

The following is an E-Mail addressed to the bass list on stuffing an enclosure. Ken Kantor is the former CEO & co-founder of NHT.

From: Ken Kantor  
Date: 04 Apr 95 03:41:37 EDT  
Subject: Stuffing Stuff

"In light of recent discussions, let me share some thoughts regarding cabinet stuffing. I'll do this from a practical point of view, partly because the physics side has been well articulated by Doug. The other reason I'll stay away from theory in that, in the matter of cabinet fill, theory has proven over the years to be of only limited help in real-world speaker design. I'll also confine most of my comments to issues related to sealed systems. Vented systems do share a few of these same issues, but really the goals and the physics of stuffing a vented box are different.

Most professional designers would agree that practical experience, combined with trial and error, is best way to find the optimum stuffing material, quantity and method for a given design. This is why good designers routinely experiment with fill in the development of a new system, ala Vance's data cited here. This particular information is a valid data point, but it is important not to over-generalize. If you are designing a system that differs substantially in shape or volume or source impedance (passive crossover) from a known you will need to iterate for best performance.

In my practice, adjusting the filling is the last step in getting the bass right, and is used mostly to fine-tune the system Qtc and resonance. As increasing amounts of polyester are added to a sealed box, the resonance and Q gradually go down. This can be shown mathematically to be due in roughly equal parts to the effects of simple resistive damping and isothermal conversion. At some point, a minimum is reached, and further material simply reverses the trend by taking up volume. During the filling process the impedance curve is constantly monitored, and convergence to optimum usually takes only a short time. Filling also has the important effect of reducing internal reflections, to reduce standing waves and comb filtering. However, the amount of filling has comparatively little effect on its efficacy in this regard.

[Side Note- it is a common misconception, I believe, that professional designers rely heavily on LEAP and SPICE and CALSOD to define their designs a priori. On the contrary, professional designers use these modeling tools mostly to guide and optimize revisions. Unlike DIY designs, a typical commercial 2-way will go through perhaps 3 revs of each driver, 2 to 4 box trials, and easily a dozen+ crossover changes.]

Lining the walls of a vented enclosure to reduce internal reflections, or filling a transmission line to absorb the back wave, highly absorptive wool or fiberglass are ideal. However, these materials will not generally provide the desired results in a sealed system. It is true that they will provide more reflection absorption than polyester, but the latter is quite good in this regard in the critical midrange. In a sealed system you don't want absorption at lower frequencies anyway; you want damping and isothermal conversion. I have tried "all-out" efforts using fiberglass lining and polyester fill to achieve the best of both worlds. I found the results to offer little practical benefit over polyester alone, but its worth looking into.

All NHT systems now use polyester fill, of one variety or another. We used to use fiberglass in our vented designs, but found a Danish polyester that mimicked the properties of fiberglass very closely. I don't know if this kind of polyester is available to hobbyists. Excluding this special poly, there are essentially two kinds of fiber available: pillow stuffing, and audio-spec polyester. The latter type allegedly has hollow core fibers, but I have been unable to verify this with my keen eyesight! Sorry, but forget the pillow type. Sure, it's easy to get. If you use enough, it will damp the midrange, and that's better than an empty box (by a lot). But it will have little effect on the lower frequencies.

Well, that's pretty much all I know about stuffing speakers."

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In another message Ken Kantor added (excerpted):

"Exact enclosure volume is not critical, and stuffing can be added or subtracted to fine tune the response. I recommend adjusting the stuffing by monitoring the impedance versus frequency of the sealed box system. Add stuffing to lower the frequency where the impedance is highest. When that impedance peak starts to rise in frequency, you have added too much. The NHT/SW3p uses 820g of acoustic polyester stuffing with the 1259, but your enclosure may do better with slightly different amount."

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