

The METAPHOR

Peerless 850439 / Hiquphon OW1
Loudspeaker Design Plans

- Introduction
- Design Features
- Specifications
- Construction techniques
- Design modifications
- Enclosure dimensions
- Crossover schematic
- System Response



Thank you for choosing the Dillon Acoustics “Metaphor” as you DIY project. The Metaphor is designed to be a true audiophile quality loudspeaker. Over one hundred hours were devoted to its design. The Metaphor is simple to build. By following the basic guidelines in this manual, you will be able to recreate the remarkable sound that these loudspeakers produce.

Geoffrey Dillon
Dillon Acoustics

Please Note:

Dillon Acoustics has made every attempt to ensure that our design plans are as accurate as possible although Dillon Acoustics will not guarantee the performance of the completed product. Dillon Acoustics will not be responsible for any damages, injuries or financial losses associated with the use of these design plans.

The
METAPHOR
Peerless 850439 / Hiquphon OW1
Loudspeaker Design Plans

Specifications

System:

System description	2-Way Bookshelf
Woofer	Peerless HDS 850439, 6.5"
Tweeter	Hiquphon OW1, 20 mm (3/4") Dome Tweeter
Bass Alignment	Vented
Frequency Response	44 Hz – 20 kHz +2 / -1.5 dB
Power Handling	80 Watts RMS / 150 Watts Peak

Crossover:

Crossover Frequency	2100 Hz
Woofer Crossover	4 th order acoustical slope
Tweeter Crossover	Transitional 4 th to 6 th order acoustical slope
Number of Components	7
Recommended Capacitors*	Polypropylene or better / 100 Volts or greater
Resistors	10 – 15 Watt
Inductors*	Air core

*See schematic for details

Recommended Enclosure

External dimensions	15.5" H x 8.5" W x 10.25" D (based on 3/4" material)
Enclosure Volume	5 cu. ft.
Port Diameter	2" (inner diameter)
Port Length	7"
Port Tuning Frequency	45 Hz
Internal Damping Material:	1/2" - 1" Acoustical Foam

The
METAPHOR
Peerless 850439 / Hiquphon OW1
Loudspeaker Design Plans

Design features:

- Defraction loss compensation. Systems without defraction compensation will sound lean in the mid-bass and lack soundstage width.
- To ensure a good off axis frequency response, a crossover point no higher than 2100Hz.
- To maintain vertical polar uniformity, the center to center inter-driver spacing must be shorter than the wavelength of the crossover frequency. If the drivers are too far apart, vertical lobing will occur.
- To keep the Hiquphon tweeter from being overdriven an attenuation rate greater than 24 dB per octave was used.
- In-phase, low "Q", 24dB per octave acoustical slopes were chosen for both the high pass and low pass sections of the crossover. This allows high attenuation rates, avoids vertical lobing, minimizes group delay and rapid phase shift. Below the crossover point, the tweeter has a higher attenuation rate of 36dB per octave. It is actually an asymmetrical crossover but behaves as a classic 24dB, Bessel filter at the crossover point.
- I like to take the minimalist approach to crossover design. It is always my goal to use a minimum number of crossover components. The Metaphor uses seven components, which is very low for a high order crossover.
- High quality drivers are chosen not only for their specifications, but were also subjectively compared to many other brands.
- When each of these design elements are properly combined, the result is a smooth on and off axis frequency response, the elimination of vertical lobing and a very coherent sound source. The Metaphor's are true performer.

The
METAPHOR
Peerless 850439 / Hiquphon OW1
Loudspeaker Design Plans

Construction Techniques:

Enclosure:

I suggest using the enclosure drawings included with these plans but other construction methods are expectable as long as the driver placement and front baffle size are not changed.

- 1) A stiffer box is better. I suggest a minimum material thickness of .75 inches. If you decide to use thicker material or more bracing, make up for any lost volume by increasing the depth of the enclosure. If the front baffle size or driver placement is changed more than $\frac{1}{2}$ " , the system performance will suffer.
- 2) To minimize diffraction, both the woofer and tweeter should be flush mounted into the front baffle.
- 3) 1" acoustical foam or other damping material should be placed on at least three of the internal surfaces of the enclosure. The rear of the enclosure should always be covered. Do not stuff a vented enclosure with damping material. If you would like to build the Metaphor as a sealed box design, loosely stuff the enclosure with polyester (Dacron) or a similar material. Fiberglass insulation works well for both lining and stuffing the enclosure but it can be a health hazard.
- 4) The enclosure edges may be rounded if desired. Rounding will not improve the sound quality but may be visually desirable.
- 5) If a thicker front baffle is desired, I recommend chamfering the inside of the baffle in order to minimize internal reflections.
- 6) To prevent air leakage, use gaskets on both drivers and the input cups.

