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(ASJ/JSA)

**Acoustics — Measurement of floor impact
sound insulation of buildings — Part 2:
Method using standard heavy impact
sources**

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Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Measuring apparatus	3
5 Measuring method	3
5.1 General	3
5.2 Generation of floor impact sound	3
5.3 Installation method of microphone	3
5.4 Frequency band for measurement	3
5.5 Measurement of maximum sound pressure level	4
5.6 Correction of background noise effect	4
5.7 Calculation of impact sound pressure level	4
6 Expression of measurement result	5
7 Report	5
Annex A (normative) Specifications of standard heavy impact sources	6
Annex B (informative) Example of standard heavy impact sources	9
Annex C (informative) Calibration method of impact force of standard heavy impact sources	13
Annex D (informative) Comparison table between previous and current editions of this Standard on technically significant revisions	15

Foreword

This Japanese Industrial Standard has been revised by the Minister of Land, Infrastructure, Transport and Tourism through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Acoustical Society of Japan (ASJ)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS A 1418-2:2000** is replaced with this Standard.

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JIS A 1418 series consists of the following 2 parts under the general title *Acoustics — Measurement of floor impact sound insulation of buildings* :

Part 1 : Method using standard light impact source

Part 2 : Method using standard heavy impact sources

Acoustics — Measurement of floor impact sound insulation of buildings — Part 2 : Method using standard heavy impact sources

Introduction

The measuring method of floor impact sound insulation of buildings, using standard light impact sources, is specified in **JIS A 1418-1** that corresponds to **ISO 16283-2**, and this method aims the measurement of the impact sound insulation when comparatively light and hard impact such as walking in shoes is applied to a floor. On the other hand, in addition to the above impact, the impact sound due to comparatively heavy and soft impact such as jumping up and down or running around of a child often becomes a problem. In response to that, the measuring method using standard heavy impact sources was specified in the previous edition, **JIS A 1418** : 1995. This Japanese Industrial Standard has been established in 2000 as **JIS A 1418-2** by dividing the contents of **JIS A 1418** : 1995, gone through three confirmations, and been revised for the first time to correspond to some modifications of the technical contents.

No corresponding International Standard has been established at this point. The comparison table between previous and current editions of this Standard on technically significant revisions is given in Annex D.

1 Scope

This Standard specifies the measuring method of the floor impact sound insulation of buildings using standard heavy impact sources. The evaluation method of the impact sound pressure level measured in accordance with this Standard is specified in **JIS A 1419-2**, using single number quantities.

2 Normative references

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

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

JIS C 1513 *Octave-band and third-octave-band analyzers for sounds and vibrations*

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

JIS C 1515 *Electroacoustics — Sound calibrators*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1

maximum sound pressure level L_{Fmax}

maximum value of sound pressure level measured using time-weighting F of sound level meter (noise meter)

NOTE 1 Maximum sound pressure level is expressed in decibels (dB).

NOTE 2 Maximum sound pressure level measured using frequency-weighting A of sound level meter is called maximum A-weighting sound pressure level ($L_{A,Fmax}$).

3.2

average maximum sound pressure level in a room $L_{k,Fmax}$

average among the measured values of maximum sound pressure level, when the point on the target floor in a sound receiving room is excited by the standard heavy impact source specified in Annex A

NOTE 1 Average maximum sound pressure level is expressed in decibels (dB).

NOTE 2 Average maximum sound pressure level measured using frequency-weighting A of sound level meter is called average maximum A-weighting sound pressure level in a room ($L_{kA,Fmax}$).

3.3

impact sound pressure level $L_{i,Fmax}$

average among the measured values of average maximum sound pressure level in a room, when two or more points on the target floor are excited by the standard heavy impact source specified in Annex A

NOTE 1 Impact sound pressure level is expressed in decibels (dB).

NOTE 2 Impact sound pressure level measured using the frequency-weighting A of sound level meter is called the A-weighting impact sound pressure level ($L_{iA,Fmax}$).

3.4

impact force $F(t)$

instantaneous value of the force applied to a floor when an impact source is dropped on the floor

NOTE Impact force is expressed in newtons (N).

3.5

impact force exposure level L_{FE}

ten times the common logarithm of the value obtained by dividing the integrated value over the full-time of the squared impact force due to an impact source by the squared reference force, which is obtained according to Formula (1)

NOTE Impact force exposure level is expressed in decibels (dB).

$$L_{FE} = 10 \log_{10} \left[\frac{1}{T_0} \int_{t_1}^{t_2} \frac{F^2(t)}{F_0^2} dt \right] \dots\dots\dots (1)$$

where, $F(t)$: impact force (N)
 F_0 : reference force (1 N)
 $t_2 - t_1$: time including impact time due to impact source (s)
 T_0 : reference time (1 s)

4 Measuring apparatuses

The following measuring apparatuses suitable for the measuring method specified in Clause 5 shall be used.

- a) **Standard heavy impact source** That conforming to the requirements specified in Annex A.
- b) **Sound level meter (noise meter)** As specified in JIS C 1509-1.

The sensitivity of the complete measuring apparatuses including microphones shall be adjusted in advance, using the sound calibrator specified in JIS C 1515. If a sound level meter calibrated for the measurements of plane progressive waves in sound field is used, a diffuse field correction shall apply.

