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**Acoustics — Laboratory measurement of  
sound insulation of building elements —**

Part 1:

**Application rules for specific products**

**AMENDMENT 1:** Guidelines for the  
determination of the sound reduction index  
of joints filled with fillers and/or seals

*Acoustique — Mesurage en laboratoire de l'isolation acoustique des  
éléments de construction —*

*Partie 1: Règles d'application pour produits particuliers*

*AMENDEMENT 1: Lignes directrices pour la détermination de l'indice  
de réduction acoustique de joints comblés de matière de remplissage  
et/ou d'éléments d'étanchéité*



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## Foreword

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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.

Amendment 1 to ISO 10140-1:2010 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*.

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# Acoustics — Laboratory measurement of sound insulation of building elements —

## Part 1: Application rules for specific products

### AMENDMENT 1: Guidelines for the determination of the sound reduction index of joints filled with fillers and/or seals

*page v, Introduction*

Add the following final paragraph.

Annex J has been developed for joints filled with fillers or seals.

*page 1, Clause 2*

Add the date “2010” to ISO 10140-2.

*page 31*

Insert Annex J, which starts on page 2, before the Bibliography.

*page 32, Bibliography*

Add the following entries.

- [15] EN 12354-3, *Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 3: Airborne sound insulation against outdoor sound*
- [16] NEN 5273, *Akoestische prestatie van kier- en naaddichting — Laboratoriummeetmethode op basis van NEN-EN-ISO 140-3* [Acoustic performance of sealing — Laboratory measurement based on EN ISO 140-3]
- [17] ERTEL, H., MEHEL, F.P. *Akustische Dichtung von Fugen durch akustisch wirksame Nebenvolumen -akustische Filter- und akustische Lippendichtungen*. [Acoustic sealing of joints by acoustically effective supplementary volumes — Acoustic filter and acoustic lip seals]. Stuttgart: Fraunhofer IRB, 1979. 37 p. (IBP Report No. BS 35/79.)
- [18] ERTEL, H. *Experimentelle Untersuchungen von akustischen Fugendichtungen — Prinziplösungen für wirksame Dichtungskonstruktionen* [Experimental investigations of acoustic joint seals — Principle of solutions for effective seal construction]. Stuttgart: Fraunhofer IRB, 1981. 44 p. (IBP Report No. BS 57/81.)
- [19] FROELICH, H., SCHUMACHER, R., SAß, B. *Konstruktionsmerkmale für schalldämmende Wohnungseingangstüren und Bürotüren aus Holz und Holzwerkstoffen — Forschungsbericht*. [Design features of sound-absorbing residential entrance doors and office doors in wood and timber materials — Research report]. Stuttgart: Fraunhofer IRB, 1996. 175 p.

## Annex J (normative)

### Joints filled with fillers or seals — Sound reduction index

#### J.1 Application

This annex applies to acoustic sealing of slits (with or without fillers) and of gaps or joints between parts of windows or doors. Fillers are materials to fill in joints, e.g. foam or sealing tape, gaskets (or seals) are elements to close openable joints, e.g. retractable floor seals or rebate seals for doors and windows.

The general guidelines in the relevant clauses of ISO 10140-2 shall always be followed. The quantity to be determined is the sound reduction index of joints,  $R_s$ , per metre of a sealed gap or joint, in decibels as a function of frequency.

The sound reduction index of joints (of the slit,  $s$ ) with sound transmission only through the joint or the slit is evaluated from Equation (J.1).

$$R_s = L_1 - L_2 + 10 \lg \frac{S_n l}{A l_n} \quad (\text{J.1})$$

where

$L_1$  is the energy average sound pressure level in the source room, in decibels (see ISO 10140-2);

$L_2$  is the energy average sound pressure level in the receiving room, in decibels (see ISO 10140-2);

$l$  is the length of the joint, in metres;

$S_n$  is the reference area, in square metres ( $S_n = 1 \text{ m}^2$ );

$l_n$  is the reference length, in metres ( $l_n = 1 \text{ m}$ );

$A$  is the equivalent absorption area in the receiving room, in square metres.

**NOTE** To achieve a better signal-to-noise ratio, simultaneous measurements can be performed on an element with enlarged length of the joint.

