Inductor Upgrades For SDA's

"The thread on the forum has correctly identified most of the concerns. Good job!

However, I can add these comments. Usually, in a typical low pass crossover, one would not want to swap out an inductor for another one with much different characteristics because it would alter the voicing of the speaker. However, in this case there could be a performance benefit if the amp being used doesn't mind seeing a lower impedance. The inductor I believe they are talking about is part of the "Full Complement Sub-Bass Drive" circuit. That's a term that Sandy coined to describe the system we used to allow the SDA drivers to work in parallel with the stereo drivers in the bass while producing the SDA signal at higher frequencies.

In this generation of the SDA's the stereo drivers were nominally 6.5 ohms and the SDA drivers were nominally 3.5 ohms. The plus terminals of the SDA drivers on each side were connected to the plus amp terminal on that side via their cross-over network. Then, the negative terminals of the SDA drivers on one side were connected to the negative terminals of the SDA drivers on the other side via the interconnect cable. This causes the SDA drivers on the right to produce an R-L signal and the ones on the left to produce L-R. Since bass is pretty much mono in most recordings, if the SDA drivers both get full-range R and L signals they would cancel at low frequencies and the SDA drivers would just sit there acting like badly tuned passive radiators. **So, we added an inductor in each speaker between the SDA driver negative terminal and the amp negative terminal on that side. At low frequencies that diverts the signal back to ground instead of through the interconnect to the SDA drivers in the other speaker.** As a result, at very low frequencies the Right SDA drivers produce only right channel bass and vice versa, while still producing the R-L and L-R signals at higher frequencies. The transition occurs between about 50Hz and 150Hz.

However, because of the DC resistance of the inductor, the system isn't perfect. I don't recall the DC resistance of these coils but it was high, at least several ohms depending on the model. This means that the SDA drivers will continue to produce some SDA signal even at very low frequencies. Decreasing the DC resistance will definitely improve the bass response of the system both qualitatively and quantitatively. However, before you rush out to buy those Hi-Q replacement inductors be aware of some concerns.

We chose the higher DC air core coils for a couple of good reasons. First, we were always on the edge of acceptability with the impedance of the SDA's. The DCR of these coils kept the minimum impedance high enough for the amps available in those days. **Depending on the model, reducing the DC resistance of these coils may take the minimum impedance down to around 2 ohms.** If your amp doesn't mind, you shouldn't either. The other concern is saturation of the inductor core. Air core inductors don't saturate. Given the cost of adequate ferrite or laminated core inductors at the time, plus the need for a higher DCR, the air core choice was obvious. So, when switching to a ferrite or laminated core inductor make sure it will handle at least 5 amps without saturation. That's equivalent to 100 watts of low frequency power through the SDA driver.

hope this helps."

-**Matthew Polk**

Resistance is not always futile. The DCR of our inductors is accounted for in the crossover design. Changing it / lowering it will affect a different balance than the design intent. We typically use large enough wire that the DCR of the woofer inductors is in tenths of an ohm range. As to switching inductor for reasons of other qualities, there can be benefits if the designer has not done his homework. We've used air-core inductors for many designs and steel or iron cores for others. We base our decisions on the perceived use of the product, cost and size. Iron or steel cores increase the value of a given inductor by focusing the magnetic field created by the windings. This has the advantage of reducing the size and number of winds needed to achieve an inductance value. This also means that larger wire or fewer turns can be used to achieve a lower DCR. The concern is that the core (iron, steel laminate, ferrite) wil saturate a some maximum field intensity and pushing current above that level into the inductor will make it become non-linear. The inductor is actually reverting to acting like an air-core as it is over-driven – but only for the overdriven portion of the signal. So the signal becomes distorted, bad noises, scratchy, etc.. We have to choose the wire gauge and core material so as to provide head-room for the largest signals (including transients) that we expect the speaker to reproduce linearly. Air-core inductors do not saturate as more current is passed through them unless the current is so great that the wire begins to heat. It is not necessary, however, for the inductors to have such high limits because there are plenty of other practical limitations on loudspeaker output. Many of

these are simply physical, like the maximum possible cone excursion of the drive units. Go beyond this and once again – distortion. Typically we can design our speakers with steel-laminate inductors and easily reach undistorted levels well in excess of 100 dB in the case of appropriately sized units. The down side of air-core inductors is as mentioned earlier that they will require more wire and hence have higher DCR. So more power from the amp will go into heating up this inductor and less into making sound. In this case, resistance is indeed futile.

As an addition to the thoughts I gave earlier on inductor quality you should advise that only laminated steel is acceptable for most any high quality system. Ferrite saturates at current levels much too low. It's high permeability allows one to make very high inductance values with less wire (so lower DCR) but the current range is poor at best. For all I know this may be the reason that all quality / high current transformers use laminated steel."

-**Stu Lumsden**