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Precision or Comfort Air Conditioning

Is it really a good idea to use a comfort air conditioner to maintain conditions in a small computer room ?

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Here is a small equipment room containing telecommunication racks, file servers or a midrange computer and it needs cooling. The hardware manufacturer recommends controlled conditions of 22.0°C ± 2.0°C and a relative humidity of 50% ± 5%. Is it really necessary? And how can it be achieved cost effectively?

The cheapest solution is clear to Building Maintenance - just fit a small comfort fan coil cooling unit tapped into the existing chilled water system. Alternatively, if the chiller is offline outside office hours, or shut down for the winter, just install a small comfort air conditioner split system. That's all there is to it! Isn't it?

The obvious (i.e. cheapest) solution is simply based on capital cost. No-one has considered running costs. At this point let us take another look and uncover the hidden costs of comfort air conditioning.

Cooling Equipment Vs Cooling People

If we look at the differences between cooling people and cooling electronic equipment, we find a mismatch in requirements. Firstly, people add moisture to a room and electronics are dry. Latent cooling is the ability to remove humidity from the air, whereas sensible cooling is the ability to remove heat. You, therefore, have to consider the actual sensible cooling capacity of any proposed air conditioning system.

Standard room air split systems, residential central air handling plant and office building air conditioning systems are usually designed with a sensible cooling ratio of around 0.60 to 0.70. In essence, this means that 60 to 70% of the work done by a comfort system will lower the air temperature and 30 and 40% of the work will remove moisture from the air. This is a typical ratio for a building full of people with a moderate degree of traffic.

Figure 1 : A precision air conditioner and a normal room air conditioner

Cooling Capacity: Total and Sensible

In contrast, precision air conditioning units have a much higher sensible cooling ratio in the region of 0.9 to 1.0. This means that over 90% of the work done by a precision air conditioner will be devoted to cooling the air with less than 10% used in the removal of moisture. How does this affect the cost equation of Comfort Vs Precision cooling?

Precision cooling?

1. The cooling capacity stated for a comfort unit is usually its total cooling capacity (i.e. sensible + latent). This means that you need more comfort capacity to do the same job as a precision air conditioning system. A general rule of thumb is that it takes 9.0 kW of comfort capacity to do the same job as a 6.0 kW precision c o o l i n g unit (i.e. 9.0 kW x 0.7 = 6.3 kW).
2. If the comfort system is removing moisture, it will drag the relative humidity level down well below what is considered to be acceptable. With no personnel adding moisture to the room, the only long-term answer is to install a wall mounted humidifier at additional cost.

Precision air conditioning units take very little, if any, moisture from the air unless the automatic control system determines that this is a necessity and energizes the dehumidification saver circuit. For the small amount of re-humidification that may be

required, precision units have an integral humidifier that will add just enough moisture to maintain the computer manufacturer's recommended level.

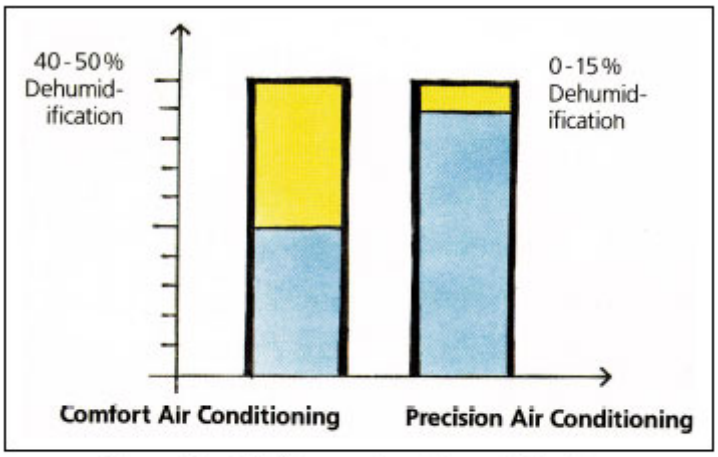

Figure 2 : Difference in dehumidification capability between comfort AC and precision AC

Equipment Load Density

The average room will, comfortably, accommodate a lot more electronic equipment than people. Consequently, computer or switch rooms require much more cooling capacity per square metre of floor space than the typical office. For general guidance, the "rule of thumb" is 5.0 kW of comfort cooling for every 20-25 sq.metres of office space compared to 5.0 kW of precision air conditioning for every 7 - 15 sq. metres of equipment space.