For this type of measurement, the influence of flanking transmission through the object in which the slits are present can be very important, so the maximum sound insulation of the test arrangement requires measurement, e.g. by sealing the test joint on both sides with elastic sealant, leading to  $R_{s,\max}$ . Unless this value is 10 dB higher than the measured value, the measurement results require correction for this flanking transmission.

Test  $R_{s,\max}$  when the test arrangement is prepared.

The sound reduction index of joints (of the slit)  $R_s$  shall be calculated according to the rules of ISO 10140-2:2010, A.3, using Equation (J.2).

$$R_s = -10 \lg \left[ 10^{-R_s'/10} - 10^{-R_{s,\max}/10} \right] \quad (\text{J.2})$$

where  $R'_s$  is the sound reduction index measured with the test element in the test opening, in decibels.

If the difference  $R_{s,max} - R'_s$  is less than 6 dB in any of the frequency bands, the correction shall be 1,3 dB.

If  $R'_s$  is larger than  $R_{s,max} - 3$  dB, the lower limit of the sound reduction index  $R_s$  may be set as  $R_{s,max}$ . The resulting number shall be presented in brackets and expressed as a minimum value, e.g. ( $R_s \geq 50,4$  dB).

The single number ratings are determined in accordance with ISO 717-1. If for one or more frequency bands the result is larger than  $R_{s,max} - 3$  dB, the single number rating is also determined with an infinitely high sound reduction index for those indicative bands. If that result differs by more than 1 dB from that first directly determined, the single number ratings shall also be presented in brackets.

The values which are evaluated can be used directly to compare products (e.g. fillers or sealings) or for the determination of the sound insulation of composite elements, taking into account the appropriate length of joints.

Besides the measurement results for well-described situations, this annex also presents a method to summarize results in a more global way, suitable for use as input data for prediction methods.

## J.2 Test element

### J.2.1 General

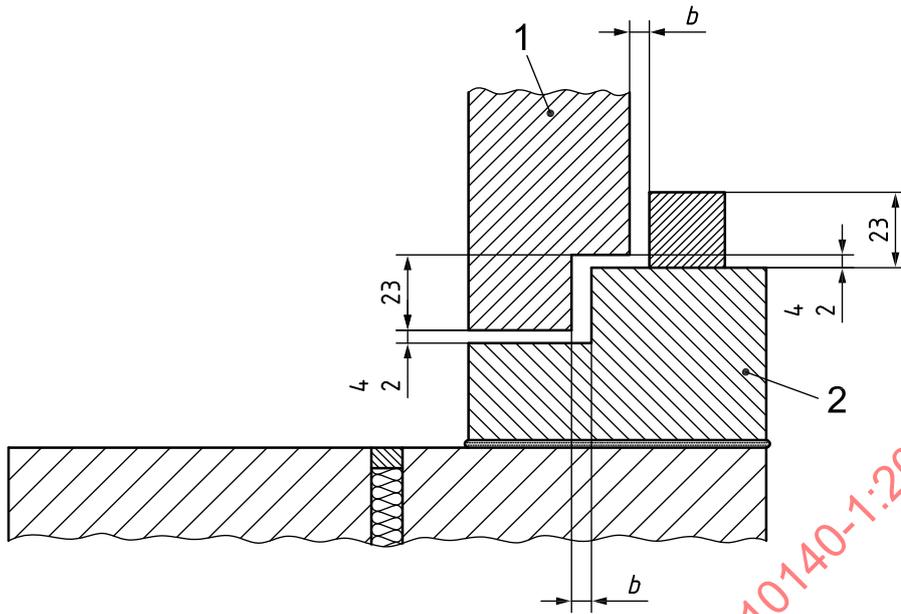
The design of the joint to be tested should be similar to the application, because the geometry of the joint is an important parameter for the sound insulation of joints. For this, the design of the environment around the test element (filler or sealing) strongly depends on the application and this clause can only give advice with the description of examples for test elements.

The length of the joint shall be greater than 1 m and the width of the joint shall be no greater than 50 mm.

### J.2.2 Illustration 1 — Gaps between windows and doors

The test element shall have a high sound reduction index  $R_{s,max}$  in order to be able to get reliable measurement results in the relevant part of the frequency range. The gap or joint under test shall have a length of at least 5,0 m with a uniform cross-section; this total length may be the sum of several gaps or joints. For comparisons, the cross-section shall comply with Figure J.1 where the relevant gap width  $b$  is also defined. Additionally other shapes can be applied, if relevant. These requirements can normally be fulfilled by using the specific small test opening as defined in this part of ISO 10140, with a panel as given in Figure J.2.

