Ten HVAC Considerations

External Information

A Heating, Ventilating and Air Conditioning (HVAC) System

- Provides thermal comfort for the building occupants.
- Introduces outdoor air into the building to meet the ventilation needs of the occupants.
- Isolates and removes odors and contaminants from the indoor environment.

The HVAC system that is properly designed, installed, operated and maintained can promote good indoor air quality. The indoor air quality may deteriorate when one or more of these basic functions are not fulfilled.

Indoor air quality has become a major concern for businesses, building managers, tenants and employees as well as for school officials, teachers, students and parents, as it can impact the health, comfort, and productivity of building occupants. A National Energy Management Institute 1995 study on "Productivity Benefits Due to Improved Indoor Air Quality" found that poor indoor air quality in buildings across the United States results in an estimated loss of $62.7 billion per year from increased health care costs and decreased productivity.

After conducting air quality investigations in over 500 buildings, the National Institute for Occupational Safety and Health (NIOSH) attributed indoor air quality complaints to the following areas:

- 52% were related to inadequate ventilation.
- 17% were related to an identifiable indoor contaminant.
- 11% were related to an identifiable outdoor contaminant.
- 5% were related to some form of microbiological contamination.
- 3% were related to building material contamination.

With more than half of the indoor air quality complaints being traced to the building ventilation system, the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) would like to offer ten HVAC system design considerations for your next building construction or renovation project.

1. Location of Outside Air Intake and Building Exhausts.
The building HVAC system utilizes outside air to dilute and exhaust indoor air contaminants. If the outside air intakes are located too closely to loading docks, heavily trafficked streets, garbage bins or the building exhaust or plumbing vents, the outside air can introduce contaminants into the building.

2. Proportion of Outside Air.
Scientific studies have been conducted to determine the appropriate ventilation rates for the HVAC system to control indoor contaminants within various facility uses. The results of these studies have typically been adopted by local building codes. To achieve these ventilation rates the HVAC system controls must be properly adjusted. Failure to bring in sufficient outside air can reduce indoor air quality. Bringing in excess outside air can result in additional energy costs because of the need to condition this air.

3. Air Filter Selection.
HVAC system filters are available in a wide range of efficiencies, capable of trapping smaller and smaller particles. As a general rule, as the efficiency of the filter increases, so does the energy used by the HVAC system to overcome the added resistance. Air filters should be selected based on the expected contaminants from your specific building's outdoor environment and its expected indoor activities and processes.

4. Air Filter Selection.
As the HVAC system cools and dehumidifies the warm air, the moisture removed from the air must be drained from the HVAC system where it could promote mold growth. To remove this condensation, the HVAC system

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cooling coil drain pan must be sufficiently sloped towards the drain and the drain must be properly trapped. The speed at which the air flows through the cooling coil must be controlled so the condensation on the coil does not get blown off into the ductwork.

5. Duct Construction and Leakage Testing.
The ductwork must be properly constructed to industry standards to minimize resistance to the airflow that could reduce the amount of conditioned air reaching the occupied space. The ductwork should also be constructed with minimum leakage. Leaks in the supply ducts reduce the amount of conditioned air reaching the occupied space, and leaks in the return ductwork can pick up contaminants as they pass through the unconditioned areas of the building.

6. Air Distribution.
The HVAC system is designed to distribute conditioned air throughout the occupied areas of your building where it mixes with air and dilutes contaminants. Interrupting this thorough distribution can result in drafty areas, pockets of stagnant air in others, and an overall decrease in indoor air quality. To achieve proper distribution, the HVAC system needs to be balanced so that sufficient conditioned air reaches every space as designed. Proper air-diffuser types and locations must be selected based on the expected types of furnishings and their locations, as high partitions can obstruct airflow.

7. Building Pressure Control.
Properly balanced, the HVAC system controls the building's pressure relationships between the building interior and the exterior as well as between individual spaces within the building. As air flows form higher pressure areas to lower-pressure areas, cross contamination of the air between two spaces can be avoided by controlling their relative air pressures.

8. Local Exhaust Systems.
The closer a source of contamination is to the exhaust intake; the more efficient the exhaust system is at removing the contaminants produced. Consideration should be given to the use of local exhaust systems if work areas or equipment within the facility is expected to generate contaminants in large volume or are harmful to the building occupants.

9. Energy Conservation Measures.
In attempts to conserve energy, outside air intakes have been sealed off, cold air supply temperatures increased, warm air supply temperatures decreased, and the amount of conditioned air supplied to the occupied areas reduced. Energy savings resulting from these efforts may be offset by the creation of indoor air quality problems. Working with the HVAC system designer and installer, the most efficient system for your building can be obtained while also maintaining indoor air quality.

10. HVAC System Maintenance.
Modern HVAC systems are designed to operate close to their maximum capacities to maximize their efficiency and to minimize the construction costs. These systems have also become more complex, as they must perform a delicate balance between energy use and indoor air quality. Proper operation of these systems is dependant upon the appropriate, regular maintenance by a skilled technician who understands the equipment and how it works as a system to maintain occupant comfort in healthy indoor environment.

Sheet Metal and Air Conditioning Contractors National Association (SMACNA)