

## CSS FR125S/WR125S Bipole ML-TL Speaker

### James R. Griffin

I recently completed a bipolar ML-TL using the Creative Sound Solutions ([www.creativesound.ca](http://www.creativesound.ca)) FR125S as the front driver and the CSS WR125S as the rear driver in each box. While you could use two FR drivers in each box for this design, the WR driver on the rear of enclosure reduces the overall cost of the speakers with no compromise in performance. The connection of the two drivers in each box is in phase so that a bipolar field (forward and rear radiation) is created within the listening room.

The enclosure for these speakers duplicates Greg Monfort's (GM) simulated design that he describes in his posting:

<http://www.diyaudio.com/forums/showthread.php?postid=672120#post672120>

In his posting Greg details several possible designs for bipole speakers using the FR125S. But the most attractive implementation is the 45 Hz F3 bass response ML-TL which had the smoothest simulation (+/- 1 dB). This design (internal dimensions) calls for a line (or pipe) length of 39.56 inches, a cross-section area of 43.68 squared inches, and a bottom vent diameter and length of 3 inches for both. The driver is spaced 14 inches down from the top. Greg recommends that the stuffing density of 0.3 pounds per cubic foot be distributed 30 inches from the top of the box. He suggests that either use a short stand or a cavity below the speaker enclosure to raise the driver closer to ear height.



Figure 1. Finished Bipolar ML-TL Speakers with front and rear views.

Pictured in Figure 1 and the attached drawings is my version of what Greg proposed. The enclosure was constructed from 0.75" thick MDF panels for the baffle, rear, and bottom of the box with 0.75" thick walnut top and side panels. Black laminate was used on the front and rear panels to enhance their visual appearance. Internally, three braces are used to strengthen the structure. The outside dimensions of the enclosure are 48" high, 7.5" wide, and 8.75" deep.

The cavity at the bottom of the box moves the drivers upward and closer to ear level. The port tube is on the rear of the speaker and just above the bottom floor of the ML-TL line. Thus drivers are positioned about 33.25" above the floor. The terminal plate is located within the cavity and wires are routed from the connector plate (I used the Madisound TD dual terminal plate but other terminal plates could be used). The cavity spaces the drivers upward and also enables room for additional stabilization mass. If you wish to better stabilize the speaker, you could attach a wider base to the bottom of the box. If any contouring components are added in the future, they could be located inside the cavity. One additional note is that the two drivers are connected in parallel so that the overall impedance of the speaker is 4 ohms.

I varied the stuffing to ascertain what amount sounded best. Originally, I tried Greg's suggestion of locating the stuffing in the upper 30 inches of the pipe. But my listening tests convinced me that when the stuffing extended only to just below the drivers, the bass response was better than when the stuffing extended down below the drivers. Thus my final implementation used 0.3 pounds of teased Acousta Stuff™ damping fiber in the upper 17.5 inches of the box. Other damping material (fiberglass or such) could be used.

The sound of these speakers is very nice indeed with more bass than you would expect from their size. For example, the low bass note in Lyle Lovett's "She Already Made Up Her Mind" from his Joshua Judge Ruth CD can be heard. The four drivers do a nice job in adding low end impact to your music. The frequency response of these drivers is very flat across the band and this design retains this benefit. More important these speakers exhibit the coherent nature that we have come to expect from quality full range drivers without a crossover.

The bipolar drivers in these speakers necessitate that you position them away from the wall--I'm using 3 feet in my room. The bipolar nature of this speaker does two things that you will notice to your listening. First, you'll notice a little ambiance as sound energy is reflected from the front wall in the room. In this case ambiance is a good thing--more apparent during say a newscast--but was not an issue when you listen to music. You can move the speakers toward or away from the wall to vary the ambiance to your preference. Secondly, the soundstage is wider than you'll have with just a single front firing driver. One very minor disadvantage to the bipolar nature of these speakers is that the stereo image is a little more diffuse than with direct firing drivers. In my opinion having a wider sweet spot is an advantage in my book.

The FR125S full range driver does an excellent job across the frequency band and for most music you'll not miss any extra airyness that a separate tweeter might contribute. Bottom line is that this is a very simple design yet it yields great results. These speakers provide a lot of bang for their cost.

