



CONSTRUCTION EQUIPMENT ASSOCIATION

Summary Paper on

Noise measurement uncertainties for Directive 2000/14/EC

1 Introduction

Directive 2000/14/EC deals with uncertainties partly by the definition of the guaranteed sound power level (GSPL) in Article 3(f) and partly by reference to the conformity assessment modules, Annexes V, VI and VIII.

Article 3(f) states that the guaranteed sound power level includes uncertainties due to production variation and measurement procedures. Annex V (internal control of production), Annex VI (internal control of production with assessment of technical documentation and periodic checking) and Annex VIII (full quality assurance), require that the technical documentation must contain the technical instruments applied and the results of the evaluation of the uncertainties due to production variation and their relation to the guaranteed sound power level. Annex VII (unit verification) is different in that it does not involve production. Annexes VI and VIII require a notified body to be involved in the assessment.

It is also clear from Article 5 of the Directive that Member States have an overall responsibility to ensure that the requirements in respect of the GSPL are carried out for all equipment covered by Articles 12 and 13. Articles 14 and 15 requires notified bodies to be appointed to carry out assessments for equipment in Article 12.

Guaranteed sound power level (GSPL). Each item of equipment covered by Directive 2000/14/EC has to be labelled with the GSPL and to be issued with a declaration of conformity. Technical documentation has to show how the GSPL has been derived.

The Directive sets out a definition of the GSPL in Article 3(f). In principle it is the measured value (usually an average of several measurements) plus an uncertainty that results from measurement and production uncertainties. It is up to manufacturers to decide the uncertainty but the technical file must show how it has been derived. In addition, where equipment has to meet a noise limit (22 categories of equipment), a notified body has to agree that the uncertainty and the test measurements have been properly arrived at.

If equipment does not have to meet a noise limit there is no requirement for the manufacturer to involve a notified body.

The Directive does not lay down the details of how uncertainties should be decided. The checks that notified bodies make for the 22 noise-limited categories of equipment are also not defined, neither the nature of the check (for example, it could be a technical file check or a noise test) nor the frequency although, in Annex VI, the frequency of the check is at least once every three years.

2 Notified Body Working Group (NBWG) proposals

The NBWG has come up with some proposals that seek to clarify and formalise how to comply with the Directive. The proposals cover the following three areas.

- some criteria relating to measurements of sound power level (SPL)
- how to determine the GSPL
- how to verify that production conforms to the GSPL

Measurements of SPL. The test methods for determining SPL are described in the Directive. CEN and ISO standards are frequently referred to. The NBWG suggests some additional test criteria to apply in order for measurements of SPL to be valid. These are as follows.

- measurements at all microphone positions to be synchronous
- qualification of the environment correction using a calibrated reference sound source
- traceability of calibration of measurement equipment
- measurements by qualified personnel
- minimum sample size is 5
- ambient temperature $20^{\circ} \pm 10^{\circ}$ C
- acceptable repeatability $s_r \ll \sigma_R$

Uncertainty K. The NBWG suggests that K is defined as $K = 1.5 s_t$ where $s_t = \sqrt{(\sigma_R^2 + s_p^2)}$. Values of σ_R are given for each category of equipment. To use these values, measurements of SPL must satisfy the above test criteria otherwise $s_t = 2.5$ and $K = 3.75$.

Verification. The NBWG suggests an algorithm using up to 4 measurements to show if production can be verified.

3 Some comments from the construction equipment industry view

- The industry aims for the lowest noise measurement uncertainty. This is desirable for an efficient manufacturing process as well as for making it easier to comply with noise limits.
- The NBWG proposals would mean that manufacturers would have to depend on uncertainties that are outside their control which is not acceptable.
- The NBWG proposals give uncertainties around 2.5 dB, which is higher than most manufacturers existing estimates. *Note: this is for a production deviation of 1,0 (0,5 is typical for EMM) and that an estimate with a 90% confidence level according to the DTI method (most favourable to a manufacturer) would be 1dB lower. When sigma P is 0,5 the difference between the DTI method (95% confidence level) and the NB proposal is 0,1 dB.*
- The NBWG proposals for criteria for measurements are issues that could be addressed by considering the CEN/ISO noise test standards (which are already referred to in the Directive) rather than by separate documentation.

- If measurements do not meet the NBWG criteria the uncertainty increases to nearly 4 dB.
- The construction equipment industry should consider treating noise measurement uncertainty along the same lines as other sectors of industry. For example, for motor vehicles and agriculture, to allow for instrumentation uncertainties, an uncertainty is subtracted from the measurement not added.
- The NBWG proposal for verification is complicated. The simple test of the measurement being less than the limit (or, as for motor vehicles, not more than one dB greater) is preferred.
- The biggest problem for us with the NBWG proposal is the specified conditions for testing, and that sigma R could change according to the round robin tests, so we don't know what the final effects of the proposal will be.
- Noise measurement uncertainty is part of the wider issue of uncertainties in all technical measurements. Perhaps the Commission should be asked to address this and, in particular, to consider if a consistent approach on uncertainties for all noise measurements, may be desirable.

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