INTERNATIONAL STANDARD

ISO 140-12

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

Part 12: Laboratory measurement of room-to-room airborne and impact sound insulation of an access floor

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

Partie 12: Mesurage en laboratoire de la transmission latérale entre deux pièces des bruits aériens et des bruits de choc par un plancher surélevé

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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 3.

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 member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 140 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 140-12 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this standard, read "...this European Standard..." to mean "...this International Standard...".

ISO 140 consists of the following parts, under the general title *Acoustics — Measurement of sound insulation in buildings and of building elements*:

— *Part 1: Requirements for laboratory test facilities with suppressed flanking transmission*

— *Part 2: Determination, verification and application of precision data*

— *Part 3: Laboratory measurements of airborne sound insulation of building elements*

— *Part 4: Field measurements of airborne sound insulation between rooms*

— *Part 5: Field measurements of airborne sound insulation of façade elements and façades*

— *Part 6: Laboratory measurements of impact sound insulation of floors*

— *Part 7: Field measurements of impact sound insulation of floors*

— *Part 8: Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a solid standard floor*

— *Part 9: Laboratory measurement of room-to-room airborne sound insulation of a suspended ceiling with a plenum above it*

— *Part 10: Laboratory measurement of airborne sound insulation of small building elements*

— *Part 11: Measurement of impact sound improvement of light-weight floors*

— *Part 12: Laboratory measurement of room-to-room airborne and impact sound insulation of an access floor*

— *Part 13: Guidelines*

Contents

Foreword

The text of EN ISO 140-12:2000 has been prepared by Technical Committee CEN/TC 126 " Acoustic properties of building products and of buildings", the secretariat of which is held by AFNOR, in collaboration with Technical Committee ISO/TC 43 "Acoustics".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2000, and conflicting national standards shall be withdrawn at the latest by July 2000.

The present draft is a part of a series of standards whose list is given below :

EN ISO 140 "Acoustics - Measurement of sound insulation in buildings and of building elements"

— *Part 1 : Requirements for laboratory test facilities with suppressed flanking transmission (ISO 140-1:1997) ;*

— *Part 2 : Determination, verification and application of precision data (ISO 140-2:1991);*

— *Part 3 : Laboratory measurements of airborne sound insulation of building elements ;*

— *Part 4 : Field measurements of airborne sound insulation between rooms (ISO 140-4:1998);*

— *Part 5 : Field measurements of airborne sound insulation of façade elements and façades (ISO 140-5:1998);*

— *Part 6 : Laboratory measurements of impact sound insulation of floors (ISO 140-6:1998);*

— *Part 7 : Field measurements of impact sound insulation of floors (ISO 140-7:1998);*

— *Part 8 : Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor (ISO 140-8:1997);*

— *Part 9 : Laboratory measurements of room-to-room airborne sound insulation of a suspended ceiling with a plenum above it (ISO 140-9:1985);*

— *Part 10 : Laboratory measurement of airborne sound insulation of small building elements (ISO 140-10:1991);*

— *Part 12 : Laboratory measurement of room-to-room airborne and impact sound insulation of an access floor (ISO 140-12:2000).*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This standard specifies a laboratory method to measure the airborne and impact sound insulation of an access floor with a plenum of defined height mounted below an acoustical barrier which separates two rooms of a specified test facility.

This method utilizes a laboratory space arranged in such a manner that it simulates a pair of horizontally adjacent, typical offices or rooms sharing a common access floor system, plenum space and a dividing wall. The dividing wall extends from the ceiling to the upperside of the floor system which at the junction is either continuous or discontinuous.

The quantities being measured are the airborne and impact sound insulation between two rooms of a specified test facility when the sound transmitted by paths other than the access floor and common plenum space is negligible. These quantities are called the normalized flanking level difference and the normalized flanking impact sound pressure level.

