INTERNATIONAL STANDARD

ISO 717-1

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

Part 1: Airborne sound insulation

Acoustique — Évaluation de l'isolement acoustique des immeubles et des éléments de construction —
Partie 1: Isolement aux bruits aériens

Reference number
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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.

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 717-1 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*.

This third edition cancels and replaces the second edition (ISO 717-1:1996), which has been technically revised. It also incorporates the Amendment ISO 717-1:1996/Amd. 1:2006.

The purpose of this revised version is to:

— allow weighting steps of 0,1 dB to be used for expression of uncertainty;

— update references.

ISO 717 consists of the following parts, under the general title *Acoustics — Rating of sound insulation in buildings and of building elements*:

— *Part 1: Airborne sound insulation*

— *Part 2: Impact sound insulation*

Introduction

Methods of measurement of airborne sound insulation of building elements and in buildings have been standardized e.g. in ISO 10140-2, ISO 140-4, and ISO 140-5. The purpose of this part of ISO 717 is to standardize a method whereby the frequency-dependent values of airborne sound insulation can be converted into a single number characterizing the acoustical performance.

References to standards which provide data for single-number evaluation are meant to be examples and therefore are not complete.

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

Part 1: Airborne sound insulation

1 Scope

This part of ISO 717:

a) defines single-number quantities for airborne sound insulation in buildings and of building elements such as walls, floors, doors, and windows;

b) takes into consideration the different sound level spectra of various noise sources such as noise sources inside a building and traffic outside a building;

c) gives rules for determining these quantities from the results of measurements carried out in one-third-octave or octave bands in accordance with ISO 10140-2, ISO 140-4, and ISO 140-5.

The single-number quantities in accordance with this part of ISO 717 are intended for rating airborne 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 for the expression of uncertainty (except for spectrum adaptation terms). The required numerical values of the single-number quantities are specified according to varying needs. The single-number quantities are based on results of measurements in one-third-octave bands or octave bands.

For laboratory measurements made in accordance with ISO 10140, single-number quantities should be calculated using one-third-octave bands only.

The rating of results of measurements carried out over an enlarged frequency range is dealt with in Annex B.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 140-4:1998, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 4: Field measurements of airborne sound insulation between rooms*

ISO 140-5:1998, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 5: Field measurements of airborne sound insulation of façade elements and façades*

ISO 10140-2:2010, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 2: Measurement of airborne sound insulation*

ISO 10848-2:2006, *Acoustics — Laboratory measurement of the flanking transmission of airborne and impact sound between adjoining rooms — Part 2: Application to light elements when the junction has a small influence*

3 Terms and definitions

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

3.1
single-number quantity for airborne sound insulation rating
value, in decibels, of the reference curve at 500 Hz after shifting it in accordance with the method specified in this part of ISO 717

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 airborne sound insulation properties of building elements and in Table 2 for airborne sound insulation in buildings. In general, new single-number quantities are derived in a similar way.

3.2
spectrum adaptation term
value, in decibels, to be added to the single-number rating (e.g. R_w) to take account of the characteristics of particular sound spectra

Note 1 to entry: Two sound spectra are defined (in one-third-octave bands and in octave bands) in this part of ISO 717.

Note 2 to entry: Annex A gives information on the purpose of introducing these two spectrum adaptation terms.

Table 1 — Single-number quantities of airborne sound insulation properties of building elements

Derived from one-third-octave band values		Defined in	
Single-number quantity	**Term and symbol**		
Weighted sound reduction index, R_w	Sound reduction index, R	ISO 10140-2:2010	Formula (2)
Weighted normalized flanking level difference, $D_{n,f,w}$	Normalized flanking level difference, $D_{n,f}$	ISO 10848-2:2006	Formula (1)
Weighted element-normalized level difference, $D_{n,e,w}$	Element-normalized level difference, $D_{n,e}$	ISO 10140-2:2010	Formula (5)

