

AS 1428.5:2021



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Australia



Design for access and mobility

Part 5: Communication for people who are deaf or hearing impaired



AS 1428.5:2021

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- Australian Institute of Quantity Surveyors
- Austroads
- Blind Citizens Australia
- Deafness Forum of Australia
- Department of Industry, Science, Energy and Resources
- Engineers Australia
- Housing Industry Association
- Human Factors and Ergonomics Society of Australia
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Design for access and mobility

Part 5: Communication for people who are deaf or hearing impaired

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Preface

This Standard was prepared by the Standards Australia Committee ME-064, Access for People with Disabilities, to supersede AS 1428.5:2010.

This Standard was formulated as part of the expanded suite of Standards that was conceived to provide a set of requirements to satisfy the Disability Discrimination Act (1992).

The objective of this Standard is to assist in the provision of an environment in which people who are deaf or who have a hearing impairment are included in public areas, transport buildings and terminals.

The objective of this revision is to update the document for the purpose of regulatory adoption.

The Standard deals with principles to consider when providing audio facilities for people who are deaf or hearing impaired. Factors affecting speech intelligibility and hearing augmentation are also considered, including electromagnetic interference to communication equipment.

The Standard sets out requirements for hearing augmentation systems, as well as defining numerous terms having previously caused confusion. Also included are emergency warning systems.

This Standard is part of a series that comprises the following:

AS 1428.1, *Design for access and mobility, Part 1: General requirements for access*

AS 1428.2, *Design for access and mobility, Part 2: Enhanced and additional requirements — Buildings and facilities*

AS 1428.4.1, *Design for access and mobility, Part 4.1: Means to assist the orientation of people with vision impairment — Tactile ground surface indicators*

AS 1428.4.2, *Design for access and mobility, Part 4.2: Means to assist the orientation of people with vision impairment — Wayfinding signs*

AS 1428.5, *Design for access and mobility, Part 5: Hearing augmentation and emergency systems for people who are deaf or hearing impaired*

The terms “normative” and ‘informative’ are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

The use of notes in this Standard is of an advisory nature only. They provide explanations and guidance on recommended design considerations or technical procedures, as well as an informative cross-reference to other documents or publications.

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Foreword

Persons with a hearing loss may or may not have a hearing device (such as a personal hearing aid, a cochlear implant, BAHA, brainstem implant or other hearing device) fitted. Using a hearing augmentation system may enable access to auditory communication, including speech, music and sound, by people with a hearing impairment who —

- (a) are not wearing a hearing device; or
- (b) have hearing device without a telecoil (also known as T-switch); or
- (c) have hearing device with a telecoil (also known as T-switch),

while retaining the ability to lip read when in line of sight with the person speaking.

Australian Standard®

Design for access and mobility

Part 5: Communication for people who are deaf or hearing impaired

Section 1 Scope and general

1.1 Scope and application

1.1.1 Scope

This Standard sets out requirements for the design, application of and measurements to be performed on hearing augmentation systems to enable access to auditory communication for people who have a hearing impairment or who are deaf.

This Standard sets out definition of and requirements for:

- (a) Hearing augmentation systems, which include —
 - (i) audio frequency induction loop systems (AFILS), commonly called hearing loop systems;
 - (ii) systems requiring the use of receivers; and
 - (iii) systems for use at counters.
- (b) Sound field amplification systems.
- (c) Inbuilt amplification.
- (d) Screens and barriers at counters.
- (e) Warning and alerting systems.

NOTE 1 For information on comparison of hearing augmentation systems, see [Appendix C](#).

NOTE 2 For information on hearing loss, see [Appendix B](#).

NOTE 3 The locations where hearing augmentation systems are required is specified in the NCC.

1.1.2 Application

This document is intended for use by planners, designers, regulators, builders, facility managers and operators of buildings and terminals to choose appropriate design solutions and equipment for the design, installation, operation and maintenance of hearing augmentation, communication and warning systems.

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:

NOTE 1 Documents referenced for informative purposes are listed in the Bibliography.

