Eighteen Sound

Interleaved Sandwich Voice Coil: ISV

An electrodynamic loudspeaker incorporates a copper or aluminum coil wound over a cylindrical former. This coil is immersed in a static magnetic field created by a dedicated magnetic circuit.
The music signal, fed from the amplifier, is transformed into vibrations and sound by the interaction between the amplifier's current and the magnetic field.
At the same time, the current heats-up the voice coil winding material by Joule effect, with a consequent rise in temperature.
The loudspeaker power handling is influenced by the capability of the moving coil to dissipate this generated heat.
Power compression (defined as the loss in acoustic sensitivity when a speaker is working at the specific power) is mainly due to an increase in coil resistance caused by the temperature rise.
Heat generated in the coil is dissipated through 3 main mechanisms:

1. conduction from the windings to air and to iron plates;
2. convection to air;
3. radiation from coils to plates.

If the speaker design is capable of extracting the heat generated, the coil life is improved, thanks to a lower temperature on the adhesive and insulation materials.

Conventional two external layer voice coils consist of 2 windings, one wound over the other, and glued externally to the cylindrical former (Fig 3).

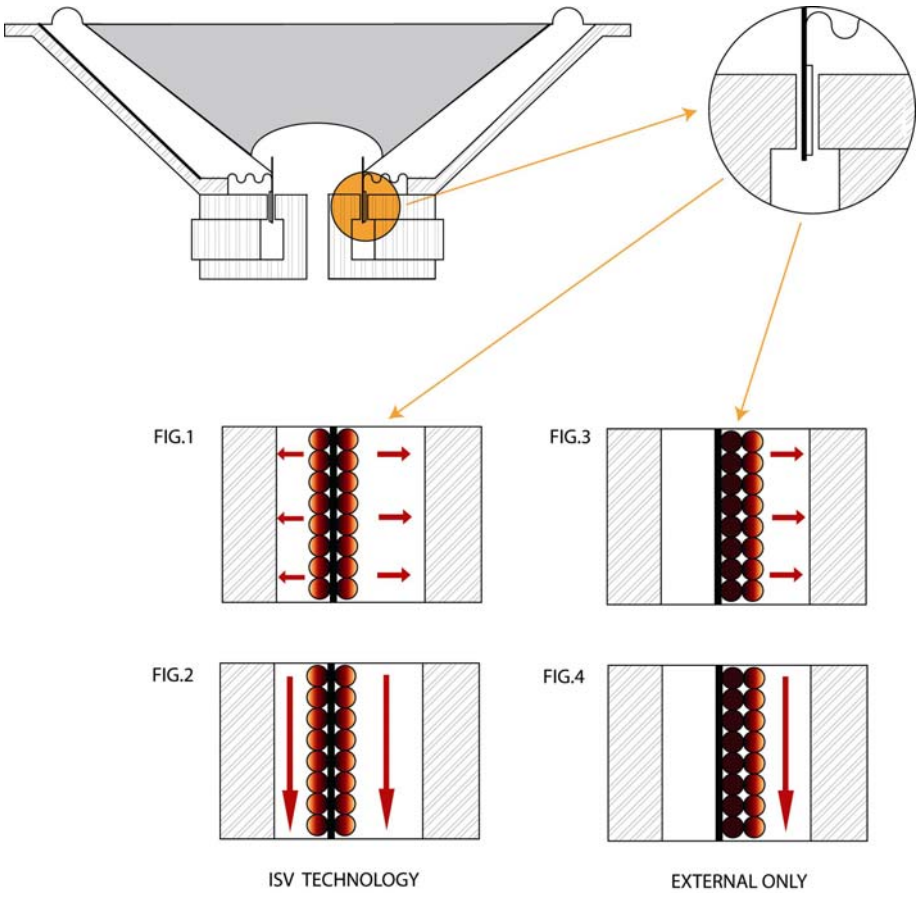
Our state-of-the-art **Interleaved Sandwich Voice coil** (**ISV**) technology consists of two windings wound internally and externally to a specific fiberglass cylindrical former (Fig. 1), using very high temperature adhesives (able to work with temperatures over 300°C).
A conventional coil mainly dissipates only to the top plate and outer gap (Fig 3-4). The ISV voice coil heat dissipation is significantly better than that of a conventional one, because both windings directly dissipate heat, thanks to the increased surface facing air and the conduction path.

A music program signal always involves instantaneous power peaks of a very high value with consistent mechanical fatigue over the windings. The ability to transfer these peaks without damage is related to coil topology. ISV, thanks to its intrinsic construction with both windings wound directly on the specific former, is able to carry higher violent instantaneous peaks than a conventional coil.

Hence, the main advantages of an ISV voice coil compared to a standard two-layer external one, in terms of power handling and power compression are:

- Mechanical integrity is improved by the direct adhesion of both windings to the fiberglass former;
- heat dissipation from the coil to surrounding air and iron plates is increased.

Eighteen Sound's ISV voice coil technology has been carefully studied over many hours of speaker operation, in dedicated power testing rooms. Specific materials, such as special former and resins, have been selected through precise research, in order to maximize the reliability of the speaker.



The graph below shows the temperature difference between two 15 inch speakers (one equipped with an ISV voice coil and the other using with a conventional external coil) during an AES power program test.

Fig 5 and 6 show the behavior of the ISV versus a conventional coil after the first 5 minutes and the 1 hour measurements. The lower temperature (25°C difference) of the ISV coil speaker is clearly shown.

