



DRAFT INTERNATIONAL STANDARD ISO/DIS 24504

ISO/TC 159/SC 5

Secretariat: BSI

Voting begins on
2012-12-29

Voting terminates on
2013-03-29

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Ergonomics — Accessible design — Sound pressure levels of spoken announcements for products and public address systems

ICS 13.180

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

Pour accélérer la distribution, le présent document est distribué tel qu'il est parvenu du secrétariat du comité. Le travail de rédaction et de composition de texte sera effectué au Secrétariat central de l'ISO au stade de publication.

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENT AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Full standard:
<https://standards.iteh.ai/catalog/standards/sist/91842e0f-d700-4a10-b3aa-7db167803803/iso-24504-2014>

Copyright notice

This ISO document is a Draft International Standard and is copyright-protected by ISO. Except as permitted under the applicable laws of the user's country, neither this ISO draft nor any extract from it may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, photocopying, recording or otherwise, without prior written permission being secured.

Requests for permission to reproduce should be addressed to either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Reproduction may be subject to royalty payments or a licensing agreement.

Violators may be prosecuted.

Contents

Page

Foreword	iv
Introduction.....	v
1 Scope.....	vi
2 Normative references.....	vi
3 Terms and definitions	vii
4 Symbols.....	viii
5 Range of sound pressure level of spoken announcements	ix
5.1 General	ix
5.2 Criteria to determine the speech level	ix
5.3 Uncertainty of environment.....	ix
5.4 A-weighted sound pressure level method to determine the speech level	x
5.5 Simplified STI method to determine minimum speech level	xi
Annex A (normative) Method for measuring the sound pressure level of spoken announcements and ambient noise	xiii
A.1 Introduction.....	xiii
A.2 Method.....	xiii
A.2.1 Types of measurement	xiii
A.2.2 Measuring devices	xiii
A.2.3 Measurement acoustical conditions of a space and installation of a signal source	xiii
A.2.4 Measurement position	xiv
A.2.5 Measurement of sound pressure levels.....	xiv
Annex B (informative) Effect of age-related hearing loss on word recognition	xv
B.1 Introduction.....	xv
B.2 Relation between PTA, gender and age.....	xv
B.3 Relation between word recognition scores and signal-to-noise ratio.....	xvi
B.4 Variation of word recognition scores.....	xvii
B.5 Required improvement of signal-to-noise ratio for older listeners.....	xix
Annex C (informative) Example record of measurement conditions and results	xx
C.1 Introduction.....	xx
C.2 Example of recording sheet	xx
Annex D (informative) STI method to determine minimum speech level.....	xxii
D.1 Introduction.....	xxii
D.2 Impulse response measurement	xxii
D.3 Measuring device	xxii
D.4 Measurement space and installation of a signal source.....	xxii
D.5 Measurement position	xxii
D.6 Measurement procedure of impulse response of transmission channel.....	xxiii
D.7 Procedures to determine the minimum speech level with octave band speech level and STI	xxiii
Bibliography.....	xxv
6 Scope.....	Error! Bookmark not defined.

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 24504 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 5, *Ergonomics of the Physical Environment*.

This is the first edition

ITeH STANDARD PREVIEW
(standards.iteh.ai)
Full standard:
<https://standards.iteh.ai/catalog/standards/sist/84260f-d700-4a10-b3aa-7db167803803/iso-24504-2011>

Introduction

In the present day, people conduct their daily lives surrounded by various products that use spoken announcements, such as home electrical appliances, information and telecommunication products, office-automation equipment, heating equipment, toys, sanitary equipment, and health-care products. Some products use spoken announcements for instructions in indoor and outdoor public areas such as ticket vending machines, elevators, and escalators. Public-address systems are installed to provide spoken announcements for users of spaces in public facilities with a single loudspeaker. These spoken announcements can be indistinct to listeners because of hearing loss that can occur with aging or because of ambient noise in the surroundings.

This International Standard specifies methods for determining a proper sound level range of spoken announcements so that all listeners, including people with age-related hearing loss, can hear them properly against ambient noises. This sound level range specification was determined based on results of experiments in which people of different ages participated. Spoken announcements for which sound pressure levels are within the range specified in this standard are expected to be audible and comfortably loud for most users in the presence of ambient noises.

This International Standard should be applied as necessary to products, depending on the product type and its conditions of use. It does not apply to spoken announcements used for evacuation and emergency purposes.