The method can be extended to the study of the additional sound insulation that can be achieved by auxiliary systems, such as material used either as plenum barriers or as backing for all of, or part of the floor.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 20140-2, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 2 : Determination, verification and application of precision data (ISO 140-2:1991).*

EN 20354, Ac*oustics - Measurement of sound absorption in a reverberation room (ISO 354:1985).*

EN 60651, *Sound level meters (IEC 60651).*

EN 60804, *Integrating-averaging sound level meters (IEC 60804).*

EN 61260, *Electroacoustics - Octave-band and fractional-octave-band filters (IEC 61260).*

EN ISO 140-1, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 1 : Requirements of laboratory test facilities with suppressed flanking transmission (ISO 140-1:1997).*

EN ISO 140-3:1995, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 3 : Laboratory measurements of airborne sound insulation of building elements (ISO 140-3:1995).*

EN ISO 140-6:1998, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 6 : Laboratory measurements of impact sound insulation of floors (ISO 140-6:1998).*

EN ISO 717-1, *Acoustics - Rating of sound insulation in buildings and of building elements - Part 1 : Airborne sound installation (ISO 717-1:1996).*

EN ISO 717-2, *Acoustics - Rating of sound insulation in buildings and of building elements - Part 2 : Impact sound insulation (ISO 717-2:1996).*

3 Definitions

For the purposes of this standard, the following definitions apply :

3.1
average sound pressure level in a room
10 times the common logarithm of the ratio of the space and time average of the squared sound pressure to the square of the reference sound pressure, the space average being taken over the entire room with the exception of those parts where the direct radiation of a sound source or the near field of the boundaries (walls, etc.) is of significant influence. This quantity is denoted by L and is expressed in decibels.

If a continuously moving microphone is used, L is determined by :

$$L = 10 \lg \frac{\frac{1}{T_m}\int_0^{T_m} p^2(t)\,dt}{p_0^2} \quad \text{dB} \tag{1}$$

where

p is the sound pressure in pascals ;

p_0 = 20 µPa is the reference sound pressure ;

T_m is the integration time in seconds.

If fixed microphone positions are used, L is determined by :

$$L = 10 \lg \frac{p_1^2 + p_2^2 + \ldots p_n^2}{n p_0^2} \quad \text{dB} \tag{2}$$

where

p_1, $p_2 \ldots p_n$ are r.m.s. sound pressures at n different positions in the room. In practice usually the sound pressure levels L_i are measured. In this case L is determined by :

$$L = 10 \lg \frac{1}{n}\sum_{i=1}^{n} 10^{L_i/10} \quad \text{dB} \tag{3}$$

where

L_i are the sound pressure levels L_1 to L_n at n different positions in the room.

3.2
flanking level difference
the difference in the space and time average sound pressure levels produced in two rooms by a sound source in one of the rooms resulting from the flanking transmission due to the tested element. This quantity is denoted by D_f and is expressed in decibels.

$$D_f = L_1 - L_2 \quad (4)$$

where

L_1 is the average sound pressure level in the source room in decibels;

L_2 is the average sound pressure level in the receiving room in decibels.

3.3
normalized flanking level difference
the flanking level difference corresponding to a reference value of absorption area in the receiving room. This quantity is denoted by $D_{n,f}$ and is expressed in decibels.

$$D_{n,f} = D_f - 10 \lg \frac{A}{A_0} \quad \text{dB} \quad (5)$$

where

A is the equivalent absorption area in the receiving room ;

A_0 is the reference absorption area (for the laboratory, A_0 = 10 m^2).

The maximum value of the normalized flanking level difference of the facility obtained according to 5.1.3 is noted $D_{n,f,max}$.

3.4
flanking impact sound pressure level
the average value of average sound pressure level in the receiving room produced by a standardized tapping machine operating at different positions on the element in the emission room, by the flanking transmission due to the tested element

$$L_f = 10 \lg \left(\frac{1}{n} \sum_i^n 10^{L_i/10} \right) \quad \text{dB} \quad (6)$$

where L_i is the average sound pressure level in the receiving room produced by the tapping machine at position i.

