

# *Sound Advice*

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Helpful Information from *Stewart Acoustical Consultants*

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## **RATING BACKGROUND NOISE IN ROOMS**

By Noral D. Stewart

The steady background sound in rooms, usually from HVAC systems, has most commonly been evaluated using NC ratings developed by Beranek in 1957. The sound is measured in octave bands from 63 to 8000 Hz and plotted against a set of curves. The lowest curve the sound spectrum touches is the NC rating. The curves for a given rating allow less sound with increasing frequency. The rating numbers correspond to the curve level in the 1000-2000 Hz octaves. Actual sound spectra frequently do not match the curves, but intercept the lowest curve at a low frequency. Thus, the actual sound at 1000-2000 Hz is often less than the NC rating. The overall sound is less than expected based on the rating, but the sound may be unpleasant.

In 1971, Beranek, Blazier, and Figwer introduced PNC curves to resolve some problems with the NC curves. These extended the range to 32 Hz and required less sound at the lowest and highest frequencies for a more pleasing spectrum. These curves were never widely accepted.

Blazier introduced a very different RC system in 1981, primarily to rate noise in offices. It responded to problems below 63 Hz, provided a numerical rating based on speech interference, and provided descriptors to indicate a rumbly or hissy nature. The numerical rating of the sound is the arithmetic average of the octave-band levels at 500, 1000, and 2000 Hz. The curves, which are straight lines, are used only to evaluate the quality of the sound. A major appeal of the system is its simplicity. However, this system was not intended for use in very quiet spaces below RC 25. This system extended criteria to 16 Hz though many believe it is too restrictive for sound below 63 Hz. Blazier has recognized this may be true for the lowest curves. The original system also did not identify some problems due to excessive noise in the 125-250 Hz region.

Beranek sought to overcome some of the problems of the RC system with the NCB curves introduced in 1987. This system adopts several principals of the RC system, but uses curves that are not straight lines. The numerical rating is determined by the arithmetic average of levels in the 500, 1000, 2000, and 4000 Hz octaves. Thus, for the same sound, the NCB rating is lower than the RC rating. This system can be used for very quiet spaces. It is much less restrictive than the RC system below 63 Hz. This is appropriate for quieter spaces since low levels of rumble are below the threshold of hearing. However, many believe the rumble criteria is not restrictive enough for louder areas such as offices.

Blazier introduced RC Mark II in 1997 to overcome some of the problems of the RC system. The primary problem addressed was the failure of RC to identify roar problems in the 125-250 Hz region. It introduces a Quality Assessment Index to rate sound quality that requires a program to easily evaluate. The RC Mark II procedure also further restricts sound at 16 Hz, except at lower rating levels where some restrictions at the lowest frequencies are relaxed.

There is currently an effort to resolve differences between the RC and NCB systems to provide a better rating system. The major difference of opinion is related to noise below 63 Hz and especially for the lowest rating levels. Many people also favor retention of the original NC system since it is easier for most people to use.