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**Ergonomics—Accessible design—
Sound pressure levels of auditory
signals for consumer products**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

Consequently **JIS S 0014**:2009 is replaced with this Standard.

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Ergonomics—Accessible design— Sound pressure levels of auditory signals for consumer products

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **ISO 24501** published in 2010 without any modifications of technical contents.

The portions with dotted underlines are the matters not given in the corresponding International Standard.

This Standard was established in 2003. And then based on it **ISO 24501** was published in 2010 as the first edition.

People conduct their daily lives surrounded by various consumer products. Consumer products, as defined in **ISO 20282-1**, include home electrical appliances, information and telecommunication products, gas-heating equipment, toys, sanitary equipment, and health-care products, many of which use auditory signals. These auditory signals can be indistinct because of the hearing loss which occurs with ageing or because of interfering sounds in the surroundings. Also, with age, our visual ability declines gradually. Auditory signals with an appropriate sound level can assist product users with auditory or visual impairment in using the product correctly and safely.

This Standard specifies methods for determining an appropriate sound level range of auditory signals, so that all product users, including people with age-related hearing loss, can hear them properly against interfering sounds. This sound level range specification was determined, based on results of experiments in which people of all ages participated. Auditory signals whose sound pressure level is in that range are expected to be audible and comfortably loud for most users in the presence of interfering sounds.

This Standard should be applied as appropriate to products, depending on the product type and its conditions of use. It does not apply to machines and equipment used for professional work.

This Standard adopts the principles of accessible design given in **JIS Z 8071** and amplified in **ISO/IR 22411**.

1 Scope

This Standard specifies methods for determining the sound pressure level range of auditory signals so that the users of consumer products, including people with age-related hearing loss, can hear the signal properly in the presence of interfering sounds.

Auditory signals, in this Standard, refer to sounds with a fixed frequency (also called beep sounds) and do not include variable frequency sounds, melodic sounds, or voice guides.

This Standard is applicable to auditory signals which are heard in the room¹⁾ at an approximate maximum distance of 4 m from the product, as long as no physical

barrier exists between the product and the user. It is not applicable to auditory signals heard through a head receiver or earphones, or to those heard with the ear located very near to the sound source because of the interference of the head with sound propagation.

This Standard does not specify the sound pressure level of auditory signals regulated by other statutes, such as those for fire alarms, gas leakages and crime prevention, nor does it specify auditory signals particular to a communication tool such as telephones.

This Standard does not specify auditory danger signals for public or work areas which are covered in **ISO 7731**, **ISO 8201**, and **ISO 11429**.

Note ¹⁾ For auditory signals which are heard at a distance exceeding 4 m between the product and the user, or in the presence of a wall between the two, higher sound pressure level than those specified in this Standard may be needed.

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 24501:2010 *Ergonomics—Accessible design—Sound pressure levels of auditory signals for consumer products* (IDT)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions (including amendments) indicated below shall be applied.

JIS C 1509-1 *Electroacoustics—Sound level meters—Part 1: Specifications*

NOTE : Corresponding International Standard: IEC 61672-1 *Electroacoustics—Sound level meters—Part 1: Specifications* (IDT)

JIS C 1514 *Electroacoustics—Octave-band and fractional-octave-band filters*

NOTE : Corresponding International Standard: IEC 61260 *Electroacoustics—Octave-band and fractional-octave-band filters* (IDT)

JIS S 0013 *Guidelines for older persons and persons with disabilities—Auditory signals for consumer products*

NOTE : Corresponding International Standard: ISO 24500:2010 *Ergonomics—Accessible design—Auditory signals for consumer products* (IDT)

JIS Z 8106 *International electrotechnical vocabulary Chapter 801: Acoustics and electroacoustics*

NOTE : Corresponding International Standard: IEC 60050-801 *International Electrotechnical Vocabulary—Chapter 801: Acoustics and electroacoustics* (IDT)

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in **JIS S 0013** and **JIS Z 8106** and the following apply.

3.1 product actuation sound

sound generated by actuation of the consumer product which incorporates the auditory signal to be designed

Example: A cooling-fan noise.

3.2 living environment sound

sound generated in the room where the consumer product which incorporates the auditory signal to be designed is used

NOTE : This includes a sound generated by user behaviour (e.g. sound of water generated when washing dishes in a kitchen) or an actuation sound of some other product incorporating the auditory signal to be designed (e.g. actuation sound of a vacuum cleaner).

3.3 interfering sound

product actuation sound or living environment sound which is likely to have the greatest effect on audibility of the auditory signal to be designed

3.4 ambient noise

sound other than the sound to be measured as an auditory signal or as an interfering sound at the measurement location

Example: Outside traffic noise.

4 Symbols

For the purposes of this Standard, the following symbols apply.

