

Cooling large home theater installations

A previous paper (one of several available from Active Thermal Management on request) described techniques for cooling mid-size enclosures. The great majority of enclosed home theater installations involve mid-size cabinets in the 10 to 30 cubic foot range.

Beyond these lie the large installations; the ones with several racks or many shelves full of equipment, located in cabinets, closets, or utility rooms. The enclosed volume of such installations ranges from the 50 cubic foot range (a converted coat closet measuring 3' x 2' x 8') to as much as 400 cubic feet; a large closet/small room with dimensions of 6' x 8' x 8'. Beyond this range, the audio-video systems designer would be wise to turn to an HVAC professional for assistance; we'll confine our discussion to the 50 to 400 cubic foot enclosure.

Consuming thousands of watts in operation, systems of this size may dissipate hundreds of watts during standby periods, due to satellite and cable boxes, whole-house amplifiers, telephone and security systems, and other "always-on" equipment. The amount of heat generated by such systems is normally too much to simply move into the theater; it has to go "somewhere else"

Depending on the location of the theater within the house, and the house's construction, "somewhere else" can be outdoors, an unfinished basement, crawl space, or an attic.

As important as removing heated air, of course, is providing fresh, or "makeup" air to the enclosure from which the heated air is being removed.

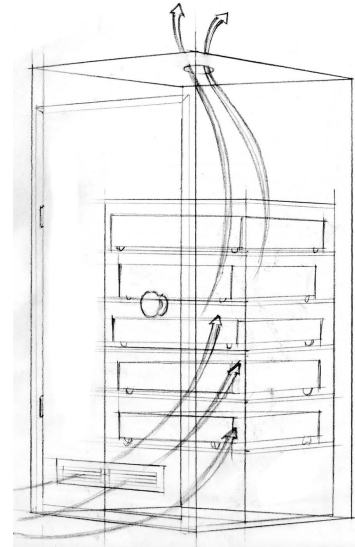
Three important points:

- 1. For every cubic foot of hot air that leaves the closet, an equal volume of fresh air has to enter. If the system can't "inhale", it can't "exhale" ...!***

2. The more easily air can move in and out of the enclosure, the less work a fan will have to do to provide ventilation. This translates directly into less fan ("motor") and air ("whoosh") noise.

3. In almost every case, ventilation is accomplished most easily, quietly, and effectively by bringing fresh air in low at the front of the cabinet or closet, and removing heated air at the highest point, towards the rear. Special cases require special solutions, such as snorkels to pull heated air downwards, etc., but the simple "in low at the front, out high at the rear" technique is the preferred method 95% of the time.

If the systems designer is given a free hand, and appearance is not a consideration (and we all know how often THAT happens...) effective ventilation is easily accomplished. As in the picture to the right, a slot in the bottom part of the door, a fan in the ceiling, and - voila! - instant ventilation.



THE PROBLEMS: It's rarely that easy. Most clients don't want slots in their enclosure or closet doors, and fans in ceilings often make objectionable levels of noise. (Just think of bathroom fans...!)

We've also overlooked the matter of control; how - and when - does the fan turn on? When does it turn off? How do we handle situations (and there are more of them every day) in which much of the equipment is on, or partially on, all the time? In almost every new installation, distribution amplifiers, cable or satellite tuners, PVRs, and combinations of these devices, frequently more than one, are generating heat 24/7.

THE SOLUTIONS: The easiest way to overcome the noise and control issues is to use cooling devices that:

- ❖ are located away from the enclosure,
- ❖ turn slowly, and

❖ are controlled by the temperature within the enclosure.

Using products that have these characteristics minimizes both the level and duration of noise generated, and ensures that cooling will be provided only when needed. Systems that simply turn on and off as the equipment goes on and off turn on well before they're needed, and turn off while there's still residual heat flowing from the equipment into the enclosure.

Locating air movers away from a closet or other enclosure can be done by using the System 1, for really large installations, or the Cool-cube, for somewhat smaller enclosures and heat loads. The Cool-cube can move air up to 8 feet (using our 4" (inside diameter)/6" (outside diameter) flex tubing. This is more than long enough to allow a Cool-cube to be located a few feet above a closet in an attic, or in a utility room behind the equipment closet or cabinet. In low speed, the Cool-cube can move 35 CFM; in high speed mode, it can move 70 CFM.

For larger enclosures, heat loads, or both, use the System 1. The System 1 can move 100 CFM short distances, and as much as 50 CFM with tubing lengths of up to 25 feet.

Contact Active Thermal Management at (661) 294-7999 M-F, 8:30 - 4:30 PST for the name of your closest distributor, for more information on the products mentioned above, or to request a catalog showing our many other quiet cooling products.

We manufacture a complete line of equipment and enclosure coolers designed to make the designers' and installers' jobs easier.

See us on the Web at www.activethermal.com.