Subject: Re: H290C Horn/Waveguide - closest equiv. in 1.5" or 2"?
Posted by Wayne Parham on Fri, 18 Sep 2020 04:09:24 GMT
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I put all of my focus on the H290C, and it's predecessor, the H390C. That was a wood horn/waveguide with the same profile but with much more mouth radius because it was designed to be free-standing and therefore have no baffle loading. But both are for 1" exit compression drivers.

I was able to do most of the acoustic development work back when I was making the H390C because it was cut on a CNC machine. So I was able to cut a physical model, test it and make incremental improvements.

Sometimes, lessons learned with one size driver don't transfer to another. But I find this more true of cone drivers than of compression drivers. So some of what I learned while optimizing the 1" drivers might transfer to larger drivers.

Here are a few main points:

1. The basic flare starts with an oblate spheroidal profile and then transitions to a flare based on elliptic cylindrical geometry. Said more simply, the throat is round and the mouth is rectangular. The same OS expansion equation is used to plot each axis, but the asymptotic angle is different in order to get the 90° x 40° shape.

A similar profile can be created with a OS to PS transition. That's oblate spheroidal to prolate spheroidal. It makes a very similar horn/waveguide but the mouth is oval-shaped instead of rectangular.

Each of these three coordinate systems are related: OS, PS and EC. They all make very similar flare profiles, just with different shaped mouths. Oblate spheroidal horn/waveguides are round, prolate spheroids are oval and elliptic cylinders are rectangular.

2. I find that acoustic loading is important. Waveguides are closely related to conical horns, which don't load well at low frequencies. But they still provide some acoustic loading and I think this is important to sound quality. So do not discount the quality of acoustic loading.

3. Radiusing the mouth edge, gradually opening up wider than the OS/EC profile, helps reduce waistbanding at the lower frequency range. With the right amount of radius area, you can completely eliminate waistbanding. But the radiused area does not contribute any acoustic loading. So it's almost like the horn/waveguide length ends at the point where the OS profile ends and the radiused profile begins.

4. Another thing that affects acoustic loading is the expansion rate. A horn/waveguide that has less expansion loads better. But this necessarily limits the overall coverage angle. I found empirically that a 90° x 40° waveguide is about as wide as can provide enough acoustic loading to offer smooth response. Any wider and the quarter-wave modes become pronounced, especially if a lot of the profile is sacrificed for waistband-reducing radius. For example, the

H290C is actually a smidge under 90° in the horizontal, and it uses baffle loading rather than a lot of radiusing at the mouth.

5. If large size is not a problem, then you can have enough mouth radius to completely eliminate waistbanding and still have enough length to provide good acoustic loading. This makes a pretty large device though, and the extra mouth area prevents close vertical spacing between the waveguide and the adjacent driver in the system. This can make it hard to get the forward lobe tall enough - The vertical nulls might narrow too far. But with a low enough crossover point, the system can have wider vertical spacing between subsystems and still have a nice tall forward lobe with widely spaced vertical nulls.