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Understanding Hybrid Air Conditioning

In recent years the use of the word "***Hybrid***" has been on the rise, due to its commercial effect of adding the illusion of being energy-efficient and environmentally conscious. But for the sake of a true understanding of what ***Hybrid*** Air conditioning means, let's first dig in to what the word ***hybrid*** means?

Instead of examining the biological meaning of the word hybrid, we'll examine its definition in a more general sense as it relates to technology. A generally accepted definition of hybrid is defined as, "***The use of two or more technologies to achieve a common goal resulting in a reduction to the total energy used."***

By this definition, the technologies that are being used and how to control them together is the most important factor to this equation.

Is using solar power considered to be hybrid air conditioner?

Recently, many manufactures are using the term hybrid air conditioner for an air conditioner that uses a solar power. Even though it appears to be the correct usage of the word hybrid, it is flawed because the two different technologies here relate to the power generation rather than the air conditioner itself. In theory, any air conditioner could be a solar air conditioner, you simply need enough solar power to run it.

However, the solar air conditioner itself uses direct expansion (DX) to cool, so technically, it is still a single technology.

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Is there another technology to cool besides DX or direct expansion?

If you ask a physicist this question, he will tell you no. He'd be right to a certain extent because all heat removal or cooling involve the evaporation of something, whether its refrigerant (Freon), water or ammonia, all the methods depend on the transformation of the heat of the evaporation or condensation (the latent heat to sensible heat).

However if you ask that same question to an HVAC engineer, he will say of course, and he would also be correct because the processes would be the same, but the technology would be different to evaporate water than it would to evaporate refrigerant or lithium bromide.

How many technologies are there for cooling?

Without getting into too much technical detail, there are basically three different cooling technologies:

1. Direct Expansion (Freon based system; hi power consumption; 2-3.5 COP; 10-16 EER)
2. Absorption system (Ammonia lithium bromide-based system; uses heat as a form of energy; 1.5 to 2.5 COP; 7-11 EER)
3. Water evaporation (Direct evaporative cooler /swamp cooler; Indirect Evaporative cooler or both IDEC; low power consumption; uses natural water evaporation; 9-12 COP; 30-50 EER)

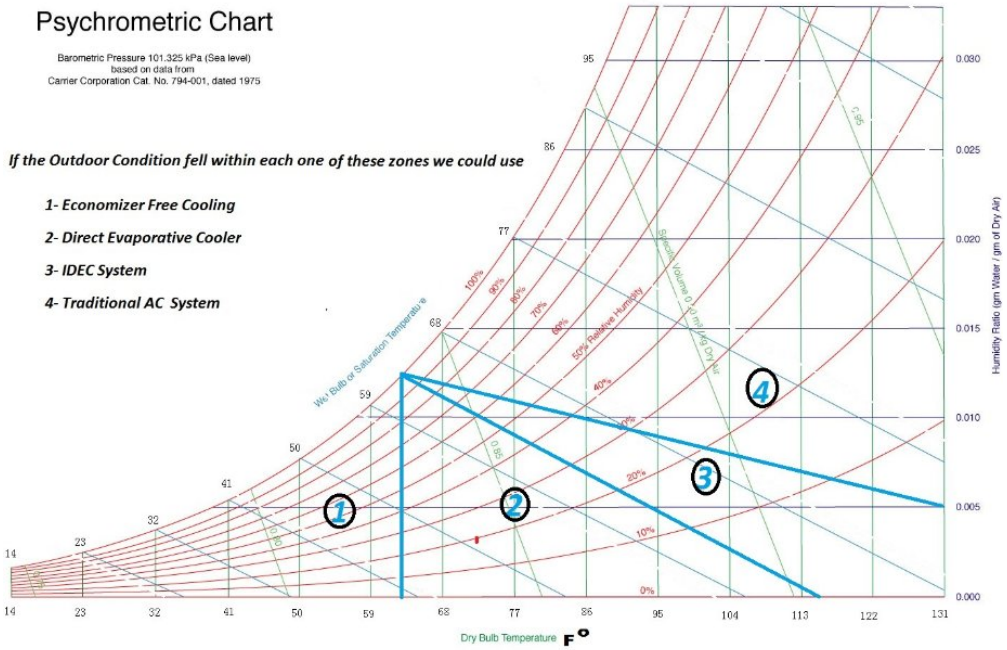
A true Hybrid Air Conditioner uses two or more of the above technologies to cool. Since processes 1 and 2 are high energy consumption, it doesn't make any sense to use those two together. The system would be most cost-effective and energy efficient if you use either 1 or 2 with 3. Although this would be the most

inexpensive way to cool a space, it does come with its challenges around the water evaporation itself, how to control the humidity level, its dependency on the climate, and how to control the unit in real-time.

