



**STANDARD
FOR
ACOUSTIC PERFORMANCE RATING FOR OPERATIONAL
NOISE OF ARCHITECTURAL HARDWARE**



SPONSOR
BUILDERS HARDWARE MANUFACTURERS ASSOCIATION, INC.

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AMERICAN NATIONAL STANDARD

(This is not part of A156.42)

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FOREWORD

(This Foreword is not a part of ANSI/BHMA A156.42)

Many facilities seek to minimize background noise to create a better experience for the occupants. The disturbance from noise can impact sleeping, learning, healing, thinking, and communication and this applies to many settings such as health care and education. The operation of architectural hardware can contribute to objectionable sounds, especially when the building structure is not optimized for blocking or absorbing noise. Customers face many choices when selecting architectural hardware and this standard provides an objective means of comparing the performance of products. The criteria in this standard are not limited to a given technology and it encourages the creativity of manufacturers to provide a high-value solution to their customers.

The general classification of builders hardware includes a wide variety of products which are divided into several categories. This Standard is a result of the collective efforts of members of the Builders Hardware Manufacturers Association, Inc. who manufacture these products. The total Product Standards effort is, therefore, a collection of sections, each covering a specific category of products.

This Standard is not intended to obstruct but rather to encourage the development of improved products. The BHMA recognizes that errors will be found, products will become obsolete, new products will be developed, and new production methods and materials will be employed. With this in mind, the Association plans to update, correct and revise these Standards on a regular basis.

Users of this Standard should consult applicable local building codes as to the requirements affecting the selection of locks used on fire doors and doors within a mean of egress.

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1. SCOPE

1.1 This Standard establishes methods for defining levels of acoustic performance for various types of architectural hardware whose non-acoustic performance aspects are described in the applicable BHMA product Standards.

1.2 This standard provides for acoustical certification of A156.2 bored locks, A156.3 exit hardware, A156.12 interconnected locks, A156.13 mortise locks, and A156.37 multipoint locks.

2. DEFINITIONS

2.1 **Acoustic** The characteristics of sound that contribute to the overall auditory experience by individuals.

2.2 **Actuating Bar** The activating mechanism of an exit device is located on the egress side of a door. The active surface of the actuating bar shall be visually and physically distinct from the rest of the device and the length shall not be less than one-half the width of the door leaf. Refer to local codes for location and length. Also called crossbar or push pad.

2.3 **Data Acquisition System** Hardware and software designed to capture, process, and analyze acoustic signals. The "front end" includes components such as microphones to capture the acoustic signals from sound waves, pre-amplifiers to amplify the electrical signals generated by the microphones, and analog-to-digital converters to process and store the recorded data.

2.4 **dB** Refers to a sound measurement in decibels (dB) that is C-weighted (corresponding to the 100-phon equal loudness curve per IEC 61672-1 (2002-05) Class 1 and ANSI S1.42-2001). It quantifies sound levels accounting for the low-frequency response characteristics of the human ear and is best suited for measuring impulse noises.

2.5 **Denim Insulation** Comprised of denim and cotton material, typically recycle content, it is available in various thicknesses and lengths (batts) for use as insulation in construction (battens).

2.6 **Foam Tape** Comprised of a closed cell foam, it remains flexible and resilient through a range of environmental conditions, is able to bridge gaps and is very effective at absorbing vibrations and forces of impact.

2.7 **Fractional Olympic Weight Plates** Dimensions are such that these can be added to standard sized Olympic weightlifting bars. Weight is typically a maximum of 1.0 lb and less (known as fractional or micro weights) and construction is solid rubber.

2.8 **Free Field** An acoustic environment where reflective surfaces have no significant effect on sound propagation.

2.9 **Free Field Microphone** A microphone specifically engineered to minimize interference with the surrounding sound field, allowing it to precisely convert acoustic energy from sounds into electrical energy.