AS/NZS 1428.1, *Design for access and mobility, Part 1: General requirements for access*

AS 1603.17:2020, *Automatic fire detection and alarm systems, Part 17: Warning equipment for people with hearing impairment*

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

AS ISO 7240-23, *Fire detection and alarm systems, Part 23: Visual alarm devices*

IEC 62489:2017, *Electroacoustics — Audio-frequency induction loop systems for assisted hearing, Part 1: Methods of measuring and specifying the performance of system components*

ITU-T Recommendation P.50 (09/99), *Series P: Telephone Transmission Quality, Telephone Installations, Local Line Networks, Objective measuring apparatus, Artificial voices*

NOTE 2 This document, labelled “Rec_P50.zip”, file labelled “p50_m.wav, can be downloaded from <https://www.itu.int/net/itu-t/sigdb/genaudio/AudioForm-g.aspx?val=1000050>.

1.3 Terms and definitions

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

1.3.1

binaural

providing the same sound to both ears

Note 1 to entry: Binaural is unlike the term stereo, which provides different sounds to each ear.

1.3.2

cochlear implant

personal device, used by people who are deaf or hearing impaired, for amplifying and processing sound, which consists of a microphone, signal processor, amplifier and earphone. It is also a hearing prosthesis that electrically stimulates the inner ear, and includes an external processor that may look similar to a hearing aid

Note 1 to entry: A cochlear implant may also be incorrectly referred to as a bionic ear.

Note 2 to entry: The need for hearing augmentation for the majority of people with cochlear implants is similar to that required by hearing aid users with a severe hearing loss or a profound hearing loss.

1.3.3

counter

structure where verbal exchanges may occur where a product and/or service provider communicates with a client or customer

Note 1 to entry: Examples of counters include ticket sales, information, or reception counters.

1.3.4

deaf

person who has total or partial hearing loss

Note 1 to entry: This term is used with a lower case “d” as in “deaf”. When used with an uppercase “D” as in Deaf, it refers to the Signing Deaf culture of Australia who use Auslan as their primary form of communication.

Note 2 to entry: Several terms are related to hearing loss and deafness, and used in different ways by different people. Common terms include deaf, hearing impaired, hard of hearing and hearing loss. The NCC uses the phrase “deaf or hearing impaired”.

1.3.5

headset

binaural audio output device connected to a receiver or loop listener to augment sound for the listener

Note 1 to entry: A headset is commonly a pair of headphones but may be a stetoclip (see [Clause 1.3.26](#)).

1.3.6

hearing aid

personal device, used by people who are deaf or hearing impaired, for amplifying and processing sound, which consists of a microphone, signal processor, amplifier and earphone

Note 1 to entry: A hearing aid is a type of hearing device.

1.3.7

hearing augmentation system

permanently installed and portable hearing loop system, emitting and receiving system, or transmitting and receiving system with a latency of less than 40 ms for enhancing intelligibility “of sound” (including speech, conversation and music) at the ear of the listener to achieve significantly improved speech intelligibility (by increasing volume and reducing reverberation and background noise) for people who are hearing impaired or deaf

Note 1 to entry: The term “deaf” may be used for any level of hearing loss.

1.3.8

hearing device

personal device, used by people who are deaf or hearing impaired, for amplifying and processing sound

Note 1 to entry: Examples of hearing devices include hearing aid, cochlear implant, bone anchored hearing aid (BAHA), brainstem implant, etc.

1.3.9

hearing impaired

describes people with a hearing loss who communicate predominantly orally and may or may not wear a hearing device

Note 1 to entry: An alternative to this term is “hard of hearing”.

1.3.10

hearing loop cable

signal emitting component of a hearing loop system, consisting of a loop or coil of wire that generates the electromagnetic field

Note 1 to entry: A hearing loop system requires that the hearing loop cable layout be precisely designed and located, as well as matched to the hearing loop amplifier it is connected to.

1.3.11

hearing loop system

wireless transmission system that emits an unmodulated audio electromagnetic signal, in which only the vertical component of the H field is utilised (measured by picking up the field from a coil of conductive material wound around a vertical core), and converts it to sound by use of hearing devices with a telecoil, or a loop listener consisting of an induction loop amplifier and a loop of wire

1.3.12

infrared system

wireless non-visible light line of sight transmission system that emits non-visible light waves from one or more infrared emitter(s) via a modulated infrared signal to an infrared receiver worn by the listener

1.3.13

latency

period of delay between when an audio signal is commenced (either by a person speaking, or commencement of a recording) and the time the receiver emits the audio signal

Note 1 to entry: Latency is usually measured in milliseconds.

Note 2 to entry: Latency greater than 40 milliseconds (ms) is an impediment to clarity for people with hearing impairment.