Jim

Parts List  
(Excluding enclosure wood and enclosure material for a pair of speakers)

Part	Quantity	Comments
CSS FR125S Driver	2	
CSS WR125S Driver	2	
Terminal Plate	2	Madisound TD Plate shown
Acousta Stuff™	1 pound	Use as specified
Mounting Screws for Drivers	16	#8 Pan Head 1 inch long

FR125S/WR125S Bipolar Speaker Drawing Notes

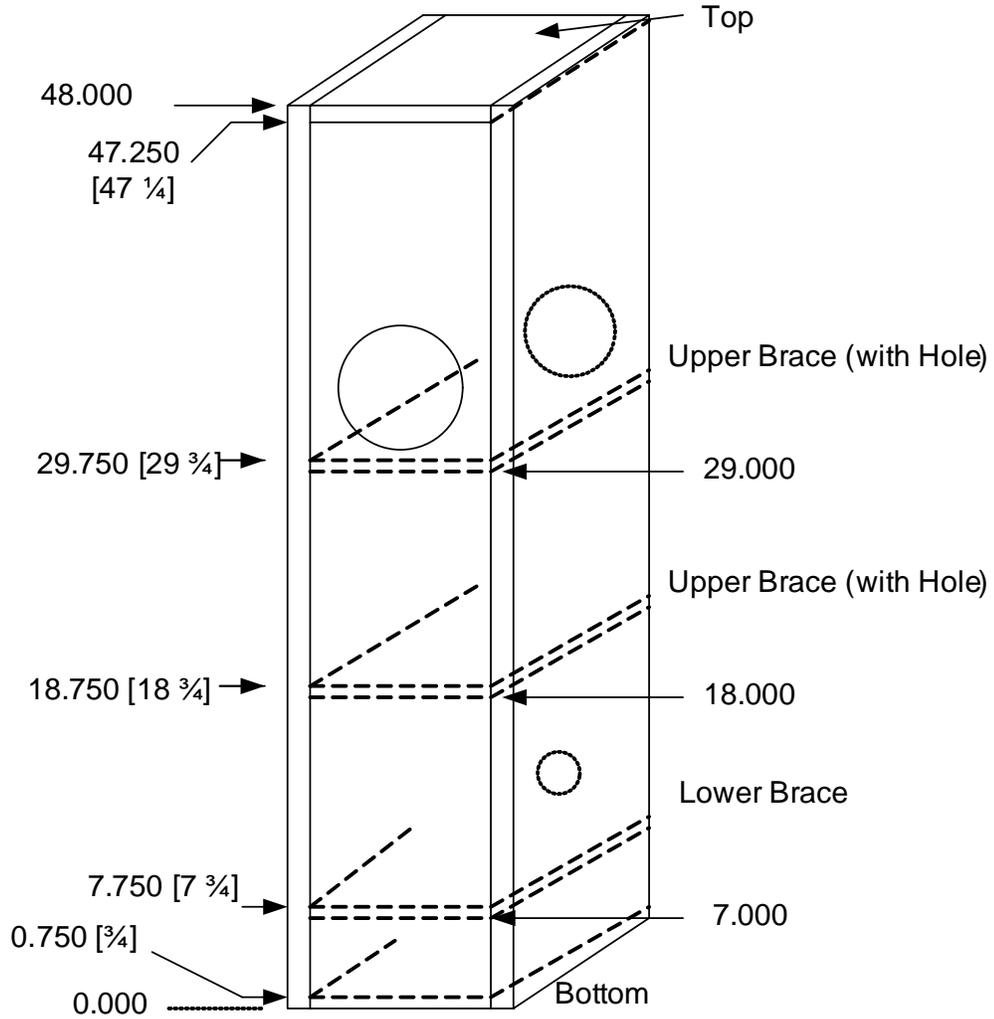
The front drivers are the CSS FR125S while the rear drivers are the CSS WR125S.

