Design & Theory of Dedicated Outside Air Systems for Humidity Control

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Course Outline

10 Min. What are the Elements that Contribute to Mold Growth?

15 Min. Understanding and Using Psychrometric’s to Combat Mold Growth.

15 Min. Equipment Design Components and Layout.

10 Min. Energy Recovery Equipment.

10 Min. True Or False?
Combat Mold with HVAC Systems

Mold is produced when spores that continually exist in outdoor and indoor air are exposed to levels of relative humidity above 70% and have a food source of dirt or building material (sheetrock, ceiling tiles, etc.).

The answer to controlling the growth of mold is to control moisture below the 70% relative humidity threshold. HVAC systems can be utilized to combat this mold growth and improve indoor air quality.
Combat Mold with HVAC Systems

The possibility of mold growth due to high humidity can occur when a heating, ventilating and air conditioning (HVAC) system has the space temperature controlled by the following:

• On/off operation, of a direct-expansion cooling coil.

• The modulation of a control valve serving a chilled-water cooling unit.

• Supply air temperatures over 65 degrees when used in under-floor displacement distribution systems or as supplied to a space.
Looking at Load Elements

Note how the ventilation air dominates to total load

TOTAL LOAD = 262 lb/h, or ... 31 gallons/hour
Spine tingling … excitement you’ve never before seen… be the first on your block to see the chilling talk brought to life by none other than

Evans J. Lizardos

The master of fascinating tales of engineering

Don’t miss this one!!!
Does HVAC Cause Mold?

Some Say – YES!
Does HVAC Cause Mold?

Some Say – NO!
Use your HVAC system to precondition outside air that is being used for ventilation to prevent mold growth in buildings.
FIGURE 1 - TYPICAL AIR CONDITIONING CYCLE
Sensible Heat Factor (SHF)

\[
SHF = \frac{\text{Sensible Heat}}{\text{Sensible Heat} + \text{Latent Heat}}
\]
Room Sensible Heat Factor (RSHF)

\[
\text{RSHF} = \frac{\text{Room Sensible Heat}}{\text{Room Sensible Heat} + \text{Room Latent Heat}}
\]
Total Sensible Heat Factor (TSHF)

\[
TSHF = \frac{\text{Room & Outdoor Air Sensible Heat}}{\text{Room & Outdoor Air Sensible Heat} + \text{Room Latent Heat} + \text{Outdoor Air Latent Heat}}
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FIGURE 2 - PRECONDITIONING THE OUTSIDE AIR

LEAVING OUTDOOR AIR COIL CONDITION

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ENTERING OUTDOOR AIR COIL CONDITION

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FIGURE 3 - DESIGN CYCLE TO PREVENT HIGH RELATIVE HUMIDITY INDOOR CONDITIONS
FIGURE 4 - MAINTENANCE OF INDOOR AIR DESIGN TEMPERATURE CONDITIONS WHILE HOLDING RELATIVE HUMIDITY LEVELS OF 50% TO 60% UNDER VARYING INTERNAL LOAD CONDITIONS
FIGURE 5 – SUMMARY OF OUTSIDE AIR MAKE UP CONDITIONS
Air-Cooled Condensing Unit or a Chilled Water Supply to a Dedicated Air Handling Unit for Preconditioning Minimum Outdoor Air that serves Multiple Air Handling Units that Utilize a Return Fan Economizer Cycle
Air-Cooled Condensing Unit or a Chilled Water Supply Serving a Dedicated Air Handling Unit for Preconditioning Minimum Outdoor Air that Serves Multiple Air Handling Units that Utilize a Power Exhaust Fan Economizer Cycle
Chilled Water Supplied Air Handling Unit with a Minimum Outdoor Air Preconditioning Coil
Air-Cooled Condensing Units Serving an Air Handling Unit with a Minimum Outdoor Air Preconditioning Coil
Bypass Damper Control of Chilled Water Coil
Good

If you program the chilled water pumps to be operational at temperatures below 32 degrees F you will prevent possible coil freeze-up. If using as a school unit ventilator, it can prevent coil freeze-up whether the system is four pipe (chilled & hot water) or two pipe (dual temperature).
Bad

Cannot achieve pump energy savings via adjustable frequency drives on the pumping system.

You may need to employ primary secondary pumping to avoid the chillers being subjected to small temperature differentials between the chilled water supply & return.
Preconditioned Outside Air Flow Diagram
Preconditioned air in the summer is cooled and dehumidified.
Using Reheat (Heating Coil) to Prevent Mold Growth When Space Relative Humidity Rises Above 70%.
True or False?

1. The Major Contributor to Mold Growth Within an Indoor Structure is the Introduction of Unconditioned Outdoor Air into the Space.
2. Use your HVAC System to Precondition Outside Air that is Being Used for Ventilation to Prevent Mold Growth in Buildings.
3. Very Low SHF can cause Mold Growth.
4. Under Partial Load Conditions When the Room Temperature is Satisfied Using a Higher Supply Air Temperature (65°F) From the Coil can Promote Mold Growth.
Thank You!