

ISO/TC 43/SC 1

Secretariat: DIN

Voting begins on:  
2020-05-11

Voting terminates on:  
2020-07-06

**Acoustics — Noise emitted by  
machinery and equipment —  
Determination of emission sound  
pressure levels at a work station  
and at other specified positions  
applying approximate environmental  
corrections**

**AMENDMENT 1**

*Acoustique — Bruit émis par les machines et équipements —  
Détermination des niveaux de pression acoustique d'émission au  
poste de travail et en d'autres positions spécifiées en appliquant des  
corrections d'environnement approximatives*

**AMENDEMENT 1**

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Reference number  
ISO 11202:2010/FDAM 1:2020(E)

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Published in Switzerland

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This document was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

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# Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections

## AMENDMENT 1

### 3.20, Note 2

Replace the note with the following:

"The work station can be located on the reference measurement surface, but this is not necessary. The reference measurement surface can be used to determine  $K_2$ ."

### 3.21, Note 2

Replace the note with the following:

"For the purposes of this International Standard, the environmental correction,  $K_2$ , is used as an indicator to qualify the environment in 6.2 and is used to calculate the local environmental correction  $K_3$  in A.2."

### 3.26

Replace the definition and Note with the following:

"mean distance from the work station to the closest major sound source of the machine under test, without screening objects protruding into the line of sight between the major sound source and the work station, given by:

$$d = \frac{d_2 + d_1}{2}$$

where

$d_1$  is the shortest distance from the sound radiating surface of the machine under test to the work station;

$d_2$  is the longest distance from the sound radiating surface of the machine under test to the work station"

### 12.5

In the Example, replace "sound power level" with "emission sound pressure level".

A.1.2, Equation (A.1)

Replace "(minimum 1 m)" with "(minimum 0,5 m)".

A.2.3

Add the following after the last paragraph:

"When measurements of both emission sound pressure and sound power are required, it can be expedient to use the same measurement surface in both cases. This is not a requirement; the optimum measurement surface for a sound power measurement (e.g. a hemisphere) is not always the best measurement surface for determination(s) of emission sound pressure level(s) around a machine.

NOTE Different measurement surfaces give different values for  $K_2$  "

A.2.5

After Figure A.3, replace:

"The accuracy can be upgraded in some cases from 3 to 2 by"

with

"The accuracy can be upgraded in some cases from grade 3 to grade 2 by"

A.2.5

Replace the last sentence with:

"If this is not possible, determination in accordance with ISO 11204<sup>[18]</sup> can improve the accuracy."

C.4.2

Replace the title with:

"Contributions to the uncertainty,  $\sigma_{R0}$ , when the estimate of the local environmental correction,  $K_3$ , is based on a localized and well-defined sound-radiating area of the machine surface"

New C.4.3

Add the following after C.4.2, renumber the following equations and update cross-references accordingly:

**"C.4.3** Contributions to the uncertainty,  $\sigma_{R0}$ , when the estimate of the local environmental correction,  $K_3$ , is based on an approximate determination of the apparent work station directivity index

The general expression for the calculation of the final result of the emission sound pressure level measurement is identical to the formulation in C.4.2, with the addition of a term related to the apparent work station directivity index,  $D_{lop}^*$ , and replacing the contribution from the local environmental

correction,  $K_3$ , with the contribution due to the environmental correction for the room,  $K_2$ . The resulting expression for  $L_p$  is given by Equation (C.3):

$$L_p = L_p \left( \bar{L}_p, \delta_{D^*}, \delta_{K_2}, \delta_{(B)}, \delta_{slm}, \delta_{mount}, \delta_{oc}, \delta_{pos}, \delta_{met} \right) \quad (C.3)$$

where

$\delta_{D^*}$  is an input quantity to allow for uncertainty due to the estimation of the apparent work station directivity index,  $D_{lop}^*$ ;

$\delta_{K_2}$  is an input quantity to allow for any uncertainty due to the environmental correction for the room,  $K_2$ .

Table C.3 provides, as an example for accuracy grade 2, some information about present expectations concerning the values for the components,  $c_i$ ,  $u_i$ , that are necessary to calculate  $\sigma_{R0} = \sqrt{\sum_i (c_i u_i)^2}$  dB.

