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These comments relate entirely to the proposed Appendix 5, and the principle that too much noise may cause people to reduce ventilation to keep the noise down and risk their health as a result.

The Institute of Acoustics welcomes the recognition that unwanted sound ("noise") from mechanical systems needs regulating to protect health of people in their homes. Our comments relate to the principles of controlling the ambient noise climate in the home, and specific comment on the proposed objective levels set out in Appendix E.

The Concept

The home can sometimes be quite a noisy place, whether it be noise breaking in from outside through open or closed windows, or noise from essential appliances like the refrigerator or central heating. Running some appliances periodically such as washing machines, cooker extractors or dishwashers generate noise, however this is within the control of the occupant in terms of timing and frequency of use. When people are sleeping or relaxing there needs to be the right environment for this to be possible, without interference from mechanical systems. The reason for Appendix E being proposed seems to be principally because of the fear of discouraging use of whole house systems, however a wider consideration of the noise in our homes is perhaps of merit to test the suitability of the approach encapsulated in the proposals.

The benchmark for noise ingress into the home remains BS8233:1999 and WHO guidelines currently, which work to sound pressure level values of 30dB (A-weighted over an 8 hour night period) for a good standard in bedrooms, and 30dB (A-weighted over an 16 hour day period) for a good standard in living rooms. This shall be revisited when considering the proposed limits.

A continuously running domestic mechanical ventilation system therefore needs to be sufficiently quiet so as to not discourage the occupant from obtaining sufficient ventilation. It should also be borne in mind however, that when trying to achieve the above standards in rooms, noise from such ventilation systems should also not raise internal noise levels significantly above these targets. Conversely however, the constant noise created by a ventilation system serves to remind the occupant that the system is operating, and combines with sound insulation between homes to determine the overall privacy experienced. This latter point is relevant as making such systems too quiet would not assist in this regard, this can be a problem when facades are sealed and passive systems do not provide any meaningful background noise.

Part E of the Building Regulations deals with sound insulation and by including noise limits within Part F, there is the opportunity to join up the thinking and assist the aims within Part E so as to achieve enhanced levels of privacy between dwellings, providing that the balance is considered

carefully. By working to the above principle, a modicum of services noise may be useful to optimise privacy between dwellings, in conjunction with Part E and the Code for Sustainable Homes, without creating internal noise conditions which are intrusive or likely to affect the way people use the systems.

The Institute would agree that at this point in time it does seem eminently sensible to include some sort of acoustic limit where mechanical systems are used, and indeed this would equally apply to hybrid systems which will also generate internal noise levels that will affect habitable environments. The distinction between a full house mechanical system and a hybrid one that uses mechanical elements to assist passive systems seems to be almost semantic now.

There is a recognition within sections 4.33, 4.34, 4.35 and 5.37 that the ingress of environmental noise through the systems themselves and the effects of noise generated by the systems upon the environment also need to be taken into account, however these are generally dealt with through the planning system.

Proposed Objective limits

Considering Appendix E of the consultation proposal in detail the following comments are put forward :

- The choice of Sound Power Level (L_w) as a parameter is understandable, because of the need to deal with regulation off site without testing, but the figures stated would suggest that these are in fact Sound Pressure Levels (L_p). The figures should be reviewed and are considered to be incorrect as currently proposed.
- BS EN 13141 is a perfectly reasonable standard for quantifying the L_w of a device, but this is an inherent quantity of energy of the unit rather than the behaviour in the system, which equally needs to be considered with the help of an acoustician. The merits of using L_w for a laboratory test is considered valid, and assessment in 1/3 octave band values is welcomed as requiring manufacturers to make available data that is not currently standard practice. This information can then be used in the assessment of mechanical systems to predict the operational noise levels in the dwelling. It might be advisable to include a simple Sabine conversion calculation from L_w to L_p as part of the standard to allow comparisons with the Part F limits, or to allow consideration by assessments against standards such as WHO or BS8233:1999.
- Field testing of the sound pressure level *in-situ* can be fraught with difficulty when the noise source levels are close to the background levels. It would therefore be useful to note this in the guidance.
- There is no mention of the reverberation conditions that should be assumed to be the benchmark, whereas Document E (via ISO 140) assumes that a typical room would have $T_{20} = 0.5$. This would assist in avoiding grey areas of assumptions to help check that any figures proposed are reasonable.
- The figures proposed in Table E1 seem to be approximately 5dB too high if they are L_p values, and too low if they are L_w figures. It is considered appropriate to aim to not raise internal levels significantly above the BS8233:1999 standard for 'good', when the system is at full duty, and although there is no need to explicitly reference the standard this principle

should be part of the thinking behind setting the limits in part F, Appendix E. It is considered therefore that limits 5dB below the figure (i.e. 25dB in bedrooms and living rooms) would only then raise the combined level to 31dB. Therefore if planning restrictions aim to keep environmental noise below 30dB in bedrooms this approach would not compromise the quality of acoustic environment and potentially add some useful masking of transportation source noise also.

- There is no clear guidance on what Standard for sound power measurement should be used when the radiated noise is tonal. This requires clarification in the guidance.

It likely needs to be spelt out that advice needs to be sought to check that the acoustic performance of the domestic system design will not compromise the internal noise climate. Reference could then be made to the standards set by BS8233 (or other relevant considerations e.g. planning condition) if considered appropriate. This is particularly important where the on-site compliance route via measurement is chosen, which we would proceed with caution .

Point 12 seems to be suggesting that where necessary to meet the values in Table E1 that attenuators might need to be added to the system. This is fine, however ductborne fan noise is simply one aspect of a ventilation scheme design. The system really needs to be checked and calculations provided to show that the targets have been achieved, and with the measures taken to do this set out (e.g. measures such as avoiding tortuous duct routes and excessive in duct air velocities so as to control regenerative noise in the system). This is fairly standard practice by acousticians and this could be dealt with by requiring that a report by a competent acoustician be provided that provides evidence of how the performance requirements are to be achieved. This is then consistent with some aspects of Part E e.g. the calculations needed to support the control of reverberation in common areas.

Finally, the applicability of this section to hybrid passive systems certainly seems to be equally strong as for pure mechanical (HVAC) systems, where there is the prolonged use of mechanical systems to assist the otherwise passive ventilation process.

In conclusion, the Institute of Acoustics supports the principle for this Appendix, but has concerns over the proposed application of parameters and the figures offered. We strongly advise a review of the performance criteria to make sure they are correct and achieve not only the intent to prevent people from being discouraged from using such systems, but so that they will not compromise the quality of the internal acoustic environment for occupants. It is thought likely that the industry will not receive this Appendix at all well, as the use of L_w to assess a system is not in common use at present for such systems and may introduce a new field not understood by many suppliers. As such it is likely that this would force assessments by acousticians to produce calculations to demonstrate compliance. If this is the intention then it should be clearly stated that such assessments should be completed and submitted for approval to Building Control.

It is hoped that these initial comments are of assistance.

The Institute would welcome the opportunity to input more directly to this section to get the limits and parameters right. Currently it is feared that this may undermine the importance of domestic

services noise at a time when where we are looking toward improving internal soundscapes to improve health and wellbeing within the sustainability remit.

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