DILLON

ACOUSTICS

www.dillonacoustics.com

The
METAPHOR
Peerless 850439 / Hiquphon OW1
Loudspeaker Design Plans

Crossover:

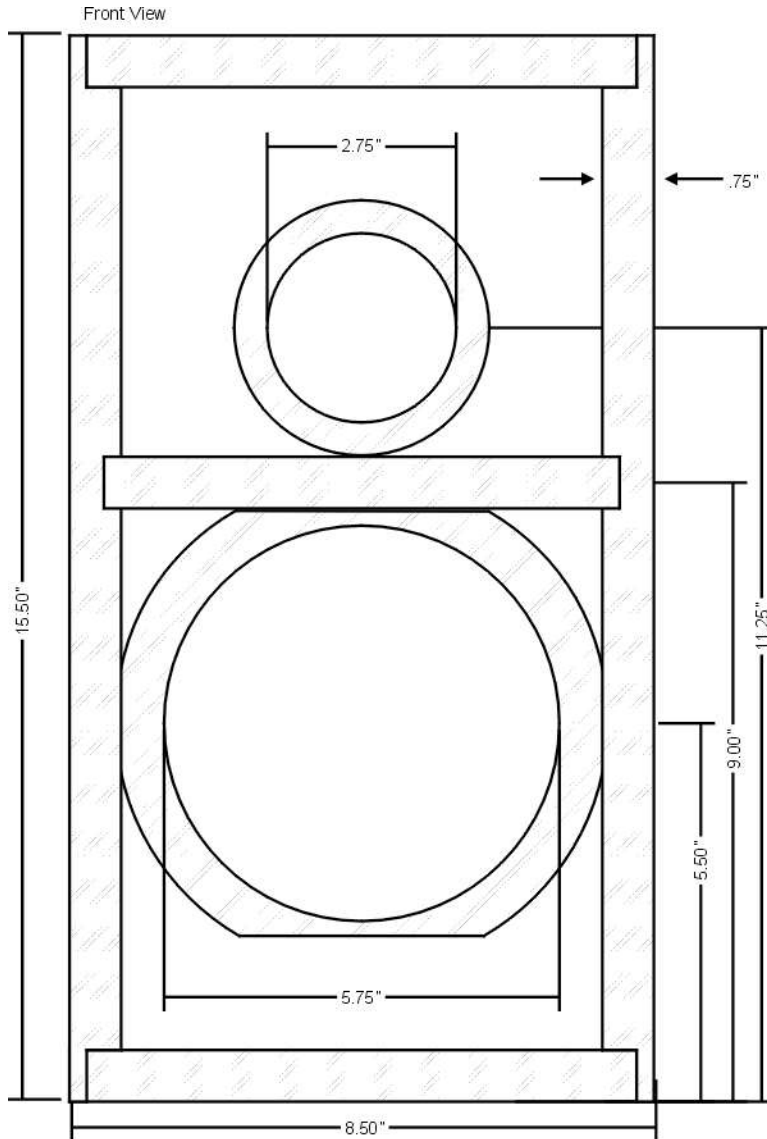
- 1) Use high quality components.
- 2) Inductors should be air core types. Note the DC resistance (DCR) stated in the schematic. Higher DCR values will alter performance.
- 3) Capacitors should be 100V polypropylene of better. If cost is an issue, you may want to use a 65uF electrolytic capacitor in the tweeter circuit.
- 4) To reduce magnetic coupling, place the inductors as far apart from each other as possible.
- 5) Solder your connections. Do not use push-on type connectors. Unsoldered connections will reduce performance and degrade over time.
- 6) Use good quality internal wiring. I recommend a minimum thickness of 18-gauge wire. High purity copper or silver wire works well.
- 7) If you are new to building crossovers, it may be easier to layout and connect the crossover components as they are pictured in the schematic.
- 8) The crossover components can either be wired "point to point" or a printed circuit board may be used.
- 9) Make sure to connect the woofer, tweeter and input terminals with the correct polarity.

