

# Equipment Noise: Acoustics 101

JOHNSON CONTROLS WEBCAST QUESTION & ANSWER

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**How does the sound level of HVAC equipment change with its life cycle?**

If the equipment is properly maintained and periodically cleaned, the sound levels should not change over time. Frequently, new sounds, such as squeaks and rattles, can appear with age; these can be attended with additional maintenance.

**How can the sound from a mechanical equipment room be effectively decoupled from occupied spaces?**

Please refer to Chapter 48 of the ASHRAE Handbook, "Noise and Vibration Control". In that chapter, there is a section entitled, "Mechanical Equipment Room Sound Isolation" that addresses in great detail this issue. In particular, it looks at room location, wall design, doors, wall penetrations, mechanical chases, floors and ceilings, and return air systems.

**Operating a supply fan in the "surge area" of its operational map resulted in elevated noise and vibration. What options are available to deal with this? Should an acoustician be hired?**

The question itself is its own answer. Once a fan has been forced, by high system pressure, to operate in its surge area, it is no longer an efficient method of moving air. No amount of acoustical treatment will change this, and it is self-defeating to do so. Unfortunately, the system was not properly specified. The fan must be replaced by one capable of handling the operating point without running in surge.

**When replacing older roof top units (RTU) with newer ones, we more often than not have to have a curb adapter fabricated to mate the newer RTU with the existing curb. Are there any factors to consider in doing this; such as, noise from curb adapters or lengthening the discharge duct path into the underside ductwork?**

When the opportunity arises to specify a replacement curb, several issues bear consideration. First, proper vibration isolation should be incorporated into the curb to isolate the new unit from the building. Second, the placement of the openings to the discharge and return ducts should be evaluated, and perhaps realigned, so that there is not direct "line of sight" from the air handler fans to the main ductwork. Finally, there are options available from third-party vendors for curbs, inside which materials are added that can absorb and / or block some sound from the unit. Curbs with silencers already incorporated are also available, but these invariably add appreciable height to the unit-curb assembly and so may not be preferred.

**What is the difference between the terms, ‘Acoustic Sound Power Level’ and ‘A-weighted Sound Power Level’? Is sound from Air Handling Units specified in one or the other of these?**

A-weighting is the process of applying a specific filter to the measured sound level to determine a single-number metric related to human response. A-weighting normally is not applied to sound power levels, but to overall sound pressure levels at a particular location. Indoor sound emanating from Air Handling Units is specified as sound power level (re 1 pW) in octave bands from 63 Hz to 8000 Hz, per AHRI 260. These levels are not summed together into an overall sound power level, nor are they A-weighted. Outdoor sound emanating from HVAC equipment is also specified as sound power level (re 1 pW) in octave bands, per AHRI 270, 370, and others. In some cases, these bands are summed and A-weighted to provide an overall, A-weighted sound power level (re 1 pW) as a convenience to the engineer estimating outdoor sound over distances.

**Are sound baffles still a common solution to air handling noise? They present a significant penalty in pressure drop.**

A sound baffle is a panel inserted into the airstream of the supply fan, often with sound-absorbing material attached. The intent of the baffle is to block the line of sight from the fan discharge to the opening of the supply duct, or alternatively, to the room (in free discharge), and to provide a measure of sound absorption downstream of the fan. Such a penetration into the airflow will always result in a loss of dynamic pressure. However, when properly designed and installed, the dynamic pressure can be recovered as static, and the airflow is not greatly impacted. Baffles should not be added as an afterthought to an installed system. They are effective when ordered with a new unit when they are designed into the system properly.

**What certification(s) are required to become a noise testing consultant?**

In the United States, no certification is required to practice acoustical consulting or noise control engineering. Other countries have other approaches, but in general, certification is rare for acoustical consulting. However, certification is available through the Institute of Noise Control Engineering (INCE). Practitioners who bear “Board Certification” from INCE have been thoroughly vetted, in the manner of a Professional Engineer, for their knowledge in the practice of noise control engineering.

Customers seeking acoustical consulting are encouraged to examine carefully the qualifications, experience, and reputation of a potential consultant. In the USA, practicing consultants can be located through the National Council of Acoustical Consultants (NCAC) and the Institute of Noise Control Engineering (INCE-USA).