

## Hearing is Believing

by Dean K. Wilson, P.E.

**The fire marshal in our jurisdiction has just told us he will not accept a fire alarm installation our firm just completed at a new office building. He says that the sounders do not produce a loud enough evacuation signal. What do we do now?**

Of all the complaints I receive from fire marshals, fire inspectors, insurance inspectors, and other public and private Authorities Having Jurisdiction (AHJs), the failure to achieve proper sound pressure levels throughout a building top the list. It seems as if designers of fire alarm systems and installing contractors can eventually place fire detection devices in the proper locations. When it comes to the audible notification appliances, however, it seems that a great cloud obscures the goal of achieving properly audible signals throughout the protected space.

NFPA 72-2002, *National Fire Alarm Code*, Chapter 7 offers clear performance requirements for the audible notification appliances. The appliances must have a specific listing for fire alarm use. They must not produce too loud a sound—not greater than 120 dB. They must produce sufficient sound pressure level—15 dB above average ambient or 5 dB above maximum sound level lasting at least 60 seconds—to alert the occupants who receive notification of a fire alarm in the public mode. For those occupants at telephone switchboards, maintenance offices, or others considered to exist in the private mode, the notification appliances must achieve a sound pressure level of 10 dB above average ambient or 5 dB above maximum, but not less than 45 dB.

How hard can this be? Apparently, most of the time, it is all too difficult. You see the problem comes when the designer or installer tries to determine what the “average ambient sound pressure level” or the “maximum sound pressure level having a duration of 60 seconds” might be. In an existing space, a determined designer or installer can actually take an exhaustive series of measurements with a sound pressure level meter and determine, with some degree of precision, these two baseline values.

In a building under construction, the designer or installer must estimate the values based on a review of the acoustical properties of the proposed walls, ceilings, floors, and so forth. In some occupancies, this can present a daunting task.

“Wait a minute,” you may say. “I’ve been designing or installing fire alarm systems for 20 years and I have never taken measurements to determine the sound pressure levels in the protected space before I design or install the fire alarm system.” Oh. Do you suppose that could represent part of the problem? Are you admitting in front of all these folks that you have not done your homework?

Every part of a fire alarm system installation should be carefully engineered, including the selection and placement of the audible notification appliances. I can’t make up for your failure to do your homework. You are going to have to start taking those measurements. But, I can offer you some suggestions on how to use the information you gather in the best possible way.

The most basic principle of audible notification design requires the use of a larger number of lesser rated audible appliances. Instead of trying to cover large areas with a few, relatively high powered audible appliances, use a greater number of lower powered appliances. This will work to your advantage every time.

When you design the loading of your notification appliance circuits, leave plenty of headroom in your power calculations so you may add more appliances, if later your testing of the system, as it nears completion, reveals that you need to do so. Some designers load notification appliance circuits to no more than 70% of their maximum capacity. This seems like a reasonable rule-of-thumb for most applications.

If you must design a fire alarm system using voice signals for a large open venue, or one with challenging acoustical properties, do not forget that you must also account for intelligibility, as well as audibility. Fortunately, manufacturers now have instruments available to measure intelligibility. Once again, you will find that using a larger number of audible appliances, with each appliance having a relatively low output rating, will usually work to your advantage in solving intelligibility problems in large open spaces or tricky acoustical environments.

Plan carefully. Do your homework. Follow the requirements of NFPA 72-2002, *National Fire Alarm Code*, to the letter. You will find that you can meet the requirements of the *Code* and satisfy the Authority Having Jurisdiction by providing a fire alarm system with audible appliances that can truly notify the occupants of an alarm.

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