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Home Theater HVAC

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The following members of the CEA/CEDIA R10 WG5 Home Theater HVAC contributed to the development of this document:

Tom Cumberland, Audio Authority Corporation

Travis Misterek, Best Buy Co. Inc.

Jon Richardson, EchoStar Satellite, LLC.

Michael Cogbill, ETC, Inc.

Jay McLellan, Home Automation, Inc. (HAI)

Andres Colpa, Home Box Office (HBO)

Ann Brigida, InfoComm

Eric Lee, Integrated Control Experts Inc.

Bob Schluter, Middle Atlantic Products

Tameez, Sunderji, Rovi Corporation

Walt Zerbe, Russound

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Foreword

This bulletin was created by the CEA/CEDIA R10 Residential Systems Committee. This bulletin focuses on sound abatement (ingress and egress) for air handling equipment (including allowing for maximum dynamic range within the listening space) proper air exchanges and treating equipment racks and spaces to maintain adequate operating temperatures and humidity.

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1. Introduction

HVAC systems should be carefully designed to meet the special needs of the home theater room. First, the HVAC system should be properly sized to accommodate the added heat load generated by people and AV equipment. Secondly, the HVAC system should maintain a low background noise level even when operating under full load conditions. The objectives are to maintain the room's environment for:

- occupant comfort (temperature and humidity),
- safe equipment operating temperatures
- Noise-free acoustics.

Added heat loads, background noise specifications and ventilation requirements should be addressed very early with the HVAC designer/installer to ensure they are included in the design.

2. References

2.1 Informative References

1. ANSI/ASHRAE 55. (2005). *2005 ASHRAE handbook — fundamentals*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers.
2. ANSI/ASHRAE 55. (2007). *2007 ASHRAE handbook — HVAC applications*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers.
3. ASTM E477-06a, *Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers*.
4. CEA/CEDIA-CEB 22. (2009). Home Theater Recommended Practice: Audio Design.
5. CRC, 1997, *Thermal Measurements In Electronics Cooling*
6. CRC, 2000, *Handbook Of Thermal Engineering*
Coyne, J.C., 1982, *An Approximate Thermal Model for Outdoor Electronics Cabinets (Bell System Technical Journal, Vol. 1, No. 2)*
7. ELLISON, G.N., 1995, *Fan Cooled Enclosure Analysis Using First Order Method*
8. SMACNA. (2004). *HVAC sound and vibration manual*. Chantilly, VA: Sheet Metal and Air Conditioning Contractors' National Association.
9. SMACNA. (2006). *HVAC Systems — Duct Design*. Chantilly, VA: Sheet Metal and Air Conditioning Contractors' National Association.
10. THE UPTIME INSTITUTE, *Changing Cooling Requirements Leave Many Data Centers at Risk*

2.2 Informative Reference Acquisition

- ASHRAE Standards
American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1791 Tullie Circle, N.E., Atlanta, GA 30329; Phone: 404-636-8400; Fax: 404-321-5478; Internet: <http://www.ashrae.org>