3.5
normalized flanking impact sound pressure level
the flanking impact sound pressure level corresponding to a reference value of absorption area in the receiving room. This quantity is denoted $L_{n,f}$ and is expressed in decibels.

$$L_{n,f} = L_f - 10 \lg \frac{A}{A_0} \quad \text{dB} \quad (7)$$

3.6
plenum space
the whole of the void below the access floor in both rooms in the test facility

4 Measuring equipment

The equipment shall be suitable for meeting the requirements of clause 6.

The tapping machine shall meet the requirements given in annex A of EN ISO 140-6:1998.

The sound level measurement equipment shall meet the requirements of a type 0 or 1 instrument according to EN 60651 and EN 60804.

The third-octave band filters shall meet the requirement of EN 61260.

The reverberation time measurement equipment shall meet the requirements of EN 20354.

NOTE Requirements for pattern evaluation and regular verification tests on the fulfilment of the equipment requirements should be considered. Recommendations on the extend of the evaluation and verification procedure are given for sound level meters in OIML R 58 and R 88, for the standard tapping machine those recommendations are given in annex A of EN ISO 140-6:1996.

5 Test arrangement

5.1 Requirements for the laboratory

The laboratory test facility is divided into two rooms of approximately equal volumes by a wall. The essential features of the test facility are specified in 5.1.1 to 5.1.6 and are shown schematically in figure 1.

5.1.1 Construction of the test facility

The ground plan of the test facility shall be rectangular. A vibration break shall be provided in the floor of the facility between the two rooms in order to ensure that flanking transmission by the floor is negligible.

Vibration breaks in the outer walls and the roof are recommended.

The level of the background noise shall be sufficiently low to permit a measurement of the sound transmitted from the source room, taking into consideration the power output of the source room and the isolating properties of the specimens for which the laboratory is intended. The reverberation time in the rooms should not be excessively long. Where the reverberation time at low frequencies exceeds 2 s or is less than 1 s, a check should be made to determine whether the measured quantities depend on the reverberation time. When such a dependence is found (even with diffusers in the rooms) the room shall be modified to reduce the reverberation time to values between 1 s and not higher than :

$$2\left(\frac{V}{50}\right)^{2/3}\ \text{s}$$

at low test frequencies (V is the room volume in cubic metres).

These requirements refer to the test rooms without test object and a heavy dividing wall.

NOTE For the purposes of determining the reverberation time of each room, a suitable impervious plenum barrier should be installed between the foot of the dividing wall and the floor.

5.1.2 Dimensions of the test facility

The width of the test facility shall be (4,5 ± 0,5) m and the height from the ceiling to the upperside of the face of the access floor shall be at least 2,3 m when all dimensions are measured internally.

The volume V of each room shall be at least 50 m^3. It is recommended that the dividing wall is positioned such that the two rooms volumes differ by at least 10 % when the access floor is in position.

The minimum depth in both room shall be 3,5 m.

NOTE 1 If large variations of the sound pressure levels in the room space indicate standing wave structures, diffusing elements should be installed in the rooms. The positions and the necessary number of elements should be evaluated by experiment with the goal that the measured quantities are not influenced when further diffusing elements are installed.

NOTE 2 The requirements and recommendations, as stated above, are intended to improve reproducibility between measurements made by different organizations on similar materials.

5.1.3 Dividing wall

The dividing wall is the acoustical barrier which divides the test facility above the access floor into two rooms. The dividing wall shall be mounted in such a way that it is not loading the access floor. The gap between the dividing wall and the access floor is sealed with a flexible material. The thickness of the wall shall be less than 200 mm or tapered to 200 mm. The tapering between the widest part of the wall and the floor shall be achieved by means of an angle not exceeding 30° from the vertical. The construction of the dividing wall shall be such that $D_{n,f,max}$ is 10 dB higher than the $D_{n,f}$ of any floor which is likely to be tested.

