ACOUSTICAL STANDARDS PLAY A KEY ROLE IN OPTIMIZED SOLUTIONS

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Acoustical standards are important to heating, ventilation, and air conditioning (HVAC) system manufacturers. Our participation in developing standards helps us by:

1. getting the right information to our customers;
2. avoiding conflicts between manufacturers and other organizations; and
3. preparing for changing system requirements.

"Providing accurate, appropriate acoustical information for our systems helps ensure that the solutions are applied correctly."

Getting the right information to customers

Our company's mission is to provide safe, comfortable, and efficient environments. Part of the comfort offering includes appropriate acoustical conditions such as sound levels that are due to system operation. Customers that specify acoustics as a design parameter range from those with very little exposure to those who are very knowledgeable acoustical professionals. To apply our systems correctly, information needs to be provided about our solutions. However various customers ask for different information.

Some customers desire information about sound power levels while some want information about sound pressure levels. Different frequency ranges are often requested. Some demand single number descriptors and some want data presented in one-third octave bands. It takes time to convince customers that the values we publish are correct, educate them on what the information means and show them how it can be used in their application. Standards help to determine what information needs to be published and how to collect that information. Some standards educate the users about what is included in the standard, why it matters, and how accurate or repeatable the tests are that determine published values.

In general, our industry prefers to provide sound power levels since it is a direct output of the systems. Sound pressure is usually controlled by factors beyond our control. We have to undertake a very large number of measurements to adequately describe our solutions, so the measurements need to be fast. Our systems are often large and generate significant levels of low frequency sound. The information we provide needs to be used by customers to design spaces that meet the acoustical requirements, without excessive controls, so it must be accurate.

Customers who have experienced untested systems and the headaches they may create have demanded check tests, so our measurements must be repeatable. To use our published information in the design process, either octave band or one-third octave band levels are needed. We have found that using qualified reverberation rooms to determine sound power meets these requirements. Furthermore, having standardized sound measurements allows for comparisons between different manufacturer's systems. (See Fig. 1)

Fig.1. Qualified reverberation room with system ready for sound power measurements.

In the 1960s and 1970s, reverberation room standards[1] were developed with considerable input from the HVAC and computer industries. The equipment specific standards have been undergoing improvements ever since.

As new methods and systems become available, the standards evolve. Those who write the standards are influenced significantly by the problems they face. Those who focus on small easily movable devices that primarily emit high frequency noise have different perspectives

than those with large systems that cannot easily be moved and generate low frequency sound.

During the 1980s and 1990s, the HVAC industry focused on system specific standards through the Air Conditioning, Heating, and Refrigeration Institute (AHRI), and reduced our activities at the Acoustical Society of America (ASA) and at the International Standards Organization (ISO). Thus, the base sound power standards moved away from addressing our needs.

Those present at the ASA or ISO standards activities often worked on computers or small appliances and tools that have different constraints and attributes. AHRI is currently working with the S12 Noise standards committee to create a new reverberation room standard that addresses the concerns and needs of HVAC manufacturers. We are spending more time now because we neglected this group for too long.

Avoiding conflict

During the 1990s the importance of acoustics of classrooms received much attention within the acoustical community. (See Fig. 2) Research was started or expanded, working groups were formed, and a standard was written to determine the requirements regarding acoustics of classrooms.[2] The HVAC industry was not actively involved. We were on the working group mailing lists; however, the effort did not get the attention it needed and we were surprised when the standard neared completion.

The result was a negative reaction to the big changes in requirements. Had we been active, we would have been aware and ready for the changes, and we would have understood why they were needed. The reaction resulted in hard feelings and mistrust between the HVAC industry and many in the acoustics community. There was significant time and money spent by both sides to defend their respective positions.

In 2009 and 2010, the standard was revised.[3] This time, the HVAC industry was actively involved (working group co-chairs: Stephen Lind and Paul Schomer). We were able to bring the people involved together to understand better why the standard was important. Many people in the HVAC industry were educated on the requirements and the reasons behind them and subsequently moved from being opposed to the standard to a neutral position (with some companies strongly supporting the standard). The cost in time, dollars, and goodwill was much lower because of the collaboration.

Fig. 2. Classroom background sound levels are significantly affected by heating, ventilation and air conditioning systems.

Preparing for changing system requirements

Being involved early in the standards development process, such as seen in the classroom acoustics standard, helps everyone to be aware of what will be required. The standards often take multiple years to write, so being involved early provides time to adjust internal procedures about how to make measurements and calculations. The standards indicate what information to publish, so that system marketing materials can be organized and ready when the requirements take effect.

Knowing that a classroom will be required to meet a 35 decibel level allows us to guide customers on using our systems to meet the goal. It also gives a design goal for systems that will be located inside the classroom where there is little that can be done to control the noise impacting the occupants. By being involved, we are more likely to understand and meet our customer's needs.

Being active in standards work helps us to agree with our customers on what is the correct information to provide. Providing accurate, appropriate acoustical information for our solutions helps to make sure the system is applied correctly and increases the likelihood that customers will be satisfied with our systems. Being proactive instead of reactive makes it easier to plan expenses and be ready for change.

Taking part in the process helps to avoid conflicts, which helps to improve relations with our customers. Being aware of new or upcoming requirements helps to make sure our system designs will be accepted in the intended markets. Having agreed upon standards helps both our customers and us.AT

References

1. P. Baade, *History of the Qualification Procedures of American National Standard S1.21-1972*, Noise Control Eng. J. **7** 48–51 (1976)
2. *ANSI/ASA S12.60-2002, American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools* (Acoustical Society of America, Melville, NY).
3. *ANSI/ASA S12.60-2010/Part 1, American National Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, Part 1: Permanent Schools* (Acoustical Society of America, Melville, NY).

Stephen J. Lind is an acoustics engineer in sound and vibration testing at Trane, a leading global supplier of indoor comfort systems and solutions and a brand of Ingersoll Rand. His work focuses primarily on measuring sound for Trane air conditioning systems. He is also active in the Air Conditioning Heating and Refrigeration Institute's Technical Committee on Sound and on the Acoustical Society of America Standards Committees S1 and S12. Lind received a Bachelor of Arts degree in physics from the University of Northern Iowa and a Master of Science in engineering degree in acoustics at the University of Texas at Austin under the supervision of Mark Hamilton and David Blackstock. Prior to joining Trane, Lind was an acoustical consultant in Los Angeles and Mississauga, Ontario. He currently resides in Onalaska, Wisconsin.