Precision Temperature Control

If the equipment room temperature gets too high or too low, data integrity and reliability of operation can be severely affected, leading to costly downtime. Some computer manufacturers state in their warranty conditions that their equipment must be maintained in stable conditions of 22.0°C ± 1°C. The rate of change is also very important where large slabs of heat load can be energized and de-energized several times a day. Precision air conditioning systems are specifically designed to maintain close tolerance conditions with ease. Typical office comfort systems simply cannot provide this level of control and the very best that can be expected is ± 3°C.

Air Distribution and Filtration

With the high heat load density identified in the typical equipment room comes another big difference in air conditioning needs. To achieve the high sensible cooling ratio, remove the high density heat load and carefully maintain the temperature and humidity levels,

requires a very large volume of air. If we compare the average comfort system, which will move air through its cooling coil at the rate of about 0.23 to 0.27 m^3/s per 5.0 kW of capacity, to the average precision system, which will move air at the rate of about 0.35 to 0.40 m^3/s, we find that the precision system is moving nearly twice the amount of air. The much larger air volume also contributes to good air distribution in the space and a better level of filtration.

Dust is the enemy of any electronic equipment. Dust will build up on printed circuit boards and charged electronic components causing overheating, short service life and premature failure. Dust in the heads of tape and disk readers will cause physical damage to storage media.

Comfort systems usually incorporate disposable or washable filters of undetermined efficiency. They are put there to protect the unit from damage. The filters fitted in a precision air conditioning system are EU 4 grade and have been selected to remove dust from the recirculated airflow to protect the customers' vital electronic equipment. Higher efficiency filters can be installed for specific applications.

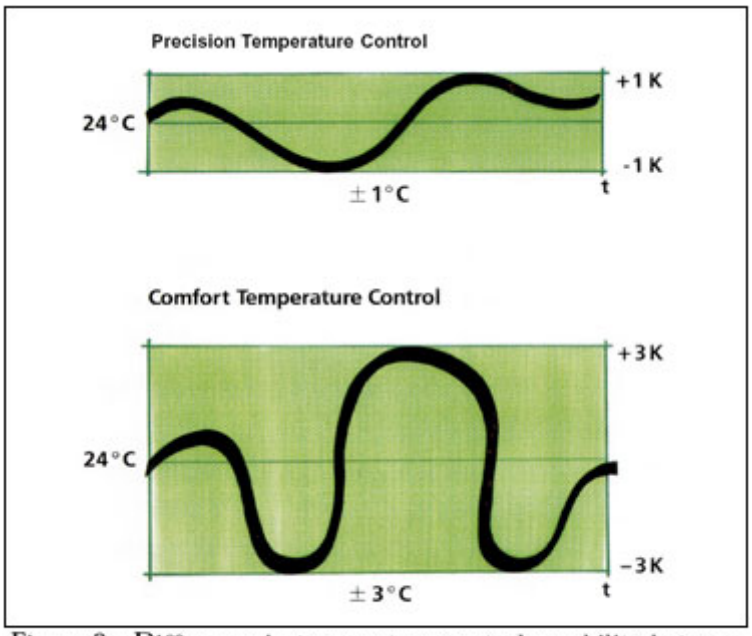

Figure 3 : Difference in temperature control capability between comfort AC and precision AC

Operating Time

A major consideration that is often overlooked is that most computer systems and telecommunications switch facilities operate continuously. This means 24 hours per day, 7 days per week for 52 weeks a year and any shutdown needs to be planned well in advance.

The air conditioning system is, therefore, in operation continuously. The circulating fan runs 8,760 hours a year with all the other components turned on and off as directed by the microprocessor environmental monitoring and control system.

In contrast to needs of equipment, comfort systems are designed to operate only when people are working or occupying the area. In real terms, this means that the comfort system is in use around 8 hours per day for 5 days a week during the cooling season. An average operating time is about 1,200 hours a year.

