Isobaric Enclosure Types

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There are several different isobaric loading configurations to choose from, so which is the right one for you? This is a loaded question that quite often has no clear-cut answer. At JL Audio, we do not recommend the use of isobaric loading to just anyone...we do not believe that the more subwoofers that you can shoe-horn into any given volume of air produces the best results. In fact, we're sure you've seen plenty of examples to support this line of thinking. So, we only recommend that you consider using isobaric loading if one or more of the following conditions hold true:

1. You have more subwoofers than space to properly utilize them. The first condition is a common occurrence if you decide to change vehicles and keep the sound system or when you out-grow that desire to consume every cubic inch of your vehicle's storage space with subwoofers. You don't want to sell your equipment because you've fallen in love with it, and so you begin to look for any possible way to keep all (After all, it *does* sound impressive to say "Hey, I've got sixteen 8-inch woofers in the back of my Jetta"). Since iso-loading allows us to use the same number of pistons (A piston is one air-moving unit; think of it as you would the pistons in your engine) in half the space, an isobaric loading scheme might prove very attractive here.

2. You have more power than you know what to do with but little space to work with. The second condition may hold true if you've suddenly acquired a 500 watt amplifier for your subs and your poor little 150W subwoofer just cannot handle that kind of power. In this case, you might switch from one 150W driver (such as a JL Audio 10W1v2) in a 0.625 cubic foot enclosure to four of the same drivers (2 isogroups) in the same sized box. This would bump your effective power handling up to 600 watts, which should handle the added power just fine. Of course, you could also simply upgrade to a single 10W7.

3. You have more money than you know what to do with. The third condition is pretty self-explanatory... you've got money burning a hole in your pocket, and rather than purchase a new set of tires to replace your balding Dunlops, you decide to splurge on stereo equipment and try to put as much stuff into your car as humanly possible.

4. You are a golden-eared tweak who can detect subtle non-linearities in your sub bass. The fourth and final condition is a subtlety that most probably won't be familiar with. One of the nice little side effects of using a face-to-face (or back-to-back) loading arrangement is the cancellation or driver non-linearities. This will be explored a little later though.

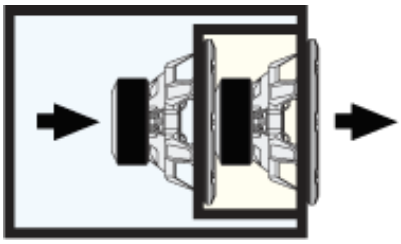
In short, if you're out to try isobaric loads for reasons such as "It looks cool" or "I heard that they 'hit harder than anything else," then your money would more likely be better spent on something else a little less costly. Of course, we wholeheartedly support those who love to try new things just for the sake of trying out new things or to further their understanding of various subwoofer systems, so don't take what you read here as discouragement...just a fair warning of what to expect.

With all this said and done, let's explore some of the advantages and disadvantages of the "piggy-back" tunnel load, back-to-back tunnel load, the planar load, and the "clamshell" isobaric configurations:

Isobaric Enclosure Types:

"Piggy-Back"

"Piggy-Back" Isobaric



The "piggy-back" tunnel-loaded isobaric configuration is probably the second most popular isobaric arrangement (the first being the face-to-face or "clamshell" configuration). It is cosmetically easier to integrate into the vehicle (as it does not have any potentially ugly subwoofer baskets protruding into the vehicle), but, unfortunately, this aesthetic benefit is offset by several important disadvantages:

1. The coupled air between the two drivers adds to the moving mass of the system and thus results in a less than optimal coupling between the drivers. Remember that the idea is to get these two subwoofers to act as one driver, and by adding a springy mass between them, this ideal is somewhat compromised. Some might find that this leads to a beneficial lowering of the system Q (when the volume indicated in blue in the picture is sealed), but, more often than not, this effect is undesirable because it makes response predictions more difficult.

