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Subject: Dimensions clarifications

Posted by [joshua43214](#) on Sat, 07 Apr 2018 19:03:50 GMT

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I was drawing up the 2Pi Towers, and noticed the note about changing the port diameter if 3/4" material is used. Looking closer, it was apparent that the dimensions on the plans are all external dimensions.

This caused me to double check the 6Pi dimensions and I found some inconsistencies. I went and reread the white paper on uniform directivity, which led to even more confusion over dimensions.

Someone asked in a previous thread if the horn dimensions are internal - and the answer was yes.

When I made my drawings, I worked from an internal mouth opening of 12"x24" tapering to 4.5"x4.5", then found a depth for the horn that averaged out the error between the 11" and 14.5" dimensions given in the instructions. The error here is pretty big, something like 3/8". The resulting horn depth is 10.25" not including the driver mount.

I referred to the white paper for help. The white paper is calling for 45x90 degrees, but the horn as drawn is closer to 40x87 degrees.

So what exactly are the critical dimensions here? The white paper says 90degrees by approximately 45degrees. 87 seems close enough, but 40 is pretty far off.

I am assuming the actual horn depth is not terribly critical, but the 4.5"x4.5" opening is important due to horn loading.

Would I be better off starting with tapers at 90 and 45ish from the 4.5"x4.5" opening and let the rest of the dimensions just follow so it fits into the cabinet?

The images below should help. The image is the space inside the horn flare itself.

This image is the flare using the dimensions as best as possible from the instructions.

This image uses flare angles of 45x90 and a 4.5"x4.5" opening.

Note the second image works out pretty nicely, except the flare mouth is almost a full inch larger than specified, though after fitting the cabinet will only be a bit oversized.

Thanks for you help,  
-Josh

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### File Attachments

1) [Clipboard01.jpg](#), downloaded 1853 times

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2) [Clipboard02.jpg](#), downloaded 1770 times

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Subject: Re: Dimensions clarifications

Posted by [Wayne Parham](#) on Sat, 07 Apr 2018 23:54:44 GMT

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You're right that the horn angles are approximately  $85^\circ \times 40^\circ$ . And that's the way the tweeter waveguide is too. That's what we want - We want a horizontal pattern that's a smidge less than the expansion of the walls from the corner. So your top drawing describes best the dimensions of the midhorn.

The  $45^\circ$  figure is actually our target to exceed for the nulls. We want the nulls out at  $\pm 20^\circ$  to  $\pm 25^\circ$ , something like that. It's a reasonable goal that gives us plenty of vertical coverage. We definitely don't want nulls too close to the vertical centerline. So to have vertical coverage in the  $40^\circ$ - $45^\circ$  range is perfect. It keeps the HF attenuated at large vertical angles - to limit ceiling slap - and it gives us plenty of coverage, a nice tall "strata" of good sound. The nulls are set just outside the vertical pattern and sort of punctuate it.

Don't get too wrapped around the axle about differences of  $5^\circ$  or even  $10^\circ$ . For one thing the beamwidth "edge" we're talking about here is defined as a -6dB point, and outside this angle isn't a brick-wall sound void but rather a gradual falloff. And for another thing, the pattern is not perfectly constant, even from a waveguide or CD device. Directivity is closer to a constant than the pattern from an exponential or tractrix horn, but it varies with frequency, especially at the low end of the passband. So an  $85^\circ$  waveguide is very similar to a  $90^\circ$  waveguide, and we'll see much more variance than that from the environment.

For example, consider the difference in the radiation pattern from the midhorn when it is placed in open freespace compared with the radiation pattern when it's placed in the corner of the room, as designed. In freespace, the pattern is approximately  $85^\circ \times 40^\circ$  at 500Hz upwards, but below that it begins to waver. It actually narrows before widening way up. But in the corner, the walls constrain the pattern and make it much more constant. The pattern can never exceed  $90^\circ$  even at low frequencies where pattern control is lost, because the walls constrain the radiation angle. And the corner loading even limits the narrowing that occurs just before pattern control is lost.

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Subject: Re: Dimensions clarifications

Posted by [joshua43214](#) on Sun, 08 Apr 2018 22:13:46 GMT

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Thanks for the clarification Wayne.

I tweaked things a bit giving more focus on the angles than the lengths. Have to love Fusion360 and the joys of parametric drawings - I based the entire drawing on the horn, so when I make

adjustments, the whole assembly just falls in line

I now have horn angles much closer to 40x85 and a horn depth a tad over 10.5" not including the driver mount. The part lengths are both about 3/16" off (one long, the other short), but I can't see that making a difference as long as they are long enough to "guide" the sound.

Just working out the petty details before I print out the plans.

I expect to start on the Pi2 towers this week, and maybe the Pi6 bass boxes.

While I have your ear (and to derail my own thread), do you have thoughts on x-over mounting? I want it accessible for the 6Pi's, and I'm thinking about building out the tweeter box to hold it.

Exactly (well, approximately) how big are the crossovers?

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Subject: Re: Dimensions clarifications

Posted by [Wayne Parham](#) on Mon, 09 Apr 2018 00:11:46 GMT

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The crossover PCB is 12" x 6" and the components mounted on it rise a couple inches above the board.

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Subject: Re: Dimensions clarifications

Posted by [joshua43214](#) on Wed, 11 Apr 2018 02:37:57 GMT

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One last question on dimensions.

I am using 3/4" materials, and I am doubling the bass bin baffle. I made adjustments to the dimensions to maintain the bass bin volume. These adjustments end up shifting the driver deeper into the corner by 1 1/8".

Do I need to worry about this? And if so, where should I make up the difference? I know the purpose of the corner sections is to position the speaker correctly, should I just make those bits longer so the driver is the correct distance from the corner and the opening is the correct size?

Thanks for all the hand holding.

-Josh

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Subject: Re: Dimensions clarifications

Posted by [Wayne Parham](#) on Wed, 11 Apr 2018 14:37:33 GMT

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Those bass bin mods will be just fine. I get really cautious with mods on cabinets that are exposed to midrange content, because midrange standing waves can create issues. But the bass bin of the constant directivity cornerhorns is insensitive to these things because it is crossed-over pretty low. Wavelengths are long, so little 1" shifts are acoustically invisible.

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Subject: Re: Dimensions clarifications

Posted by [joshua43214](#) on Sat, 14 Apr 2018 17:39:49 GMT

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One last question (I hope).

Can you provide me with the infos for flush mounting the drivers on the 2Pi towers?

Specifically, the outside diameter of the frame, the thickness of the frame, the bolt hole circle diameter, and the number of bolts for both drivers.

The part numbers are fine provided I can get manufacturers info online.

A nice bonus would also be the hook up plate dimensions.

teaser pic.

You know this would look much better with driver cutouts...

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### File Attachments

1) [thumbnail.jpg](#), downloaded 1280 times

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Subject: Re: Dimensions clarifications

Posted by [Wayne Parham](#) on Sun, 15 Apr 2018 16:38:53 GMT

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Here you go:

Alpha 10A midwoofer specs

DX-25 tweeter specs

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