

Building Your First DIY Speaker – The MB27 – part 1

I thought I'd start a thread about building some real speakers, not subwoofers, but 2-way speakers with a midwoofer and a tweeter ☺. I hope to interest people who would like to build their own, but have never done it before, and are not sure just how to go about it. There are kits that come with all the necessary parts including assembled and wired crossover boards and cabinets with all the necessary holes. They require only simple assembly, and some even result in decent speakers. An example is the inexpensive BR-1 sold by Parts Express. There are many others sold by Parts Express, Madisound, and Meniscus Audio.

I want to take it one step beyond building a simple kit. I have chosen a proven speaker design which is available on the internet, but no kit for it exists. Building this design does require:

1. All the necessary drivers and crossover parts
2. Providing your own cabinet and cutting holes and recesses in it
3. Building your own crossover from a schematic diagram
4. Assembling and wiring all the components into the cabinet

Because the carpentry for building your own cabinet is a complex subject by itself, I won't try to describe that in this thread (maybe another time). This thread makes use of premade cabinets that come without any holes cut for drivers or port tube. I will show, in detail, how I cut out the mounting holes for the drivers in the front baffle and the port vent in the rear. And I will show in detail how I made the crossover board, and how I wired it to the drivers and binding posts.

Tools & Supplies

- Plunge router with circle cutting jigs (two sizes of Jasper Jigs models 200 & 400) and bits (1/4" spiral up-cut bit & 1 1/4" mortise bit). Other methods do exist for cutting holes for speaker drivers, but I have these tools and will illustrate their use.
- Tools for wiring: wire cutters, small needle-nosed pliers, wire strippers, crimper tool, etc.
- Soldering iron and 63% tin/37% lead (63/37) or 60/40 rosin core solder
- 16 gauge copper wires with red and black insulation (use two colors), cable ties, crimp caps (I like using these instead of screw caps), small & medium sized female quick connects (medium 0.187", and small 0.110"), crimp on terminal rings
- Saw capable of cutting thin plywood or Masonite (hardboard) for crossover boards

The speaker design is Dennis Murphy's MB27 <http://murphyblaster.com/content.php?f=MB27.html>. It is a high quality 2-way design, intended for a small bass reflex cabinet. Many people have built this design successfully – it has stood the test of time. It can be built for a moderate cost, about \$273 (as of August 2012) for all parts excluding cabinets. See the parts list. This is far less than what it would cost for a similar quality speaker if you bought it at a retail store. Even with the finished cabinets that I chose to buy (see below), which cost nearly as much as the parts alone for the MB27, the total cost is less than half of what you might pay retail for a pair of quality small 2-ways.

The crossover in the MB27 design was specifically designed for the GR Research M130 woofer and SEAS 27TFFC tweeter. The width of the front baffle, the interior volume of the cabinet, and the mounting positions of the drivers relative to each other on the front baffle, are also critical features of the crossover design. If you change any of these, it may not work as well.

Although the design details are specific for the MB27, I hope my directions and methods will still be useful for anyone who wants to build a different DIY speaker design. It is, however, not my intention to discuss changing major details of the MB27, such as using a different tweeter or woofer. To do that requires a speaker measuring setup and experience in using it correctly. So, for all those who can't resist

the temptation to tweak things, I strongly advise you to follow this recipe. If you change it, it will be at your own risk.

Cabinet Modifications

The cabinet as originally designed is 12½" high × 8" wide × 10½" deep. Those are the external dimensions of a cabinet meant to be built with ¾" MDF. See this link: http://murphyblaster.com/files/MB1_Enclosure_Drawings.pdf. You can build your own cabinets by following those plans, or buy pre-made cabinets from a variety of sources for a wide variety in prices.

In this example, the cabinets are finished in gloss black. I have learned the hard way that a smooth glossy paint finish is more difficult for me to do than veneer, so I bought these finished cabinets from Parts Express:

<http://www.partsexpress.com/pe/showdetl.cfm?Partnumber=302-711>. These cabinets have curved sides and have an internal volume of 0.38 ft³.

The front baffles are held in place by 4 bolts, making them removable for cutting the driver mounting holes and installing the crossover boards. These cabinets also come in two other wood finishes, and flat sided cabinets with similar volume, finishes, and construction are also available at lower cost.



Any sturdily built cabinet with a similar internal volume ($\pm 10\%$) and an 8" wide front baffle should work equally well with this design. The curved sides are not required, but they do look cool. These cabinets are not the exact same dimensions as in Dennis Murphy's drawings, but their internal volume is about the same and the front baffle width is exactly the same 8". Those are the critical cabinet dimensions.

Photo 1 shows a cabinet with the front baffle attached. The 4 bolts are loosely attached so they stand out better in the photo. **Photo 2** shows the view from the rear. You can see it came with a pair of ¼" holes for individual binding posts.

Magnets in the grill frame line up with the steel bolts that hold on the front baffle.



Photo 3 shows the cabinets with front baffles removed, providing a view of the interior cross braces. They extend full height & width, and divide the cabinet floor into two uneven spaces.

As a result, I had to put the crossover on 2 separate boards.

Two such boards sit in front of the cabinets in the photo. The woofer circuit will be on the larger board (left) and will be mounted on the cabinet floor behind the cross brace. The tweeter circuit will be on smaller board (right) and will sit on the floor in front of the cross brace.



I had to cut out a notch in the lower hole of the cross brace to allow the woofer board to pass through.