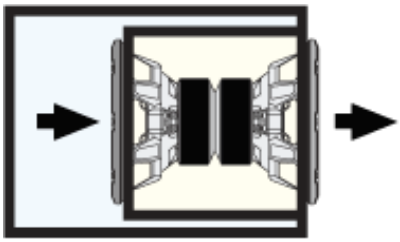
2. The coupling chamber negates one of the primary benefits of iso-loading (small enclosure size). By the time we account for the displacement of this coupling tunnel in determining the gross volume of the blue chamber, the enclosure starts to approach the volume required by a single conventionally mounted driver. This begs an obvious question: Why are we doing this?

3. Since the drivers are both firing in the same direction, we do not reap the benefit of cancelled driver non-linearities as we would with a design implementing a push-pull configuration. Why are we doing this again?

4. The driver whose magnet structure is housed in the coupling tunnel is in a highly unfavorable cooling environment and will be subject to power compression at lower levels. Basically, the drivers will be more or less equal performers at first, but as things start to heat up and the impedance of the front driver rises due to rising voice coil temperatures, the drivers start to fight each other to some degree rather than complement one another. This results in increasingly non-linear behavior with possible unpleasant audible side effects (e.g. sloppy transient behavior). Really: Why are we doing this? In essence, the "piggy-back" configuration is more of a cosmetic "oh neat-o" design more than anything else, and we recommend that it not be used, especially for high-powered applications where the thermal power handling of the drivers would be called into question.

Back-to-Back

Back-To-Back Isobaric



This design was thought up by someone who wanted to reap the advantages of canceling driver non-linearities without having to resort to the "clamshell" loading and its inherent cosmetic problem (namely that of hiding an exposed subwoofer basket). This design, like its cousin, the "piggy-back" tunnel-loaded isobaric, also has several issues that make it an undesirable choice:

1. It shares the same problems with the added springy mass of air that couples the two drivers. This problem is made even worse by the fact that the coupling chamber is now even larger, adding more moving mass and springiness over the "piggy-back" design, which makes frequency response predictions even more difficult.

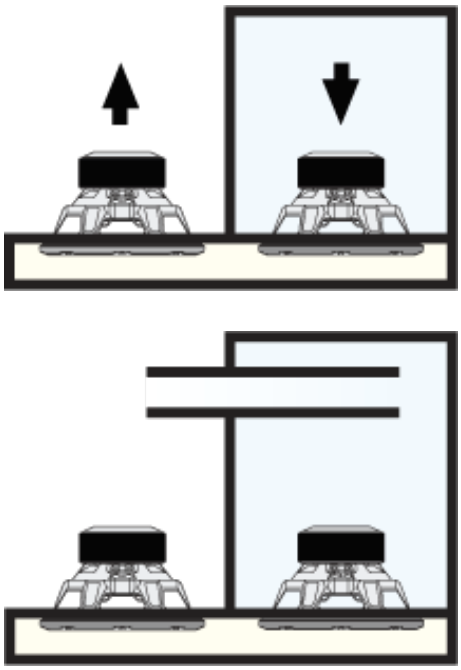
2. The increased coupling chamber (yellow volume) means that the blue volume and the entire enclosure must be even larger, even more closely approaching the volume of a conventionally loaded single subwoofer. In a home this might not be a problem, but in a vehicle where space is at a premium, this is a definite disadvantage!

3. Now that both magnet structures are in identical cooling environments, they will more closely track each other's performance, but, unfortunately, now we have two heat dissipating structures in the same tiny enclosure, which will greatly reduce the thermal power handling of both drivers, not to mention the fact that as the air heats up, it expands, thus pushing each of the subs outward and further limiting output by reducing each driver's potential excursion!

While the original creator of this design should be given a pat on the back for creativity, he might also merit a kick in the behind for the reasons stated above. This is definitely not a design that we recommend under any circumstances.

Planar Load

Planar Isobaric Planar Isobaric



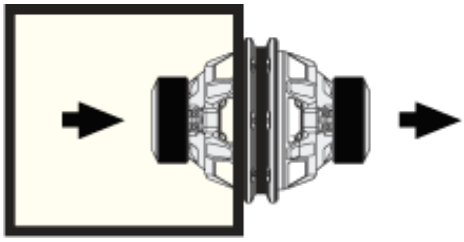
This alignment is similar in concept to a “clamshell” or face-to-face isobarik and will behave in a similar manner. However, it also has some of the problems of the tunnel-loaded isobaric that are associated with having a coupling chamber between the two drivers. It is somewhat space inefficient since it requires you to give up usable space behind the outside driver, but it produces a very interesting visual effect if you put a sheet of plexiglass in front of the speakers.