NOTE For checking the airborne sound insulation of the facility, a suitable plenum barrier of construction similar to the dividing wall can be installed between the foot of the dividing wall and the floor, without the access floor.

5.1.4 Access floor height

The access floor height as measured from the surface of the access floor to the surface of the floor of the test facility shall be 150 mm. If this height is not possible because of constructive reasons, a height as near to 150 mm as possible shall be used. Other heights may be tested if need be.

5.1.5 Plenum lining

One sidewall and both endwalls of the plenum shall be lined with suitable sound-absorbing material. This material shall have such properties that when tested as a plane absorber in accordance with EN 20354, it has sound absorption coefficients not less than those shown in the following table.

Octave band centre frequency in Hz	125	250	500	1 000	2 000	4 000
Sound absorption coefficient, α_s	0,65	0,80	0,80	0,80	0,80	0,80

For the other sidewall and the floor, the sound absorption coefficient shall be less than 0,10 at all frequencies given in the table.

For practical purposes, the thickness of the lining shall not exceed 150 mm.

5.2 Installation of access floor

The area of a floor should be equal to the area given by the length and width of the test facility.

If for practical reasons, the length of the test object should be less than that of the facility, the test object shall have a length of at least 3,5 m and be rigidly terminated.

The floor components shall be representative of those used in practice in actual field installations. The floor shall be installed in accordance with the recommended practice of the manufacturer or with the recommended practice of an installation standard.

6 Test procedure and evaluation

6.1 Generation of sound field in the source room

6.1.1 Airborne noise

The sound generated in the source room shall be steady and have a continuous spectrum in the frequency range considered. Use filters with a bandwidth of at least one-third octave. White noise as source signal is recommended. When using broad band noise the spectrum of the noise source may be modified to ensure an adequate signal to noise ratio at high frequencies in the receiving room. The sound spectrum in the source room shall not have level differences larger than 6 dB between adjacent one-third octave bands.

The sound power should be sufficiently high for the sound pressure level in the receiving room to be at least 15 dB higher than the background level in any frequency band. If this is not fulfilled, corrections shall be applied as shown in 6.5.

If the sound source enclosure contains more than one loudspeaker operating simultaneously, the loudspeakers shall be driven in phase. Multiple sound sources may be used simultaneously, provided that they are of the same type and are driven at the same level by similar, but uncorrelated signals. Continuously moving loudspeakers may be used. When using a single sound source it shall be operated in at least two positions. They shall be in the same room or the measurement shall be repeated in the opposite direction by changing source and receiving room with one or more source positions in each room.

Place the loudspeaker enclosure so as to give a sound field as diffuse as possible and at such a distance from the test specimen that the direct radiation upon it is not dominant and that structure-borne sound transmission through the floor is avoided. The sound fields in the rooms depend strongly on the type and on the position of the sound source. Qualification of the loudspeakers and of the loudspeaker positions shall be performed using the methods used in annex C of EN ISO 140-3:1995. Guidance for the use of continuously moving loudspeakers is given in C.2.5 of EN ISO 140-3:1995.

6.1.2 Impact sound pressure level

The larger room is always the receiving room.

The impact sound shall be generated by the tapping machine (see clause 4). The distance of the tapping machine from the edges of the floor shall be at least 0,5 m and at least 0,8 m from the separating wall, but not more than 3 m (see figure 2). As a minimum, four tapping machine positions evenly distributed in the permitted area shall be used ; in the case of anisotropic floor constructions (with ribs, beams, etc.) more positions can be necessary. The hammer connecting line should be orientated at 45° to the direction of the beams or ribs.

The impact sound levels can reveal a time dependency after the tapping is started. In such a case the measurements should not begin until after the sound level has become steady. If stable conditions are not reached after 5 min, then the measurements should be carried out during a well-defined measurement period. The measurement period shall be reported.

