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Analysis of ISO 8297:1994 with improvement proposals

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Abstract
The ISO 8297:1994 has been used successfully to find out the Sound Power Level of different industries during more than 20 years, however the standard includes some limitations, namely: a) the assumption of a sound reflector type of ground (sound absorption coefficient = 0); b) the application only to industries without many obstacles; c) the assumption of a parallelepiped surface instead of a spherical surface; d) the method it is limited to industries with the largest horizontal dimension not bigger than 320 meters; e) attenuation terms, due to atmospheric absorption, based on ISO 3891:1978 and not on the latest associated standard ISO 9613-1:1993. Thereby, the aim of this article is to analyze the consequences of ISO 8297:1994 limitations, found by the authors during the work development, and present, justifiably, associated proposals to complement and/or improve the standard.

Keywords: ISO 8297, Industrial Noise, Multisource Industrial Plants, Sound Power Level.

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1 Introduction

The ISO 8297:1994 [1] must be reviewed during 2016. Maybe it is an opportunity to clarify some points and to introduce some improvements, and/or to think in the possibility of procedure extension to other kind of noise sources, for example Recreational Activities [2-4].

2 ISO 8297 atmospheric coefficients

In fact, once ISO 9613-1:1993 [5] was published before ISO 8297, is strange that the step 7 of ISO 8297 speaks about ISO 3891:1978 [6] for atmospheric absorption, instead of ISO 9613-1. Note that ISO 9613-1 was confirmed in 2015 and ISO 3891 was withdrawal in 2010, so at least a reference to ISO 9613, instead of ISO 3891, must be included in the review of ISO 8297. This change is more important because the attenuation values of ISO 3891 are different from the attenuation values of ISO 9613-1. In Table 1 we can compare the two sets of values (α: atmospheric attenuation coefficients in dB/km), for typical atmospheric conditions of temperature and relative humidity (15 ºC and 70 %), and find out that for 8000 Hz octave band the values are very different. For ISO 9613-1 the coefficients can be calculated in the following site: http://resource.npl.co.uk/acoustics/techguides/absorption/ (accessed in May of 2016).

Table 1 – Comparison between ISO 3891 and ISO 9613-1 atmospheric coefficients.

Temperature: 15 ºC; Relative Humidity: 70%							
ISO 3891				ISO 9613-1			
Octave band [Hz]	**α dB/km**	**Octave band [Hz]**	**α dB/km**	**Octave band [Hz]**	**α dB/km**	**Octave band [Hz]**	**α dB/km**
31	≈ 0	1000	≈ 5	31	≈ 0	1000	≈ 4
63	≈ 0	2000	≈ 10	63	≈ 0	2000	≈ 9
125	≈ 0	4000	≈ 26	125	≈ 0	4000	≈ 27
250	≈ 1	8000	≈ 46	250	≈ 1	8000	≈ 95
500	≈ 2			500	≈ 2		

3 Outside noise levels prediction methods and ISO 8397 limitations

ISO 9613-2: 1996 [7] was an important standard/method for the prediction of noise levels outside, so was one of the interim methods presented in the Environmental Noise Directive 2002/49/CE [8], and was one of the methods with important contributions for the advent of software development for outside noise levels predictions.

In the Directive (EU) 2015/996 [9], establishing common noise assessment methods in Europe, there is no more reference to ISO 9613-2, but there is reference to ISO 9613-1.

The advent of software for outside noise levels predictions, based in 3D models (typically CAD or SHD files) permit a very rigorous definition of the reality, so can be used to simulate the conditions in a multisource industrial plant, or other kind of noise source, and calculate the Sound Power Level, by comparison of the measured (ISO 8297) and foreseen (software) Sound Pressure Levels values, without the limitations of ISO 8297:

a) Assumption of a sound reflector type of ground (sound absorption coefficient = 0):
The Step 4 of ISO 8297 (section 10.4) defines a parallelepiped volume above ground witch surface area must be logarithmic "add" to the Sound Pressure Level in order to calculate the Sound Power Level. This approach means the assumption of an acoustic reflector ground (not considering the imaginary volume below the ground), which may not be the case in many practical situations. In a software 3D acoustic model we can define the actual ground sound absorption coefficient.

b) Application only to large industrial plants without many obstacles:
In chapter "1.1 General" is stated: "*The method is limited to large industrial plants with multiple noise sources ... having their main dimensions in the horizontal plane, and which radiate sound substantially uniformly in all horizontal directions*". The Area Term of ISO 8297 (parallelepiped surface; step 4) it is only valid for a "free-field" sound propagation, and for a parallelepiped surface area not very different from the associated (distance) spherical surface, so we must have some dimension limitations (largest horizontal dimension not bigger than 320 meters). In a software 3D acoustic model we can define the actual obstacles and use any dimension and calculate accurately the Sound Power Level with its influence.

4 Conclusions

Taking the above into account it is deemed important to include in the review of ISO 8297 some alternatives for overcoming the limitations of the current terms of ISO 8297, to transform Sound

Pressure Levels into Sound Power Level. Among other possibilities, the environmental noise prediction software might be used for a practical implementation of the standard.

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