Photo 3 shows one notch only on the left cabinet, but both cabinets did get modified. Later during assembly, I found that two notches were required (**Photo 15**). **Photo 4** shows the Stanley Sharptooth saw I got to do that job. The 10" blade is long enough to reach the cross brace and the teeth cut on both push and pull strokes.



The MBOW1 cabinet drawing shows a tweeter flange diameter of $4\frac{1}{8}"$ which fits the Seas 27 TFFC. It is horizontally centered $3\frac{3}{16}"$ below the top edge of the front baffle. The woofer center is 8" below the top edge. The PE cabinet is $1\frac{1}{2}"$ taller but the same width:

MBOW1 Cabinet

8" wide \times $12\frac{1}{2}"$ high \times $10\frac{1}{2}"$ deep

PE Dayton 302-711 TWC-0.38BK

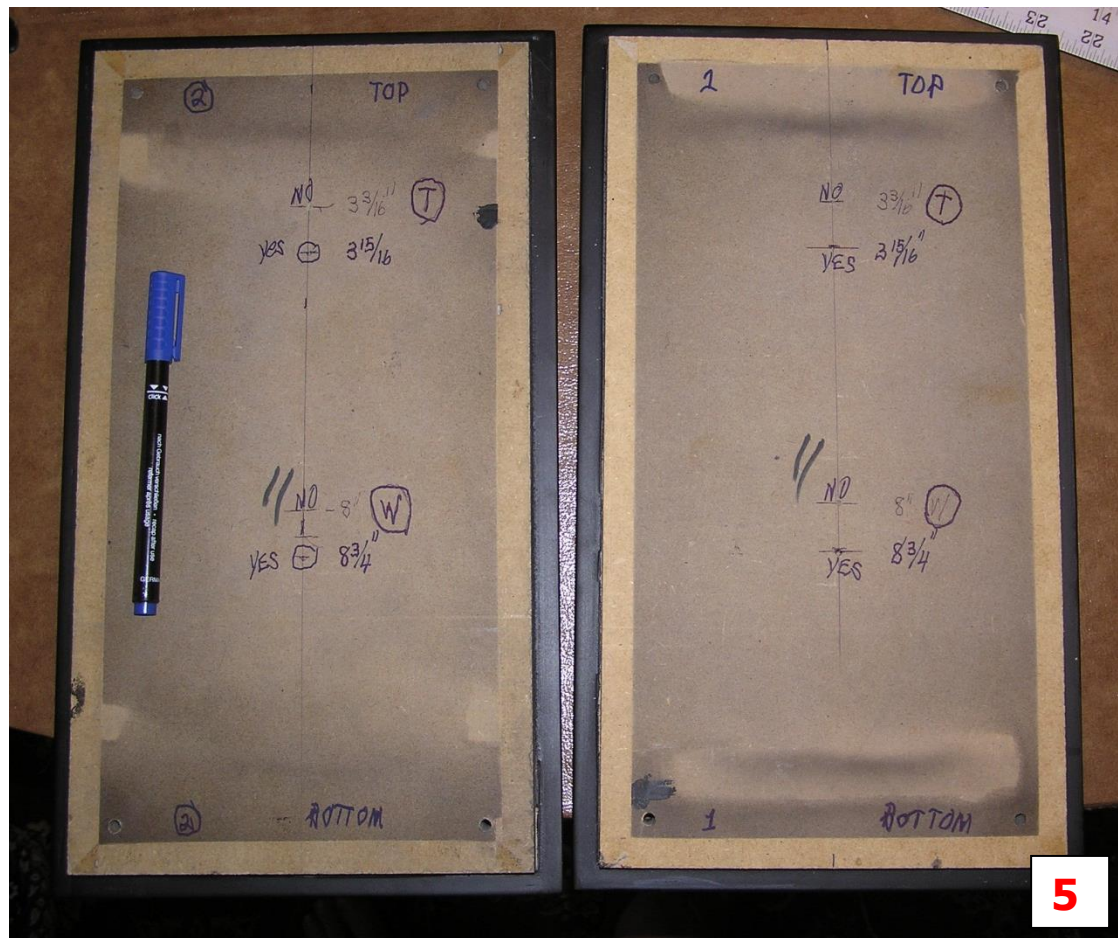
8" wide (front) \times 14" high \times 11.8" deep

To keep the driver vertical locations comparable to those shown in the MBOW1 cabinet drawing, I moved the driver locations lower by $\frac{3}{4}"$.

Tweeter Drill $\frac{1}{8}"$ hole, centered horizontally, $3\frac{15}{16}"$ below the top edge

Woofer Drill $\frac{1}{8}"$ hole centered horizontally, $8\frac{3}{4}"$ below the top edge

I next marked the layout on the backs of the front baffles (**Photo 5**).



I drilled $\frac{1}{8}"$ holes all the way through in the spots marked YES. Ignore the spots marked NO – they are an example of the “measure twice but cut once” rule in action.

These holes will be the pivot points for the circle cutting jig with a plunge router mounted on it.

Photo 6 shows the router with a 1¼" mortise bit (red) mounted on the large Jasper Jig (model 200, grey with many holes). This jig has an opening large enough for that bit.

I set the plunge depth on my router by putting the flange of the tweeter (plus a bit of gasket tape) directly between the guides. In my hands, this works better than trying to measure the thickness of the flange and transferring that measurement to the plunge depth gauge. This is why a plunge router does this job better than a standard router.

Unfortunately, I took the photo showing the back of the router, so you can't see the plunge depth gauge.

I covered the fronts of the baffles with shelf paper so I wouldn't scratch their smooth black finish with the router/circle cutting jigs (**Photos 7-11**).



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