The
METAPHOR
Peerless 850439 / Hiquphon OW1
Loudspeaker Design Plans

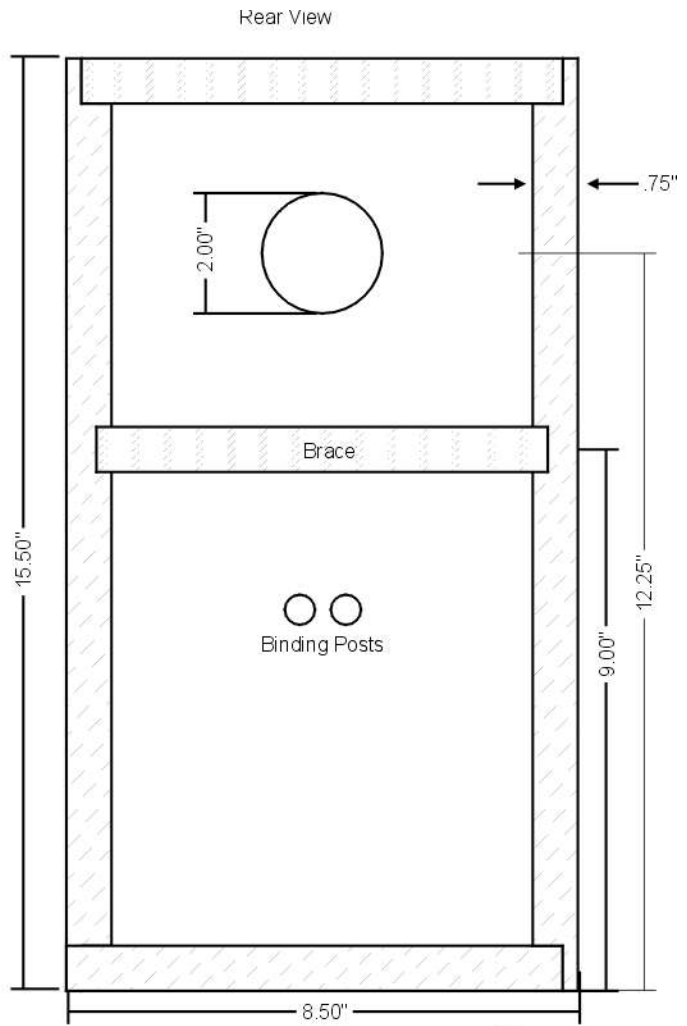
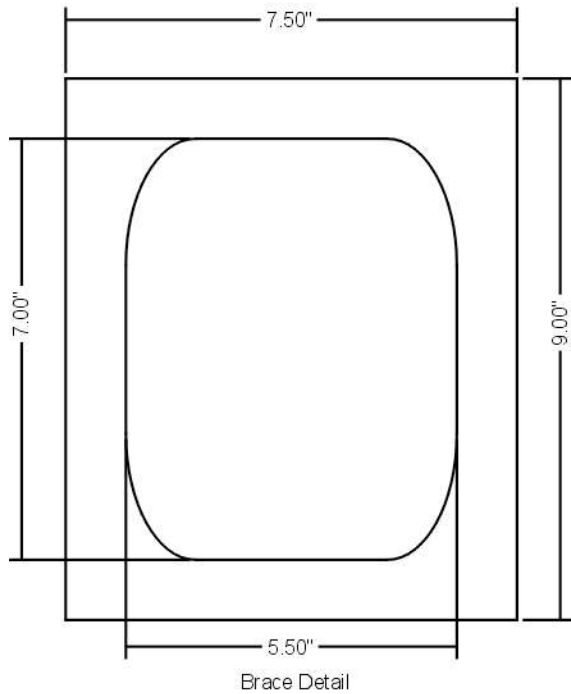
Design Modifications:

