LUNDAHL
– TRANSFORMERS –

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Transformer Design Philosophies

Our transformer design philosophy is based on forty years of experience from manufacturing transformers for a diversity of applications. Our transformers are used in professional audio and hi-fi as well as in power supplies, telecommunications, welding, military applications etc.

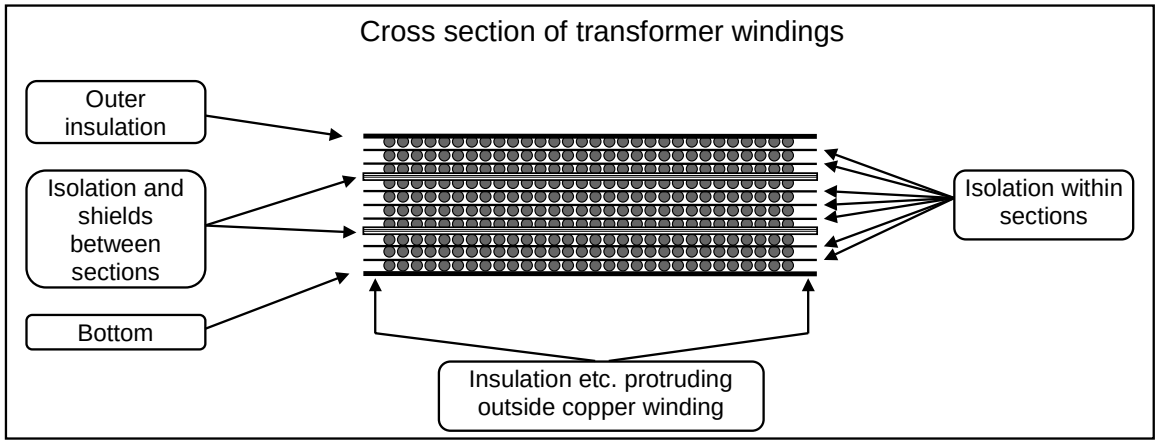
We have evolved some unique problem solving strategies when designing transformers, discussed further below, and we design and build our own production machines in order to fulfill otherwise unobtainable transformer design goals.

1. Winding technique
Most manufacturers of audio transformers use a conventional bobbin winding system: Within a transformer section, the copper wire is wound in a more or less "random" fashion, and thus the voltage difference between two adjacent wires may be substantial. Transformer sections (such as primary and secondary sections) are separated by isolation film and tape, but the isolation materials is confined by the same bobbin sides as the copper wire. Static shields are also confined to the same limits.

The Lundahl Transformers winding technique does not use bobbins. Our open end winding technique (with insulation between each layer of copper wire within a transformer section) is consistently applied, even for the smallest transformer types and for the thinnest wire dimensions. This gives the following advantages:

- The wire is wound in well-ordered layers. As a result, no wires are crossed and the fill factor is increased (in spite of more insulating material!).
- As additional isolation is applied in the vertical direction, the isolation is reinforced where strong mechanical forces and high voltage differences occur.
- The copper wire is in close contact with low-voltage neighbors of the same layer only.
- Inter-winding capacitance is reduced and reproducible.

Insulation and, if applicable, electrostatic shields are placed between each section, protruding outside the copper wire edges to improve the insulating capability as well as the electrostatic shielding.



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2. Dual coil structure.
Our transformers are built up from two coils, each coil with both primary and secondary windings. (It is a common misconception that the primary winding is placed in one coil and the secondary winding is placed in the other. This was the case in high school physics laboratory classes, but such a transformer does not perform very well in the real world.)
The dual coil structure has many advantages:
Magnetic immunity is improved with about 40 dB, as a signal caused by an external magnetic field is cancelled between the two coils.
Magnetic stray field is likewise reduced.
CMRR is improved, in particular if windings are used in parallel across the two coils, as plus and minus contributions cancel.

3. Choice of core shape and core materials
In order to meet customer requirements on both electrical and mechanical parameters, we manufacture not only transformer coils, but also cans and C-cores (and machines for can and C-core production) in house. For some applications, we also use amorphous metal cores made in a "inverted toroid technique" developed in house. These manufacturing capabilities give us a large freedom to optimize design also for limited volume applications. We focus on PCB mount transformers as we think this is a rational way of using small size transformers and regularly turn down requests for flying leads.

4. Long lifetime and high insulation requirements
Our winding technique gives us an excellent base for high insulation requirements. A molding process fills empty space in the transformer. When impregnated with epoxy resin, the result is high electrical insulation (normally 4 kV between windings) and excellent mechanical strength.

5. Price / performance considerations:
Manufacture of high quality audio transformers is, in spite of a semi automated production process, a very labor-intensive task. Cheap transformers can be found in many electronics supply catalogs. However, it is not the transformers you would like to listen to in your application. Truly sound transparent transformers are manufactured by a handful of companies only.