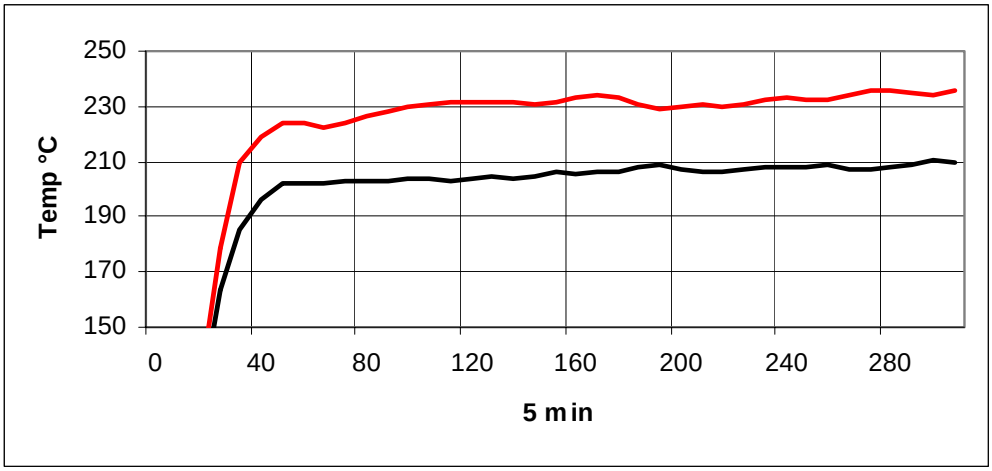


Fig 5 – First 5 minutes of an AES standard power test (temperature versus time). 15 inch speaker comparison, black plot ISV voice coil, red plot conventional external type. The 25°C difference is mainly due to increased conduction surface (Fig 1 vs. Fig 3).

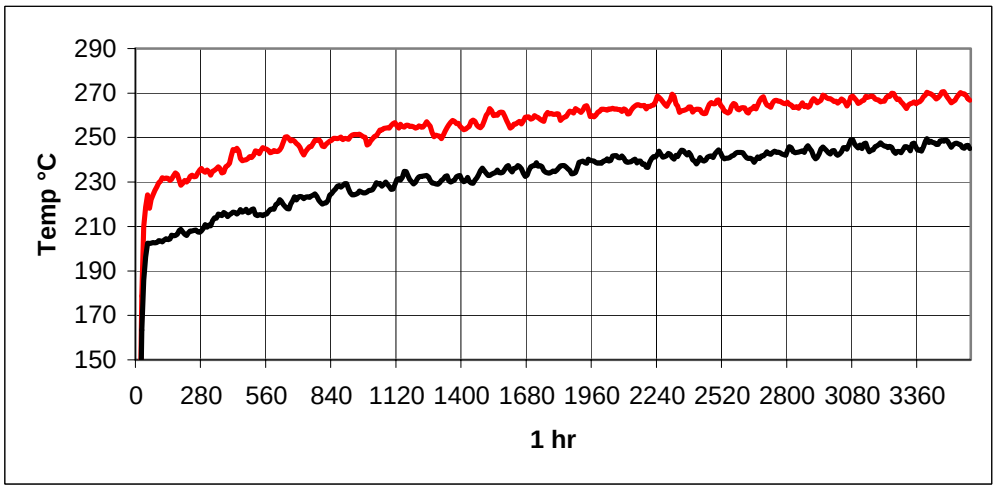


Fig 6 – First hour results of the same AES standard power test (temperature versus time, 15 inch speaker comparison); black plot ISV, red plot external coil.

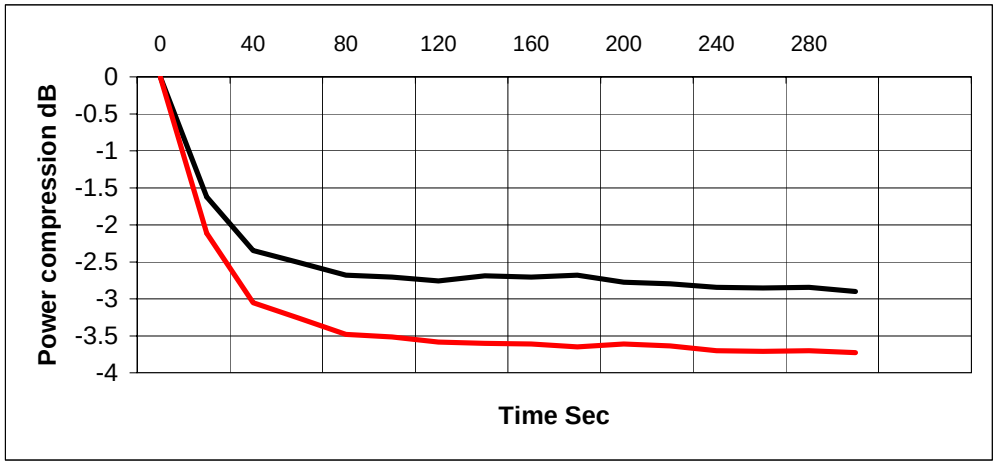


Fig 7 – Power compression in the first 5 minutes of an AES standard power test (temperature versus time, 15 inch speaker comparison): black plot ISV, red plot external coil.

Fig 7 demonstrates that the power compression figure is reduced by 0.7dB, compared to traditional coils. This results in a superior speaker output.

It is evident that ISV technology offers a superior heat transfer when compared to conventional voice coils, reducing the operating temperature and increasing the voice coil life.

Another advantage of ISV technology is that by doubling the coil surface (in the proximity of the steel plates) increases thermal capability, permitting the speaker to withstand higher power levels.

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