

Evaluating Air Conditioning Systems in Schools

When officials are considering a new air conditioning system, they need to first evaluate the condition of the school, energy efficiency, insulation, etc. The first step to efficient heating and cooling systems is to reduce the heating and cooling demand by ensuring that the building envelope and the air distribution duct systems are properly insulated. School buildings should also be constructed to take advantage of passive systems. School construction concepts such as using thermal mass and east-west axis orientation, can help limit energy needed to keep buildings comfortable.

Efforts to improve energy efficiency in buildings by tightening building envelopes and improving thermal insulation do not address indoor air quality (IAQ) issues or the latent (moisture-related) cooling loads in buildings. Conventional air conditioners are not designed to handle the large ventilation rates needed to provide acceptable IAQ or overcome moisture buildup. The effects of the "sick building syndrome" on public health and productivity and of moisture damage are major incentives to develop energy-efficient space conditioning systems that provide high levels of humidity control.

What Causes Indoor Mold?

Mold is a natural part of the environment, and some mold spores can be found floating around just about everywhere. Nevertheless, mold will only start to grow indoors when it finds sufficient food and moisture to survive. Because mold decomposes dead organic material, food for mold is present in every building. Cellulose materials, such as wood and the paper backing of gypsum board (drywall), are particularly susceptible to mold growth. Ceiling tiles, insulation, and carpets (adhesive and dirt) can also support mold growth.

However, the real determinant for indoor mold problems is the presence of moisture. There are numerous sources, but among the most common are rain and plumbing leaks, condensation on cold surfaces, and poor control of humidity in the air. Buildings that are free of moisture problems will not have indoor mold problems.

Desiccants can improve the indoor air quality of all types of buildings. Desiccant cooling systems can be used as stand-alone systems or with conventional air-conditioning. In these systems, a desiccant removes moisture from the air, which releases heat and increases the air temperature. The dry air is cooled using either evaporative cooling or the cooling coils of a conventional air conditioner. The absorbed moisture in the desiccant is then removed (the desiccant is regenerated, or brought back to its original dry state) using thermal energy supplied by natural gas, electricity, waste heat, or the sun.

Desiccant systems can supplement conventional air conditioners, reducing the need for vapor-compression systems to operate for long cycles and at low temperatures in order to handle temperature and humidity. By working together, conventional cooling systems and desiccant systems can tackle the temperature and humidity loads separately and more efficiently. Heating, ventilating, and air conditioning (HVAC) engineers can then reduce compressor size and eliminate excess chiller capacity.

When installing an HVAC system, make sure that the HVAC system is properly designed for the needs of the building. This includes making sure there is enough ventilation for the number of people expected in the school and that ventilation rates are high enough given the activities that are going to be conducted in the school. Also be sure that:

- Air supply vents are not too close to building exhaust vents, and
- Supply vents are placed away from outdoor sources of pollution such as:
 - Loading docks,
 - Parking and heavy traffic areas,
 - Chimneys,
 - Furnace, kitchen, or bathroom exhausts, and
 - Trash dumpsters

Conduct proper and regular HVAC inspection, cleaning, and maintenance. A { HYPERLINK "http://www.questline.com/service/www.cdc.gov/niosh/pdfs/hvaclong.pdf" } recommended by NIOSH includes the following steps.

- Make sure that vents are open, fans are on, and filters are cleaned on a regular maintenance schedule. Change air filters regularly. In many schools, air filter efficiency ranges from 10-40%. This is not good enough to minimize dust levels and the filters do a poor job of removing pollen from the air. Filters should be upgraded to 85% filters, but an HVAC engineer should be consulted first to make sure that the equipment can handle this kind of filter.
- Use air cleaners that are part of the HVAC system. This should only be done in addition to controlling pollutants at the source and properly maintaining the HVAC system. These air cleaners should include high efficiency filters that can remove some of the particles in the air. These filters will not be able to remove any of the gases or vapors, however, unless the filters are specially treated with something like activated charcoal. In addition, the blower on the HVAC system must be designed to be powerful enough to blow air through a high-efficiency filter. Many HVAC systems have low efficiency filters that are only designed to prevent dust from damaging the blower fans.
- Make sure that air intake vents are open, clean, and far from air pollution sources such as kitchen exhaust vents, truck-unloading areas, and smoke stacks, and clear of other sources of contamination such as pigeon droppings.
- Check the exhaust system to make sure that air can adequately be exhausted from the building.
- Properly maintain and clean humidification and dehumidification systems to prevent the growth of harmful bacteria and fungi. This includes things like making sure there is no water in the drain pan. Failure to properly treat the water in cooling towers to prevent growth of organisms, such as Legionella, may introduce such organisms into the HVAC supply ducts and cause serious health problems.
- Frequently inspect and clean the heating and cooling coils, cooling tower, and drip pan to prevent microbial contamination. Wall-mounted fan coil units are often found in educational facilities. These units are frequently not well maintained. This often results in dirty coils, dirty condensate pans, and dirty or missing filters.
- Ensure that air dampers are clear of obstruction and operating properly. In school buildings, supply grilles are often blocked by books or papers.
- Inspect and clean the inside of air handling units as needed.
- Inspect fan motors and belts.
- Regularly inspect and clean air humidification equipment and controls.
- Inspect and clean air distribution pathways and variable air volume (VAV) boxes as needed.
- Maintain building temperatures and humidity levels within the recommended range.
- Ventilate the building with at least 20 cfm unless occupant activities are such that higher ventilation rates are needed.
- Install local exhaust ventilation to remove pollutants from areas where they may build-up such as rest rooms, copy rooms, and printing facilities.
- If the ducts have fiber glass liners that have gotten wet, the North American Insulation Manufacturers Association (NAIMA) recommends that they be removed and thrown out as soon as possible to prevent mold and fungi from growing on them. This is because it is so hard to properly clean these ducts. Clean air handlers yearly and ducts every five to ten years or as needed. Use the best possible filtration that your system can handle.

The best HVAC system is durable, reliable and economical. As a school administrator, it is not your job to know the inner workings of an HVAC system. Your role is to justify its cost and its performance, leaving design and installation up to engineers and contractors. But you know the needs of your school better than anyone, so your first step is determine your school's unique issues and requirements, then assemble a knowledgeable design team and convey your goals to them.

Such a team consists of facilities managers, maintenance personnel, design engineers and contractors. Each will apply his or her expertise toward meeting energy reduction goals. Just as every school is different, every HVAC system is different. The key is to design a system tailored specifically for your school and its requirements.