ASHRAE Design Condition

Engineers often design cooling systems based on one single extreme condition (usually summer or winter), on the ASHRAE Design Condition.

In reality however, we live with a spectrum of conditions that vary between hot, mild, cold, dry and wet. Depending on the specific condition, different cooling strategies could be used that are often not thought of including Traditional Direct Expansion (DX) AC, Direct Evaporative, Indirect Evaporative, Indirect/Direct (IDEC) and/or Economizer … (true hybrid operation).



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ACSESS™

The ACSESS Control System can automatically respond to external weather conditions, switching its cooling strategy from evaporative cooling to air-conditioning when needed to maintain indoor comfort levels. This control strategy insures comfort performance, high efficiency and significant energy savings. This also means that the leading cooling technology can be applied anywhere in the world, providing energy efficient cooling without compromise.

The system uses a psychometric calculation to determine and then select the best cooling approach at any point in time. Psychometric calculations are based on:

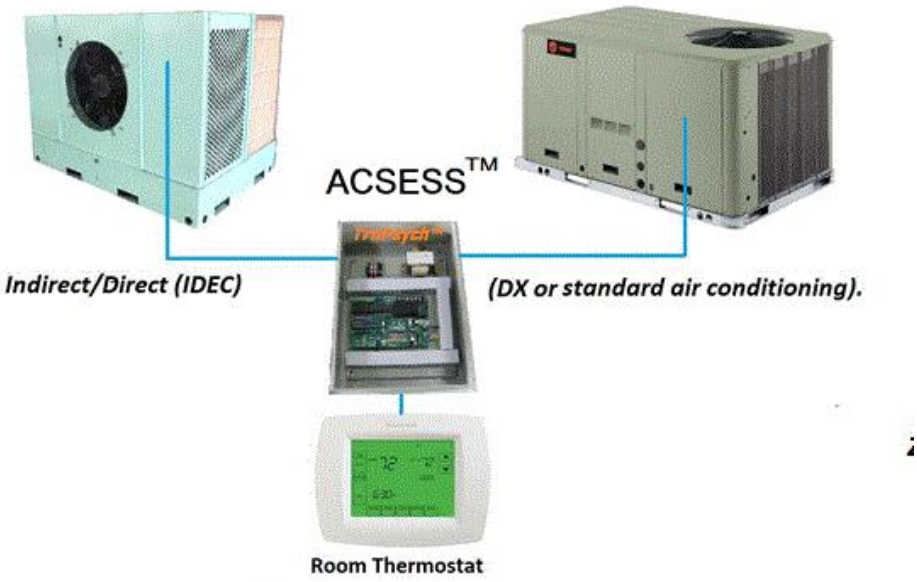
- 1993 ASHRAE Handbook: Fundamentals
- The ASAE D271 Standard Psychrometric Data

Operation

The control system creates a virtual Psychrometric chart based on a specific elevation entered by the user. Thus, the control strategy is specific to anywhere in the world. This allows the system to instantly plot an effective comfort zone for that location based on a series of desired indoor environmental input parameters, including indoor temperature and humidity.

The system then uses state-of-the art electronic controls and sensors to plot the outdoor condition on the virtual Psychrometric chart. The ACSESS™ system combines outdoor conditions and the established comfort zone to instantly select the most efficient cooling strategy, thus assuring the highest equipment efficiency. As ambient conditions or comfort zone inputs change, the system will recalculate and choose the best available cooling strategy. Depending on the

