

Carolina Heat Pipe Inc.

"The Humidity Control Specialists"

CURING SICK BUILDINGS

You can become sick from the ways buildings are constructed and maintained. Buildings can foster mold, viruses and bacteria and they are often labeled "sick buildings". Five items need to be emphasized in the design, development and construction of buildings:

1. Prevent moisture from entering the building.
2. Control the humidity level in the building and in air conditioning ducts.
3. Avoid hazardous construction materials.
4. Control the sources of material that promote mold, virus and bacteria growth.
5. Recommend maintenance procedures for building owners and managers.

For their own good, every owner and tenant needs to be cooperative with architects and design engineers to ensure that these five elements are followed.

Moisture Cause

Moisture is the number one breeding ground for mold, viruses and bacteria.

In a colder climate, you want to keep the heat and moisture inside the building during the winter. To do this, you insulate the building and put a moisture barrier on the inside of the building.

In a warmer climate, you want to keep the hot and humid air outside of the building. You need a moisture barrier at or near the outside of the building. The exterior moisture barrier should reduce the operating cost of the building and provide a healthier environment in the building.

You should avoid a ventilated attic and ventilated crawl space or put a vapor barrier in the attic or crawl space. A brick or porous wall needs an air space, a vapor barrier and a method to drain any moisture. Synthetic stucco needs a moisture barrier on the exterior surface or an air space and a vapor barrier.

Humidity Level

To control the humidity level in a building, the mechanical design team needs to know what you expect.

A 40 to 60% humidity level is considered optimum. At this humidity level, the growth of mold, bacteria and viruses are minimized.

For energy efficiency, use a controllable wrap-around thermosyphon heat pipe exchanger to reduce the duct humidity to 70% and allow the air conditioning system to maintain a 40 to 60% humidity level in the building. This is a low operating cost method of controlling the humidity level.

The key requirement is to specify an air conditioning system that has excellent moisture removal at part-load applications (that is, applications that are lower than peak load).

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If the engineer designs for peak load and ignores the part-load applications, then you may have an oversized system that may not work efficiently for moisture removal. For example, at a 50% part load most air conditioning systems will have very limited moisture removal ability.

It is necessary to have moisture removal at part-load applications. The controllable thermosyphon heat pipe will allow the air conditioning system to maintain a good level of moisture removal at part-load applications.

The engineer should require a positive pressure in the building during the hot and humid conditions and minimum ventilation during the other seasons. In locations where the winter design temperature is below 20°F and the latent load may not maintain 40% humidity, some moisture may need to be added.

Hazardous Materials

Hazardous materials should be obvious, but sometimes they are hard to anticipate. Just as there are side effects in the medical industry from treatments or drugs, there are the same types of problems with construction materials.

What are the side effects of the building materials that we use?

Examples of the hazardous materials to avoid are the lead in paint; the asbestos in floor tile, roofing felt and insulation material; the formaldehyde in particle board glue; the ketones in paint fumes; and flammable materials.

The off gassing of carpets and particleboard are two examples of components that can reduce the indoor air quality in a building. Additionally, any materials that are toxic, carcinogenic, or will cause an allergic reaction, a rash, or asthma should be avoided.

Carpet, textiles and other materials to optimize the esthetic impact of a building can, at times, provide a source of food for molds, viruses and bacteria.

When buildings are designed for the sick, the elderly, restaurants or schools, carpets and textiles should be limited, as they can be food for molds, viruses and bacteria.

Building Maintenance

A poorly maintained building will be dirty and have a source of food for mold, viruses and bacteria. The air conditioning system, without proper maintenance, may not be operating efficiently and it may not remove the moisture in a building and the humidity level may be excessive. The owners are responsible for maintaining the building and a clean healthy environment.

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Moisture Codes

The code requirements for moisture resistant construction vary. This is an expanding and developing part of the construction industry.

The Southern Standard Building Code Congress does require an exterior vapor barrier. There is also a section in the Fundamental Handbook of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) on the subject. ASHRAE discusses it in the Chapter on Thermal Insulation and Vapor Retarders in air conditioning buildings in humid climates.

ASHRAE does recommend a building relative humidity of 40 to 60% and a 70% duct relative humidity in ASHRAE Standard 62-2001.

The code requirements are usually considered to be the minimum construction standards. In an area of developing code requirements, exceeding the minimum code requirements is recommended.

While there are many factors that can cause a sick or unhealthy building, when relative humidity in the air is maintained in the range of 40-60% health factors such as Bacteria, Viruses, Fungi, Mites, Allergic Rhinitis, Asthma, Chemical Reactions are minimized or practically non-existent. Furthermore, when the relative humidity increases above 60% due to a humid atmosphere, these human health conditions become proportionally more dangerous to human health.

Existing Buildings

With existing buildings, the emphasis should be placed on the same key elements. Moisture barriers may need to be added, mechanical equipment should be modified to improve the moisture removal of capacity of the systems. The emphasis on inspection and the analysis of the building will be the design development phase of a project. Emphasis should be placed on improving the moisture removal of the mechanical system and improving the buildings' energy efficiency.

About the Author: Mr. Louis N. Drake III is well known in the Charleston-Columbia regions of South Carolina. He has been a practicing professional engineer in the air conditioning field since graduating from Georgia Tech. His professional career includes employment as a Naval Officer, Sales Engineer for an air conditioning equipment manufacturer and a Design Engineer at the Charleston Navy yard. He is a founding member of the Charleston Chapter of the American Society of Heating Refrigeration and Air Conditioning (ASHRAE). During the period 1980-1995 he was employed as a Staff Engineer and Project Manager at the Veterans Administration (VA) Medical Center, Charleston, S.C. Projects he managed included chiller replacements, air handler replacements, ice storage systems and ward renovations.