



Defining Quality. Building Comfort.

Return *Air* Bypass

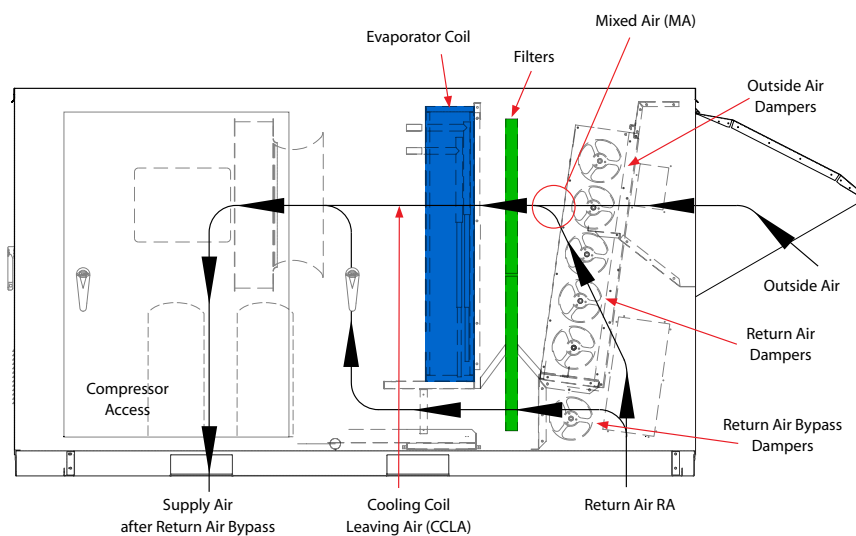


Indirect Dehumidification Enhancement for Constant Volume Systems

Return Air Bypass is an airflow configuration with three independently controlled dampers - return air dampers, return air bypass dampers and outside air dampers. During the return air bypass, or dehumidification, mode of operation, return and outside air are cooled and dehumidified as the air passes through the evaporator coil and then reheated with return air bypassed around the evaporator coil. This *return air reheat* is used to prevent overcooling of the zone during the dehumidification mode of operation.

Bypassed return air provides reheat with air that has already been dehumidified by the system during the cooling mode of operation and the heat in this air comes from the load of the zone, not an auxiliary source. Return air should be used as a reheat source instead of mixed air (outside air + return air) when the humidity ratio of the mixed air is greater than the humidity ratio of the return air.

Return air bypass provides dehumidification capabilities to a constant volume system at a low initial cost. Return air bypass can often control the humidity of zones which experience interior loads with at least a 0.7 sensible heat ratio (SHR). Zones with interior loads less than 0.7 SHR often require a dehumidification system such as modulating hot gas reheat.



AAON Packaged Rooftop Unit with Return Air Bypass

Benefits of Return Air Bypass

There are many benefits to including return air bypass to control the zone relative humidity.

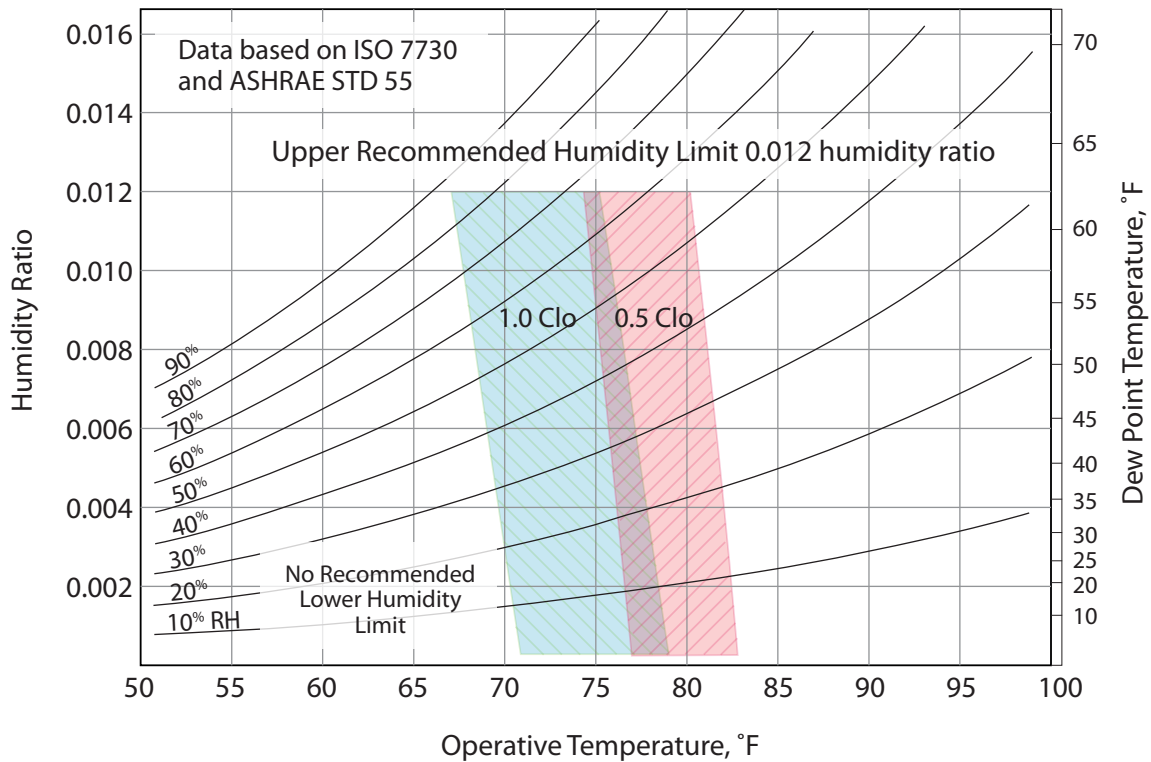
Occupant comfort and well being will increase during the cooling season, because the zone humidity will be controlled better than with a conventional constant volume system. Also, because return air bypass includes fully modulating damper control dramatic zone temperature swings will not occur, even during the dehumidification mode of operation.

