

AUTO BALANCED COOLING (ABC)

Auto Balanced Cooling, or ABC, is a combination of techniques that P Audio is utilizing for a wide range of very high performance loudspeaker designs. ABC technology produces substantially higher power handling and superior power compression performance. These new techniques will yield higher product reliability and higher sound pressure level capability.

ABC technology uses the air flow produced by the loudspeaker dust cap and cone to channel air flow across the voice coil. These surfaces are shown below in Figure 1.

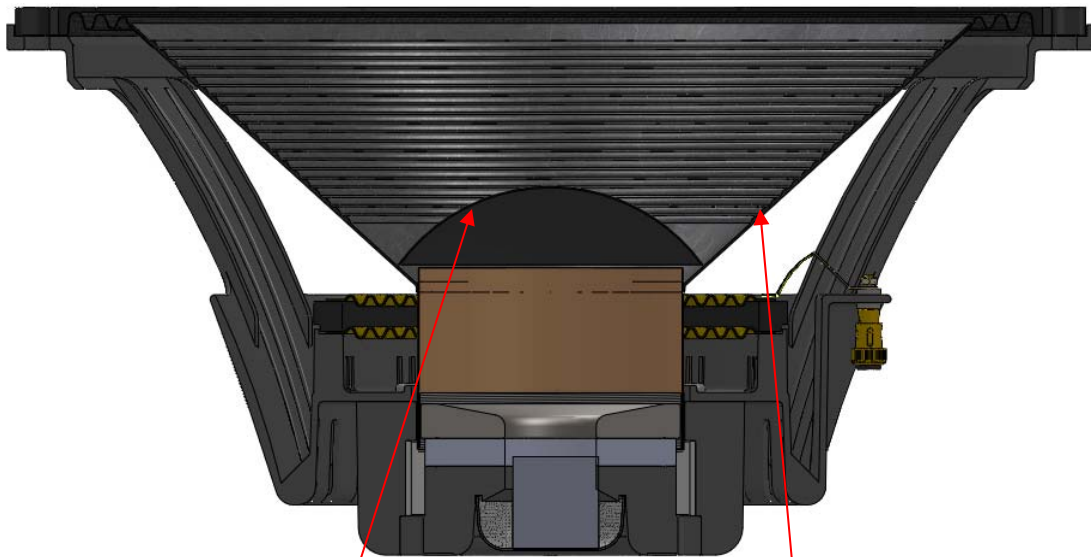


Figure 1

Rear surface of dust cap

Rear surface of cone

When any loudspeaker is used the majority of the electrical input is converted to heat rather than sound. The conversion of electrical energy to sound is measured in the loudspeaker efficiency parameter and is often quoted on manufacturer's data sheets. For ALL loudspeaker components the conversion efficiency from electrical energy to acoustical energy is fairly low. The majority of the electrical input energy is converted to heat as shown below in Figure 2. The loudspeaker voice coil heats and reduces the current flow to the speaker. The heat puts severe stress on the adhesive systems used to

bond the voice coil to the coil assembly and also reduces the current draw from the amplifier. When the current draw from the amplifier is reduced the loudspeaker efficiency is further reduced. This effect is referred to as power compression. The areas shown in red indicate the sections of the loudspeaker that are heated when the voice coil converts electrical input energy to heat. Not only is the voice coil heated, thus reducing efficiency, the loudspeaker magnet structure is also heated. As the temperature of the magnet structure increases the magnetic energy is also reduced and produces yet another reduction in acoustic output.

