Heat Recovery Ventilation in HVAC Systems

An Online Continuing Education Course for Engineers

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HEAT RECOVERY VENTILATION IN HVAC SYSTEMS

Energy recovery ventilation is the process of exchanging the energy contained in a normally exhausted building or space air and using it to treat or "precondition" the incoming outdoor ventilation air in residential and commercial heating, ventilating, and air conditioning (HVAC) systems. During the warmer seasons, the system pre-cools and dehumidifies, whereas during the cooler seasons, it humidifies and pre-heats.

The benefit of using energy recovery is the ability to meet the ASHRAE ventilation and energy standards while improving indoor air quality and reducing total HVAC equipment capacity.

The high-performance Heat Recovery Ventilators (HRV) and Energy Recovery Ventilators (ERV) ensure a continuous ventilation supply and a comfortable and healthy indoor environment. This technology not only demonstrates an effective means of lowering energy costs and heating and cooling loads, but it has also enabled HVAC equipment to be scaled down. These energy recovery systems have attracted a lot of interest for industrial, office, and household applications. Popular methods include ‘air-to-air’ systems, in which heat recovered from the exhaust air stream is used to preheat incoming fresh air, and heat pumps, in which heat from the exhaust air stream is used to preheat the building’s hot water or space heating system.

This 5-hour course outlines the fundamental principles of heat and energy recovery systems. This includes understanding the basic principles of various air-to-air energy recovery devices, as well as typical applications, calculations, advantages, and limitations.

Learning Objectives:

Understand the basic principles pertaining to building ventilation design with emphasis on the following:

- The concept of building ventilation and the benefits of air-to-air energy recovery systems
- Various energy-recovery technologies include plate-type exchangers, enthalpy wheels, heat pipes, and run-around loops.

- Alternatives to air-to-air recovery techniques such as economizers, demand control ventilation, and the use of exhaust air heat pumps.
- Advantages, applications, and limitations of various air-to-air energy recovery technologies
- Learning how to calculate the minimum ventilation rates using ASHRAE 62.1 standards
- Impact of energy codes such as ASHRAE 90.1 standards on the selection of ERVs
- Psychrometric analysis and energy saving calculations for heat and energy recovery systems

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1 CHAPTER 1:VENTILATION SYSTEMS FOR BUILDINGS

Ventilation is necessary in buildings to maintain good indoor air quality (IAQ), offset exhaust air from bathrooms, kitchen hoods, other exhaust systems, and building pressurization.

The American Society for Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) standard -62.1 – "Ventilation for Acceptable Indoor Air Quality" provides guidance on the minimum ventilation rates based on the building area and occupant's activities in the building. Depending on the occupancy type, the Heating, Ventilation, and Air-conditioning (HVAC) system of a building may be required to push [illegible] ir per minute per square foot of the building. Tha[illegible]

A higher ver[illegible] of indoor air with equivalent an[illegible] ccupied space, significant wo[illegible] d/or dehumidify it, which woul[illegible]

One way to elin[illegible] levices, commonly know[illegible] ators (HRVs). Both ERVs and H[illegible] r before it leaves the buildin[illegible] ntilation while reducing a b[illegible] ntly more economical.

2 Concept and[illegible]

Today, modern build[illegible] icient and tightly sealed for efficiency. However, they also tra[illegible] indoor air pollutants. Tight, energy-efficient construction risks mold, mildew, and indoor air quality issues without proper ventilation.

The figure below depicts an HVAC system for an airtight residential dwelling with an energy recovery ventilation system installed in the attic space. A ventilation system is installed to bring in fresh air while expelling stale air.

When the outside air temperature is low in the winter, the building is predominantly in heating mode. The heat exchanger-based energy-recovery system would transfer heat energy from the