

**Comprehensive
Product Noise
Declarations for
Noise Planning and
Commerce**

Buy Quiet 2011

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OUTLINE

- Introduction
- Scope of Presentation
- Current Product Noise Declarations
 - ISO 4871
- Different requirements
 - Industrial users - hearing loss
 - Commercial/Government/Schools – performance/annoyance
 - Outdoor – hearing loss/acceptability AND environmental level
- Recommendations

Introduction – Who am I?

- Noise Control Engineer – Board Certified by INCE/USA
- Experience – Industry, Government, Consultant (many “hats”)
- Past Experience:
 - NASA
 - Aerospace Industry
 - Government – Illinois Environmental Protection Agency (IEPA)
 - Industry – HP/Compaq/DEC
- Present Experience
 - Noise standards organizations
 - Consultant
 - IT products
 - Environmental noise
- Consumer

Introduction – Product Noise Declaration

- What is a “product noise declaration”?
- Information
 - on the noise emitted by a product
 - provided by the manufacturer
 - for purchasers
- Basic requirements:
 - Based on standard measurements
 - Presents useful information
 - Values are verifiable
- ISO 4871
- In this presentation: “Label” has a broad meaning and includes information in technical literature

Scope of Presentation

- Commerce/Government/Schools/Industry/Outdoor
 - Requirements and concerns
 - Industrial users – primarily hearing loss
 - Commercial/Government/Schools – performance/annoyance
 - Outdoor – affects both users and others - hearing loss/acceptability AND environmental
- Not consumer product or purchasers – other presentations today
- Not transportation sources; however, concepts are similar

Product Noise Declarations per ISO 4871

- In order to be useful, *uniform* methods of measurement and declaration are necessary to achieve the following purposes:
 - Measurement of noise emission
 - Determination of the noise emission value to be declared
 - Presentation of declared noise emission values
 - Verification of declared noise emission values
- ISO 4871 is based on the statistical methods of ISO 7574
- ISO 7574 assumes a large number of machines are tested to determine:
 - mean noise level value
 - Standard deviation of production

Product Noise Declarations per ISO 4871

- ISO 4871 permits two type of declarations:
 - Dual number: Report both L_{WA_m} and K
 - Where L_{WA_m} = average L_{WA} for batch of products
 - K = Uncertainty factor: depends on measurement precision and product unit-to-unit variation
 - Single number: report statistical maximum L_{WA_d}
 - Where $L_{WA_d} = L_{WA_m} + K$
- Similarly for emission sound pressure level at operator position L_{pA}
- Other parameters may be reported

Product Noise Declarations per ISO 4871

- Problems with dual number values L_{WAm} and K:
 - Difficult to compare reported values from products that are using single number declaration
 - Rewards poor product quality or poor measurement techniques since consumers will ignore or not understand K
 - K is larger for inaccurate and lower grade measurements and poor product quality, i.e., large variation in product unit to unit noise emissions

Example Product Noise Declarations per ISO 4871

Product RSV, Model 123		
DECLARED SINGLE NUMBER NOISE EMISSION VALUES		
A-weighted sound power level: <i>L_{WAd}</i> declared sound power level in decibels	Idle	Operating
	92	100
A-weighted sound pressure level: <i>L_{pAd}</i> declared sound pressure level at the operator's position), in decibels		
	82	91
In accordance with ISO 4871 -1996 and ISO 7779 -2010		

Requirements and concerns - Industry

- Primary concern: Hearing loss of machinery operator and workers in shops
- Ultimate needs – Immission sound pressure level at 1) the operator and 2) in the shop.
 - A-weighted sound pressure level
 - (Peak sound pressure level)
- Product noise declaration requirements:
 - Sound Power Level
 - Product Emission Sound Pressure Level at Operator Position
- Operator position sound pressure levels supplied directly from label
- Shop sound levels determined using sound power level on label

Reqmts/concerns - Commercial/Govt/Schools

- Primary concern: Performance, activity interference, speech interference, annoyance.
- Ultimate needs – Immission sound pressure level at the user positions in the office and school.
 - A-weighted sound pressure level
 - (Octave band sound pressure level)
 - (Tonal, impulsive, other characteristics: amplitude modulation etc.)
- Product noise declaration requirements:
 - Sound Power Level
 - (Product Emission Sound Pressure Level at Operator Position)
- User position sound levels determined using sound power level on label and room equations
- Other descriptors of sound are missing