1.3.14**level control**

electronic system that maintains the audio signal to the user at a constant level to compensate for fluctuating signal input levels

Note 1 to entry: Level control is required as hearing loss affects a user's ability to cope with variations in volume level.

Note 2 to entry: Level control may be built into a hearing loop amplifier, transmitter or emitter, or may be a supplied as a separate unit.

Note 3 to entry: A number of systems may be employed to achieve level control, including compression and automatic gain control, or a combination of both. This may be slow acting or fast acting.

1.3.15**lipreading**

process by which a lip reader observes the lip movements, facial expression and body language of the person speaking to gain information and understanding of the spoken word

1.3.16**loop listener**

portable device that picks up the signal from a hearing loop system or neckloop and converts it to sound by use of a headset

1.3.17**modulated radio system**

wireless system consisting of transmitter/s and receiver/s as per [Clauses 2.2.4.1](#) and [2.2.4.2](#), and excluding infrared systems

1.3.18**monaural**

provides the sound to only one ear

Note 1 to entry: An example of a monaural device is an earpiece.

Note 2 to entry: For a person with hearing loss, having sound to both ears increases intelligibility.

1.3.19**phased dual array**

hearing loop system consisting of a hearing loop amplifier, which has two amplifier modules and a 90° phase shifter, and two hearing loop cable layouts interlaced over each other

Note 1 to entry: Predominantly used for large areas, areas in which there are considerable losses in the electromagnetic field due to the presence of metal structures, and/or to prevent signals from a hearing loop system being heard outside the coverage area, such as adjacent coverage areas. Phased array loops can be specifically designed to reduce magnetic spill when required.

1.3.20**reverberation**

persistence of reflected sound

Note 1 to entry: Reverberation is an impediment to clarity for people with hearing impairment.

1.3.21**shall**

indicates a mandatory requirement

1.3.22**should**

indicates a recommendation

1.3.23**simulated speech**

synthetic speech material that contains the features of speech in terms of its components, frequency, amplitude, and temporal characteristics, but has no recognizable intelligibility, as specified in ITU-T Recommendation P.50 09/99

Note 1 to entry: For the purpose of this document, simulated speech is the male speech specified in ITU-T Recommendation P.50 09/99, Artificial voices.

1.3.24**sound field amplification system**

specialized amplified sound system that provides low-level amplification, more even distribution of sound (compared to traditional amplification systems) through the room, and reduces the effects of reverberation

Note 1 to entry: Sound field amplification system was traditionally used in a classroom.

1.3.25**speech intelligibility**

measure of the proportion of the content of a speech message that can be correctly understood

1.3.26**stetoclip**

alternative to headphones that couples sounds to both ear canals of the user and sits under the user's chin (rather than over the head like headphones) and is inserted in both ears

Note 1 to entry: Typically, a stetoclip has a cable from the sound source below the chin to each ear, and the sound source is electrically driven.

Note 2 to entry: Stetoclip is also spelled as stethoclip.

1.3.27**T-switch**

switch that activates the telecoil in the hearing device

Note 1 to entry: The switch is commonly a push-button on the hearing device to select the telecoil program, or a button on a remote control for the hearing device.

Note 2 to entry: The terms T-switch and telecoil are used by the general public interchangeably.

1.3.28**telecoil**

internal induction coil of a hearing device that receives electromagnetic signals, such as those emitted by hearing loop systems and neckloops, and is activated by the T-switch on the hearing device to select the telecoil program, or a button on a remote control for the hearing device

Note 1 to entry: The terms T-switch and telecoil are used by the general public interchangeably.

1.3.29**wi-fi**

wireless system that allows smartphones, tablets and/or computers to connect to the internet, including hotspots, within a particular area

1.4 Abbreviations

EWIS	Emergency warning and intercom system
FM	Frequency modulation
ms	millisecond

r.m.s root mean square

Section 2 Hearing augmentation system

2.1 General

The ability to effectively hear and understand sound impacts upon communication. For any degree of hearing loss, effective speech intelligibility relies on an appropriate acoustic environment.

Other aspects to be considered are—

- (a) reverberation due to reflections of sound;
- (b) background noise from building services, equipment, and occupants;
- (c) distance from the sound source, and volume and shape of the room;
- (d) relationship between sender and receiver, including direct line of sight; and
- (e) other variable factors such as contents of the room, crowd size, and the like.

NOTE The above factors relate directly to hearing. Indirect factors also apply, which affect lip reading, including lighting, non-reflectiveness and anti-glare and reading captions on-screen.