Dimensions in millimetres



**Key**

- 1 movable panel
- 2 frame
- b* variable gap width

**Figure J.1 — Cross-section of gap with definition of gap width**

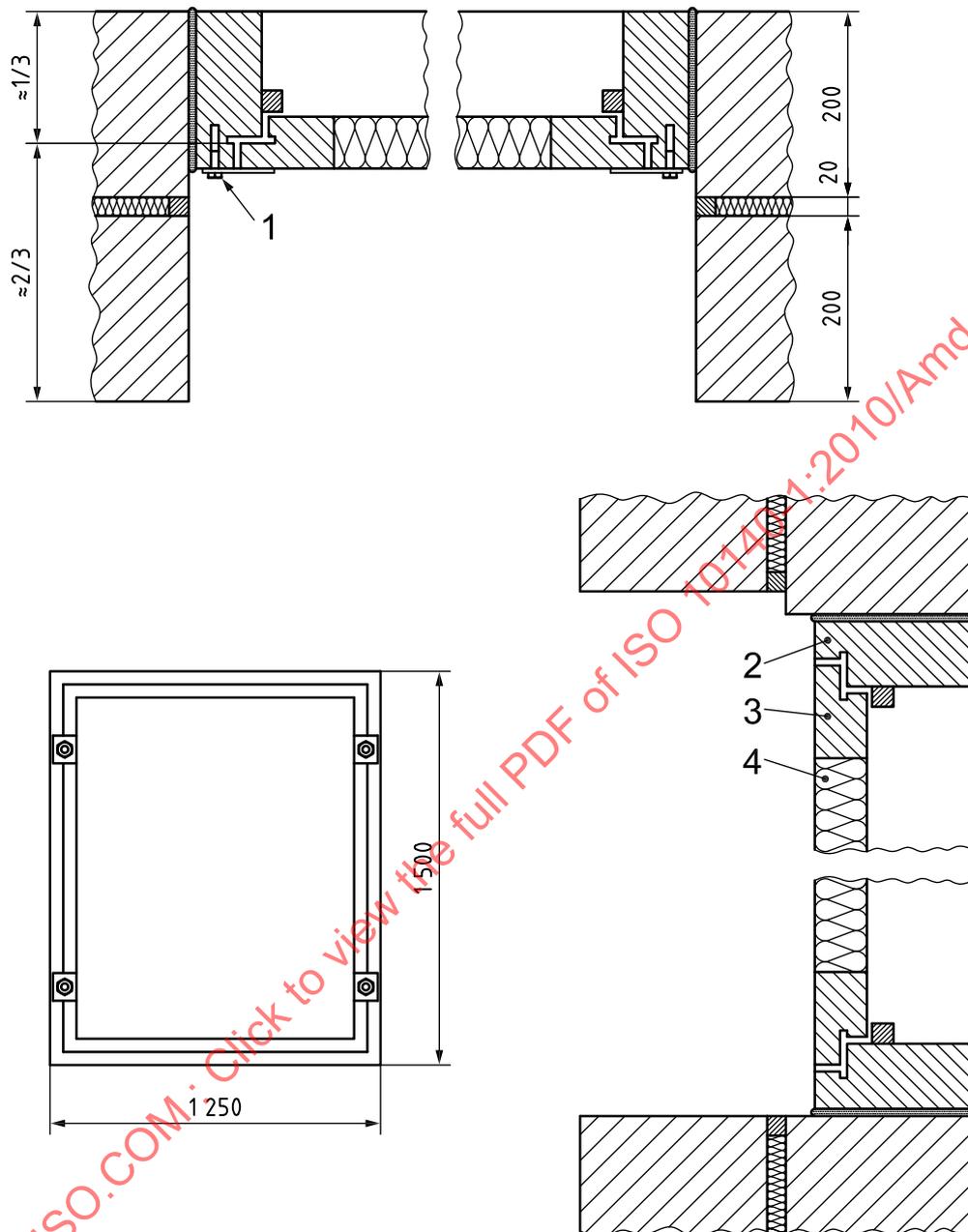
With additional wood strips of identical dimensions (23 mm × 23 mm, with gap tolerances between 2 mm and 4 mm) this profile can also be adapted to double sealing systems; see Figure J.2.