Type of Products - Outdoor Equipment

- Construction equipment
 - Bull dozers
 - Jack hammers
- Outdoor maintenance equipment
 - Lawn mowers
- Building external heating/cooling equipment
 - Roof top building fans
 - Commercial building cooling and heating systems
 - Home air conditioning units
- Transformers

Requirements/concerns - Outdoor Equipment

- Primary concerns:
 - To user: Hearing loss and acceptability
 - To neighbor: Annoyance [may not be considered by purchaser of some products, e.g., lawnmower]
- Ultimate needs – sound pressure level at the operator position [and immission sound pressure level at neighbor].
 - A-weighted sound pressure level
- Product noise declaration requirements:
 - Product Emission Sound Pressure Level at Operator
 - A-weighted Position Sound Power Level
 - [Octave band sound power level]
- Operator position sound pressure levels supplied directly from label
- Neighbor sound levels determined using octave band sound power level on label with equations/software, e.g., CADNA/A

Discussion

- Who uses K in ISO 4871?
 - K is based on two factors, one of which is out of the control of the manufacturer:
 - Measurement uncertainty associated with measurement standard (e.g., lab-to-lab variation)
 - Engineering grade will have a smaller K than survey grade measurements
 - Product variation (i.e., products with large variation will have higher K value)
- I would suggest that there are very few purchasers who are concerned with K
 - Only those who wish to have a statistical maximum
 - Regulations could specify that L_{WAd} not be exceeded
- The largest group that needs to know K (and the single number declared values) are those who *verify* declared values!
- If products are unregulated, manufacturers may report an accurate L_{WAm} and report an artificially high K value to ensure verification.

Discussion (Cont.)

- A large group of purchasers have insufficient information from ISO 4871 declarations: Those who require octave band sound power levels
 - Planners or commercial groups who are purchasing equipment for outdoor installation and use programs such as CADNA/A to predict neighborhood sound levels.
 - Purchasers of HVAC equipment who require compliance with NC (or similar) indoor criteria

Summary and Recommendations

- ISO 4871 provides methods to report A-weighted product noise emissions that are measured according to standards, determined according to ISO 4871, and verifiable.
- ISO 4871 does not provide methods to report descriptors that would permit purchasers to determine annoying characteristics other than loudness (which for most cases is determined by A-weighted sound levels).
- There are objective methods for determining tonal aspect or prominent discrete tones, e.g., ISO 7779, ANSI S1.13, and DIN 45681
- ISO 4871 does not include octave band sound power levels, which are important for many types of commercial users

Recommendations

- Modify ISO 4871 to eliminate single number declarations with only L_{WAd} and dual-number declarations with (L_{WAm} , K) and replace with a new dual-number declaration with both L_{WAm} and L_{WAd}
- Reporting both L_{WAm} and L_{WAd} would avoid confusing customers and manufacturers. [L_{WAd} in small print?]
 - The measured value equals the mean reported value
 - Comparisons of sound power levels could be made between products of different families
- The only groups that would be using the L_{WAd} would be those who verify the values or those purchasers who are concerned with a statistical maximum value and regulations.
- Eliminating K as a means of verifying would prevent manufacturers from artificially having high values of K for purchasers and regulators who do not specify L_{WAd} .
- Regulations could specify that L_{WAd} not be exceeded.

Roadblocks to product noise information

- **Hypothesis: Product sound power and emission sound pressure metrics (decibels) were designed for “acousticians” and not for consumers or the public.**
 - **Confusion over the same unit (decibels) for sound power levels and sound pressure levels**
 - ISO 374X L_W emission data vs. ISO 1120X L_p emission data vs. room L_p immission criteria and occupational L_p noise criteria
 - **Confusion over product declared noise values that are “statistical maximum” values and those that are mean values.**
 - ISO 4871 dual number declarations
 - ISO 4871 single number declarations
- *Other types of energy sources do not have these fundamental problems: radiated heat and light*

Thank you – Merci Beaucoup

- DISCUSSION
- QUESTIONS

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