2.2 Types

2.2.1 General

Hearing augmentation systems shall be one, or a combination, of the following:

- (a) Hearing loop system (referred to as an audio frequency induction loop system).
- (b) Receiver systems (referred to as systems requiring the use of receivers).

NOTE 1 Systems requiring use of receivers fall into two categories:

- (a) Modulated radio transmission systems, including but not limited to FM digital, wireless technology to connect hearing devices to mobile/cellular devices and sound field systems which include receivers.
- (b) Non-visible light systems, which are line of sight systems (referred to as infrared systems).

NOTE 2 Hearing augmentation systems for counters or similar are specified in [Clauses 2.11, 3.3, and 7.2](#).

2.2.2 Terminology

2.2.2.1 Hearing loop system

A hearing loop system is known by the following terms, acronyms or abbreviations:

- (a) Hearing loop system (most common term in use).
- (b) Audio loop.
- (c) Hearing augmentation (includes hearing loop systems and receiver systems).
- (d) Audio frequency induction loop system (AFILS).
- (e) Audio induction loop system (AILS).
- (f) Hearing aid loop.
- (g) Loop.
- (h) Powered audio induction loop system (PAILS).

(i) Deaf aid loop

NOTE The above terms are usually used with or without the word “system”.

The term “deaf aid loop” shall not be used to describe a hearing loop system.

2.2.2.2 Receiver systems

A receiver system, or part of a receiver system shall not be referred to by, labelled with or include any of the terms in [Clause 2.2.2.1](#), regardless of whether a neckloop is included with the receiver system.

NOTE There are common misuses of the terminology used to describe hearing loop systems, and receiver systems.

This is particularly prevalent where neckloops are issued with receiver systems, being then referred to as hearing loop system, which they are not.

2.2.3 Hearing loop system

A hearing loop system emits an electromagnetic signal at audio frequencies to the hearing device of a user. The benefit of a hearing loop system is that the telecoil is built into many hearing devices, and therefore separate receivers are not required.

A hearing loop system shall conform to [Sections 2](#) and [3](#).

2.2.4 Receiver system

2.2.4.1 General

The following requirements apply to receiver systems:

- (a) They shall consist of receivers and transmitter(s)/emitters.
- (b) They shall be either —
 - (i) modulated radio systems ([Clause 2.2.4.2](#)); or
 - (ii) infrared systems ([Clause 2.2.4.3](#)).
- (c) They shall have a latency (i.e. the time difference in synchronisation between visual, amplification audio and receiver audio) must be less than or equal to 40 ms.

NOTE 1 The term “Receiver System” is used by the NCC

NOTE 2 For additional details regarding latency see [Appendix D](#).

2.2.4.2 Modulated radio system

2.2.4.2.1 Types

Modulated radio systems are most commonly referred to as FM systems, even though they include digital systems.

A modulated radio system may be any one of the following:

- (a) Traditional FM.
- (b) 2.4 GHz, or other frequency, using digital transmission.
- (c) Public broadcast FM including digital audio broadcasting (DAB) or digital FM.

- (d) Wi-fi with latency less than 40 ms.
- (e) Mobile/cellular network with latency less than 40 ms.

Wireless technology to connect hearing devices to mobile/cellular devices

Modulated radio systems shall conform to [Sections 2](#) and [4](#).

2.2.4.2.2 Public wi-fi system and mobile/cellular network

A number of devices can be attached to a wi-fi system and mobile/cellular network, which enables the audio to be streamed through the wi-fi system or mobile/cellular network to a user's personal device (usually with a dedicated application).

The wi-fi system or mobile/cellular network shall conform to [Sections 2](#) and [4](#), including provision of receivers.

NOTE 1 Systems advertised as low latency is not evidence of conformance to latency of less than or equal to 40 ms, as latency is contributed to by a number of factors, including the wi-fi router and other elements of the wi-fi system.

NOTE 2 Wi-fi systems have a typical latency between 100 ms and 500 ms. Latency varies widely between different wi-fi systems. See [Clause D.1](#) for important information regarding latency.

NOTE 3 One method to achieve the required latency may be to provide a separate network for hearing augmentation wi-fi, and testing the latency with the minimum number of receivers required by the NCC.

2.2.4.2.3 Wireless technology to connect hearing devices to mobile/cellular devices system

The wireless technology to connect hearing devices to mobile/cellular devices shall conform to [Sections 2](#) and [4](#), including provision of receivers.

