

JANTZEN AUDIO

FAQ

Answers to the most frequently asked questions

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Can we help design crossovers/speakers?

We unfortunately cannot help with designing speakers and/or crossovers.

What we can help with is to give some general advice about choosing components, but it does require that the crossover/speaker design has already been completed and that you send us the crossover schematic.

We often get inquiries from DIY enthusiasts who asks if we can help design crossovers for a set of drivers, they already own.

The short answer is that no one can design a speaker/crossover by using driver data alone and by software simulation.

Using the manufacturer's driver data in a software simulation is only the first of many steps required, to properly design speakers/crossovers.

To properly tweak a speaker/crossover design, you will always need to have the drivers mounted on the actual baffle, make measurements of amplitude, phase, and impedance, import data to simulation software to generate the crossover, and make test crossovers to measure/hear if things work out correctly.

This means that a speaker design process requires the designer to have the crossovers and the actual baffle in-hand in the workshop.

Coil types

Air cored single wire, multi-strand (litz) and foil-based induction coils:

Our Air Core Wire Coils, Litz Wire Wax Coils, Cross Coils and Wax Coils are all either made without a core or with a neutral wooden core.

These coil types can generally be used across the board for all positions on the crossover.

The differences between single wire, stranded wire and foil-based inductors relates to both power handling and added dynamic headroom.

General difference between air and ferromagnet cored coils:

Inductors with ferromagnetic cores tend to become saturated as the current increases.

Air Core induction coils, however, have no core to saturate, and therefore are independent of electrical currents.

Iron Core Coils & C-Coils:

Any induction coil made with a ferromagnetic core will have a certain level of audible distortion.

The link below offers information how to measure distortion in mainly ferromagnetic cored coils:

<https://hificompass.com/en/projects/experiment/test-couple-iron-core-inductors>

When it comes to our Iron Core Coils (with or without discs) these coils are generally recommended for the bass and mid-range section and as a rule of thumb for positions below 1 kHz.

Our C-Coils (toroidal core) are only recommended for application in separate bass filters and as a rule of thumb for positions below 200 Hz.

Wire/Foil Gauges:

The gauge/thickness of wire or foil will influence both the resistance of the coil (DCR) and the power handling of the coil.

A larger/thicker gauge gives a lower DCR and a larger power handling.

General thoughts:

Which coil will give the best performance is dependent on crossover design and to budget (increased performance versus cost). To choose the “right” coil, both the technical reasoning and personal preferences must be factored in.

Coil power handling (watt RMS)

The reason why it is difficult to exactly determine the exact power handling data for a specific coil (gauge/core type and size) has to do with the complexity of doing such measurements, below are listed some of these complications:

- Are we talking 4Ω or 8Ω impedance when measuring?
- At what frequency are we measuring?
- At what amplifier output voltage / amperage are we measuring?

Music consists of a very wide range of signals across the frequency response range.

How a specific coil will perform in a crossover will therefore depend on the music type played and volume levels over extended play time, etc.

To measure the exact wattage load where a coil would start losing inductance, a core saturates or when audible distortion would occur is there for complicated.

It will often be possible to get advice and hands on experience from audio experts and amateurs alike, who have a lot of hands-on experience with coil selection via articles or via online audio forums.

In many cases it is also a matter of personal preference, budget, and philosophy which coils could or should be used and if any theoretical or measured potential “issue” is in fact audible to the human ear.

If you want to go down the route of getting a better idea of what a coils overall power handling would be, a setup will have to be made, where you use a white noise test signal., It would simulate/represent the full power bandwidth energy area in the audible band (20-20kHz) run through the coil during such a test.

Another thing to note is that even if you make a test using a white noise signal, the results may not translate into something that you can physically hear for your specific speaker design.

Capacitor types

Voltage Rating:

All audio grade capacitors will have sufficient voltage rating for application in most passive loudspeaker crossovers (for home use).

Specific voltage ratings for both DC and AC current are given on the capacitor datasheets.

When using capacitors in amplifiers it is far more important to be mindful of the voltage load of the amplifier and choosing a capacitor with a sufficiently high voltage rating, for valve amplifiers.

Bass, mid-range and tweeter section of crossovers:

For the bass section we recommend choosing good quality, but lower cost capacitors, e.g., our Cross Caps, Standard Z-Caps or “eleCaps” 5% tolerance electrolytic caps.

Specifically for electrolytic capacitors, we recommend avoiding capacitors with less than a 35VAC rating and no more than a 10% tolerance on capacity (best to choose 5% tolerance models).

From a technical perspective it would generally be complete overkill to use expensive high-end capacitors for the low frequency area (bass), as the improvements in performance / sound of higher-grade capacitors, would not be audible in this frequency range.

For the mid-range section, using higher grade capacitors like our Superior, Silver or Alumen Z-Caps can add better performance/sound, but it will depend on specific crossover design, drivers used, and of course personal preference.

The tweeters are always the most revealing part of any speaker system and therefore the most common position on a crossover to use high-end capacitors, will be the tweeter section.

Depending on preference in sonic profile, we recommend our Superior, Silver, Alumen or Amber Z-Caps, as the best choice for tweeter capacitors.

