DECLARATION AND VERIFICATION OF NOISE EMISSION VALUES

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1. INTRODUCTION

It is not enough to have a noise test code telling how to determine noise levels under specified operating conditions. It is also necessary to give guidelines on how to handle the measured data. Which value is to be given by the manufacturer to the customer? The average value of measurements on 100 different machines or the highest value of any single machine? And if the buyer wants to verify the value given by the seller. How does he do that and when is the machine within the specifications and when is it not? The new, completely revised, international standard ISO 4871, [1], gives these answers and many more. ISO 4871 which applies to machinery and equipment

- gives information on the declaration of noise emission values,
- describes acoustical and product information to be stated in technical documents supplied to users by the manufacturer,
- specifies the methods for verifying the declared noise emission values stated by the manufacturer.

ISO 4871 is based on ISO 7574, [2], but it is considerably easier to read and to use. It is at present accepted as a draft international standard and it is expected to become a full international and European standard in the near future. As an European standard it will become very important as the machine safety directive of the European Community(89/392/EC) makes noise declarations mandatory for most machines. This directive will enter into force on December 31 1992 although there will be an additional transition period of two years.

In ISO 12001, [3], which provides rules for the drafting and presentation of a noise test code, it is required to include a paragraph on declaration and verification of noise emission values, based on ISO 4871.

2. DECLARATION OF NOISE EMISSION VALUES

Noise emission values of machinery and equipment shall be declared in such fashion that the values can be verified according to ISO 4871. The declaration is the sole responsibility of the manufacturer. The reason for this is that the manufacturer alone can deal with the statistics of his product and the commercial risks involved. If he declares a very low number he will get many complaints from dissatisfied customers trying to verify the numbers and if he declares very high numbers he may not be able to sell his product because it is assumed to be too noisy.

As the declaration is the sole responsibility of the manufacturer the standard cannot tell the manufacturer how to arrive at the proper value to declare. However, the standard does give some guidelines. The declared value L_d is calculated from

$$L_d = L_m + K \qquad (1)$$

where L_m is the estimate of the average noise emission value and K is a constant to be determined. K is usually about 3 dB for ISO engineering and precision methods and about 7 dB for ISO survey methods. This means that if the manufacturer chooses a cheap survey method he has to add a larger margin than if he chooses a more expensive and more accurate method. Following the guidelines normally results in a 5% risk of rejection for a sample of 3 or more machines.

In principle, the use of these kinds of statistical methods allows measurement methods of different accuracies to be used and test code restrictions, such as requiring a certain basic acoustical test standard for the acoustical measurements, are not necessary as long as the important operating conditions remain the same.

The most common types of noise data to declare are:
- the A-weighted sound power level L_{WAd}
- the A-weighted emission sound pressure level, L_{pAd}, at a specified position
- the C-weighted peak emission sound pressure level, L_{pCpeak}, at a specified position

Manufacturers are recommended always to declare L_{WAd} because it is the most useful quantity in practical noise calculations and for comparison purposes. According to the European machine safety directive L_{pAd} has to be declared whenever it is higher than 70 dB. When it is higher than 85 dB L_{WAd} has to be declared as well. L_{pCpeak} has to be declared whenever it exceeds 130 dB.

3. VERIFICATION OF NOISE EMISSION VALUES

Verification shall be effected by means of noise measurements made according to the same test code or basic measurement method with the same or better grade of accuracy, and under the same machinery or equipment operating conditions as those to which the declared noise emission values refer. Unless the test code otherwise specifies the following procedures shall be followed:

If one machine is evaluated the declared value L_d is verified if the measured noise emission value is less than or equal to the declared value. In principle it is also possible to verify the declared value by using a test method with a lower grade of accuracy. However, in that case allowance must be made for the lower accuracy by subtracting the difference in K-value between the two methods. For example, if a survey method is used to verify a declared value obtained by an engineering method L_d is verified if the noise emission value is less than or equal to the declared value + 4 dB(approximately).

If three machines are evaluated to verify the declared noise emission values of a production series of machines the declared value L_d is verified if

$$L_d - L_m \geq 1{,}1 \text{ dB} \qquad (2)$$

The verification procedure for a batch ensures that there is 95% probability of acceptance if no more than 6,5% of the equipment in a batch has measured noise emission values greater than the declared noise emission value L_d.

4. CALCULATION OF K

When more details about the test methods and the test objects are known the constant K in eq. (1) can, for a sample size of three machines, be calculated from

$$K = 1{,}5\, s_t + 0{,}564(\sigma_M - s_t) \qquad (3)$$

where

s_t = the total standard deviation = $\sqrt{s_R^2 + s_p^2}$,
s_R = the standard deviation of the reproduceability,
s_p = the standard deviation of the production,

σ_M = the reference standard deviation = a total standard deviation specified for machinery and equipment which is considered typical for batches of equipment concerned.

Estimated values of s_t and σ_M, which may be used when values are not given in the test code, are as follows:

Accuracy grade of the measurement method	Estimated values, dB	
	s_t	σ_M
Engineering(Grade 2)	2,0	2,5
Survey(Grade 3)	4,5	5,0

REFERENCES

[1] ISO 4871, Acoustics - Verification and declaration of noise emission values of machinery and equipment, ISO, Geneva, Switzerland, 1991 (at present at the stage of draft)

[2] ISO 7574, Acoustics - Statistical methods for determining and verifying stated noise emission values of machinery and equipment, ISO, Geneva, Switzerland, 1985

[3] ISO 12001, Acoustics - Noise emitted by machinery and equipment - Rules for the drafting and presentation of a Noise Test Code (at present at the stage of draft)

Note - all the above standards are, or will become, European Standards. The EN-number is obtained by adding 20.000 to the ISO-number.