Another consideration is cold weather operation. Standard comfort split systems using external condensing units are typically inoperable when outside temperatures drop below 0°C due to liquid slugging and evaporator freezeup. In comparison, precision systems will operate down to –12.0°C and special units are available for lower ambient circuits that will operate perfectly well down to –50.0°C.

In addition, whereas comfort split units turn into heat pumps during the winter, some manufacturers can offer an energy saving “free cooling” system which makes use of the low ambient conditions as the prime source of cooling instead of the refrigeration circuit. Running without the compressor at low ambient temperatures reduces operating costs substantially.

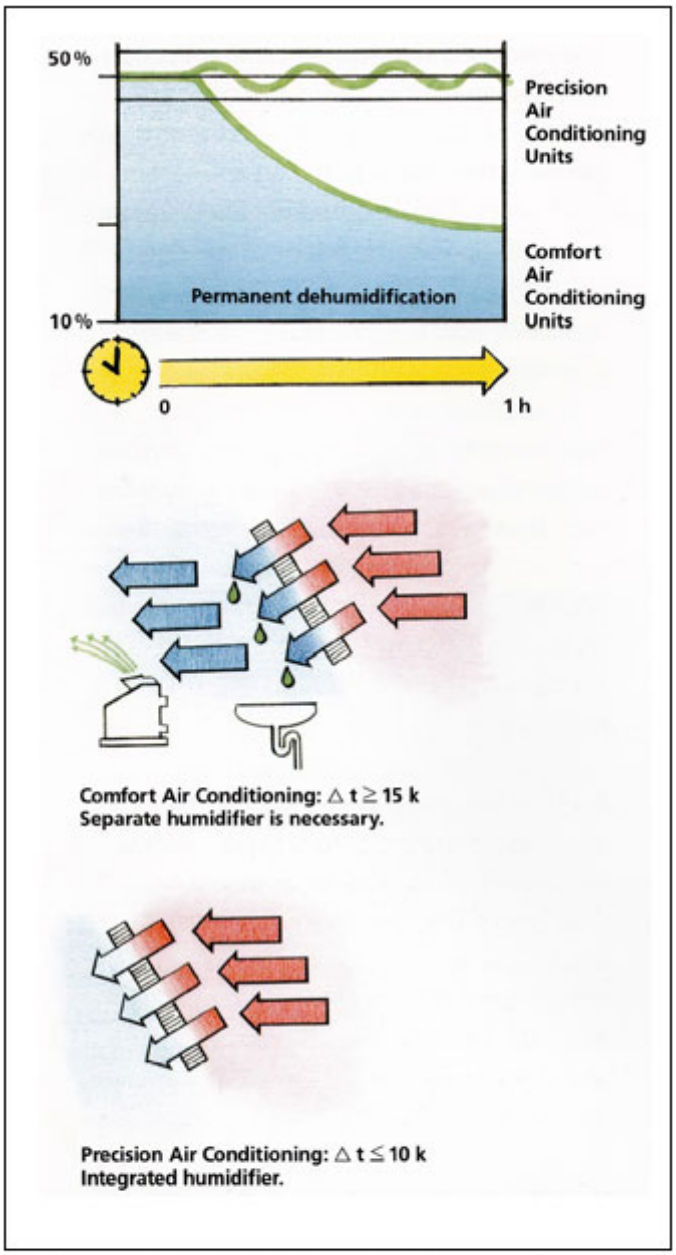

Figure 4 : Difference in humidity control capability between comfort AC and precision AC

Precision Humidity Control

Humidity or lack of it can be a major problem to electronic equipment. High humidity levels cause paper handling problems and the possibility of condensation in the electronics. Low humidity levels give rise to static electricity where the discharge from a finger touch can destroy components and alter data. In addition, magnetic media can suffer oxide shedding increasing the possibility of lost or altered data.

The target area is 45% to 55% which is within the range of precision units designed with a control accuracy to meet and maintain a set point of 50% ±5%.

Comfort air conditioning has two main modes of operation: cooling and perhaps heating. Part of the nature of comfort cooling is to dehumidify, but this takes place continuously and there is no method of rehumidifying the air. Basically, a comfort system rarely offers any control whatsoever over humidity levels.