



## Sealed, ported, or bandpass subwoofer enclosure- which one?

Almost all subwoofers require an enclosure to give the maximum performance the subwoofer can deliver. A subwoofer without an enclosure is in an infinite baffle configuration. It usually consists of a woofer mounted in a rear package tray or on a board (called a baffle board) that is mounted up to the back of the rear seat in a sedan. This will have a smooth and clean frequency response but will not have as much volume output or power handling as the same woofer in an enclosure. There are many variations of each of the enclosures so we will try to keep it simple and cover the basics.

**Sealed enclosure:** Also called an acoustic suspension enclosure. In this type of enclosure, the air in the box acts like a limiting spring to help control the movement of the cone of the woofer. There are no vents or ports of any kind in the enclosure. The lower bass response will roll off at 12dB/octave. The rear wave is essentially sealed in the enclosure and provides no additional output. They vary in size and shape and are considered one of the most accurate sounding enclosures when built properly. They will have very deep and smooth bass response, good power handling, deep bass, and tight, hard hitting sound. This will all depend on how the box is constructed. If the air volume of the enclosure is too large, it will no longer behave as if it were in a sealed enclosure. It will sound and perform like an infinite baffle.

- 1) Small sealed enclosures have very tight bass response, smooth low frequency roll off, high power handling, and work great for music that has more upper, punchy bass. It will have limited lower bass response because there is less air in the enclosure and it acts like a stronger spring that will limit the woofers cone movement.
- 2) Larger sealed enclosures have deeper bass and a smooth frequency response. They are great when you are wanting a more accurate response. They can handle less power than a small sealed enclosure depending on box size and woofer design. This is because the larger volume of air in the enclosure will have a softer spring effect which may allow too much travel of the woofer cone causing mechanical damage to suspension of the speaker.
- 3) Very large sealed enclosures will act more like the infinite baffle. Since there is a large volume of air in the enclosure, it will provide little or no effect on cone movement. This will limit the power handling of some woofers. These enclosures are very accurate and have the smoothest frequency response of all the enclosures but they have very limited output.

**Ported enclosure:** These are also called bass reflex enclosures. Ported boxes can be different sizes and it the size will have a great effect on overall sound, performance, and durability of the woofer. They have one or more ports or slots in the enclosure to allow the rear sound wave to couple with the front sound wave of the speaker for greater output. The lower bass response will roll off at 24dB/octave, twice as fast as a sealed enclosure. Because the rear sound wave is allowed to couple with the front sound wave from the speaker, they will have an increased output around the tuning frequency. This



increase in bass response makes them very popular where more bass is required such as hip hop and rap recordings.

Ported enclosures are typically used to get more output from the same power of an amplifier than a sealed enclosure because they are more efficient. They will also have more overall output than a sealed enclosure which means they can play louder overall. This gain in output comes at a small cost.

They are harder to build and usually require more airspace than sealed enclosures. The porting parameters must be very accurate. If constructed incorrectly, they can have port noise from the air traveling too fast in and out of the port(s). They can also lead to woofer damage and failure if they are constructed incorrectly. The other disadvantage is that the bass is not as tight and defined as a sealed enclosure due to the rear sound wave not being in time alignment with the front sound wave.

Below the tuning frequency of the enclosure, there is no acoustic suspension for the woofer and it will perform like an infinite baffle. This is called “unloading” and this can damage the suspension of the woofer due to excessive cone travel. All ported enclosures should have a subsonic filter to limit very low frequencies. There are a lot of amplifiers that have a subsonic filter built in to them. Some are subsonic filters are fixed and some are adjustable in frequency. You should have a subsonic filter set close to the tuning frequency to limit frequencies below tuning of the enclosure. Above the tuning frequency they perform more like a sealed enclosure with good control of cone movement.

Because it is harder to tune a small vented enclosure to a lower frequency, they are generally tuned to a higher frequency. This is because the vent length and area are too large to physically fit inside the smaller vented enclosure for lower tuning. This will limit power handling of a smaller ported enclosure because it is more susceptible to unloading at lower frequencies.

Not all woofers are suitable for a ported enclosure. Always refer to the owner’s manual or the manufacturer for proper porting specifications. Failure to do so will lead to premature woofer failure and poor overall sound quality.

- 1) Small ported enclosures have to be tuned at a higher frequency than larger ported enclosures. They will have less low bass and not play as loud as a larger ported enclosure. This will also limit the power they can handle. They do have tight bass but not as tight as a sealed enclosure.
- 2) Large ported enclosures will play lower frequencies and will have more overall output than small ported enclosures. This is because they can be tuned lower and are less likely to unload. This means they can handle more power than small ported enclosures. The bass response will not be as tight as a small ported enclosure or sealed enclosure but will play louder overall and have deeper bass response.

**Bandpass enclosures:** These are sometimes mistakenly called fourth order enclosures. This type of enclosure will have the woofer mounted completely inside of the enclosure. It consists of a single enclosure with a divider inside that will form two chambers. The divider is also mounting surface for the woofer. One of the chambers is sealed the other is vented. They too, come in different sizes. The only sound from the woofer exits through the vent in one of the chambers. One of the main advantages of a bandpass enclosure is the sound can be directed directly from the port into a vehicles cabin through a smaller hole than is normally required. They are a great way to get bass into a vehicle such as a



Mercedes, BMW, or Audi sedan where the package tray and back of the seat are steel. You can direct the vent to pass bass through hole in the rear armrest between the rear passenger seats. Another advantage of this type of enclosure is when built right, they are very efficient at passing a limited band or range of frequencies. Since one chamber is sealed, they will have a low frequency roll off the same as a sealed box or 12 dB/octave. The sealed chamber works just like a sealed enclosure. The larger the sealed chamber is, the deeper the bass. As in a sealed enclosure it can limit power handling if it gets too large. The upper frequencies are also rolled off at 12 dB/octave. This is why they call them bandpass enclosures. They only pass a limited band of frequencies. The ported chamber of the enclosure is also very critical of the air volume and porting specs. Just like a ported enclosure, this has to be built to specifications of the manufacturer for good performance, no port noise and good woofer durability.

This type of enclosure will also have some disadvantages. They get much harder to construct because the woofer is totally inside the enclosure. You will have to make an airtight access panel for service of the woofer in case of woofer failure. These enclosures are extremely critical on the design and you must follow the manufacturer's instructions to avoid speaker damage and failure. They also mask distortion, which is the number one reason for a speaker failure. This means you may not even hear the distortion that can damage your woofer. The bass response from a bandpass enclosure is typically not very tight and punchy. The design of the enclosure will limit the upper bass that makes up the punch you would hear in a sealed or ported enclosure.

- 1) Larger bandpass enclosures will have a smoother and deeper frequency response than a smaller bandpass enclosure but not as smooth as sealed or ported enclosures. They can be much larger than the sealed enclosures if you are trying to pass a wide band of low frequencies.
- 2) Smaller bandpass enclosures are much more efficient but do not pass as wide of a band of frequencies. The smaller enclosures will not have as smooth frequency response as larger enclosures in the frequencies they pass. This means that some frequencies will be much louder than others. Typically, one frequency gets very loud as compared to others.