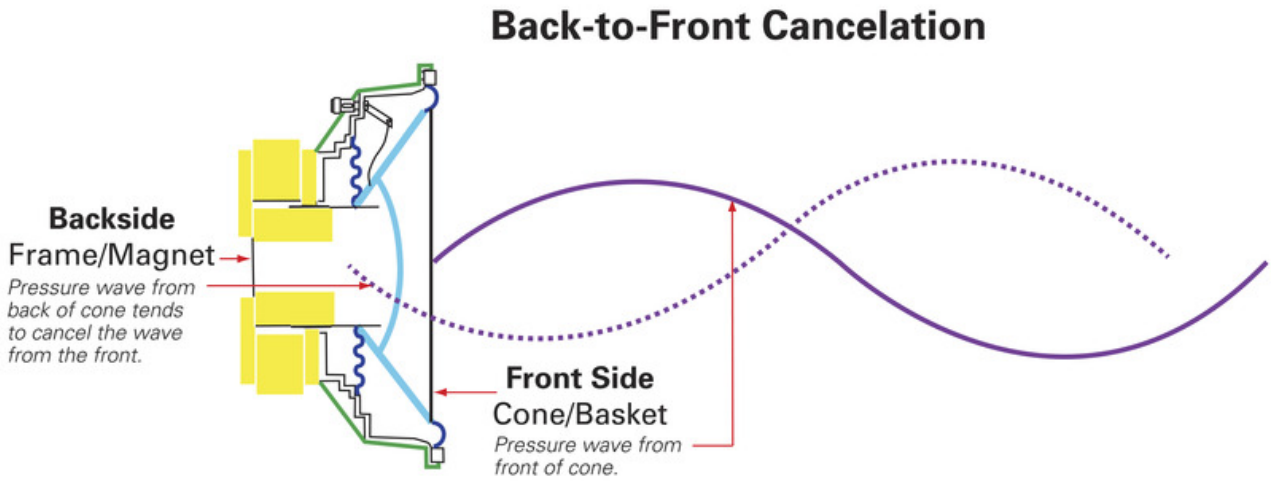
Baffles and Enclosures

Not all speakers work equally well in any enclosure. It's important to learn about isolating and defining the low frequency sound energy that radiates off the backside of a loudspeaker. You'll see the advantages of different types of enclosures, how to test them, and how to select which is best for creating the sound you want.

Why are enclosures and baffles needed?

All loudspeakers require some form of isolation of the Low Frequency sound energy that will radiate off of the Speaker Backside –Vs – the direct Low Frequency energy radiating from the Speaker Front Side.



Low Frequency wave lengths (bass output) are extremely long, compared to a typical loudspeaker's basket or frame diameter. Sound waves generated off the speaker's backside will approach – 180 degrees out of phase with the front wave and therefore cancel all low frequency output.

Baffles or some sort of enclosure are needed to maintain and define low frequency output. However, regardless of the type enclosure, it is important to remember that all speakers are securely mounted and that no air leaks exist in any selected speaker mounting, or in the enclosure's panel construction.

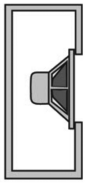
Enclosure Types & Advantages:

Flat baffle

Flat or Infinite Baffle – Generally used with in-wall or ceiling mounted speakers, will provide front-to-back speaker isolation while using close to an infinite amount of air space as the enclosure. A good rule of thumb to note; an infinite baffle speaker will require, at least, 10 times its published Vas in order Not to see an increase in free air resonance.

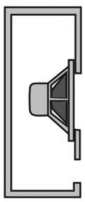
Open back baffle

Open Back Baffles – Are typically not used for extreme low frequency applications. They are best known for Guitar Speaker / Amplifier Combo Units. These types of speakers are specifically designed for open-back applications. Their stiffer suspensions are balanced with appropriate magnetic motor strength.



Closed baffle

Acoustic Suspension Enclosures – Also called Closed Baffles, use the sealed amount of air in the enclosure as an air spring to add to the speaker's air resonance in order to define the low frequency output of the system. Compliance of the enclosed air in an acoustic suspension system will be typically 30% or less that the compliance of the speaker. Speakers are designed, specifically, for sealed enclosure applications by balancing suspension stiffness with moving mass and magnet motor strength.