When floors with soft coverings are under test the standard tapping machine shall fulfil special requirements given in annex A of EN ISO 140-6:1998. Advice regarding the mounting of the standard tapping machine on soft floor coverings is given also in annex A of EN ISO 140-6:1998.

6.2 Measurement of the average sound pressure level

6.2.1 General

Obtain the average sound pressure level by using a single microphone moved from position to position or by an array of fixed microphones or by a continuously moving microphone or by swinging the microphone. The sound pressure levels at the different microphone positions shall be averaged on an energy basis (see formulas (1) to (3)) for all sound source positions.

6.2.2 Microphone positions

As a minimum, five microphone positions shall be used in each room ; these shall be distributed within the maximum permitted space throughout each room taking in the room space uniformly. When using a moving microphone the sweep radius shall be at least 1 m. The plane of the traverse shall be inclined in order to cover a large proportion of the permitted room space and shall not lie in any plane within 10° of a room surface.

The duration of a traverse period shall be not less than 15 s. The following separating distances are minimum values and should be exceeded where possible :

a) 0,7 m between microphone positions ;

b) 0,7 m between any microphone position and room boundaries or diffusers ;

c) 1,0 m between any microphone position and the sound source ;

d) 1,0 m between any microphone position and the test specimen.

6.2.3 Averaging time

At each individual microphone position the averaging time shall be at least 6 s at each frequency band with centre frequencies below 400 Hz. For bands of higher centre frequencies the time may be decreased to not less than 4 s. Using a moving microphone, the averaging time shall cover a whole number of traverses and shall be not less than 30 s.

6.3 Frequency range of measurements

The sound pressure level shall be measured using one-third octave band filters having at least the following centre frequencies in Hz :

100	125	160	200	250	315
400	500	630	800	1 000	1 250
1 600	2 000	2 500	3 150	4 000	5 000

If additional information in the low frequency range is required, one-third octave band filters with the following centre frequencies should be used :

50 Hz	63 Hz	80 Hz

For such additional measurements in the low frequency bands guidance recommendations are given in annex F of EN ISO 140-3:1995.

6.4 Measurement of reverberation time and evaluation of the equivalent sound absorption area

The correction term of equation (7) containing the equivalent sound absorption area is evaluated from the reverberation time measured according to EN 20354 and determined using Sabine's formula :

$$A = \frac{0{,}16\ V}{T} \tag{8}$$

where

A is the equivalent sound absorption area, in square metres ;

V is the receiving room volume, in cubic metres ;

T is the reverberation time in the receiving room, in seconds.

Following EN 20354, the evaluation of the reverberation time from the decay curve shall begin about 0,1 s after the sound source has been switched off, or from a sound pressure level a few decibels lower than that at the beginning of the decay. The range used shall not be less than 20 dB, and should not be so large that the observed decay cannot be approximated by a straight line. The bottom of this range shall be at least 10 dB above the background noise level.

The minimum number of decay measurements required for each frequency band is six. At least one loudspeaker position and three microphone positions with two readings in each case shall be used.

Moving microphones which meet the requirements of 6.2.3 may be used but the traverse time shall be not less than 30 s.

6.5 Correction for background noise

Measurements of background noise levels shall be made to ensure that the observations in the receiving room are not affected by extraneous sound such as noise from outside the test room, electrical noise in the receiving system, or electrical cross-talk between source and receiving systems. To check the last named condition the microphone should be replaced by a dummy microphone or the loudspeaker should be replaced by an equivalent impedance. The background level should be at least 6 dB (and preferably more than 15 dB) below the level of signal and background noise combined. If the level difference is smaller than 15 dB, but greater than 6 dB, calculate corrections to the signal level according to the equation :

$$L = 10\ \lg\left(10^{L_{\mathrm{sb}}/10} - 10^{L_{\mathrm{b}}/10}\right)\quad \mathrm{dB} \tag{9}$$

where

L is the adjusted signal level ;

L_{sb} is the level of signal and background noise combined ;

L_{b} is the background noise level.