This International Standard adopts the principles of accessible design from ISO/IEC Guide 71, which are amplified in ISO/TR 22411.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Full standard:
<https://standards.iteh.ai/catalog/standards/sist/91842e0f-d700-4a10-b3aa-7db167803803/iso-24504-2014>

Ergonomics — Accessible design — Sound pressure levels of spoken announcements for products and public address

1 Scope

This International Standard specifies methods to determine an appropriate sound pressure level range for spoken announcements in noisy environments. The specified method follows the concepts of ISO/IEC Guide 71 and includes consideration of older persons with decreased hearing ability to determine sound pressure levels of spoken announcements. The spoken speech levels that are specified in this standard are for products and public-address systems. Spoken announcements shall be not only audible but also presented at comfortable speech levels to improve their usability and acceptability. This standard specifies a different method from ISO 9921, which specifies recommended levels of speech-communication quality necessary for conveying comprehensive messages in different applications. This standard does not specify any requirement for sound pressure levels of spoken announcements.

The target products that present spoken announcements are consumer products such as electronic home appliances, information and communication technology services, and products providing services for general users in public facilities indoors and outdoors such as train stations, airports, meeting rooms, amusement parks, and fairs.

This standard is applicable to spoken announcements that are audible to native speakers of the language of the announcement with normal hearing for their age when presented by a target product under quiet and anechoic conditions. This standard is applicable for both recorded voice and synthetic speech announcements. This standard is applicable when a loudspeaker producing a spoken announcement is located at a short distance from the user in the environment where the A-weighted sound pressure level of ambient noise does not exceed 80 dB.

This standard does not specify sound pressure levels of spoken announcements for systems with automatic sound pressure level control to compensate for fluctuating ambient noise levels. This standard is not applicable to spoken announcements heard through headphones or earphones, nor to spoken announcements heard with the ear close to the speech sound source, such as in ear loudspeakers specified in IEC 60268-7. This standard considers only the audibility of speech and not the process of speech understanding.

This standard does not specify the sound pressure levels of spoken announcements presented in emergency situations such as signals for fire alarms, gas leakage and crime prevention; those are covered in ISO 7240-16 and ISO 7240-19. This standard does not specify the sound pressure levels of spoken announcements in automobiles; those are covered in ISO 15006.

2 Normative references

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

ISO 1996-1, *Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and procedures*

ISO 8253-1, *Acoustics – Audiometric test methods - Part 1: Pure-tone air and bone conduction audiometry*

ISO 389-1, *Acoustics – reference zero for the calibration of audiometric equipment – Part 1: reference equivalent threshold sound pressure levels for the pure tones and supra-aural earphones*

ISO 3382-2:2008, *Acoustics – Measurement of room acoustic parameters – Part 2: Reverberation time in ordinary rooms*

IEC 60050-801, *International Electrotechnical Vocabulary – Chapter 801: Acoustical and electroacoustics*

IEC 61260, *Electroacoustics – Octave-band and fractional-octave-band filters*

IEC 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*

IEC 60268-16, *Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission index*

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in IEC 60050-801 and IEC 60268-16, and the following apply.

3.1

spoken announcement

message presented by a human voice, a synthesized voice or a recorded/digitized human voice

NOTE Spoken announcements provided by specific products to limited users, with fewer than three messages are easily distinguished and require a lower S/N ratio.

3.2

ambient noise

sound other than the sound to be measured as signal

NOTE For this standard, spoken announcements are regarded as signals.

3.5

speech transmission channel

acoustic and/or electro-acoustic signal path between a source of signal and a user

3.6

speech transmission index (STI)

metric ranging between 0 and 1 representing the transmission quality of speech with respect to speech intelligibility by a speech transmission channel (IEC 60268-16)

3.7

simplified STI

metric ranging between 0 and 1 representing the transmission quality of speech with respect to speech intelligibility by a speech transmission channel calculated only with octave band sound pressure level difference between the sound pressure level of spoken announcements and sound pressure level of ambient noise based on STI specified in IEC 60286-16

NOTE simplified STI does not account for effects of reverberation.