1. Since everyone has different listening tastes, the Metaphor can easily be adjusted to suit your needs. If the tweeter sounds too dull or too bright, simply raise or lower the resistance of the $2\frac{1}{2}$ Ohm series resistor in the tweeter circuit. I suggest subtracting up to 1 Ohm if you want a brighter sound and adding 1 Ohm for a more laid back sound, use your ears!
2. The enclosure volume and port tuning were optimized to have the best overall sound quality but if you feel like experimenting, you may want to adjust the enclosure size and / or the tuning frequency of the port. A longer port will give you a more refined, less "punchy" sound. A shorter port will give you more "punch" but with less low frequency bass extension. Again, use your ears!
3. The crossover was design using a specific driver placement and baffle size. Because of baffle edge defraction as well as baffle defraction loss, any dimensional changes greater than $\frac{1}{2}$ " may effect the performance of this system. If you wish to change the enclosure volume or use a material thickness greater than $\frac{3}{4}$ ", I recommend that you adjust only the depth of the enclosure.
4. The Metaphor will work well with the enclosures sealed. A sealed enclosure may actually integrate better with a subwoofer. With a sealed enclosure, the low frequency limit (-3 dB) would be about 78 Hz. If you would like to design a sealed version of the Metaphor, the internal volume can be reduced to as little as .3 cu. ft. For best results, remember to loosely stuff the enclosure with Dacron or a similar type of polyester material.

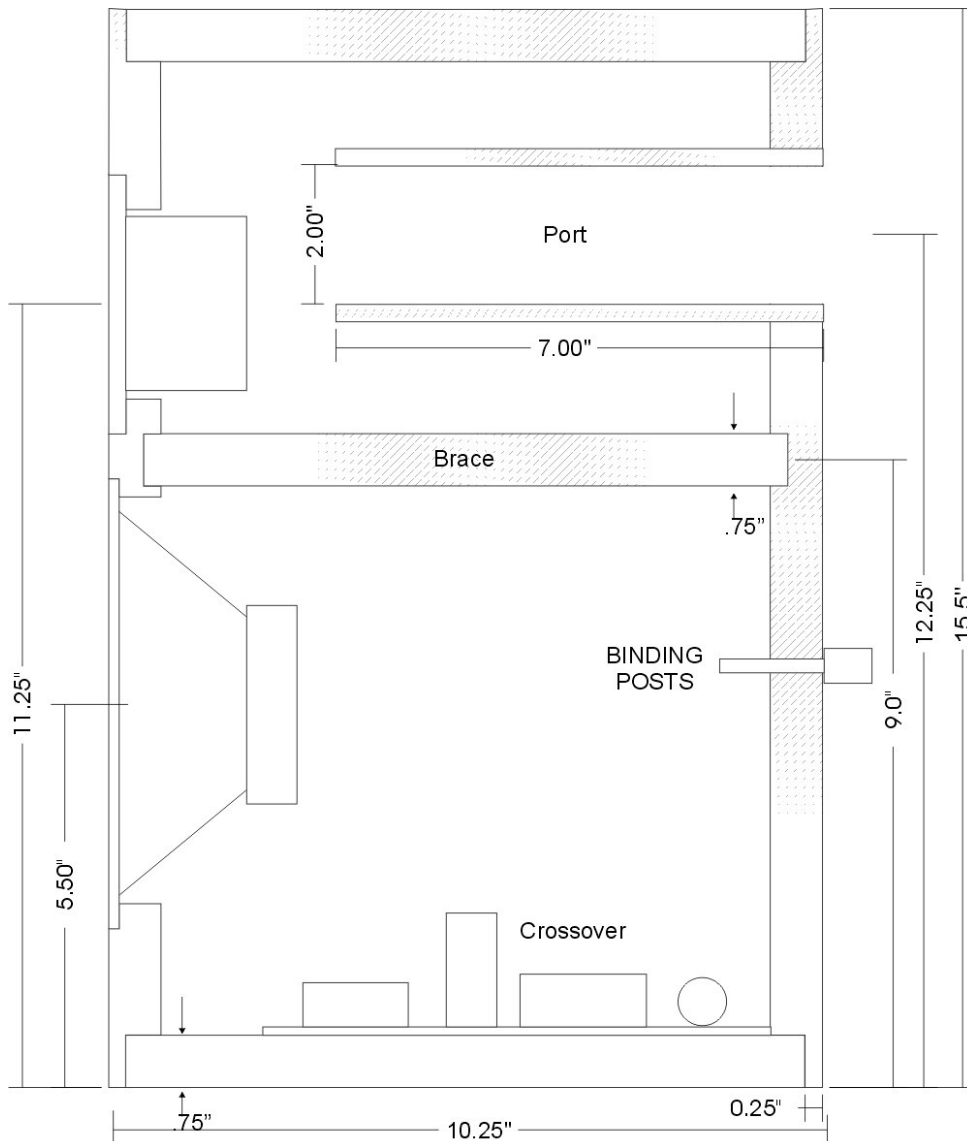
The
METAPHOR
Peerless 850439 / Hiquphon OW1
Loudspeaker Design Plans