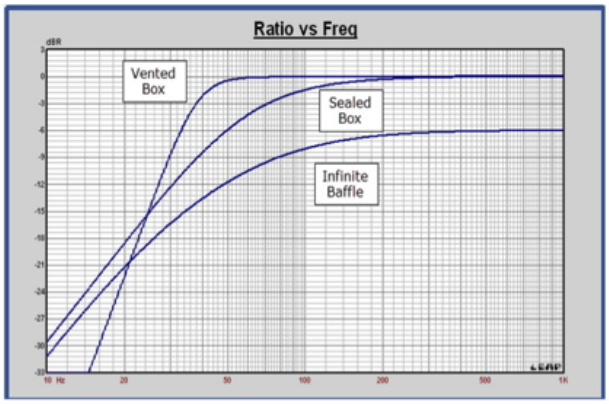


Bass-reflex baffle

Bass Reflex – Also called Vented Box Enclosures, are used when extended low frequency output is required. A port (vent) is added to an otherwise sealed enclosure and the port ID and length together, create a Helmholtz resonance that reinforces the systems' low frequency output. As with other enclosure types, speakers are specifically designed for Bass Reflex Applications.

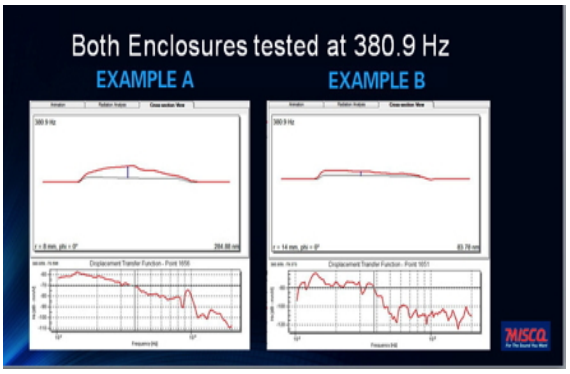
Sound Enhancements

One of the greatest misconceptions about baffles / enclosures appears to be that all speakers will work equally well in any enclosure style and that speaker mounting configuration is not critical. Because of the large air spring present in an infinite baffle enclosure, extreme cone travel will occur and allow Xmax levels to be easily exceeded. This uncontrolled cone excursion can cause increased audible distortion and risk mechanical damage to the speaker. Reducing system power will control the excursion...but at the cost of reduced system output or SPL.



Enclosure Testing

Proper enclosure choice and design is not a trivial exercise. Comprehensive electrical and acoustic testing can certainly validate your design. However, testing will also not be trivial. A simple detail like enclosure panel resonance can be over-looked. Poor panel damping can cause enclosure panels to resonate at specific frequencies and add audible sound colorations in mid-band frequency range.



Which Speaker Works with Which Enclosure?

(Or, Selecting your low frequency isolation)

EBP, or Energy Bandwidth Product is the loudspeakers free air resonance (Fs) divided by its electrical Q (Qes). If the calculated EBP is 100 or greater it would be best suited for a vented box design. As an example, consider the MISCO Speaker Model # LC62W-8A (shown here). Take the speakers Resonant Frequency (fo) 38 divided by the Electrical Q (Qes) 0.3..... 38 divided by 0.3 = 127 EBP. At 127EBP this speaker is an excellent model for a Bass Reflex (vented box) Enclosure.

SMALL SIGNAL PARAMETERS		UNIT of MEASURE
Resonant Frequency (fo)	38	Hz
D.C. Resistance (Re)	6.0	ohms
Mechanical Q (Qms)	3.8	
Electrical Q (Qes)	0.3	
Total Q (Qts)	0.27	
Compliance Equivalent Volume (Vas)	26.0	ltr
BL Product (BL)	6.8	T-M
Maximum Linear Excursion (Xmax)	7.0	mm
Surface Area of Cone (Sd)		cm2
Moving Mass (Mmd)		g