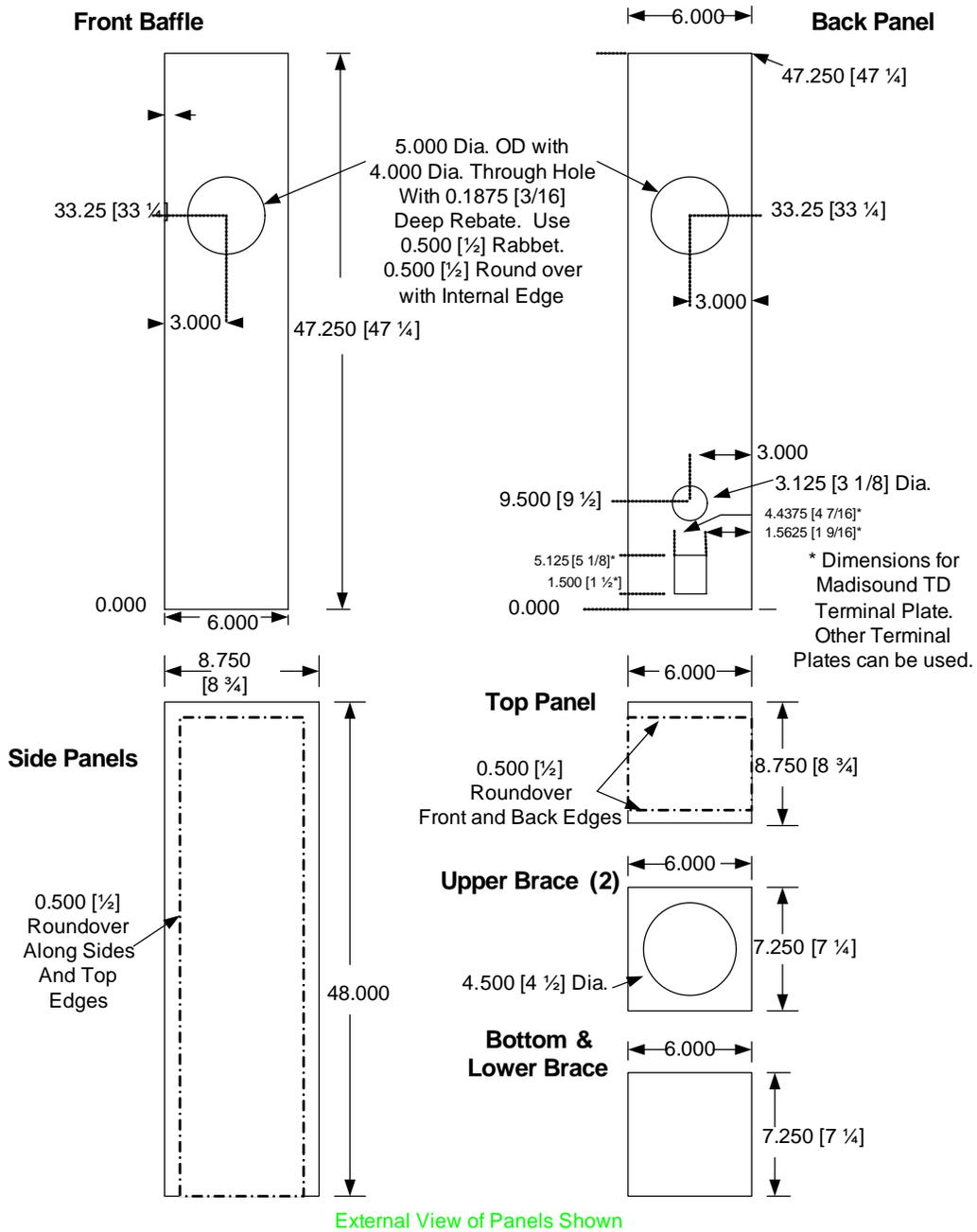
Material for the enclosure can be MDF, void free plywood or hardwood as selected by the builder. Nominal thickness for all panels and braces is 0.75 inches.

Box assembly should be done with minimal visible screws or brads on external surfaces. Panels and braces can be jointed via various methods including butt joints with nails or screws, internal battens or glue blocks, dadoo/rabbet joints, pocket screws, etc.

In the drawings all dimensions are nominal and in inches with both decimal and fractions given as indicated.

# X-ray View of Assembled Enclosure Showing Internal Bracing Locations (Dimensions from bottom)





## ML-TL Bipolar Speaker Connections