**Table C.3 — Uncertainty budget for determinations of emission sound pressure level**

Quantity	Estimate dB	Standard uncertainty, $u_i$ dB	Probability distribution	Sensitivity coefficient, $c_i$	Uncertainty contribution, $c_i u_i$ dB
$L_p$					
$\bar{L}_p$	$\bar{L}_p$	$s_{L_p}$ (e.g. 0,5)	Normal	1,25	0,63
$\delta_{D^*}$	$D_{lop,approx}^*$	0,7	Normal	0,6	0,4
$\delta_{K_2}$	$K_2$ (e.g. 0,9)	0,3 $K_2$	Normal	2,6	0,8
$\delta_{(B)}$	$K_1$	e.g. 0,7	Normal	0,25	0,18
$\delta_{slm}$	0	0,5	Normal	1	0,5
$\delta_{pos}$	0	0,2	Normal	1	0,2
$\delta_{met}$	0	0,3	Normal	1	0,3
$\sigma_{R0} = \sqrt{\sum_i (c_i u_i)^2}$ dB = 1,3 dB					
NOTE The values shown are examples related to accuracy grade 2 determinations.					

Explanations for the additional uncertainty parameters in Table C.3 not found in Table C.2 are given below.

$u_{D^*}$  is the uncertainty in determining the apparent work station directivity index,  $D_{lop}^*$ . In accordance with Equation (A.2), this uncertainty is a function of the measured difference  $D_{lop,approx}^* = L_p^* - L_{p,approx}^*$ . Assuming  $u_{L_{p,approx}} = u_{L_p} = 0,5$  dB, this results in  $u_{D^*} = \sqrt{0,5^2 + 0,5^2}$  dB = 0,7 dB.

$c_{D^*}$  is the sensitivity coefficient associated with the uncertainty in  $D_{lop,approx}^*$ . It is the derivative of  $L_p$  with respect to  $D_{lop,approx}^*$  when  $L_p$  is corrected using only  $K_3$  [Equation (A.3)] and other corrections [e.g. the background noise correction in Equation (10)] are assumed to be independent.

$$c_{D^*} = 10^{0,1 K_3} - 1$$

For the exemplary values in Table C.2, assume  $D_{lop,approx}^* = -3$  dB,  $K_2 = 0,9$  dB and  $K_3 = 2$  dB resulting in  $c_{D^*} = 0,6$ .

NOTE 1 To account for source dimensions as in Figure A.3,  $(D_{\text{top,approx}}^* - \Delta D_I^*)$  is substituted for  $D_{\text{top,approx}}^*$ .

$u_{K_2}$  is the uncertainty due to influences of the room environment. From empirical experience, it is known that the uncertainty on  $K_2$  can roughly be expressed as  $K_2 \pm K_2/2$ , where a rectangular distribution is assumed (total spread of values  $\pm K_2/2$ ). Then the standard deviation can be calculated from  $u = \frac{K_2}{2\sqrt{3}} \approx 0,3K_2$ .

$c_{K_2}$  is the sensitivity coefficient related to the uncertainty caused by room environmental correction. It is similar to the previous calculation for  $c_{D^*}$ .

$$c_{K_2} = \frac{10^{0,1K_3} - 1}{1 - 10^{0,1K_2}}$$

For the exemplary values in Table C.3, assume  $D_{\text{top,approx}}^* = -3$  dB,  $K_2 = 0,9$  dB and  $K_3 = 2$  dB resulting in  $c_{K_2} = 2,6$ .

NOTE 2 To reproduce the results of Table C.2, if there is omnidirectional radiation from a small source area,  $D_{\text{top,approx}}^*$  and  $u_{D^*}$  can both approach zero. In this case only, a different  $K_2$  is calculated based on the small source area, i.e., not the same  $K_2$  as used in Table C.3 which is based on a measuring surface that encloses the machine. In Table C.2, outside of the small source area, the rest of the machine is irrelevant because it is assumed it does not radiate any sound.

NOTE 3 If the sound from the source is directed primarily toward the operator, uncertainty contributions can be smaller in Table C.3 than in Table C.2.

NOTE 4 The validity of the uncertainty coefficients  $c_{D^*}$  and  $c_{K_2}$  is limited to  $K_3 \leq 7$  dB [ $z > 0,2$ , Equation (A.4)]."



## Annex ZA (informative)

### Relationship between this European Standard and the essential requirements of Directive 2006/42/EC aimed to be covered

NOTE Annex ZA is not included in the final ISO publication.

This European Standard has been prepared under a Commission's standardization request M/396 (Machinery) to provide one voluntary means of conforming to essential requirements of Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast).

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

**Table ZA.1 — Correspondence between this European Standard and Directive 2006/42/EC**

Essential Requirements of Directive	Clause(s)/sub-clause(s) of this EN	Remarks/Notes
1.7.4.2 u)	All clauses	

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