3.8

speech level

A-weighted or octave band equivalent sound pressure level of a spoken announcement

3.3

signal-to-noise ratio (S/N)

relative sound pressure level of signal measured to ambient noise

**3.9
minimum speech level**

speech level with standard frequency weightings A at which all listeners can achieve perfect recognition of spoken information

**3.10
maximum speech level**

speech level with standard frequency weighting A at which half of the listeners feel that the spoken announcement is too loud

**3.11
audibility**

extent to which the words of spoken announcements are recognizable by the listeners

**3.12
hearing threshold level (HTL)**

for a specified signal and a specified manner of signal presentation under specified conditions according to ISO 8253-1, a level of sound at which a person gives 50% of corrected detection responses on repeated trials at the reference point minus the reference equivalent threshold sound pressure levels specified in ISO 389-1

**3.14
reverberation time (T)**

duration required for the space-averaged sound energy density in an enclosure to decrease by 60 dB after the source emission has stopped

NOTE The reverberation time is expressed in seconds.

4 Symbols

Symbols used in this document are the following:

- I STI or simplified STI calculated as a weighted average of T_i from 125 Hz to 8 kHz octave bands.
- $L_{N,A}$ sound pressure level of ambient noise with standard frequency weighting A, in decibels, as measured using the method specified in Annex A.
- $L_{N,i}$ an octave-band sound pressure level of ambient noise in band i , in decibels, as measured using the method specified in Annex A.
- $L_{S,A}$ speech level with standard frequency weighting A, in decibels, as measured using the method specified in Annex A.
- $L_{S,i}$ an octave-band sound pressure level of spoken announcements in band i , in decibels, as measured using the method specified in Annex A.
- R_A signal-to-noise ratio in decibels ($L_{S,A} - L_{N,A}$).
- R_i an octave-band signal-to-noise ratio in band i , in decibels ($L_{S,i} - L_{N,i}$).
- R'_i an octave-band signal-to-noise ratio in band i , considering reverberation for calculation of STI, in decibels.

T_i a transmission index of octave band i , presented as a metric rating between 0 to 1.

5 Range of sound pressure level of spoken announcements

5.1 General

The range of the sound pressure level of spoken announcements shall be determined with a minimum speech level and a maximum speech level. The minimum speech level for older users is higher than that for young users, as presented in Annex B. To determine the speech level with consideration of older users, a minimum speech level for older users shall be used. The maximum speech level is same for both young and older users. Usually, an A-weighted speech level ranges from 50 to 90 dB at 1 m distance from a talker [7].

When a spoken announcement with a fixed sound pressure level is used, the level shall be adjusted to fall between the minimum and the maximum speech levels as calculated according to this standard. When the sound level is controllable by the users, the level shall be variable to cover at least the entire range.

The A-weighted sound pressure level method is the simplest method, but it has limitations. It shall not be applied when ambient noise has a dominant tonal component and in the case of noises that are predominantly low-frequency noises. In these cases, the effect of ambient noise will not be estimated correctly. The simplified STI method, which is based on STI specified in IEC 60286-16, is applicable for broadband noise both with and without dominant narrow band components. This method is more accurate than the A-weighted sound pressure level method.

NOTE In the condition where required conditions for both methods listed above cannot be followed, the STI method described in IEC 60268-16 is useful.

5.2 Criteria to determine the speech level

The required signal-to-noise ratio used to determine the minimum speech level for older adults with various hearing ability can be estimated with the information provided in Annex B. Typical older listeners with 20 dB of pure-tone average hearing level (PTA), which is arithmetic average of hearing-threshold-level of 0,5, 1, 2, and 4 kHz, requires 5 dB signal-to-noise ratio, which corresponds to 0,65 of STI, or better for perfect understanding of a clearly spoken single word in an anechoic condition.

Maximum speech level shall be determined by following 5.4. The level is applicable for both young and older users.

5.3 Uncertainty of environment

The effect of reverberation in the enclosed spaces and distance between a signal source and a listener shall be regarded as determining the speech level in an environment. To adapt the criteria of STI 0,65 in a closed or a semi-closed space, signal-to-noise ratio shall be given allowance for uncertainty of an environment.

Another uncertainty is the quality of speech and factors related to listening conditions. Annex B presents results of variation of a word recognition test conducted in six countries. The difference of mean scores between different languages for young listeners is around 5 dB.

Using spoken announcements for consumer products and present instruction to the users, they are expected to be around the product. A simulation method of STI standardized in Annex L of IEC 60268-16, 2 m of distance between a signal source to the users will meet the criteria 0,65 of STI under a typical reverberant environment when the signal-to-noise ratio is 10 dB.

Figure 1 presents the typical relation between the signal-to-noise ratio and STI with distance of 2 m. At distances greater than 2 m, sound reflections might detrimentally affect speech transmission under usual reverberant conditions.