Designing an havc system in a skyscraper's project

Engineering

Designing an HAVC system in a skyscraper's project The main purposes of a Heating, Ventilation, and Air-Conditioning (HVAC) system are to help maintain good indoor air quality through adequate ventilation with filtration and provide thermal comfort. HVAC systems are among the largest energy consumers in schools. The choice and design of the HVAC system can also affect many other high performance goals, including water consumption (water cooled air conditioning equipment) and acoustics. Codes and Standards The national consensus standard for outside air ventilation is ASHRAE Standard 62. 1-2010, Ventilation for Acceptable Indoor Air Quality and its published Addenda. This standard is often incorporated into state and local building codes, and specifies the amounts of outside air that must be provided by natural or mechanical ventilation systems to various areas of the school, including classrooms, gymnasiums, kitchens and other special use areas. Potential for Natural Ventilation and Operable Windows In some parts of the country, where temperature and humidity levels permit, natural ventilation through operable windows can be an effective and energy-efficient way to supplement HVAC systems to provide outside air ventilation, cooling, and thermal comfort when conditions permit (e. g., temperature, humidity, outdoor air pollution levels, precipitation). Windows that open and close can enhance occupants' sense of well-being and feeling of control over their environment. They can also provide supplemental exhaust ventilation during renovation activities that may introduce pollutants into the space. Selection of HVAC Equipment In most parts of the country, climatic conditions require that outdoor air must be heated and cooled to provide acceptable thermal comfort for building occupants, requiring the addition of HVAC systems. The selection of equipment for heating, cooling and

ventilating the school building is a complex design decision that must balance a great many factors, including heating and cooling needs, energy efficiency, humidity control, potential for natural ventilation, adherence to codes and standards, outdoor air quantity and quality, indoor air quality, and cost. Energy Recovery Ventilation Indoor air can be 2 to 5 times more polluted than outdoor air; therefore, most HVAC system designers understand that increased amounts of outdoor air supply is generally better for IAQ. Yet there are concerns over the implications that this added amount of outdoor air supply has on the first cost and operating cost of the HVAC system, as well as moisture control for the school (too wet or too dry). Outdoor Air Quantity In spaces where the number of occupants is highly variable such as gyms, auditoriums and multipurpose spaces, demand controlled ventilation (DCV) systems can be used to vary the quantity of outside air ventilation in these spaces in response to the number of occupants. One technique for doing this is to install carbon dioxide (CO2) sensors that measure concentrations and vary the volume of outside air accordingly. If an auditorium fills up for school assembly, then CO2 concentrations will increase, a signal will be provided to the HVAC system and outside air volumes will be increased accordingly. When the spaces served by an air handler have highly variable occupancy, this type of control can both save energy and help control moisture (and mold) by reducing the quantity of humid outside air when it is not needed for ventilation. CO2 and other sensors must be periodically calibrated and maintained. Air Filtration In addition to " atmospheric dust," airborne particulates can include pollen, mold (fungal) spores, animal dander, insect proteins, pesticides, lead, and infectious bacteria and viruses. Designers can integrate features into the

ventilation system that will provide benefits for the school occupants as well as the efficiency and longevity of the HVAC system. In addition, these features can reduce the need for expensive cleaning of the duct work and air handling units. Air Cleaning for Gaseous Contaminants The most effective means of reducing exposure of occupants to gases and VOCs is to manage and control potential pollution sources. Filters are available to remove gases and volatile organic contaminants from ventilation air; however, because of cost and maintenance requirements, these systems are not generally used in normal occupancy buildings or schools. In specially designed HVAC systems, permanganate oxidizers and activated charcoal may be used for gaseous removal filters. Some manufacturers offer " partial bypass" carbon filters and carbon impregnated filters to reduce volatile organics in the ventilation air of office environments. Ventilation Controls Although a typical HVAC system has many controls, the control of outdoor air quantity that enters the building can have a significant impact on IAQ, yet typically is not part of standard practice. Demand controlled ventilation is addressed as a method of humidity control, but is not otherwise discussed here because its primary use is to reduce the supply of outdoor air below the recommended minimum for the purposes of saving energy, not for improving IAQ. Air Distribution and Duct Insulation Dirt and moisture should not be present in duct systems, and must be controlled to prevent mold growth. However, it is not always possible to assure that ducts remain dirt and moisture free. In many existing schools, sheet metal ducts, as well as those constructed of or lined with insulation products, are often contaminated with mold because dirt and moisture found their way into the system. Duct board and duct liner are widely used in duct systems because of their excellent acoustic, thermal,

and condensation control properties. If the HVAC system is properly designed, fabricated, installed, operated and maintained, these duct systems pose no greater risk of mold growth than duct systems made of sheet metal or any other materials. Work cited Bobenhausen, William. Simplified design of HVAC systems. New York: Wiley, 1994. Print. Collins, Lane M.. Guidelines for improved duct design and HVAC systems in the home. New York: Nova Science Publishers, 2012. Print. Energy Efficiency and Indoor Air Quality in Schools Businesses : ENERGY STAR High Performance Building Guidelines, April, 1997, city of New York, Department of Design and Construction. Grondzik, Walter T., and Refrigerating and Air Conditioning Engineers Heating. Air-conditioning system design manual. 2. ed. Amsterdam [u. a.: Elsevier/Butterworth-Heinemann, 2007. Print. Haines, Roger W., and C. Lewis Wilson. HVAC systems design handbook. 4th ed. New York: McGraw-Hill, 2003. Print.