Modeling and Energy Consumption with Parallel and Series VAV Terminal Units with ECM and PSC Motors

Seventh Edition

An ASHRAE Topical Compilation

Expanded to Include New Research



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Introduction

Since fan-powered variable-air-volume (VAV) terminal units were introduced to the marketplace, proponents of both parallel and series types have argued about which provides a system with the highest energy efficiency.* ASHRAE/AHRI research was undertaken to define the operation of each type and investigate the issue. Descriptions of the findings are described in the first six papers included in this collection. Additional research was undertaken by a consortium of terminal unit manufacturers, motor manufacturers, and Texas A&M University to evaluate motor types (electrically commutated motors vs. permanent split capacitor motors) and their associated effects in both terminal unit designs. All of this second research was donated to AHRI and ASHRAE to get the information into the public domain. Since the original research was completed, 13 papers have been written describing the processes and the results. Two of them—"Performance of Series Fan-Powered Terminal Units with Electronically Commutated Motors" and "Modeling the Performance of ECM and SCR Parallel Fan-Powered Terminal Units in Single-Duct VAV Systems"—won the Crosby Field Award for the highest-rated paper presented at a Technical Session, Symposium, or Poster Session for an ASHRAE Society year.

At this point, AHRI has begun modeling research and the papers are focusing on energy modeling and how to get the research data into a format that programs such as the U.S. Department of Energy's *EnergyPlus* and other proprietary models can use. Getting the research into the hands of those who can use it to better design occupied spaces and those modelers who can accurately predict energy usage has been difficult. Many different models are in use today, and none of them accurately use all the variables that were evaluated and found to be significant in the research.

This collection contains the published papers that describe the processes, the tests, and the outcomes and gives the reader insight into the research and the results. It also introduces the problems of getting research into current energy models and the current solution to those problems. There are plans for many additional papers as we continue to model the different types of terminal units, comparing energy consumption between them. Hopefully, this collection will continue to grow as the research continues.

* *ASHRAE Handbook—HVAC Systems and Equipment* provides detailed descriptions of parallel and series units and *ASHRAE Handbook—HVAC Applications* provides descriptions of the different characteristics of the units.

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