

## What is so important about HVAC noise?

### *How it affects intelligibility*



When designing a room the noise criteria of the HVAC system noise specification should be enforced to ensure a worship space that is enjoyable for everyone. However HVAC noise is very often an overlooked point in new construction, until the very end of the job. Which more often than not the noise level is very high; so high as to be quite objectionable. This will cause several problems that we will discuss in this article and as you will learn; fixing them after the fact can be quite expensive.

First the basic specs: Many times we are asked “Could you come measure the level of the noise coming out of the HVAC system; I think it is too loud”. Our general response is that if you think it is too loud, then it probably is.

The website: [http://www.hvac-toolbox.com/35\\_60.html](http://www.hvac-toolbox.com/35_60.html) gives general specifications and guidelines for designing a proper HVAC system. Noise Criterion - NC - was established in U.S. for rating indoor noise, noise from air-conditioning equipment etc. Following these guidelines we ideally recommend an NC rating of 35; not an exact dB measurement number except at 1000 Hz. At other frequencies it is a number based on a chart of noise interference. A quick measurement which can give an approximation is to use the “A” weighted scale on a sound level meter and subtract 10 from the reading. Even though this can give a false reading depending on the problem frequencies, it should be a good start.

The HVAC industry suggests an NC rating of 25 for a house of worship however this is about 10dB quieter than desired. However, very often we actually get NC ratings of 50-60. This is WAY outside of anyone’s specification.

There are several problems that loud HVAC systems can cause. The most noticeable is during the sermon and other speaking parts of the service. The HVAC noise interferes with the intelligibility of the sound system in 2 ways.

First imagine this scenario: In your car tune the radio to a talk station while you are sitting parked with the engine off. Turn it up to an acceptable level. Now start to drive and roll the windows down. Can you still hear the radio clearly? Do you have to turn it up? What if you are in a church and simply turning it up causes feedback? Is the problem gain before feedback or is it simply that you can’t hear the system because the noise is too loud?

The other problem is that the HVAC noise can get into the microphone and simply turning up the mic will also make the noise louder as well. This does not get the voice any louder in relation to the noise level. This is referred to the “signal to noise ratio”. There has to be enough difference or the speech will be difficult to understand.

Then the problem arises in the question of “why is the HVAC system too loud”? Very often the answer is budget. The church in an effort to be a good steward goes with the lowest bidder and does not hold them responsible to their industries own specification. To achieve the proper levels the cost will go up quite a bit.

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Unfortunately many HVAC providers' primary concern is whether the system cools and heats properly with less emphasis on the impact that the noise from their system makes on the worship experience. The result can be both an irritating noise and a detriment to speech intelligibility. Another example of how one contractor can cause other problems would be the parking lot paving company. What if they pave the parking lot, but do not slope it right and water runs into the church? All you asked for was to get the parking lot paved, but if you don't specify exactly how to pave the parking lot, the result could be disastrous.

To avoid problems from the beginning, a few basic guide lines that should be used include the fundamental fact that to make a system quiet, you need to move a lot of air very slowly. This includes large lined ducts that have bends far from the vents. When the air "bends", it makes noise and when it does this close to the vent you hear it a lot louder. Another common mistake is to use vents that have a rating of "so-so" dB noise. The problem is that when you use say 50 or more of these type vents in a facility, the noise goes up in the room.

The bottom line to prevent HVAC from being an issue with poor intelligibility is to specify with your contractor in the beginning to have a NC rating of around 35. It is then the contractors' job to make this happen. After an improper system has been installed, it is much more expensive to replace than it would have been to put it in properly from the start.