FINAL
DRAFT

INTERNATIONAL
STANDARD

**ISO/FDIS
717-2**

ISO/TC **43**/SC **2**

Secretariat: DIN

Voting begins on:
2020-09-16

Voting terminates on:
2020-11-11

Acoustics — Rating of sound insulation in buildings and of building elements —

Part 2:
Impact sound insulation

Acoustique — Évaluation de l'isolement acoustique des immeubles et des éléments de construction —

Partie 2: Protection contre le bruit de choc

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/FDIS 717-2:2020(E)

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Published in Switzerland

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 126, *Acoustic properties of building elements and of buildings,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 717-2:2013), which has been technically revised.

The main changes compared to the previous edition are as follows:

— A new Annex D with a method for rating heavy/soft impact sound insulation using an A-weighted maximum impact sound pressure level.

A list of all parts in the ISO 717 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Methods of measurement of impact sound insulation in buildings and of building elements have been standardized in ISO 10140-3 and ISO 16283-2. These methods give values for the impact sound insulation which are frequency dependent. The purpose of this document is to standardize a method whereby the frequency-dependent values of impact sound insulation can be converted into a single number characterizing the acoustical performance.

Acoustics — Rating of sound insulation in buildings and of building elements —

Part 2:
Impact sound insulation

1 Scope

This document

a) defines single-number quantities for impact sound insulation in buildings and of floors,

b) gives rules for determining these quantities from the results of measurements carried out in one-third-octave bands in accordance with ISO 10140-3 and ISO 16283-2, and in octave bands in accordance with that option in ISO 16283-2 for field measurements only,

c) defines single-number quantities for the impact sound reduction of floor coverings and floating floors calculated from the results of measurements carried out in accordance with ISO 10140-3, and

d) specifies a procedure for evaluating the weighted reduction in impact sound pressure level by floor coverings on lightweight floors.

The single-number quantities in accordance with this document are intended for rating impact sound insulation and for simplifying the formulation of acoustical requirements in building codes. An additional single-number evaluation in steps of 0,1 dB is indicated where it is needed for the expression of uncertainty (except for spectrum adaptation terms). Numerical values of the single-number quantities are specified where required for calculations.

The rating of measurements over an enlarged frequency range is given in Annex A.

A method for obtaining single-number quantities for bare heavy floors according to their performance in combination with floor coverings is given in Annex B.

Example calculations of single-number quantities are given in Annex C.

The rating of measurements with a heavy and soft impact source (rubber ball) is given in Annex D.

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. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10140-1, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 1: Application rules for specific products*

ISO 10140-3:2010, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 3: Measurement of impact sound insulation*

ISO 10140-5, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 5: Requirements for test facilities and equipment*

ISO 12999-1, *Acoustics — Determination and application of measurement uncertainties in building acoustics — Part 1: Sound insulation*

ISO 16283-2:2018, *Acoustics — Field measurement of sound insulation in buildings and of building elements — Part 2: Impact sound insulation*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
single-number quantity for impact sound insulation rating
value of the relevant reference curve at 500 Hz after shifting it in accordance with the method specified in 4.3.1 or the value of the relevant reference curve at 500 Hz after shifting it in accordance with the method specified in 4.3.2, reduced by 5 dB

Note 1 to entry: Terms and symbols for the single-number quantity used depend on the type of measurement. Examples are listed in Table 1 for impact sound insulation properties of building elements and in Table 2 for impact sound insulation in buildings. In general, new single-number quantities are derived in a similar way.

Note 2 to entry: This quantity is expressed in decibels.

3.2
spectrum adaptation term
C_I
value to be added to the single-number quantity (e.g. L_n) to take account of the unweighted impact sound level, thereby representing the characteristics of typical walking noise spectra

Note 1 to entry: This quantity is expressed in decibels.

