Subject: Heat exchanger effectiveness
Posted by Wayne Parham on Wed, 21 Jun 2006 18:27:40 GMT
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I have recently answered a lot of E-Mail's about the effectiveness of the heat exchanger on the

thoroughly last year when the device was being developed but I suppose it merits another examination here.

In short, speakers run at high power levels dump a lot of heat into the magnet and pole piece. Some voice coil heat is removed by air cooling through the vent but this does almost nothing to cool the motor core. Heat is generated in the motor core from magnetic losses. It is also radiated from the voice coil into the pole piece. This heat tends to buildup in the core, and within a few minutes it can become hot enough to boil water. This heat surrounds the voice coil raising its local ambient temperature. This makes it less able to sustain additional heat from signal current flowing through it. Eventually, the heat causes the voice coil adhesive to weaken and fail. The coil separates from the former. This is the most common failure mode of any speaker.

The heat exchanger is simple. It wicks the heat away from the pole piece, sinking it into a large plate which then radiates it away. The same mechanism can be used by virtually any speaker to improve thermal performance. Power handling is increased and thermal compression reduced.

For the LAB12, power handling increased over 225% over a driver in free air. If placed in a small contstrained space where the air can become superheated, the performance increase may be more. But the improvement was measured with a driver surrounded by air conditioned cool air. The problem isn't limited to systems with small sealed rear chambers; The problem is that the heat is retained in the magnet and pole piece.

If you think about it, a speaker voice coil is applied several hundred watts, so it gets hot like a large soldering iron. Even if the speaker system is very efficient, you still have hundreds of watts dissipated as heat. Take a theoretical 400 watt speaker at a very optimistic 50% efficiency level - You still have 200 watts of heat. This heat source is surrounded by steel and then covered by a large chunk of ceramic. This is a pretty good heat container, one that is almost made to hold heat. So one of the best things you can do is to get a good conductor of heat down inside the motor, in contact with the pole piece. Wick the heat out of the core and radiate it away.

Every loudspeaker can take advantage of this technology, including those with open backs.
Woofer cooling device - Destructive test
Speaker Voice Coil Cooling System - Heat Sink - Photos
Woofer cooling device - Test Cycle with Heat Exchanger Installed
Woofer cooling device - Ruminations