THE CURRENT STATUS OF INTERNATIONAL STANDARDS FOR SOUND LEVEL METERS

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1. INTRODUCTION

Sound level meters are the most widely-used instruments for acoustical measurements. Most of the well-known International Standards for sound level meters, integrating sound level meters and dose meters [1 to 6] have been in place for over 20 years. In that period, advances in technology have not only transformed the appearance and capabilities of traditional stand-alone sound level meters, but also given rise to new instruments that incorporate personal computers or telecommunications links. Changes in regulatory regimes, the demands of international trade and experience of designing and testing meters to the specifications of the various Standards have also shown up limitations in the old specifications [1 to 6] that must be addressed.

A good description of the changes in the newly published IEC 61672-1 specifications for sound level meters [7] with respect to the current standards can be found in [8]. IEC 61672 will eventually be published in three parts; Part 1, which contains the performance specifications, was published in May 2002. The technical work on Part 2, which specifies the tests required for pattern evaluation (type testing) of new models of sound level meter, is complete and the document will be circulated as a Final Draft International Standard for voting by national committees. Part 3, which specifies the periodic tests (calibration) for sound level meters, is being drafted.

IEC 60651 [1] and IEC 60804 [3] will not be withdrawn until all three parts of IEC 61672 are published. The status of the existing Standard for personal exposure and dose meters [5, 6], is unaffected by the introduction of IEC 61672. The current ANSI S1.4 American National Standard Specifications for sound level meters (1983) (R 2002) and its amendment S1.4A (1985) (R 2002) have been reaffirmed recently [2]. At this stage, the publication of IEC 61672-1 is unlikely to have any real impact on sound level meter usage in North America.

2. CHANGES IN IEC 61672-1

2.1 Performance

The previous Standards for sound level meters classified the performance of instruments into Types 0, 1, 2 and 3 in decreasing order of accuracy. IEC 61672-1 replaces these Type designations with performance classes 1 and 2, whose requirements are broadly equivalent to those for the old Types 1 and 2. However, some notable changes have been made to the specifications to reflect technological advances and to improve international compatibility.

The specifications for directional response now permit meters that are designed to measure random incidence sound (diffuse sound field), as well as those designed to measure sound from one direction in a free field.

Frequency weighting A is mandatory for all sound level meters, frequency weighting C is mandatory for class 1 meters, and frequency weighting B has been eliminated. Although impulse time weighting I is no longer recommended for use, IEC 61672-1 contains an informative Annex that provides recommendations for the specification and testing of time weighting I, should it be implemented in a meter.

The specifications for response to transient signals have been made more stringent with the introduction of specified responses to tone-bursts of durations as short as 0.25 ms, compared to the minimum duration of 5 ms of previous sound level meter specifications.

The minimum level range for meters with digital displays has been increased to 60 dB from 15 dB.

IEC 60651 was amended in 2000 to include specifications for immunity from radio frequency interference, and these amendments have been incorporated into the new Standard.

2.2 Uncertainties

Uncertainties of measurements have been a major concern of international standardization. Normative Annex A in IEC 61672-1 lists the maximum measurement expanded uncertainties, which must be calculated according to the ISO/IEC Guide to expression of uncertainty in measurement (1995). When testing a meter's conformance to the new Standard, the calibration laboratory's measurement uncertainties must now be taken into account and must not exceed the maximum permitted uncertainties for each test that are specified by IEC 61672-1. As a result, the budget for tolerance limits available to manufacturers for the design of a sound level meter is decreased by the maximum permitted uncertainty of the laboratory that tests the meter.

3. IMPLICATIONS

3.1 Measurement capabilities

The design goals for the various frequency weightings specified by IEC 61672-1 remain the same as those of the previous Standards. However, the tolerance limits around these design goals have been re-evaluated. In general the tolerances of IEC 61672-1 have improved. For class 2 instruments, the tolerances for the weightings at 10 kHz are + 5.6 dB and minus infinity. As in the existing standards, this minus infinity tolerance permits the manufacturer to employ a low capability microphone that is unable to response to signals at 10 kHz or higher. For the measurement of impulsive sounds, such an instrument will give relatively large erroneous high frequency level readings. Similarly, for class 1 instruments, the tolerances for the weightings at 16 kHz and 20 kHz are + 3.5 dB and – 17 dB, and + 4 dB and minus infinity, respectively. The tolerances that include minus infinity allow a microphone that is unable to respond to above 16 kHz to be used in a class 1 instrument. The users of all sound level meters should take note on these limitations.

The current ANSI Type 1 and Type 2 specifications [2] have similar limitations for the measurement of impulsive sound as discussed above for class 1 and class 2 instruments. The electrical response of ANSI Type 1 instruments has tolerances for 16 kHz and 20 kHz of + 3 dB and – 7.4 dB, and + 3 dB and – 8.7 dB, respectively. By not having a minus infinity tolerance at 20 kHz, ANSI Type 1 instruments are able to respond to electrical signals at 20 kHz. Also, IEC 61672-1 has eliminated the Type 0 instruments that the ANSI sound level meter standard retains [2]. Type 0 instruments that have tighter tolerances are very useful for precise measurements and calibration laboratories. In North America, the hearing aid industry uses the ANSI sound level meter standard.

3.2 Periodic Calibration

IEC 61672 Part 3 is being drafted with the aim of producing a set of simplified tests for an individual instrument that can be completed by a calibration laboratory with an automated system in less than half a day. By concentrating on areas where existing designs are known to have difficulty in meeting specifications, the new tests are also more likely to detect shortcomings in the performance of an instrument. The drafting experts for the document are faced with two difficult questions: (a) How to determine whether an instrument has been submitted by the manufacturer for pattern evaluation? And (b) if the instrument has not been type tested, how to select the necessary tests to ensure conformance at a reasonable cost? With the above insight, and before the purchase of a new sound level meter, it is sensible for the user to ask whether the instrument has been submitted for type testing. The answer to this question may eliminate the doubt whether the claims stated in the specifications for the instrument are true.

3.3 National Standards

The Canadian Standards Association (CSA) has endorsed the ANSI sound level meter standard [2]. Some Canadian organizations prefer to quote the existing IEC sound level meter standards [1, 3]. The question on the preference for 3 dB or 5 dB exchange rates for sound exposure and noise dosimeters in North America [5, 6] is still to be resolved.

4. CONCLUSIONS

International consensus has led to the publication of a new specification standard for sound level meters [7]. Until all three parts of IEC 61672 are published, the existing standards [1, 3] are still acceptable for current use.

REFERENCES

[1] IEC 60651 Sound level meters (1979)

[2] ANSI S1.4 American National Standard Specification for sound level meters (1983) (R 2002) with amendment ANSI S1.4A (1985) (R 2002)

[3] IEC 60804 Integrating-averaging sound level meters (1985)

[4] ANSI S1.43 American National Standard Specifications for Integrating Averaging Sound Level Meters (1997) (R 2000)

[5] IEC 61252 Electroacoustics – Specifications for personal sound exposure meters (1993)

[6] ANSI S1.25-1991 (R 2002) American National Standard Specification for Personal Noise Dosimeter.

[7] IEC 61672-1 Electroacoustics - Sound level meters – Part 1: Specifications (2002)

[8] Meldrum, B. H. Sound level meter standard for the 21st century. *Acoustics Australia*, vol. 30, no. 2. (200x) (To be published)