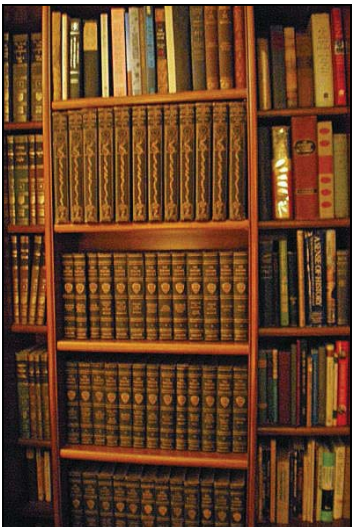


Tech Byte 18: Precision Environmental Control - Outside the Computer Room

Utilizing Liebert Precision Cooling Equipment For Unique Applications That Require Precise Environmental Control

Computer rooms and datacenters are not the only applications that require precision environmental control. Research laboratories, book rooms, product demonstration rooms, paper and document production and archive areas are just a few examples of spaces that also require environmental control beyond that which typical comfort cooling can offer. In these application examples, less than precise environmental control can result in temperature and/or humidity fluctuations, causing undesirable consequences that range from destruction or premature aging of products to the compromising of research experiments. Because of this, end users, designers, and/or solution providers must consider solutions that offer more precise control than typical building air conditioning systems. The preferred solution will depend on the following variables:



Book Storage Room

- The degree of precise control required for the application
- The limitations posed by the construction of the room or space being considered for use
- The costs of the options being considered and the project budget allowance

Before getting into specific equipment and designs, let us take a look at some of the concerns that are present in a few of these applications. First, let's take a look at storage of books, documents, or artifacts. Proper environmental control of the storage areas for these items is the most important considerations for long term preservation. In a book entitled "*The Care of Antiques and Historical Collections*", P.E. Guldbek notes that temperature and humidity are two of the more significant variables that can cause serious damage to artifacts and books if not properly managed. He notes that it is ideal to prevent variance of temperature and humidity throughout the course of the entire year. Sudden or

gradual fluctuations can cause serious damage. Periodic, rapid, or long term changes in humidity during the seasonal cycle (from 15% in winter up to 80% in summer) can lead to sweating on metal objects or hard surfaces. This can cause paint layers and wood veneers to crack and flake, and can lead to corrosion of metals. The fluctuation of humidity can also cause stress in wooden objects due to repeated expansion and contraction.



Research Laboratory

In conditions where the air is too hot and too dry, paper and leather become brittle, and textiles become weaker over time. Where the air is too hot and humidity too high, mold, mildew, and bacteria flourish and feed on paper products. Combining this hot and humid condition with stagnant air causes leathers and textiles to be destroyed.

In a real world example of the consequences of poor environmental control, The Rare Book and Manuscript Library at the University of Illinois suffered a mold outbreak in 2008, and was forced to close their doors for 8—10 weeks. The library is home to

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300,000 volumes, and many books throughout the collection were affected. The staff attributed the problem to humidity fluctuations in the space, providing an ideal environment for mold to grow. To correct the problem, the library employed a vendor to clean the affected collection, the entire HVAC system, and the interior of the space. They then had to look at ways to improve the environmental control of the space, so as to avoid future out-breaks.



Artifact Storage Areas

Now that the risk of poor environmental control is understood, let's discuss the desirable conditions for these unique areas and define the challenges to maintaining them.

Ideally, maintaining a temperature of approximately 70°F, and a relative humidity between 45% to 60% is desirable. And it is important that we have equipment that can achieve maintaining BOTH of these conditions concurrently. This challenge must be addressed in two ways:

- The space must lend itself to precision control.
- The HVAC equipment must be designed to maintain precise temperature and humidity levels *concurrently*, at all times.

Most often, the challenge in these applications is properly designing or renovating the space to *allow for* precision environmental control. Although *precision* HVAC products offer control of temperature and humidity, it doesn't mean that they can be applied anywhere and achieve the desired results in that space. We would not apply this equipment on a back porch of a house and expect the back yard to become regulated. The challenge is defining the space, and isolating it from the external environment.

To isolate a given space, the most important piece is providing a vapor barrier. Many materials used as interior coverings for exposed walls, such as dry wall, wood paneling, and plywood, permit water vapor to slowly pass through them. When the relative humidity at the surface of an unprotected wall in a given space is greater than that within the wall, water vapor will migrate through the finish into the stud space or adjacent space. Vapor barriers are used to resist this movement of water vapor or moisture in various areas. A vapor barrier can be integrated during construction or renovation of a space by applying the material between the framing and the wall finish. Figure #1 shows an example of a vapor barrier installation. If the room being considered is already constructed, there are a variety



Vapor Barrier Installation

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of vapor retardant paints available that can serve as a vapor barrier for the space.