- a) $L_{S,A}$: A-weighted sound pressure level of an auditory signal, in decibels, measured using the method specified in Annex A.
- b) $L_{N,A}$: A-weighted sound pressure level of interfering sound, in decibels, measured using the method specified in Annex B.
- c) $L_{S,oct}$: level of the frequency band, in decibels, which has the maximum value among octave-band sound pressure levels of auditory signals, measured using the method specified in Annex A.
- d) $L_{N,oct}$: octave-band sound pressure level, in decibels, of interfering sound at the same frequency band as $L_{S,oct}$, measured using the method specified in Annex B.
- e) $L_{S,1/3oct}$: level of the frequency band, in decibels, which has the maximum value among one-third-octave-band sound pressure levels of auditory signals, measured using the method specified in Annex A.
- f) $L_{N,1/3oct}$: one-third-octave-band sound pressure level, in decibels, of interfering sound at the same frequency band as $L_{S,1/3oct}$, measured using the method specified in Annex B.

5 Range of sound pressure levels of auditory signals

5.1 General

The range of sound pressure levels of auditory signals shall be determined following the procedure in **5.2** or **5.3**, depending on whether the masking effect of interfering sound is taken into consideration or not.

When an auditory signal with a fixed sound level is used, the level shall be selected to fall in the range specified by application of the method. When the sound level is controllable by the user, the level shall be variable to cover the entire range.

NOTE : It is important for designers to consider the implication of adjustable volume controls with respect to caution signals, if the adjustable range extends below the lower end specified by application of the method. An example of the record of measurement conditions and results is shown in Annex C. Some examples of measurement and range setting of the sound pressure level of auditory signals are shown in Annex D.

5.2 When not considering the masking effect of an interfering sound

5.2.1 General

For a case in which the masking effect of interfering sound can be ignored because its level is very low, only the users' hearing-ability change which occurs with ageing is considered for setting the range of the sound pressure level of the auditory signal.

The range of the sound pressure level shall be determined in accordance with either method using octave-band analysis or one-third-octave-band analysis, both of which are described in **5.2.2**. For the methods for measuring the sound pressure level using octave-band analysis and one-third-octave-band analysis, see Annex A.

NOTE : The method using one-third-octave-band analysis provides a more accurate range of sound pressure levels because the auditory signal is analysed more precisely with a narrower frequency bandwidth.

5.2.2 Method using octave-band analysis or one-third-octave-band analysis

The range of the sound pressure level of the auditory signal determined using octave-band analysis or one-third-octave-band analysis shall be as described below.

a) **Lower end of $L_{S,oct}$ or $L_{S,1/3oct}$** The lower end of $L_{S,oct}$ or $L_{S,1/3oct}$ shall be determined as follows.

1) The lower end of $L_{S,oct}$ and $L_{S,1/3oct}$ shall be as given in tables 1 and 2, respectively.

Table 1 Lower end of $L_{S,oct}$

Centre frequency of band Hz	250	500	1 000	2 000	4 000 ^{b)}
Sound pressure level dB	30 ^{a)}	25	25	35	60
Notes ^{a)} The value of this frequency band is applied only to extremely quiet conditions. ^{b)} The fundamental frequency of the auditory signal should not be higher than 2 500 Hz (see JIS S 0013). The values of those frequency bands are for auditory signals of specific products only (e.g. very small products in which only a tiny, high-frequency sound device can be implemented).					

Table 2 Lower end of $L_{S,1/3oct}$

Centre frequency of band Hz	250 to 315	400 to 1 250	1 600	2 000	2 500	3 150 ^{b)}	4 000 ^{b)}
Sound pressure level dB	30 ^{a)}	25	30	35	40	50	60
Notes ^{a)} The value of this frequency band is applied only to extremely quiet conditions. ^{b)} The fundamental frequency of the auditory signal should not be higher than 2 500 Hz (see JIS S 0013). The values of those frequency bands are for auditory signals of specific products only (e.g. very small products in which only a tiny, high-frequency sound device can be implemented).							

- 2) Make the lower-end level higher than the value specified in 1) by 5 dB, to ensure signal perception in the case of reception and start signals, starting position signals, end signals (case of hearing at a position distant from the product), and strong caution signals with repeat counts of fewer than five times, in accordance with the classification of auditory signals specified in clause 5 of **JIS S 0013**.

b) **Upper end of $L_{S,oct}$ or $L_{S,1/3oct}$** The upper end of $L_{S,oct}$ or $L_{S,1/3oct}$ shall be determined as follows.

- 1) The upper end shall be 70 dB for auditory signals with a frequency of 2 500 Hz or lower.
- 2) Make the upper-end level higher than the value specified in 1) by 5 dB, to ensure signal perception in the case of end signals (case of hearing at a position distant from the product) and strong caution signals in accordance with the classification of auditory signals specified in clause 5 of **JIS S 0013**.

5.3 When taking the masking effect of interfering sound into consideration

For a case in which the masking effect of assumed interfering sound in the environment for use of the product and the users' hearing-ability change with ageing are considered, the range of the sound pressure level of the auditory signal shall be determined so that any of the methods in 5.3.1 to 5.3.3 is met. For the procedures of octave-band analysis and one-third-octave-band analysis, see Annexes A and B.