The loading chamber (indicated by the yellow shaded region) should be as short as possible while still allowing for free movement of the speaker’s surrounds. You should also do everything possible to minimize the surface area of the loading chamber since any trapped air in it essentially becomes part of the moving mass of the speaker system.

If you intend to utilize a ported design, port lengths can be rather large. This is common with single isogroup enclosures because of the small box volumes. For this reason, you may want to fire the port as shown in the diagram below. This should allow you to extend part of the port tube outside the enclosure without it being visible.

Clamshell

Clamshell Isobaric



The face-to-face or “clamshell” configuration as it is commonly called is the most compact and, therefore, the most practical isobaric loading method to use, considering the tight confines of the average automobile. This configuration also provides the beneficial side effect of canceling driver non-linearities.

If there is one recurring theme in engineering, it’s that Mother Nature is lazy. She has made it a law that anything at rest wants to stay at rest, and, similarly, anything in motion would much rather stay in motion in a straight line. Such is life in general, and a speaker’s dynamics are no exception. It’s called the law of inertia, and there is no escape.

When a subwoofer does its job, it is called upon to compress and rarefy the air in the listening environment many times per second, and more often than not it is required to do so over great distances. This places a great strain on the cone itself as it fights to retain its shape in the face of intense acceleration and deceleration. Ideally, a speaker’s cone would be infinitely rigid and wouldn’t deform under any circumstances, but this is not a perfect world a perfect world, and we have to deal with the consequences of fighting Mother Nature.

As the cone pushes outward, it is somewhat flattened out as it attempts to kick-start the air in front of it into motion. Likewise, the cone is deformed the other way when the cone returns and attempts to compress the air in the subwoofer enclosure. The extent of this deformation is a function of the cone’s geometry, construction and the amount of power with which the subwoofer is driven. A good engineer will design his cones so that this effect is minimized, but there is only so much engineers can do if he wants to keep moving mass and/or costs low.

Construction tips

It is important to note that when mounting the drivers to each other and then to the enclosure, a separator of some sort must be used to space the drivers apart. If the drivers are not physically separated, their surrounds may rub against each other, which will lead to premature failure of the driver. We recommend the use of a 5/8-inch thick ring of Medium Density Fiberboard (MDF) with appropriately spaced holes to pass the mounting bolts or screws through.

Lay the bottom driver in the box after wiring it up (this driver should have its positive leads wired to the positive terminal(s) of the amplifier and its negative terminals wired to the amp’s negative terminal(s). Lay the MDF Iso-Ring atop this driver, invert the second driver over the first, line up the mounting holes, and screw the whole assembly to the enclosure.

Assuming your driver's gaskets are clean and unscathed, and the MDF ring is equally smooth on its contact surfaces, no other sealing agents need be used to assure a good air-tight seal at the driver/ring interfaces. If you decide to use silicone or some other sealant, be prepared to go through one hell of a fight if for some reason you need to disassemble the isogroup!

Some prefer to mount one driver inside the box and its partner atop the box, using the enclosure wall itself as the spacing mechanism. However, we have found that this makes driver servicing unnecessarily difficult; rather than just undo the eight bolts/screws using our suggested mounting method, one would have to have someone come in from a removable panel on the other side of the enclosure and hold up the other driver. In short, mounting everything from the outside makes much more sense and is infinitely easier to service.

When all is securely mounted, wire the outer subwoofers (the ones with their magnets exposed) so that the (+) on the speaker is wired to the (-) on the amplifier and visa versa. This will assure that both drivers are moving in the same direction when a voltage is applied. If you hook everything up and get no bass from your new isoload, chances are that either a lead fell off inside the enclosure, or you've got a driver's polarity reversed...double check everything before powering up.