As an example, Figure J.2 gives a test element in the specific small test opening, where the panel in the casement consists of steel sandwich plates of thickness 2 mm and a rectangular wooden frame of cross-section 54 mm × 90 mm, the cavity being filled with mineral wool of surface density 40 kg/m<sup>2</sup>.

Determine the gap width at a minimum of four positions, evenly distributed over the total length of sealing. The results shall not deviate by more than 0,3 mm, otherwise readjust the mounting. The average value is denoted as gap width *b*.

NOTE With this construction, a maximum sound reduction index of  $R_{s,max,w}(C;C_{tr}) = 60(-5;-10)$  dB can be achieved.

Dimensions in millimetres



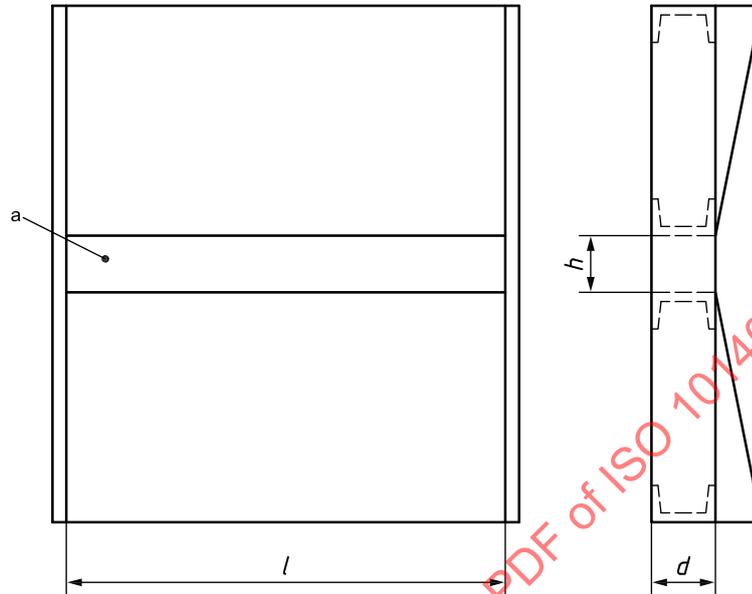
**Key**

- 1 adjustable closing mechanism, e.g. a steel plate with hole, screw and thumb-nut
- 2 frame 67 mm × 139 mm
- 3 frame 54 mm × 90 mm
- 4 sandwich panel

**Figure J.2 — Illustration of a test element in the specific small test opening**

**J.2.3 Illustration 2 — Test element for slits and gaps**

For determination of the sound insulation of joints, a test opening according to the procedure for small elements in Annex E is required. A convenient way to carry out tests of the sound insulation of joints is to use the test opening for glass tests in accordance with ISO 10140-5:2010, 3.3.3. For this purpose, a highly sound-insulating element should be prepared, leaving a small opening of, for example, 1 200 mm × 120 mm (see Figure J.3). In this opening, the geometry of the joint to be tested can be designed.



**Key**

- d* depth
- h* height
- l* length
- a* Opening for test element.

**Figure J.3 — Illustration of preparation of a test opening for joints in an element with high sound insulation**

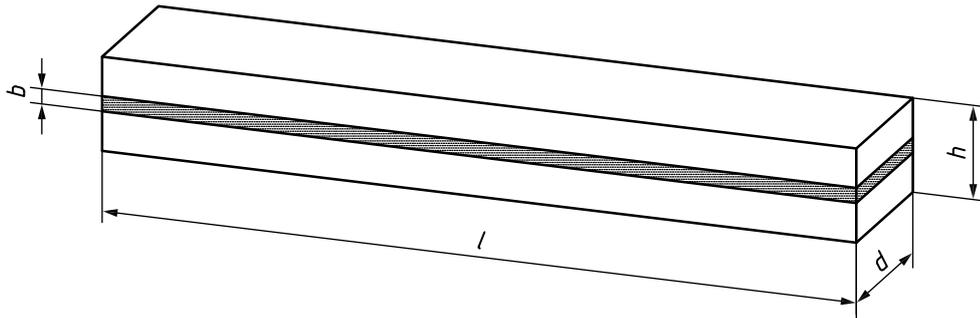
**J.3 Boundary and mounting conditions (to be applied before installation)**

**J.3.1 General**

Because the geometry of the joint is an important parameter for the sound insulation of joints, and the boundary and mounting conditions depend on the application, this clause can only discuss and advise on typical examples of test elements.