Table 2 — Single-number quantities of airborne sound insulation in buildings

Derived from one-third-octave or octave band values		Defined in	
Single-number quantity	**Term and symbol**		
Weighted apparent sound reduction index, R'_w	Apparent sound reduction index, R'	ISO 140-4:1998	Formula (5)
Weighted apparent sound reduction index, $R'_{45°,w}$	Apparent sound reduction index, $R'_{45°}$	ISO 140-5:1998	Formula (3)
Weighted apparent sound reduction index, $R'_{tr,s,w}$	Apparent sound reduction index, $R'_{tr,s}$	ISO 140-5:1998	Formula (4)
Weighted normalized level difference, $D_{n,w}$	Normalized level difference, D_n	ISO 140-4:1998	Formula (3)
Weighted standardized level difference, $D_{nT,w}$	Standardized level difference, D_{nT}	ISO 140-4:1998	Formula (4)
Weighted standardized level difference, $D_{ls,2m,nT,w}$ or $D_{tr,2m,nT,w}$	Standardized level difference, $D_{ls,2m,nT}$ or $D_{tr,2m,nT}$	ISO 140-5:1998	Formula (7)

4 Procedure for evaluating single-number quantities

4.1 General

The values obtained in accordance with ISO 10140-2, ISO 140-4, and ISO 140-5 are compared with reference values (see 4.2) at the frequencies of measurement within the range 100 Hz to 3 150 Hz for one-third-octave bands and 125 Hz to 2 000 Hz for octave bands.

The comparison shall be carried out as specified in 4.4.

Furthermore, two spectrum adaptation terms shall be calculated (see 4.5) based on two typical spectra within the frequency range as quoted above. These two terms may optionally be supplemented by additional spectrum adaptation terms covering (if need be and if measured data are available) a wider frequency range between 50 Hz and 5 000 Hz.

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 Figure 1 and Figure 2.

Table 3 — Reference values for airborne sound

Frequency	Reference values dB	
Hz	One-third-octave bands	Octave bands
100 125 160	33 36 39	36
200 250 315	42 45 48	45
400 500 630	51 52 53	52
800 1 000 1 250	54 55 56	55
1 600 2 000 2 500	56 56 56	56
3 150	56	

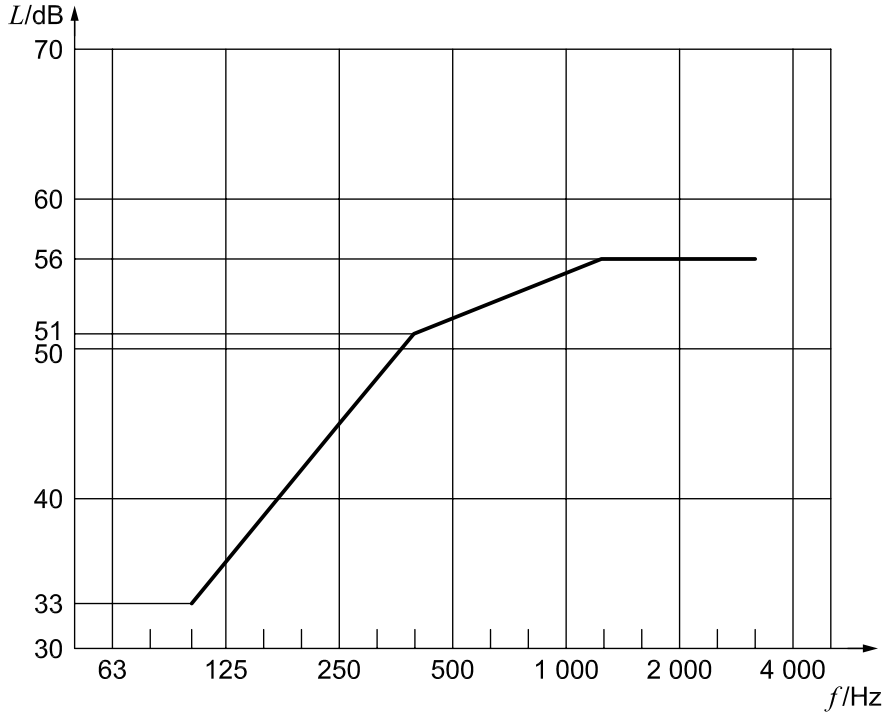
4.3 Sound spectra

The set of sound spectra in one-third-octave bands and octave bands to calculate the spectrum adaptation terms shall be as given in Table 4 and shown in Figure 3 and Figure 4. The spectra are A-weighted and the overall spectrum level is normalized to 0 dB.