2.10 **Gaffers Tape** A non-reflective (matt black), heavy cotton cloth, pressure-sensitive tape.

2.11 **General Purpose Felt** Also known as industrial, pressed or technical felt, it is a non-woven and interlocking blend of wool and synthetic fibers. Per SAE J314 (2012) Felts - Wool and Part Wool, grade ratings are used to delineate performance as a function of wool content, durability, hardness, and related tolerances.

2.12 **Hemi-Anechoic Chamber** An externally isolated environment for acoustic testing with sound-absorbing materials on the walls and ceiling and a floor that reflects sounds to simulate real-world conditions.

2.13 **Latch** A device used to hold a door closed and requiring movement of an element before the door is released for opening.

2.14 Loudness A psychoacoustic metric quantifying the amplitude of sound as perceived by humans, defined by various standards such as ISO 532B, the "Zwicker Loudness" model. Measured in sones, loudness is commonly favored over physical measures like sound pressure level (dB) in sound quality applications where subjective perception is most relevant.

2.15 Optical Tachometer A device that measures rotational speed or angular velocity using light sensors and reflective markers on the object. The markers consist of alternating dark (black) and reflective strips with a known width and the reflection of light from the moving markers allows for the calculation of rotational speed.

2.16 Overall Sound Pressure Level (dB) A physical quantity describing the amplitude of a sound, commonly expressed in decibels relative to sound pressure in pascals. This level may be weighted to emphasize specific frequency ranges, such as A-weighting, which is an approximation of a low-level loudness curve (dBA), and C-weighting, an approximation of a high-level loudness curve (dBC).

2.17 Peak Instantaneous Loudness (PIL) The maximum value of time-varying loudness, with the calculation of time-varying loudness specified in standards like ISO 532B.

2.18 Percentile Loudness Indicates the loudness exceeded over a certain percentile of the entire sound duration. For instance, in the case of a 2-second sound file, the N5 Loudness represents the loudness exceeded for 0.1 seconds (or 5%) of the file.

2.19 Psychoacoustics The responses associated with how a human interprets auditory stimuli. Examples include sounds that influence cognitive processes, including attention, memory, and learning. Other examples include sounds that cause physiological changes in the body such as an increased heart rate, heightened alertness, and changes in blood pressure.

2.20 RMS Sum A description of the total sound level calculated over a specified frequency range. To calculate this, the auto-power spectrum (FFT) of the signal is calculated. In the case of the report, the peak spectrum was used (over the time period of consideration). This spectrum was A-weighted, hence dBA. The spectrum values from 0 to 200 Hz were then root sum squared to obtain the total dBA value of this range.

2.21 Roughness A psychoacoustic metric that quantifies the amount of mid- to low-frequency (from 20 to 300 Hz) variations in the signal amplitude. Roughness is calculated from time-varying loudness and is a function of both modulation frequency and modulation depth. Roughness can be useful for phenomena such as metallic rattling.

2.22 Roughness vs Time Integral Quantifies the temporal overall roughness by integrating the time-varying roughness values over a defined time period.

2.23 Sone A unit of loudness that directly quantifies how a sound is perceived by an average listener. The relationship between loudness level in sones and the physical intensity of a sound is roughly linear.

2.24 Sound Quality Equation An objective and empirical means of analyzing the noise from a variety of similar products and predicting the preference or annoyance experienced by an average person. Also known as a golden equation or a preference equation, its weighting scale is developed from data gathered from a sound jury.

2.25 Strike A mortised or surface mounted plate fastened to the door frame into which the bolts project.

2.26 Undercut The clearance between the bottom of the test door and the mounting surface for a floor strike.

2.27 Universal Door Used in place of a commercially available hollow metal door, it is primarily constructed from square tubing for strength and low weight. Replaceable wood blocks are employed such that different configurations of latching hardware can be easily installed without altering the base framing.

2.28 Unlatch To unfasten, disengage or retract a latch by the movement of an element to release the door for opening.