

Addressing disturbing noise characteristics in HVAC systems

Noise levels from ventilation systems has become an increasingly pressing topic in recent years, and an onus is now being placed on manufacturers, system designers and contractors to safeguard acceptable internal noise levels for occupant comfort, *writes Glen Plunkett, Acoustician with iAcoustics.*

Noise from mechanical and electrical equipment can be disturbing and fatiguing, and may interfere with the functionality of a space and the productivity of those who occupy it. Most new

building projects in the commercial, educational and healthcare sectors strive for BREEAM, LEED and WELL accreditations which are very much in line with the push for sustainability and energy efficiency. Part of the

green-movement package rightly includes basic requirements for indoor comfort levels which embraces acoustics and noise control as a key component.

The background noise level requirements for internal spaces are typically specified in terms of a maximum permissible dB(A) level measured over time, or by using the Noise Rating (NR) curve. The reason for using one or the other, or both, may be justified in the project documentation.

Regardless of which single-figure parameter is used as a performance indicator for internal background noise levels, none provide a means by which the subjective quality of the operational noise source(s) can be addressed. It follows that two different ventilation systems in two separate rooms can achieve the same noise level yet

sound completely different to each other.

The Association of Noise Consultants (UK) attempts to address this in a simplified way for specification and commissioning purposes by imposing a 5dB penalty for noise with disturbing characteristics. This, however, implies that a noise source with a disturbing character may become acceptable by making it quieter, which is often not the case. Most attempts to coin a performance indicator for disturbing noise characteristics from HVAC systems have proven to be unfeasible for everyday use.

Types of problems

Disturbing characteristics of HVAC systems typically include noise that is tonal, intermittent or impulsive in operation or that emits a distinctive "hum". Such characteristics have been shown to increase the subjective prominence of a noise source when compared to steady-state noise at the same level. If we consider two meeting rooms for example, one which achieves NR30 with a distinguishable "hum" from the fan coil unit, the other room achieving NR35 with no distinct acoustic characteristics, people may well find the former



Glen Plunkett is an acoustician with iAcoustics, a company with a proven track record in M&E design consultancy that has designed systems down as low as NR17. It conducts noise transmission calculations using standardised guidance contained in ISO 12354-5, and also the procedures recommended in CIBSE Guide B4 to demonstrate compliance with the project criterion.

to be more annoying even though the actual background noise level is lower.

Acoustic specification

Acoustic specification for internal background noise levels tend to set out a maximum permissible level not to be exceeded under normal operating conditions. Not all specifications or project criteria set out a design aim on account of the acoustic quality of the system(s), stating that all systems must not emit any disturbing characteristics, including noise which is tonal, intermittent or impulsive in nature.

In the absence of such a design statement, disputes can arise at the commissioning stage because the contractor was only required to achieve a specified noise level, irrespective of providing a

"good-sounding" system. It is less problematic if the client and contractor agree that the acoustic quality HVAC system will be addressed at the design stage. Furthermore, it may be difficult to justify the presence of a distinct acoustic feature because of the lack of standardisation and guidance in this area.

Designing M&E systems to sound good

It is common for system designers to meet a specified NR curve which defines a set of maximum permissible frequency values for a specified NR value. However, this does not imply that the design achieves a pleasant noise profile. CIBSE proposes that a better alternative is to design to a target spectrum which falls with frequency to around 5dB/octave to provide a more balanced sound.

The first step is all to do with layouts. If a mechanical unit is to be suspended off the ceiling void within the space, what impact does the unit breakout noise have on the space below and on adjacent spaces? Where can fan coil units and duct runs be placed to minimise noise impact?

Careful selection of equipment on account of the frequency spectrum of the unit follows closely. Ventilation elements such as fans, grilles and diffusers with a well-balanced noise spectrum should be considered with equal importance to the overall noise level output.

There are many practical solutions available to minimise potentially-disturbing characteristics and it is advisable to seek the advice of an experienced acoustic consultant. ■

