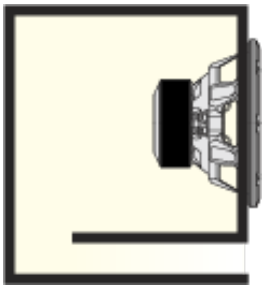
Ported Enclosure Characteristics

JL AUDIO | Help Center

Ported Enclosure



Ported enclosures (aka: Bass-Reflex, Vented) have actually been around longer than sealed designs. The ported enclosure was patented in 1932 by A.C. Thuras. Further development since then has defined the behavior of ported systems much more precisely. A.N. Thiele and Richard Small are generally credited with having done the most definitive work in this area, which is why enclosure/speaker parameters are commonly referred to as Thiele-Small parameters.

Primary advantages

- Efficient
- Low distortion around port tuning

The coupling of a port or duct to the air inside the enclosure allows the subwoofer system to take advantage of the work being done by the rear of the woofer cone to reinforce the low-frequency response. The resonant characteristics of the column of air in a port, when installed in a given box, are adjusted by altering its resistance to motion, which is accomplished by changing the dimensions of the port. In some designs, instead of a port, a speaker cone with no motor assembly or a flat diaphragm is used to achieve the same effect. This is known as a passive radiator. The resonance of a passive radiator system can be adjusted by altering the radiator's surface area, mass and compliance (stiffness of suspension). In a ported enclosure, there is a delicate relationship between the volume of air in the box, the resonant effect of the port, and the parameters of the speaker being used. When these three factors are correctly integrated, the rear output wave of the speaker is delayed just enough so that when it comes out of the port, it is in relative phase with the wave being produced by the front of the speaker. The result is constructive output from the port limited to a desired low-frequency range.

This low-frequency reinforcement is one of the big advantages of a well-designed ported system. Using the work of the rear of the cone in a constructive manner means that a gain in efficiency of about 3dB over a broad band in the sub-bass range can be achieved, as compared to a sealed enclosure using the same woofer.

The other big advantage is that the interaction of the port, the enclosure and the speaker's resonant characteristics also reduces cone motion and, therefore, distortion at higher volume levels in the frequency range controlled by the port. The downside is, at frequencies below the tuning of the port, the speaker gradually begins to act as if it were not enclosed at all (more on this later).

The increased output, combined with reduced distortion in the "meat" of the bass range (35–60 Hertz), is a big reason why many home speakers and high-power sound-reinforcement systems use ported enclosures for low-frequency reproduction. Many high-output studio monitors also use ported enclosures for the same reasons. The rules governing the behavior and proper design of ported speaker systems are considerably more complex than those for sealed enclosures. For this reason, it is a good practice to follow the advice of the speaker manufacturer or an experienced enclosure designer when it comes to designing a ported system. It is very easy to screw up a ported box if you just guess at the size and length of the port or the tuning frequency for the box. Not only will a poorly designed box sound bad, but it can easily damage the speaker if it is played hard.