The
METAPHOR
Peerless 850439 / Hiquphon OW1
Loudspeaker Design Plans

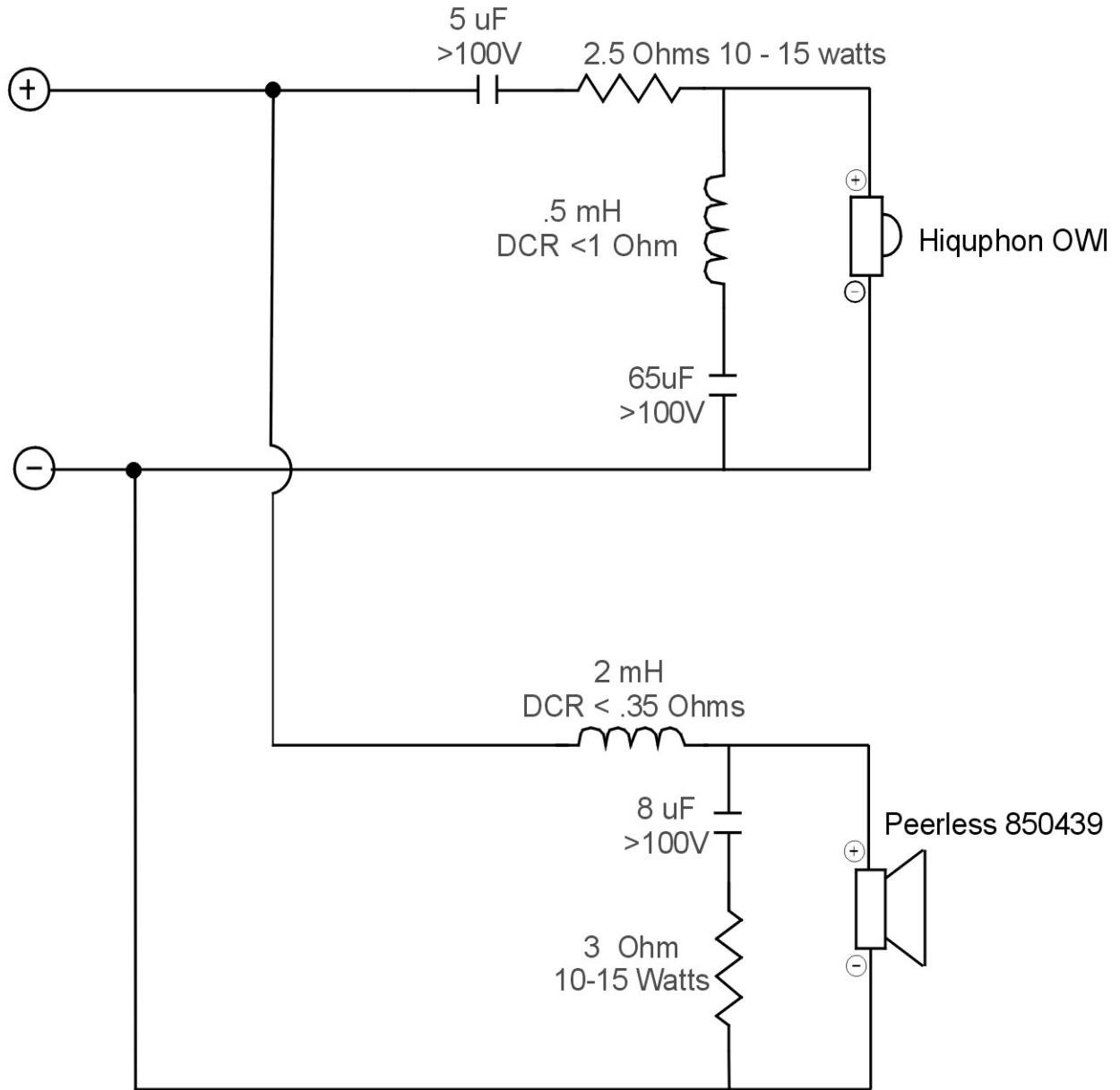


The
METAPHOR
Peerless 850439 / Hiquipon OW1
Loudspeaker Design Plans



Side View

THE METAPHOR



Metaphor System On axis response