NOTE 1 While some hearing devices have inbuilt wireless technology to connect hearing devices to mobile/cellular devices, the majority do not. Of those available only the more expensive models have inbuilt functionality.

NOTE 2 Wireless technology to connect hearing devices to mobile/cellular devices is not commonly used as hearing augmentation.

2.2.4.3 Infrared system

Infrared systems shall conform to [Sections 2](#) and [5](#), including provision of receivers.

NOTE Non-visible light systems are commonly referred to as infrared systems.

2.3 Inbuilt amplification system — Definition

An inbuilt amplification is defined as permanently installed equipment that delivers sound, whether for entry, information, entertainment, or for the provision of a service.

Inbuilt amplification systems include the following:

- (a) Where the loudspeakers are mounted in the ceiling or on the walls, including:
 - (i) Audio visual system.
 - (ii) Public address system.
 - (iii) Paging system.
 - (iv) Music system.

- (v) Background music system.
- (vi) Video conferencing system.
- (b) Mounted speakers.
- (c) Wall or ceiling mounted television, regardless of whether it includes a soundbar.
- (d) Wall or ceiling mounted monitor that includes an audio capability, regardless of whether that audio capability includes a soundbar.
- (e) Sound field system.
- (f) Where the emergency warning intercommunication system (EWIS) is used for any other additional purpose than emergency warning.

NOTE 1 For inbuilt amplification systems at counters see [Clauses 2.11, 3.3, and 7.2](#).

The use of captions or subtitles in no way reduces the requirements for hearing augmentation systems.

NOTE 2 The following groups may find captions unusable: non-English speaking background, vision impaired, out of sight of captions, at a distance at which captions appear too small, elderly, dyslexic etc.

2.4 Emergency warning intercom system (EWIS)

If the EWIS is used for any additional purpose other than emergency warning, it shall be deemed to be an inbuilt amplification system. The area covered by the inbuilt amplification system shall include a hearing augmentation system.

2.5 Coverage and receiver quantities

2.5.1 Coverage

The hearing augmentation system shall cover the following:

- (a) All wheelchair seating spaces.
- (b) In areas with more than one seating option—
 - (i) each area of seating shall include hearing augmentation; and
 - (ii) coverage in each area shall not be less than the coverage requirements.

NOTE 1 Examples of areas with more than one seating category are theatres, stadiums, and places of worship.

NOTE 2 An example is a theatre with the main floor and one balcony. Both the main floor and the balcony must have hearing augmentation, and both must separately meet the coverage requirements of [Clause 2.5.2](#), depending on whether the hearing augmentation system is a hearing loop system or infrared system. In addition, all wheelchair seating spaces must be included in the hearing augmentation coverage regardless of their locations.

- (c) Where an inbuilt amplification system is capable of sending concurrent audio signals to different areas, with different sound sources, including where there are removable or bifold walls, or multiple speaker zones, the following apply:
 - (i) Each area shall have its own hearing augmentation system utilizing the signal(s) for that area.
 - (ii) Signal/s shall include all sound sources in that area (e.g. all microphones and the TV, etc).

- (iii) The hearing augmentation system for each area shall —
 - (A) have the required percentage coverage of the space; and
 - (B) if a receiver system, have the required number of receivers and attachments.

NOTE 3 An example of the above is a large room in a conference centre that can be split up into separate meeting rooms, where each room has its own microphones, TVs etc. These are frequently called speaker zones and are particularly common where removable/bifold walls are used.

NOTE 4 Solutions for the above may include —

- (a) a separate hearing loop in each area;
- (b) a radio system with separate channels for each room; or
- (c) an infrared system for each room.

2.5.2 Hearing loop system coverage

In addition to the requirements of [Clause 2.5.1](#) —

- (a) hearing loop system coverage shall be measured and recorded; and
- (b) where two hearing augmentation systems are within 5 m of each other, if either are hearing loop systems, the hearing loop systems shall be phased dual array type systems, consisting of two hearing loop amplifiers, a 90° phase shifter and two loop cables interlaced.

NOTE The two hearing loop amplifiers and the 90° phase shifter are commonly combined as one unit.

2.6 Receivers

2.6.1 Battery

Each receiver shall have a minimum battery life of 6 h.

2.6.2 Attachments

Where a receiver system is provided, each receiver shall be provided with one binaural headset, and one neckloop.