Once the space has been properly isolated, the next step is to select the proper HVAC equipment that will provide the environmental control. Previously we discussed the need for control of temperature AND humidity for these sensitive applications. Effective management of both of these variables demands a higher level of precision performance than a comfort cooling system can offer. Comfort cooling systems are not designed to maintain a precise temperature or humidity band, and are nearly always operating based on a temperature set point - not a humidity set point. Therefore, humidity levels can vary significantly without action by the cooling equipment. Plus, comfort cooling systems are designed for seasonal use only. This means in the winter, the cooling system will either not be operating, or will likely not be operating very reliably. The solution: A precision cooling system designed for year round use in all ambient outdoor conditions. Below are a few significant benefits of Liebert precision cooling systems when applied in one of these unique applications.



Vapor Retardant Paint for Vapor Barriers

Precision Cooling System Benefit #1: Control of Relative Humidity

A relative humidity target of 45% \pm 5% is no problem for a Liebert precision cooling system. It has the accuracy and precision to meet that target, and it can operate in whatever mode is most appropriate (see chart below). A comfort system has only two modes of operation...cooling and off. True, while it's cooling, it's also dehumidifying, but that's incidental. It is not capable of reacting to an out of tolerance relative humidity level while maintaining precise control of the room temperature. Moreover, it is incapable of adding humidity during the winter season. When you get right down to it, a comfort system offers no control over relative humidity without specialty controls and additional equipment.

A Liebert precision cooling system adds not only the added benefit of onboard, supplemental humidification capability, but also the ability to add supplemental heat. This allows the system to dehumidify the space, and simultaneously prevent over-cooling in light load conditions.

Precision Cooling System Benefit #2: Precision Temperature Control:

Precise control of temperature, in conjunction with control of relative humidity, is very important in these applications. Relative humidity is affected by temperature. The higher the temperature, the more water vapor a volume of air in a given space can hold. Therefore, if the temperature in the room drops, the air in the space can hold less moisture in suspension, and condensation potential exists. Precision control of both of these variables is critical for this reason. Liebert precision cooling systems can do this with ease. Comfort systems just aren't designed to maintain close tolerances on temperature and relative humidity. The very best temperature control you could expect is \pm 5 °F.

% OF OPERATING TIME (north/south)	TASK
30%/50%	COOLING
0%/20%	Dehumidifying
10%/20%	Dehumidifying & Heating
10%/5%	Humidifying
30%/5%	Cooling & Humidifying

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Precision Cooling System Benefit #3: Operating Hours

A Liebert precision air conditioning system is designed to operate whenever you need environmental control. For the applications being discussed, that means 24 hours per day, 365 days a year. Therefore, the circulating fan runs 8,760 hours a year, while the other components turn on and off as directed by strategically placed temperature and humidity sensors. If the cooling system was not designed for this type of rigorous workload, chances are, it won't hold up over time.

Precision Cooling System Benefit #4: Low Outdoor Ambient Operation

Another consideration is cold weather operation. Comfort systems with outside heat exchangers are typically inoperable when outside temperatures drop below about 40°F due to liquid slugging and evaporator freeze-up. Even systems equipped with a "low ambient" option only operate down to 0 degrees at best, unless it's windy. A precision system, by way of comparison, will operate perfectly well down to -30 °F.

Some Liebert models offer an exclusive option for cold weather operation - GLYCOOL™ free cooling. When outside temperatures drop below +60 °F, the system shifts to use mother nature as the primary source of cooling instead of the compressor. Running without the compressor at low ambient temperatures is substantially less expensive and extends compressor life.

In conclusion, a combination of proper room preparation and the use of Liebert precision cooling system can offer the precise environmental control that many unique applications require. Liebert offers a variety of styles and configurations of equipment in order to meet even the most challenging applications. Contact Hedrick Associates for more information!

References:

Per Ernst Guldbek, A. Bruce MacLeish, *"The Care of Antiques and Historical Collections"*, 1985



**Liebert Challenger
Floor Mount System**



http://www.liebert.com/product_pages/MainCategory.aspx?id=4



**Liebert MiniMate
Ceiling Mount System**



**Liebert DataMate
Wall Mount System**