If the difference is less than or equal to 6 dB in any of the frequency bands, use the correction 1,3 dB corresponding to a difference of 6 dB. In that case, the results shall be given in the measurement report in such a way that it clearly appears that the reported values are the limit of measurement (see j) of clause 9).

6.6 Maximum value of normalized flanking level difference

In laboratories complying with EN ISO 140-1 the sound transmitted by any indirect path should be negligible compared with the sound transmitted through the test specimen. In order to check this, the value of $D_{\mathrm{n,f,max}}$ for the laboratory facility shall be measured. This is done by using a construction as described in the note of 5.1.3.

If the measured value of $D_{n,f}$ for a test specimen is less than or equal to ($D_{n,f,max}$ - 10 dB), the indirectly transmitted sound can be considered negligible and the result is called $D_{n,f}$.

Appropriate statements in the test report are necessary (see j) of clause 9) if finally $D_{n,f}$ is larger than ($D_{n,f,max}$ - 10 dB). No calculated corrections shall be applied.

7 Precision

It is required that the measurement procedure gives satisfactory repeatability. This is determined in accordance with the method shown in EN 20140-2 and should be verified from time to time, particularly when a change is made in the procedure or instrumentation.

NOTE Information on repeatability of similar measurements is given in EN 20140-2.

8 Expression of results

For the statement of the normalized flanking level difference or the normalized flanking impact sound pressure level of the test specimen, the results shall be given at all frequencies of measurement to one decimal place in tabular form and/or in the form of a curve. For graphs with the level in decibels plotted against frequency on a logarithmic scale, the following dimensions shall be used :

a) 5 mm for one-third octave ;

b) 20 mm for 10 dB.

The use of forms in accordance with annex G of EN ISO 140-3:1995 or annex E of EN ISO 140-6:1998 is preferred. Being a short version of the test report, all information of importance regarding the test object, the test procedure and the test results shall be stated.

If results evaluations are needed in octave bands, these values shall be calculated from the three one-third octave band values in each octave band using the following equations :

c) for the normalized flanking level difference :

$$D_{n,f,oct} = -10 \lg \left(\frac{1}{3} \sum_{n=1}^{3} 10^{-D_{1/3oct,n}/10} \right) \quad \text{dB} \tag{10}$$

d) for the normalized flanking impact sound pressure level :

$$L_{n,f,oct} = 10 \lg \left(\sum_{j=1}^{3} 10^{L_{n,1/3oct,j}/10} \right) \quad \text{dB} \tag{11}$$

If the test procedure is repeated either in the same or in the opposite measurement direction, the arithmetic mean of all measurement results at each frequency band shall be calculated.

For impact measurements, the larger room is always the receiving room.

For the evaluation of single number ratings, see EN ISO 717-1 and EN ISO 717-2.

9 Test report

With reference to this European Standard, the test report shall state :

a) name of organisation that has performed the measurements ;

b) manufacturer's name and product identification ;

c) name of client ;

d) date of test ;

e) description of test specimen with sectional drawing and mounting conditions, including size, thickness, mass per unit area, curing time and conditions of components and description of floor covering, if any ; statement indicating who mounted the test object (test laboratory or manufacturer) ;

f) volumes of both reverberant rooms ;

g) air temperature and humidity in the measuring rooms ;

h) normalized flanking level difference and normalized flanking impact sound pressure level of test specimen as a function of frequency ;

i) brief description of details of the test procedure and equipment ;

j) indications of results which are to be taken as limits of measurement. They shall be given as $D_{n,f} \geqslant$...dB or $L_{n,f} \leqslant$ ... dB. This shall be applied if the sound pressure level in any band is not measurable on account of background noise (acoustic or electrical, see 6.5), or if the value of maximum normalized flanking level difference is not sufficient (see 6.6) ;

k) maximum normalized flanking level difference of the test facility $D_{n,f,max}$ as a function of frequency;

l) acoustic performance of the plenum lining.