NOTE 1 Where a receiver is provided with an integrated headset, one way to conform to this clause is to provide an additional receiver with a neckloop.

NOTE 2 Receivers used by people who are hearing-impaired require a louder output than normal and need attachments for use both with the telecoil on the hearing device (e.g. neckloop) and acoustically (e.g. headphones).

2.7 Signal source

The hearing augmentation system shall be permanently connected to the inbuilt amplification system so that all the signals from the loudspeakers of the inbuilt amplification system go to, and are fully accessed by, the hearing augmentation system.

NOTE Examples of signal sources include speech, television, music, video conferencing, inbuilt amplification, etc.

2.8 Power source

Transmitters shall not contain batteries except where the transmitter is built into a microphone. Repeaters shall not contain batteries.

NOTE 1 Both non-rechargeable and rechargeable batteries will fail and subsequently leak, releasing corrosive elements and damaging the transmitter/emitter, causing it to fail. As the transmitter/emitter is mains powered, the failed batteries will not be revealed until the unit is damaged.

NOTE 2 Wherever possible, the mains power to the hearing augmentation system should be connected in such a way that when the inbuilt amplification system is powered, the hearing augmentation is also powered. One example is to connect the hearing augmentation systems to the same socket-outlet (previously known as GPO – General Power Outlet) as the inbuilt amplification system. This is to ensure that the hearing augmentation system is powered and operational whenever required, that is when the inbuilt amplifications system (sound source such as microphone, television, PA, music, etc.), is being used.

2.9 Loop listener

Every hearing augmentation system shall include a loop listener for testing the hearing loop system or for testing the neckloop of the receiver system.

The loop listener shall:

- (a) Contain a telecoil pickup, compatible with hearing loop system.
- (b) Have a volume control that is either continuously variable or can be adjusted in steps of no more than 2 dB increments.
- (c) Have a volume range of 30 dB.
- (d) Have a headset socket that is 3.5 mm tip, ring, sleeve (TRS).
- (e) Be provided with a stereo headsets and batteries. The headset shall not be monaural.
- (f) Have a maximum acoustic output of the combined receiver and headset shall be between 110 dB SPL and 125 dB SPL.

NOTE The loop listener should remain in the area where the hearing augmentation system is located.

2.10 Technical specifications

The hearing augmentation system shall meet the requirements of [Section 2](#), [Clauses 3.1](#), [3.2](#), [4](#), [5](#) and [7.1](#).

2.11 Hearing augmentation system at counter

2.11.1 Type

A hearing augmentation system at a counter (see [Clause 1.3.3](#)) shall be a permanently installed hearing loop system conforming to this Clause, and [Clauses 3.3](#), and [7.2](#).

2.11.2 Screen at a counter

A screen, obstruction, substance, material or blockage separating the two sides of a counter shall be deemed to be a barrier, except where there is a continuous opening that is —

- (a) not less than 400 mm wide at any point above the counter top up to a height of 1.8 m above finished floor level; and
- (b) centred opposite the service provider.

Obstructions may be within the opening, provided that they are —

- (i) not greater than 10 % of the area of the opening; and
- (ii) not greater than 10 mm wide at any location in the opening.

NOTE 1 Further information regarding where hearing augmentation systems are required is detailed in the NCC and in the Disability (Access to Premises — Buildings) Standards (see Bibliography).

NOTE 2 The minimum of 400 mm for the opening is based on the width of a person's head including ears, plus an allowance for movement by either party, as well as that different people will sit/stand in slightly different places.

NOTE 3 An example of a screen at counter is shown in [Figure 2.11.2](#).

NOTE 4 For counters without barriers, a permanent hearing loop system should be provided where communication or a transaction occurs across the counter.