**J.3.2 Illustration 1 — Geometry of a joint to test fillers in a cassette**

For the measurement of the sound insulation of joints from fillers, two elements can be arranged one upon the other. The width and the geometric details of the joint have to be adapted to the requirements of the construction to be tested, e.g. width of the joint,  $b = 10$  mm or  $b = 20$  mm; depth of the joint,  $d = 50$  mm or  $d = 100$  mm. The filler to be tested is applied in the joint between the two elements. The overall dimensions should allow the cassettes to fit into the opening of the highly sound-insulating element. See Figure J.4.

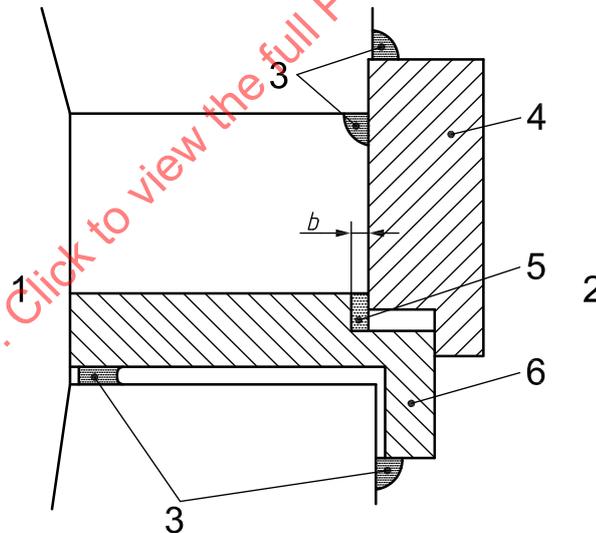
**Key**

- $b$  width of the joint
- $d$  depth of the joint
- $h$  height of both elements and filler
- $l$  length of the joint

Figure J.4 — Example of a designed joint element for fillers

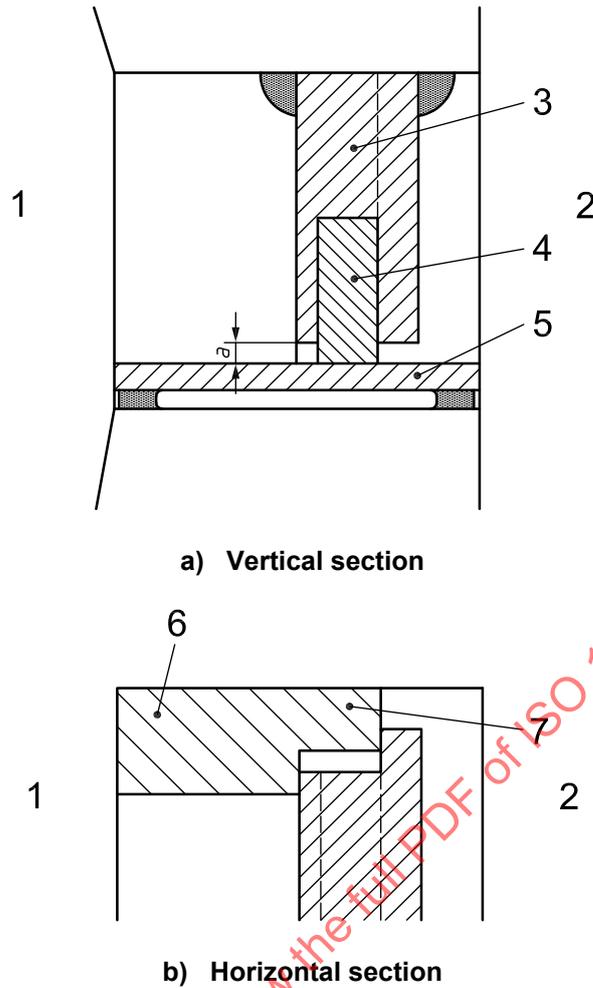
**J.3.3 Illustration 2 — Geometry of a joint to test gaskets**

For the measurement of the sound insulation of joints closed with sealings or gaskets, it is necessary to replicate the usual construction of the seal mounting, e.g. a rebate of doors. Within such measurements, single parameters of the joint (e.g. width) can be varied. See Figures J.5 and J.6.