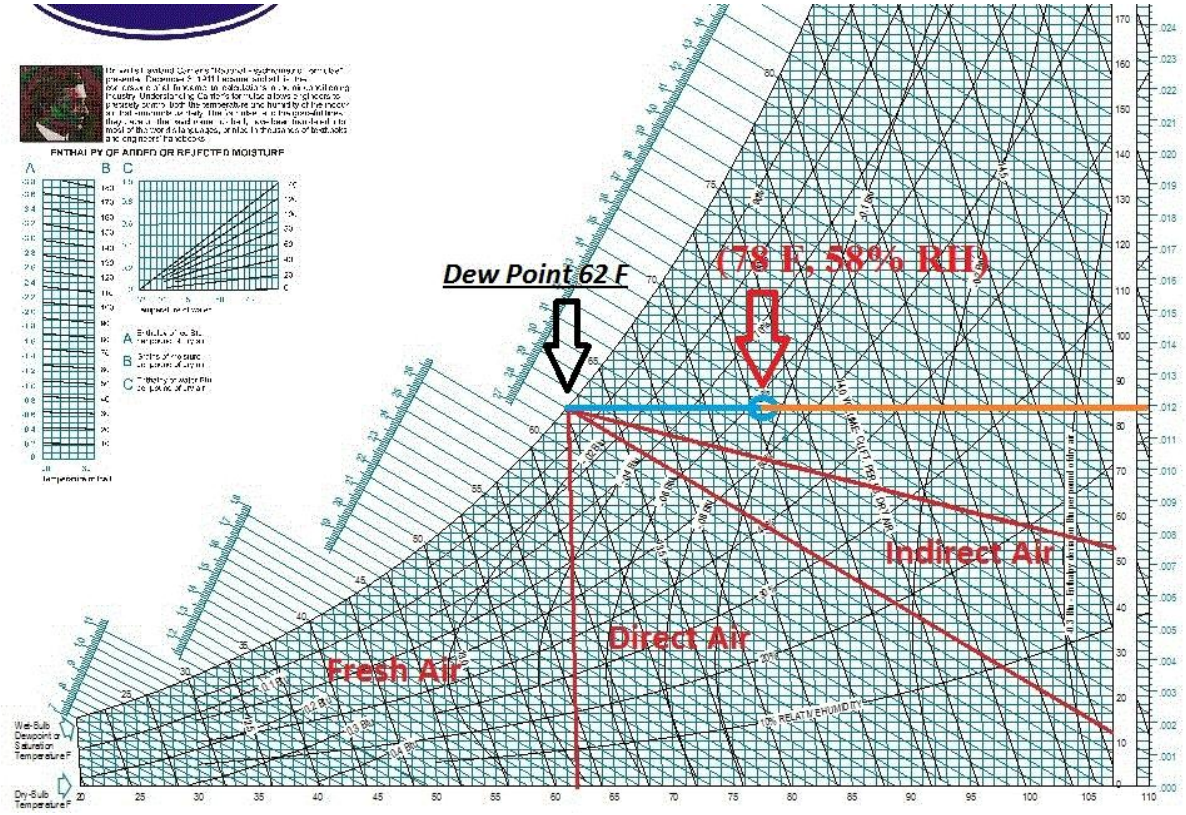
equipment, these strategies can include fresh air cooling (economizer), direct evaporative, indirect evaporative, IDEC, and/or DX standard air conditioning.



Applying Dew Point Analysis with the Internal Comfort Condition

- The maximum saturated supply air temperature to maintain a certain comfort condition

(Dry bulb and relative humidity) is the dew point of that specific condition



- This dew point is the center block of the control system “set point” - entered by the user.

It is the upper right corner of the comfort zone (78°F, 58% RH)

Operating Features

- Based on a proprietary algorithm, the system predicts the supply temperature for each cooling strategy.
- The system senses the outdoor dry bulb condition and relative humidity, and calculates the wet bulb condition in real time based on a specific elevation entered by the user.

- DEF, IDEF are the wet bulb effectiveness for the direct evaporative only section and the IDEC combination respectively (selection entered by user), that will allow the board to deal with a variety of evaporative cooling components by simply changing the effectiveness input or entering a 0, if that section does not exist.
- The system continuously rechecks for any changes to correct its control strategy in real-time.
- The system does have an override function to force the DX system component to engage regardless of the weather condition.
- The system can deal with a wide variety of RTUs: heat pumps, units with 2-stage cooling and 2- stage heating, and standard package units.
- The system connects with:
    - The room thermostat through standard 24VAC
    - The DX system through standard 24VAC
    - The evaporative cooling section with 24VAC or 240 line voltage

About Us

Air_2O is a solutions provider of intelligent, efficient and clean cooling systems to commercial and residential customers worldwide. We educate, inspire and assist engineers and others throughout the world to apply our best in class, clean and energy efficient cooling and energy recovery products, which decrease initial installation costs by up to 50 percent, and reduce energy consumption by up to 80 percent.

For more information on Air_2O, please visit our website at www.air2o.com , or contact Todd Miller at todd@air2o.com.