11.1 General

Radio transmission path systems shall conform to either BS 5446-3:2015 Annex E or the radio transmission path requirements of AS ISO 7240.25.

NOTE Refer to the Australian Communications and Media Authority for legislative requirements covering devices utilizing the radio-frequency spectrum.

3.11.2 Operating range

A radio transmission path shall have a minimum free-air range of 100 m. Where the manufacturer specifies a range greater than 100 m, the declared range shall meet the requirements of [Clause 3.11.1](#).

3.11.3 Fault monitoring

An acceptable alternative to the fault indication of a transmission path failure between components is for the generation of an alarm condition at the affected component.

3.12 Audible alarm device (option with requirements)

An audible alarm device (AAD) shall meet the requirements of AS ISO 7240.3 or AS 3786.

NOTE An AAD may be a separate device or be integrated with other components to supplement any required, audible, occupant warning that is already provided.

The AAD shall operate for a minimum of 4 min in alarm when powered from main or standby power.

3.13 Labelling

The controls and indication shall meet the requirements of AS 7240.2.

3.14 Software

The software design shall meet the requirements of AS 7240.2. When reading or applying AS 7240.2, substitute FDCIE with control panel.

3.15 Component conformance

All components shall meet the requirements of —

- (a) this document; and
- (b) at least one of the component Standards listed in [Table 1](#); and
- (c) AS/NZS 3100.

Where the warning system for people with hearing impairment forms part of an AS 1670.1 system, the CIE, power supply and transmission path requirements of AS 1670.1 shall apply.

NOTE Refer to the Australian Communications and Media Authority for relevant legislative requirements.

Table 1 — Applicable Standards for demonstrating conformance

Component category	Relevant AS 1603.17 Clause	Applicable standard or system for conformance
Initiating devices	3.5	AS 3786 or FDAS alarm output or AS1670.4
Power supply	3.7	AS 3786 or AS 7240.4
Control panel or CIE	3.2	AS 1670.1 AS 1670.4 or AS 1603.17
Vibrating pad	3.9	BS 5446-3:2015 Annex G

Table 1 *(continued)*

Component category	Relevant AS 1603.17 Clause	Applicable standard or system for conformance
Vibrating alerter	3.10	BS 5446-3:2015 Annex E
Audible alarm device	3.12	AS ISO 7240.3 or AS 3786
Visual alarm device	3.8	AS ISO 7240.23 Class C or W
Radio transmission paths	3.11	BS 5446-3:2015 Annex E or AS ISO 7240.25

Section 4 Testing

4.1 General

When reading or applying AS 7240.2, substitute the term FDCIE with control panel.

The testing of equipment shall be in accordance with AS 7240.2:2018 Clause 5.1 except for Clause 5.1.4.1. Clause 5.1.4.1 shall be replaced with the following text:

“For tests that require the specimen to be operating, it shall be powered from a supply that meets the requirements of [Clause 3.7](#)”.

4.2 Functional test

The functional test shall be structured in accordance with the relevant clauses specified in AS 7240.2:2018 Clause 5.2.

4.3 Environmental tests

The Test Schedule in AS 7240.2:2018 Table 1 shall be used.

For non-fixed units, the impact test in AS 7240.2 shall be replaced with the text in [Table 2](#).

Table 2 — Non-fixed unit impact tests

Impact test	Type of non-fixed unit	AS 7240 clause number
Shock	Operational	Clause 4.4
Drop	Operational	Clause 4.5

4.4 Shock test

The objective of the test is to demonstrate the immunity of the equipment to mechanical shocks, which are likely to occur in the anticipated service environment.

4.4.1 Test procedure

4.4.1.1 General

The test apparatus and procedure given in IEC 60068-2-27 shall be used.

4.4.1.2 Initial examination

Before conditioning, subject the specimen to the functional test specified in [Clause 4.2](#).

4.4.1.3 State of the specimen during conditioning

The specimen shall be tested in the quiescent condition, mounted as specified in [Clause 4.1](#), and connected to a suitable power supply.

4.4.1.4 Conditioning

The conditioning shall be as follows:

- (a) Pulse duration: 6 ms.
- (b) Maximum acceleration: $10 \times (100 - M) \text{ m/s}^2$ (where M = mass of the control panel, in kg).

- (c) Number of shock directions per axis: 6.
- (d) Number of pulses per direction: 3.

The specimen shall be monitored for false operation and fault signals during the conditioning period and a further 2 min after the end of the conditioning period.

4.4.1.5 Measurements during conditioning

The specimen shall be monitored during the conditioning periods to detect any changes in functional condition and to ensure that the results of shock do not influence subsequent series of impacts.

4.4.1.6 Final measurements

After the conditioning, the specimen shall be subjected to the functional test specified in [Clause 4.2](#) and inspected visually for mechanical damage both externally and internally.

4.4.2 Test requirements

No alarm or fault signals shall be given during the conditioning period or the additional 2 min.

The conditioning shall not detach any components or sub-assemblies from their mounting.

All required and optional functions claimed by the manufacturer shall operate according to the requirements of this document.