**Key**

- 1 receiving room
- 2 source room
- 3 sealing to the test rig
- 4 lead-covered door leaf section
- 5 sealing (test element)
- 6 door frame, lead-covered
- $b$  gap width

Figure J.5 — Illustration of a test arrangement for rebate seals for doors (vertical section)



**Key**

- 1 receiving room
- 2 source room
- 3 lead-covered door leaf section, with mounted floor seal
- 4 floor seal, the test element
- 5 floor covering
- 6 rebate
- 7 lead bonding door frame

**Figure J.6 — Illustration of a test arrangement for floor seal in horizontal and vertical section**

**J.4 Test and operating conditions (to be applied after installation)**

The test can be performed for specific slits, gaps or joints, with or without fillers.

For variable slits, as with openable windows or doors, the test shall be repeated for the following gap width:

- a)  $b_n$ , the nominal gap width as given by the manufacturer — if unknown  $b_n = 5$  mm is to be taken;
- b)  $b_{min}$ , the minimal gap width, at maximal pressure of which the applied force,  $F_{b,min}$ , is to be noted — normally  $F_{b,min} = 100$  N per metre sealing length is taken;
- c)  $b_n+3$ , i.e. a gap width 3 mm more than nominal,  $b_{n+3} = b_n + 3$ .

NOTE 1 To characterize the sealing completely, it can be useful to determine the sound reduction index with gap width in steps of 1 mm from maximum compression till a gap is present.

NOTE 2 The results from this test only apply to joints with comparable geometry and cross-section.

Some fillers, e.g. sealing bands, need time to expand. The elements have to be expanded in the way they are used in field.

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**J.5 Expression of results**

Figure J.7 is a sample form for expression of results.

<b>Sound reduction index of joints according to ISO 10140</b>																																									
Determination of sound reduction index of joints																																									
Client:																																									
Description of the test specimen:																																									
Date of test:																																									
Test length <i>l</i> :																																									
Separation wall:																																									
Test noise:																																									
Volumes of the test rooms:																																									
Maximum joint sound reduction index:																																									
Mounting conditions:	..... frequency range of weighting curve																																								
Climate in the test rooms:	_____ test curve																																								
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Frequency</th> <th style="text-align: center;">Sound reduction index</th> </tr> <tr> <th style="text-align: center;"><i>f</i> Hz</th> <th style="text-align: center;"><i>R<sub>s</sub></i> dB</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">100</td><td></td></tr> <tr><td style="text-align: center;">125</td><td></td></tr> <tr><td style="text-align: center;">160</td><td></td></tr> <tr><td style="text-align: center;">200</td><td></td></tr> <tr><td style="text-align: center;">250</td><td></td></tr> <tr><td style="text-align: center;">315</td><td></td></tr> <tr><td style="text-align: center;">400</td><td></td></tr> <tr><td style="text-align: center;">500</td><td></td></tr> <tr><td style="text-align: center;">630</td><td></td></tr> <tr><td style="text-align: center;">800</td><td></td></tr> <tr><td style="text-align: center;">1 000</td><td></td></tr> <tr><td style="text-align: center;">1 250</td><td></td></tr> <tr><td style="text-align: center;">1 600</td><td></td></tr> <tr><td style="text-align: center;">2 000</td><td></td></tr> <tr><td style="text-align: center;">2 500</td><td></td></tr> <tr><td style="text-align: center;">3 150</td><td></td></tr> <tr><td style="text-align: center;">4 000</td><td></td></tr> <tr><td style="text-align: center;">5 000</td><td></td></tr> </tbody> </table>	Frequency	Sound reduction index	<i>f</i> Hz	<i>R<sub>s</sub></i> dB	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		
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Evaluation according to ISO 717-1 (in one-third octave bands): $R_{s,w}(C; C_{tr}) = ( \quad , \quad )$ dB $C_{100-5\,000} =$ dB; $C_{tr, 100-5\,000} =$ dB;																																									
Test report No:																																									
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**Figure J.7 — Sample form for expression of results**