4.4 Method of comparison

To evaluate the results of a measurement made in accordance with ISO 10140-2, ISO 140-4, and ISO 140-5 in one-third-octave bands (or octave bands), the measurement data shall be given to one decimal place.[1)] Shift the relevant reference curve in increments of 1 dB (0,1 dB for the 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 (measurement in 16 one-third-octave bands) or 10,0 dB (measurement in 5 octave bands).

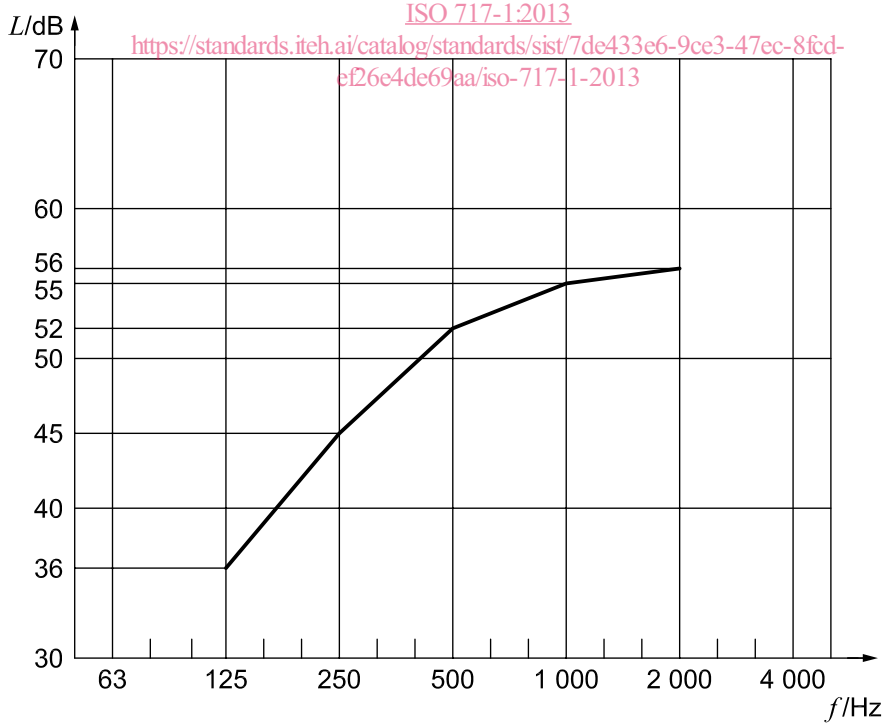
1) The different parts of ISO 140 state that the results shall be reported “to one decimal place”. However, if the octave or one-third-octave values have been reported with more than one decimal digit, the values shall be reduced to one decimal place before use in the calculation of the single number 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]



Key

L reference value *f* frequency

Figure 1 — Curve of reference values for airborne sound, one-third-octave bands



Key

L reference value *f* frequency

Figure 2 — Curve of reference values for airborne sound, octave bands

Table 4 — Sound level spectra to calculate the adaptation terms

Frequency	**Sound levels, L_{ij}** dB			
Hz	**Spectrum No. 1 to calculate C**		**Spectrum No. 2 to calculate C_{tr}**	
	One-third octave	Octave	One-third octave	Octave
100 125 160	−29 −26 −23	−21	−20 −20 −18	−14
200 250 315	−21 −19 −17	−14	−16 −15 −14	−10
400 500 630	−15 −13 −12	−8	−13 −12 −11	−7
800 1 000 1 250	−11 −10 −9	−5	−9 −8 −9	−4
1 600 2 000 2 500	−9 −9 −9	−4	−10 −11 −13	−6
3 150	−9		−15	
NOTE All levels are A weighted and the overall spectrum level is normalized to 0 dB.				