

# TECH TALK

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## Noise Criteria (NC) – Part 2

by Dave Fetters

As we indicated last month, grille, register, or diffuser (GRD) selection and sizing are often influenced by the potential noise the product is likely to make when air is flowing through it.

**Noise and Sound:** We need to be careful about terms and definitions here. The word *noise* and the word *sound* are often and incorrectly used as one and the same. **Noise** is an **undesired** sound. Noise is erratic, intermittent, or random, and interferes with normal room activity. **Sound**, on the other hand, is perceived or “heard” as comfortable, wanted, or at least not annoying, not too loud, and relatively constant as it blends into the background and/or has pleasing qualities to it. Sound is noise if it is too loud, unexpected, annoying, uncontrolled, occurs at the wrong time, or is unpleasant—you get the picture. One person’s loud stereo system is “wanted sound” to him, but to his neighbor at bedtime it is unwanted, undesired, too loud, and therefore noise. Noise is usually (but not always) inclusive of most frequencies at the same time. **Frequency** (tone or pitch) is a method of categorizing sound. Low frequency sounds rumble, even vibrate or rattle, like thunder. High

frequency sounds include hiss, whine or buzz.

Examples of pleasant sounds are wind chimes or stereo music that is soothing, water lapping against a sailboat hull, or a light breeze rustling leaves in a tree. A motorcycle has a satisfying “sound” to its rider. Boisterous conversation is an enjoyable sound to the participants, but may be unwanted noise to someone seated nearby. A crying newborn is probably a satisfying sound (and a relief) to the mother, while to the uninterested, noise.

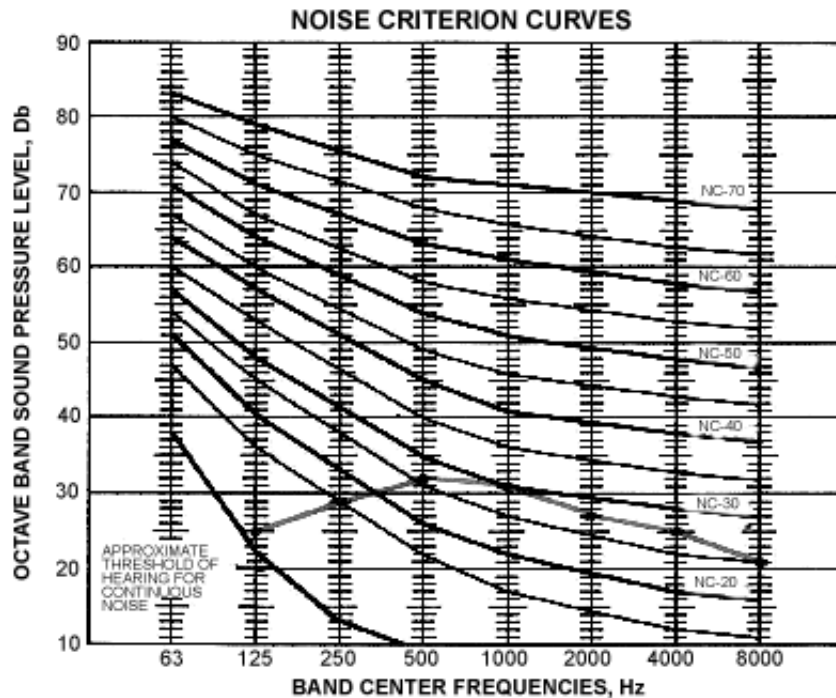
The perception of sound is influenced by loudness (magnitude). A noise can be less harsh than a sound that is too loud. Niagara Falls is a loud noise of complex tones, but it’s enjoyable. The electronic hum of a poorly working computer is a sound of a simple tone that can be very annoying if the office is otherwise quiet. Orchestras can be very loud, but the music is anticipated and, therefore, a pleasant *sound*. Jet engines at close range are very loud and unpleasant. A mosquito buzz isn’t loud, but it is a noise that equates to an unpleasant experience.

How we perceive sound is also influenced by the frequency. Humans can stand louder sounds at low frequencies than at high frequencies. The duration or how long a sound lasts influences a person's reactions to it as does how often it occurs. Unfortunately, it is hard to predict in any precise way peoples' response to sound. It is part physiological and part psychological; it depends on the situation, and it depends on the individual. The NC number we use for our products is a simplified approach to acoustics—the study of sound. Our concern in the HVAC arena is to limit the background interference of whatever human activity is taking place. A noise criteria chart has been developed to show lines of “constant loudness” as the human ear would perceive it.

The plot on the chart below is typical of a “sound room test” result we might see

from a particular register at a single airflow rate. The highest NC number generated is 30 determined by the highest penetration of octave band level into the curves. Even though it occurs at 1000 Hertz, the NC doesn't tell us anything about the frequency. It only gives us an idea of the relative loudness.

So even though we spend considerable time measuring sound in our reverberation chamber at different airflows and frequencies for each size and model of product, the end result is still the single-number “NC.” NC does not address acoustical **quality** properties, such as whether the background noise generated by the register will be annoying (rumble, hiss, machinery noise, or vibrations), only whether the background noise will noticeably interfere with sounds people want to hear, such as speech.



Hart & Cooley, Inc. 800.433.6341 toll-free  
 500 East Eighth Street 616.392.7855 phone  
 Holland, MI 49423 800.223.8461 toll-free fax  
 info@hartcool.com 616.392.7971 fax  
 www.hartandcooley.com