3.3
weighted reduction in impact sound pressure level
difference between the weighted normalized impact sound pressure levels derived with a bare heavy reference floor or a lightweight reference floor, without and with a floor covering

Note 1 to entry: The quantity derived with a bare heavy reference floor is denoted by ΔL_w and is expressed in decibels.

Note 2 to entry: The quantity derived with a lightweight reference floor is denoted by $\Delta L_{t,w}$ and is expressed in decibels. According to the type of reference floor it is denoted as $\Delta L_{t1,w}$, $\Delta L_{t2,w}$, $\Delta L_{t3,w}$.

3.4
equivalent weighted normalized impact sound pressure level of a bare heavy floor
$L_{n,eq,0,w}$
sum of the weighted normalized impact sound pressure level of the bare floor under test with the reference floor covering and the weighted reduction in impact sound pressure level of the reference floor covering

Note 1 to entry: This quantity is calculated in accordance with the method specified in this document.

Note 2 to entry: This quantity is expressed in decibels.

3.5
A-weighted maximum impact sound pressure level
$L_{iA,Fmax}$
A-weighted maximum impact sound pressure level determined with Fast time-weighting when measured with a heavy and soft impact source, the rubber ball

Note 1 to entry: This quantity is expressed in decibels.

Note 2 to entry: For field measurements it is denoted as $L'_{\mathrm{i,Fmax}}$.

Note 3 to entry: It is determined as described in ISO 10140-3, ISO 10140-5 or ISO 16283-2. The reported values are averaged over all receiving points and all source positions.

3.6
Standardized A-weighted maximum impact sound pressure level
$L_{\mathrm{iA,Fmax,}V,T}$
A-weighted maximum impact sound pressure level determined with Fast time-weighting when measured with a heavy and soft impact source, the rubber ball, and increased by a correction term for room volume and reduced by a correction term for reverberation time and Fast time weighting

Note 1 to entry: This quantity is expressed in decibels.

Note 2 to entry: For field measurements it is denoted as $L'_{\mathrm{i,Fmax,}V,T}$.

Note 3 to entry: It is determined as described in ISO 10140-3, ISO 10140-5 or ISO 16283-2. The reported values are averaged over all receiving points and all source positions.

4 Procedure for evaluating single-number quantities for impact sound insulation rating

4.1 General

The values obtained in accordance with ISO 10140-3 and ISO 16283-2 are compared with reference values (see 4.2) at the frequencies of measurement within the range 100 Hz to 3 150 Hz for measurements in one-third-octave bands or 125 Hz to 2 000 Hz for measurements in octave bands.

The comparison shall be carried out in accordance with 4.3.

Table 1 — Single-number quantity for impact sound insulation of floors

Derived from one-third-octave band values		Defined in	
Single-number quantity	Term and symbol		
Weighted normalized impact sound pressure level, $L_{\mathrm{n,w}}$	Normalized impact sound pressure level, L_{n}	ISO 10140-3:2010	Formula (1)

Table 2 — Single-number quantities for impact sound insulation in buildings

Derived from one-third-octave band or octave band values		Defined in	
Single-number quantity	Term and symbol		
Weighted normalized impact sound pressure level, $L'_{\mathrm{n,w}}$	Normalized impact sound pressure level, L'_{n}	ISO 16283-2:2018	Formula (3)
Weighted standardized impact sound pressure level, $L'_{\mathrm{n}T\mathrm{,w}}$	Standardized impact sound pressure level, $L'_{\mathrm{n}T}$	ISO 16283-2:2018	Formula (1)

4.2 Reference values

The set of reference values used for comparison with measurement results shall be as given in Table 3. The reference curves are shown in Figures 1 and 2.