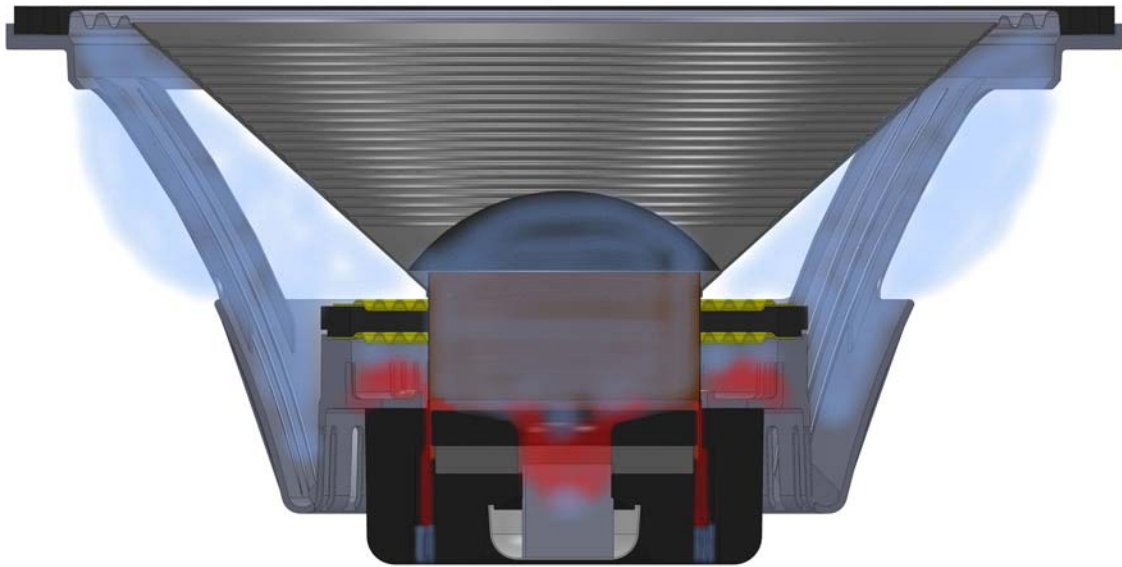


Figure 2

Conventional high output professional loudspeakers use a large diameter opening in the back section of the magnet structure that allows the high pressure air under the dust cap to “vent” to the enclosure volume. This technique produces little cooling although many manufacturers claim otherwise. This opening is shown in Figure 3. This method does offer a performance advantage however. The airflow from the underside of the dust cap is directed out of the magnet structure through the large opening shown by the red arrows. This large opening reduces high pressure inside the magnet structure that produces turbulent air flow and acoustic noise. Unfortunately none of this airflow is available to improve product performance when this method is used. A better approach is to “balance” the air flow and direct the proper amount of air past the voice coil where that air flow can produce large performance and reliability benefits. Although the majority of the performance improvements seen with ABC technology are associated with airflow over the voice coil both the dust cap airflow and rear side cone airflow also act to reduce magnet structure temperatures and further reduce power compression effects.

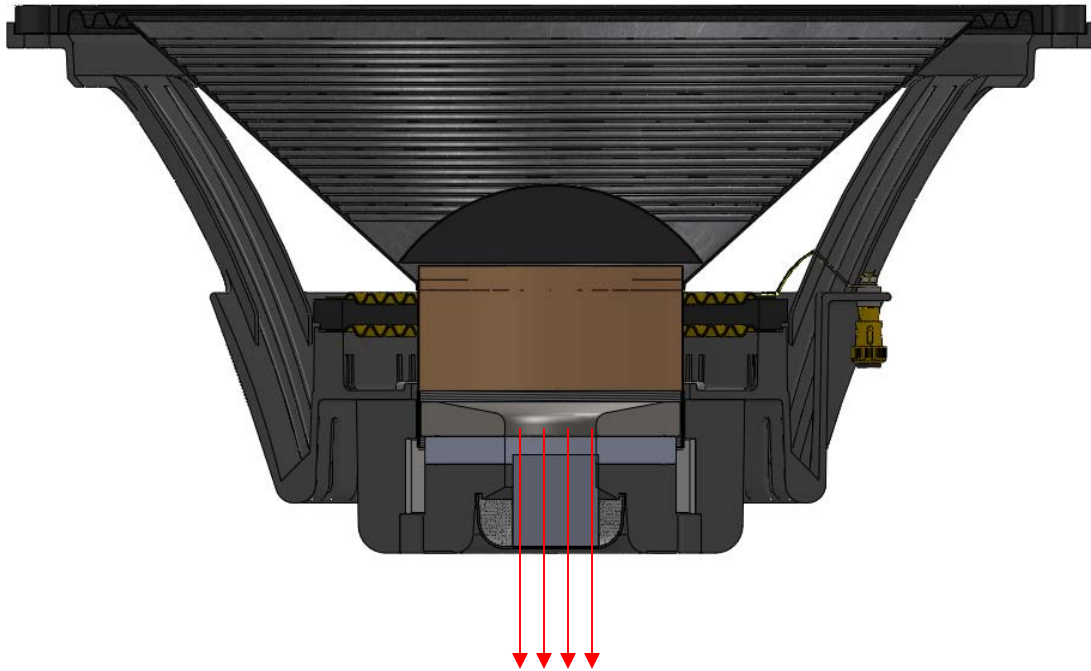


Figure 3

P Audio's solution to this problem is to "balance" the air flow from under the dust cap and from the rear side of the cone. The technique of "Auto Balanced Cooling" uses the air flow under but redirects this flow onto the voice coil. The airflow is essentially "balanced" in a way that allows the proper distribution of air motion in each section of the magnet structure. The air flow is balanced by adjusting the acoustic resistance of the various air paths to achieve the desired velocity distribution throughout the magnet structure and voice coil areas. The result of this balanced air flow is a 20% or greater reduction in the voice coil temperature. The proper balance of air flow provides the necessary reduction in turbulence as does the conventional technology but also provides the noted 20% increase in voice coil cooling. This cooling allows substantially increased power handling ratings and substantially increased reliability.

The new series of P Audio products utilizing ABC technology have power handling rating increases of 20% to 30% based in large part on the advantages of Auto Balanced Cooling technology.

The best way to understand the performance advantages and airflow balancing is with a visual representation of Auto Balanced Cooling.

[Click here for a complete visual presentation](#)