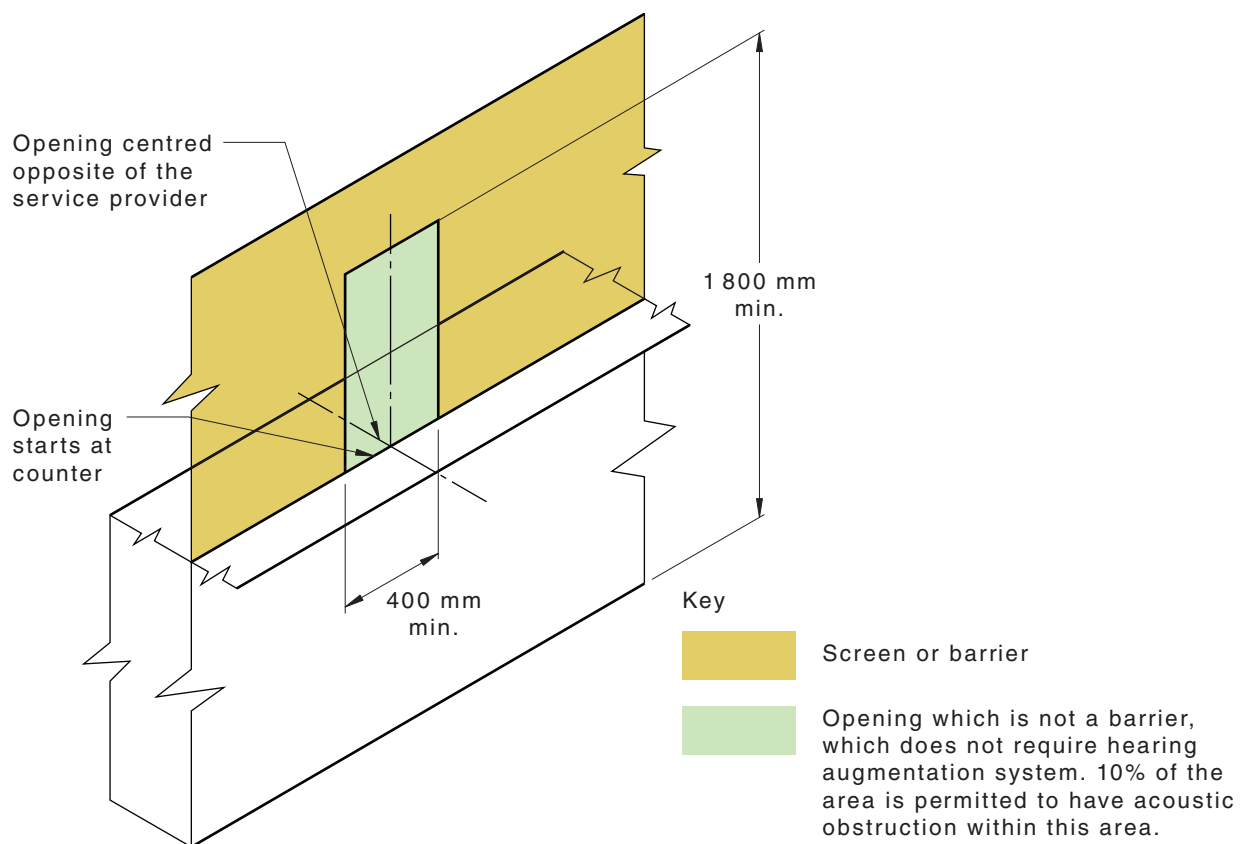


Figure 2.11.2 — Example of a screen at counter

2.11.3 Power source

Where inbuilt amplification is installed in a counter, the mains power to the hearing augmentation system shall be connected in such a way that when the inbuilt amplification system is powered, the hearing augmentation system is also powered.

NOTE One example is to connect the hearing augmentation systems to the same socket-outlet as the inbuilt amplification system. This is to ensure that the hearing augmentation system is powered and operational whenever required, that is when inbuilt amplification is being used.

2.11.4 Loop listener

Where a hearing loop system is installed at one or more counters, one loop listener, which conforms with [Clause 2.9](#), for testing the hearing loop system shall be provided for testing all the counter hearing loop systems. Where counter hearing loop systems occur on more than one floor in a building, each floor with counter hearing loop systems shall have one loop listener.

NOTE The loop listener should remain in the area where the counter loops are located.

2.12 Microphones

2.12.1 General

Where more than four microphones are required and microphones cannot be switched off or muted manually, an automatic mixer shall be installed which includes automatic muting.

All testing using microphones shall be performed using the microphone in the fashion and at the levels at which the microphone in the given situation will be used in practice.

NOTE 1 An example is that when talking into a microphone at a lectern, the person is to stand up straight and talk (as if to an audience). The person is not to bend over and talk closer to the microphone, as this is not the way the system will be used.

The following microphones shall not be used for or with hearing augmentation systems, unless the signal from these microphones is fed through the speakers of the inbuilt amplification:

- (a) Table microphones.
- (b) Ceiling microphones.
- (c) Gooseneck non-directional microphones.
- (d) Boundary non-directional microphones.