4.5 Drop test

The objective of the test is to demonstrate the immunity of the equipment to drops, which are likely to occur in the anticipated service environment.

4.5.1 Test procedure

4.5.1.1 General

The test apparatus and procedure given in IEC 60068-2-31 shall be used.

4.5.1.2 Initial examination

Before conditioning, subject the specimen to the functional test specified in [Clause 4.2](#).

4.5.1.3 State of the specimen during conditioning

The specimen shall be tested in the quiescent condition, mounted as specified in [Clause 4.1](#), and connected to a suitable power supply.

4.5.1.4 Conditioning

The conditioning shall be as follows:

- (a) *Number of drops*: 6 (two directions in each of three mutually perpendicular axes).
- (b) *Height of drop*: 0.5 m onto a hard surface in accordance with IEC 60068-2-31 free fall procedure.

The specimen shall be monitored for false operation and fault signals during the conditioning period and a further 2 min after the end of the conditioning period.

4.5.1.5 Measurements during conditioning

The specimen shall be monitored during the conditioning periods to detect any changes in functional condition and to ensure that the results of 6 drops do not influence subsequent series.

4.5.1.6 Final measurements

After the conditioning, the specimen shall be subjected to the functional test specified in [Clause 4.2](#) and inspected visually for mechanical damage both externally and internally.

4.5.2 Test requirements

No alarm or fault signals shall be given during the conditioning period or the additional 2 min.

The conditioning shall not detach any components or subassemblies from their mounting.

All required functions and optional functions claimed by the manufacturer shall operate according to the requirements of this document.

Section 5 Marking and data

5.1 Individual component marking

Each component shall be legibly and indelibly marked with the following:

- (a) The number of the Standard to which the component conforms, i.e. AS ISO 7240.23 for visual alarm devices and BS 5446-3:2015 Annex G for vibrating pads.
- (b) The name or trademark of the manufacturer or supplier.
- (c) The model designation (type or number) and description.
- (d) The date of manufacture or the batch number.
- (e) For components incorporating user-replaceable batteries, the type and number of batteries recommended by the manufacturer, and the following instruction to the user, which shall be visible during the operation of changing the batteries:

“TEST FOR CORRECT OPERATION WHENEVER ANY BATTERY IS REPLACED”
- (f) For components incorporating non-replaceable batteries, the following warning, which shall be visible during normal use:

WARNING — BATTERY NOT REPLACEABLE — SEE INSTRUCTION MANUAL
- (g) For components where it is not practicable to include the marking specified, a key referring to the component reference numbers and giving the relevant information specified in [Clause 5.3](#).

NOTE Additional conformance marking may be required by other Standards, e.g. AS/NZS 3100 or radiocommunications standards.

5.2 Point of sale packaging

5.2.1 Kits

Kits shall be marked with the following:

- (a) The number of this Standard, i.e. AS 1603.17.
- (b) The model designation (type or number).
- (c) The name or trademark of the manufacturer.
- (d) A list of the components included in the kit.

The markings shall be visible from the outside of the packaging.

5.2.2 Individual components

The point-of-sale packaging of the component shall be marked with the following:

- (a) The number of the Standard to which the component conforms, i.e. AS ISO 7240.23 for visual alarm devices and BS 5446-3:2015 Annex G for vibrating pads.
- (b) The model designation (type or number).
- (c) The name or trademark of the manufacturer.

The markings shall be visible from the outside of the packaging.

5.3 Hardware documentation

The following information shall be documented:

- (a) Information detailing the system and its components, including all its functions, and explanation of all controls and indicators.
- (b) Instructions for locating, installation, maintenance and use of each individual component.
- (c) A diagram identifying the components and their interconnections.
- (d) A statement warning that only compatible components shall be interchanged with other components. These components shall be of the exact types and allowable numbers specified in the documentation. Documentation shall state that failure to adhere to this prerequisite might render the system unsafe.
- (e) Instructions for mounting the visual alarm device, including guidance on any unsuitable or unsafe locations.
- (f) Instructions for locating the vibrating pad in the correct orientation, including guidance on any unsuitable or unsafe positions.
- (g) For warning equipment that includes a vibrating pager, instructions for wearing the device correctly and guidance on the operating range of the radio system.
- (h) Where a component contains user-replaceable batteries:
 - (i) Specific guidance on changing the batteries, including the types and reference numbers of the recommended batteries.
 - (ii) Any advice that is necessary to ensure that the batteries are properly connected.
 - (iii) A recommendation that the operation of warning equipment be tested whenever batteries are replaced.
- (i) Specific instructions that the operation of the entire system is to be tested following the completion of the installation. Where radio communication paths are used, the operation of portable radio devices such as vibrating pagers shall be checked in all accessible areas.

5.4 Test report

The test report shall contain as a minimum the following information:

- (a) Identification of each component tested.
- (b) Reference to the relevant component Standard(s).
- (c) Results of the test.
- (d) Details of any operations regarded as optional.
- (e) Details of marking, packaging and documentation.

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