Demand controlled ventilation for multi-family dwellings - DTU Orbit (31/03/2019)

**Demand controlled ventilation for multi-family dwellings: Demand specification and system design**

The present thesis “Demand controlled ventilation for multi-family dwellings” constitutes the summary of a three year project period during which demand specification and system design of demand controlled ventilation for residential buildings were studied.

Most standards and buildings codes specify desired levels of indoor air quality through ventilation rate requirements. The Danish Building Code requires a constant air flow rate equivalent to at least 0.5 air changes per hour in residential buildings. A constant air flow requirement is inconsistent with the time varying needs for ventilation in residential buildings that depend on occupancy, pollutant emission, etc., and results in periods with poor air quality and/or unnecessary energy consumption. If the ventilation rate is varied according to the demand, the indoor climate can be improved and the energy consumption for ventilation can be reduced compared to a system with constant air flow.

A literature study on indoor pollutants in homes, their sources and their impact on humans formed the basis for the demand specification. Emission of pollutants in residential buildings roughly fall into constantly emitted background sources and step-wise constantly emitted sources related to occupancy and activities. Theoretical analyses of these two sources showed the air quality implications associated with the time-varying air flow rates in an occupancy based demand controlled ventilation (DCV) system in comparison to the required constant air flow rate. These analyses were also used to describe the potential air flow savings associated with occupancy based DCV that provide the same average occupant exposure as a system with constant air flow. Results showed that air flow saving up to 26% can be achieved in occupancy based DCV systems compared to systems with constant air flow rates. The trade-off is an increase in peak concentration. However, the time-varying air flow rates of the DCV system are not expected to introduce problematic acute conditions. The issue of system design was focused on simple and cost-effective solutions for centrally balanced DCV systems with heat recovery. A design expected to fulfill this requirement was investigated in detail with regard to its electricity consumption by evaluating a control strategy that resets the static pressure set point at part load. The results showed that this control strategy can reduce the electricity consumption by 20% to 30% compared to a system with fixed static pressure control.

The results of the project provide more flexible approaches to ventilation design for residences that allow occupancy based DCV approaches to comply with codes and standards that are currently based on continuous ventilation rates. Furthermore, a simple, cost-effective and energy-efficient system design for DCV in multi-family dwellings is proposed.

**General information**

State: Published  
Organisations: Department of Civil Engineering  
Contributors: Mortensen, D. K.  
Number of pages: 124  
Publication date: 2011

**Publication information**

Publisher: Technical University of Denmark, Department of Civil Engineering  
ISBN (Print): 9788778773210  
Original language: English  
(DTU Civil Engineering Report; No. R-241).  
Electronic versions:  
Toke_Rammer_Nielsens_PhD.pdf  
Research output: Research › Ph.D. thesis – Annual report year: 2012