- c) **Frequency analyser** Octave-band filters or one-third-octave-band filters specified in JIS C 1514.

Real-time spectrum analyser conforming to the requirements specified in JIS C 1509-1 and JIS C 1513 may be used.

5 Measuring method

5.1 General

Measurements shall be carried out on each octave-band and/or one-third-octave-band.

5.2 Generation of floor impact sound

The target floor shall be excited using the standard heavy impact source specified in Annex A to generate the impact sound. The impact positions shall be equally distributed three to five points, including one point near the centre of the flat plane of floor 50 cm or more apart from the peripheral walls of room. The target floor shall be a smooth and flat plane to such an extent that the standard heavy impact source can be dropped without hindrance.

5.3 Installation method of microphone

In the sound receiving room, four or more measuring points 70 cm or more apart from each other shall be spatially and uniformly distributed in a space that is 50 cm or more apart from the ceiling, peripheral walls, floor surface, etc.

5.4 Frequency band for measurement

The maximum sound pressure level shall be measured in the bands having the following centre frequencies.

Octave-band measurement : 63 Hz, 125 Hz, 250 Hz and 500 Hz

One-third-octave-band

measurement : 50 Hz, 63 Hz, 80 Hz, 100 Hz, 125 Hz, 160 Hz, 200 Hz, 250 Hz, 315 Hz, 400 Hz, 500 Hz and 630 Hz

If the measurement in low-frequency band is required, a frequency band having the centre frequency 31.5 Hz shall be added for the octave-band measurement, and bands having the centre frequencies 25 Hz, 31.5 Hz or 40 Hz for the one-third-octave-band measurement.

5.5 Measurement of maximum sound pressure level

The maximum sound pressure level ($L_{Fmax,j}$) of each frequency band for every excitation point shall be measured, using the time-weighting F of sound level meter at all the measuring points. The background noise level shall always be checked in the measurement.

5.6 Correction of background noise effect

If the difference between the maximum sound pressure level of the sound generated due to the standard heavy impact source and the sound pressure level of the background noise is 6 dB or over to and excluding 15 dB, the sound pressure level shall be obtained from which the background noise effect is removed according to Formula (2). When the difference is less than 6 dB, the measurement result of sound pressure level shall be recorded as a reference value without this correction.

$$L_{Fmax} = 10 \log_{10} (10^{L'_{Fmax}/10} - 10^{L_b/10}) \dots\dots\dots (2)$$

where, L_{Fmax} : corrected maximum sound pressure level (dB)

L'_{Fmax} : measured value of maximum sound pressure level including background noise effect (dB)

L_b : sound pressure level of background noise (dB)

5.7 Calculation of impact sound pressure level

In each frequency band, the average maximum sound pressure level in a room shall be calculated according to Formula (3) for every excitation point, and the result shall be rounded off to the first decimal place.

$$L_{k,Fmax} = 10 \log_{10} \left(\frac{1}{m} \sum_{j=1}^m 10^{L_{Fmax,j}/10} \right) \dots\dots\dots (3)$$

where, $L_{k,Fmax}$: average maximum sound pressure level in a room (dB)

$L_{Fmax,j}$: measured value of maximum sound pressure level at j th measuring point (dB)

m : number of measuring points

The impact sound pressure level ($L_{i,Fmax}$) in each frequency band shall be calculated by arithmetically averaging the values of average maximum sound pressure level in a

room obtained from Formula (3), and the result shall be rounded off to the first decimal place.

6 Expression of measurement result

The measurement results shall be expressed using diagrams and tables. The graduations of diagram shall be taken so that the width of octave becomes 15 mm (5 mm for the width of one-third octave) and 10 dB becomes 20 mm. The measurement result for each frequency shall be plotted by a dot, and each dot shall be connected by a straight line one by one.

The case where the value for each octave-band is calculated using the measurement results of one-third-octave-band shall be in accordance with Formula (4).

$$L_{i,Fmax,oct} = 10 \log_{10} \left(\sum_{j=1}^3 10^{L_{i,Fmax,1/3oct,j}/10} \right) \dots\dots\dots (4)$$

where, $L_{i,Fmax,oct}$: impact sound pressure level for each octave-band (dB)

$L_{i,Fmax,1/3oct,j}$: impact sound pressure level for one-third-octave-band included in relevant octave band (dB)

NOTE Uncertainties of measurement results can be confirmed in accordance with **ISO 12999-1**.

7 Report

The following information shall be described in the report with the measurement results.

- a) Number of this Standard
- b) Name of test laboratory
- c) Name and address of client
- d) Date of measurement
- e) Explanations on structure of buildings (floor plan, detail diagram of floor cross-section, interior finish, etc.) and measurement conditions (relation between target floor for measurement and sound receiving room, positions of excitation points, arrangement of measuring points, etc.)
- f) Volume of sound receiving room
- g) Measurement result of impact sound pressure level $L_{i,Fmax}$

NOTE Measurement result of A-weighting impact sound pressure level $L_{iA,Fmax}$, as appropriate

- h) Explanations on measuring method and apparatus
- i) Indication of measurement limit like $L_{i,Fmax} \leq \dots$ dB, if the measurement result is affected by background noise (including electrical noise)
- j) Other references (if abnormal sound such as rattling of house is heard at the time of measurement, its position and degree, situations of indoor furniture, etc.)