Series filters:

For series filters, we generally advise to use the same grade of capacitors for all positions, as all capacitors are in direct line with the tweeters.

Signal direction

All our capacitors are all **non-polarized** audio grade capacitors.

This means that for our capacitors there is no “right” or “wrong” signal direction.

It does not matter from which lead wire the signal enters and from which it exits.

Music is an AC signal, and it therefor makes no audible difference from which direction the music signal enters a **non-polarized** capacitor, an induction coil, or a resistor.

Signal direction only applies to **polarized** capacitors.

We have done thousands of in-house tests and we have exchanged test results and feedback from listening tests, with many of the world’s most acclaimed speaker designers.

Based on these tests and feedback, the broad consensus is that for **non-polarized** capacitors, induction coils and resistors, there is no audible difference that the human ear can detect, not matter from which direction the music signal enters.

Inner & outer foil

Our Cross Caps and all our Z-cap series capacitors are wound uniformly, and the leads are connected to high-connectivity “end-discs” that are then connected to the whole rolled capacitor (the foil) itself.

There is therefore no “inner” or “outer” foil for the Cross Caps and Z-cap series capacitors.

Burn-in for audio grade capacitors

The subject of “burn-in” time for audio capacitors is a widely discussed topic, often sparking heated debates between “believers” and “non-believers”.

We have done our own tests and exchanged opinions with a wide range of speaker designers on this subject.

It is our subjective experience and opinion that for most people and for most applications there is no audible change in the characteristics of our capacitors over time that most human ears will be able to identify.

It is much easier to agree about the burn-in / play-in that takes place for e.g. bass or mid-woofer speaker units, where the fabric outer suspension and/or fabric spider often becomes softer over time and reduce point of resonance. Light-weight non-treated paper cones may also become slightly softer over time and change properties.

The “mental” burn-in time:

It is a bit easier to talk about a sort of “mental burn-in”, where your ears and hence your brain, will need time to adjust and reflect on the change that has happened, as the result of a capacitor swap or upgrade.

When it comes to swapping / upgrading capacitors it will always be a matter of taking some time to get used to something new, by listening to many types of recordings and even from different media. After a longer period, it is completely up to the listener to determine if the change is a preferable thing or not and perhaps discover that less is more.

Doing conventional A/B listening test with a switch between different capacitors, is asking an awful lot of our brain.

After a short time, all the impressions become muddled, and we end up more confused than enlightened.

It is our opinion that a more effective A/B listening test is to make a setup A and listen to that for an extended period and then do a setup B and do the same.

Then return to setup A again to see how we feel about the capacitors in setups A and B.

Our capacitor philosophy

Our main goal is with our higher-end capacitors is to get rid of some of that “coloration” that can occur with lower end capacitors and to let the sonic profile sound a bit less “bright”.

We are trying to make recordings sound as close as possible to how it sounded when it was recorded.

Obviously, there will be big differences when comparing electronically produced music versus microphone recorded acoustic music.

Some listeners will miss the sort of painted on “coloration” or added “brightness” that they were used too from lower grade capacitors, and they will have to decide if the new sonic profile is preferable.

However, all kinds of manipulation of a music signal is a type of distortion, but for some a welcome distortion.

Choosing the right coil/capacitor type

We often get asked which coil or capacitor type will sound the best or will give the best performance?

This is one of the most difficult questions to answer, as personal preferences often outweigh the technical reasons for choosing crossover components.

General thoughts on choosing components:

Coils do not have the same instant or direct influence on the sonic profile as capacitors, but they are equally important, but for different reasons.

These reasons are generally more closely related to dynamic headroom and overall system capabilities.

When having considered the technical aspects, one must look at things like:

- Budget for the components and overall cost of the design
- Cost of crossover components in relation to overall cost of the system
- Which sonic profile or “flavor” is preferred
- The ratio related to the increased gain in performance versus the additional cost

It is not an easy task to describe how a component will change or “upgrade” the sound of a specific loudspeaker, as what constitutes “good sound” is of course very subjective.

The best way to find the components you like is to test them yourself, but the second-best thing is to get inspiration and help from the DIY audio community and to read component reviews as well.

Helpful articles & audio forums

Choosing coil types for crossovers:

Article by Mr. Troels Gravesen.

Read article [here](#)

Placement of coils on crossovers:

Article by Mr. Troels Gravesen.

Read article [here](#)

Measuring low resistance (DCR) coils (e.g. C-Coils):

Article by Mr. Troels Gravesen.

Read article [here](#)

Audio Grade Induction Coil Types Explained:

Article by Audio Judgement

Read article [here](#)

Popular DIY audio forums:

[diyAudio.com](#)

[DIYaudioprojects.com](#)

Capacitor reviews

Alumen Z-Caps:

Review by Mr. Troels Gravesen.

Read review [here](#)

Amber Z-Caps:

Review by Mr. Troels Gravesen.

Read review [here](#)

Cross Cap & Z-Cap series reviews:

Reviews by Humblehomadehifi

Read review [here](#)

Z-Cap series capacitor reviews:

Reviews by audio experts and customers

Read review [here](#)