NOTE 2 These types of microphones defeat the purpose of hearing augmentation system due to room reverberation and therefore they severely degrade speech intelligibility.

NOTE 3 When used with a hearing augmentation system, the following microphones should be used only within the distance specified from the mouth of the person speaking:

- (a) Head worn — 5 mm to 50 mm.
- (b) Lapel or body worn microphone — 80 mm to 200 mm.
- (c) Hand-held microphone — less than 100 mm.
- (d) Gooseneck directional — 300 mm to 600 mm.
- (e) Boundary hypercardioid or unidirectional microphone — 150 mm to 500 mm.

NOTE 4 Boundary hypercardioid or unidirectional microphones are placed on the table or counter directly in front of the person speaking.

NOTE 5 The specified limits help to ensure adequate speech intelligibility by minimizing the effects of room reverberation.

Section 3 Hearing loop system

3.1 Telecoil orientation

For a hearing device with an electromagnetic induction telecoil (commonly called T-switch), the telecoil is the antenna that receives the signal from the hearing loop system. The telecoil is mounted vertically in the hearing device worn by the user i.e. a coil of conductive material wound around a vertical core.

The measurements shall be performed with a measuring device with a vertically orientated pick-up coil.

NOTE An example of a hearing aid and the telecoil is shown in [Figure 3.1](#).

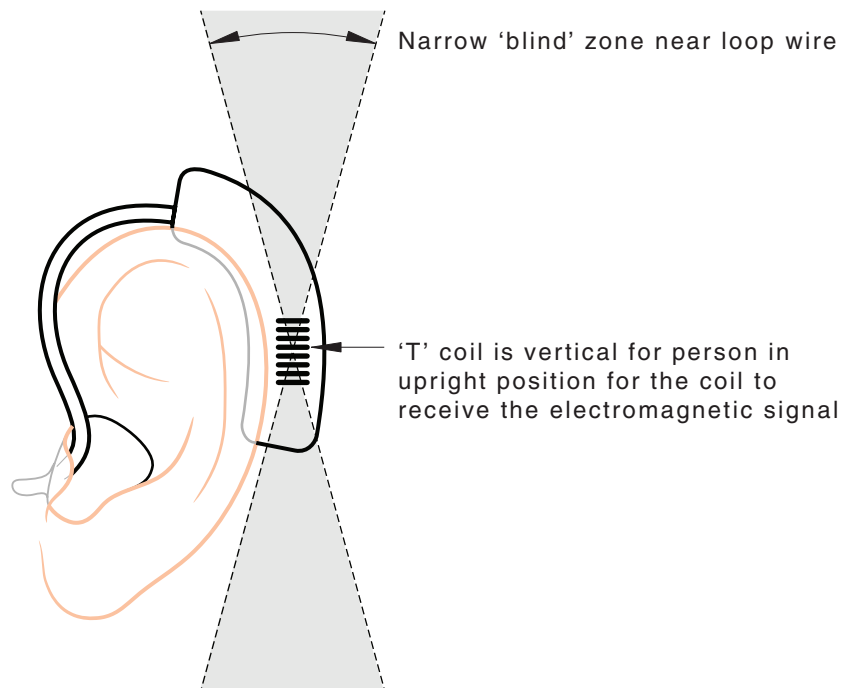


Figure 3.1 — Telecoil in hearing aid

3.1.1 Blind zones

For a hearing loop system which is not a phased dual array, the area either side of the hearing loop cable shall be excluded from the coverage area as follows:

- (a) 500 mm if the hearing cable is below 200 mm above floor level.
- (b) 1 000 mm if the hearing loop cable is above 2000 mm above floor level.

NOTE The telecoil in a hearing device is mounted vertically, and consequently can only receive electromagnetic signals in the vertical field.

Therefore, in regard to a perimeter loop, when the hearing device is over the top of, or under, a hearing loop cable, only the horizontal field is present. As the hearing device moves to the inside of the perimeter loop, the field strength of the vertical field increases.

Even though the signal may reach sufficient field strength, relatively close to the cable, slight movements of the head of the person wearing the hearing device can cause the signal level to fluctuate, making the system unsuitable for people who are deaf or hearing impaired when in close proximity to the hearing loop cable.

NCC performance requirement is that a system “must be suitable for occupants who are deaf or hearing impaired.”