NOTE The reference values for the octave bands 125 Hz to 1 000 Hz are equivalent to the energetic sum (rounded to integers) of these for the relevant one-third-octave band. The energetic sum from one-third-octave bands 800 Hz, 1 000 Hz and 1250 Hz is 61,41 dB which is rounded to 61 dB. Despite this, the reference value for the octave band 1 000 Hz is 62 dB to keep it consistent with older versions of this standard. The reference value for the octave band 2 000 Hz has been reduced to take care of the one-third-octave band 3 150 Hz, which (for bare heavy floors) can contribute considerably to the unfavourable deviations.

4.3 Method of comparison

4.3.1 Measurements in one-third-octave bands

To evaluate the results of a measurement of L_n, L'_n or L'_{nT} in one-third-octave bands, the measurement data shall be given to one decimal place.1) Shift the reference curve in increments of 1 dB (0,1 dB for the purpose of expression of uncertainty) towards the measured curve until the sum of unfavourable deviations is as large as possible but not more than 32,0 dB.

An unfavourable deviation at a particular frequency occurs when the results of measurements exceed the reference value. Only the unfavourable deviations shall be taken into account.

The value, in decibels, of the reference curve at 500 Hz, after shifting it in accordance with this procedure, is $L_{n,w}$, $L'_{n,w}$ or $L'_{nT,w}$ respectively.

Table 3 — Reference values for impact sound

Frequency Hz	Reference values dB One-third-octave bands	Reference values dB Octave bands
100	62	
125	62	67
160	62	
200	62	
250	62	67
315	62	
400	61	
500	60	65
630	59	
800	58	
1 000	57	62
1 250	54	

1) The different parts of ISO 10140 and ISO 16283 state that the results shall be reported “to one decimal place”. However, if the octave or one-third-octave values have been reported with more than one decimal digit, the values shall be reduced to one decimal place before use in the calculation of the single number rating. This is done by taking the value in tenths of a decibel closest to the reported values: XX,XYZ ZZ ... is rounded to XX,X if Y is less than 5 and to XX,X + 0,1 if Y is equal to or greater than 5. Software developers should ensure that this reduction applies to the true input values and not only to the displayed precision (as shown on the screen or printed on paper). Generally this can be implemented by the following sequence of instructions: multiply the (positive) number XX,XYZ ZZ ... by 10 and add 0,5, take the integer part and then divide the result by 10. For further details see ISO 80000-1[1].

Table 3 *(continued)*

Frequency	Reference values dB	
Hz	One-third-octave bands	Octave bands
1 600	51	
2 000	48	49
2 500	45	
3 150	42	

4.3.2 Measurements in octave bands

To evaluate the results of a measurement of L'_{n} or $L'_{\mathrm{n}T}$ in octave bands, the measurement data shall be given to one decimal place.[1)] Shift the reference curve in increments of 1 dB (0,1 dB for the purpose of expression of uncertainty) towards the measured curve until the sum of unfavourable deviations is as large as possible but not more than 10,0 dB.

The value, in decibels, of the reference curve at 500 Hz, after shifting it in accordance with this procedure and then reducing it by 5 dB is $L'_{\mathrm{n,w}}$ or $L'_{\mathrm{n}T,\mathrm{w}}$, respectively.

An unfavourable deviation at a particular frequency occurs when the results of measurements exceed the reference value. Take into account only the unfavourable deviations.

4.4 Statement of results

The appropriate single-number quantity shall be given with reference to this document. The results of measurements shall also be given in the form of a diagram as specified in ISO 10140-3 and ISO 16283-2.

The uncertainty of the weighted single-number quantities may also be stated, in accordance with ISO 12999-1. In this case the numbers shall be given to one decimal place.

EXAMPLE

$L_{\mathrm{n,w}}$ = 53,2 db ± 1,0 db

Spectrum adaptation terms do not have uncertainty values of their own.

For field measurements in accordance with ISO 16283-2, it shall be stated whether the single-number quantity is calculated from results in one-third-octave bands or octave bands. In general, there can be differences between single-number quantities calculated from one-third octave or octave band measurements of about ±1 dB. Ratings based on one-third octave band measurements are preferred.