Occupant productivity will increase because less time will be spent by the occupants adjusting the zone temperature or using auxiliary sources of cooling (i.e. personal fans) to compensate for the uncontrolled humidity.

Indoor air quality will improve because high relative humidity conditions will be better controlled. Out of control humidity can lead to condensation within the building, wood rot, paper deterioration, and mold and microbial growth.

Occurrences of sickness and allergies will decrease with the addition of humidity control to a zone because humid spaces are more likely to include mold, fungi, bacteria and other allergens all of which can cause health issues.

Ventilation standards can be met or exceeded while still meeting energy use standards because return air bypass can control additional light latent loads, or be matched with modulating hot gas reheat to meet larger latent loads, while still using return air reheat and saving energy.



ASHRAE Standard 55 - Acceptable Range of Zone Temperature and Relative Humidity for Occupant Thermal Comfort

1.0 CLO = Clothing insulation worn during cool ambient conditions
 0.5 CLO = Clothing insulation worn during warm ambient conditions
 Ranges are based on 80% occupant acceptability

Limitations of Return Air Bypass

Return air bypass is an ideal dehumidification option for constant volume systems which serve zones with light latent loads. Zones with large latent loads and zones that have peak sensible and latent loads occurring at the same time require an additional dehumidification system, such as modulating hot gas reheat.

As with any system which attempts to satisfy the latent load of a zone, additional energy use is required with return air bypass. Because the latent load of the zone is now being satisfied, however, energy savings is possible if the zone temperature setpoint is adjusted based on the humidity control provided by return air bypass. According to ASHRAE Standard 55 - Thermal Environmental Conditions for Human Occupancy, as the zone

humidity is reduced and controlled the zone temperature can be increased without sacrificing occupant thermal comfort.

Return Air Bypass with AAON

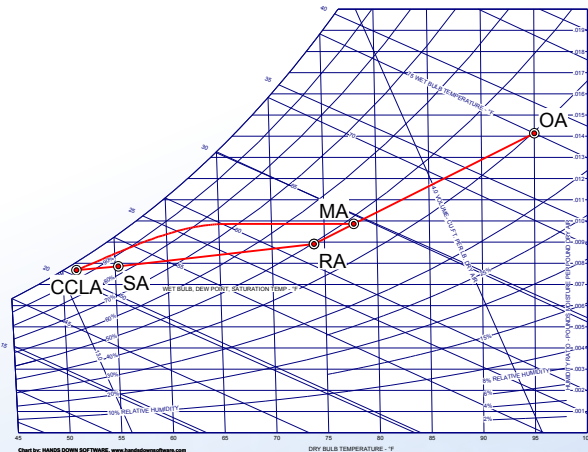
Return Air Bypass is available on AAON packaged rooftop units, from 6-230 tons, to control the humidity of any constant volume application with light latent loads. Ideal applications for return air bypass include supermarkets, schools, libraries, office buildings, lodgings, printing facilities, industrial facilities, data centers and LEED or green buildings.

To specify Return Air Bypass on your next system contact your local AAON sales representative.

Sensible Design Application

A zone is served by a constant volume system, at the sensible design ambient conditions of 95°F DB/75°F MCWB. It requires 2,000 cfm of supply air and 300 cfm of ventilation outside air (15%) and includes 41 MBtu/h of sensible zone load and 10 MBtu/h of latent zone load (0.80 SHR). The desired zone conditions are 74°F DB and 50-55% RH.

At the sensible design load the constant volume system can directly control the zone temperature to the desired 74°F DB, with no return air bypass, and indirectly control to the desired maximum zone relative humidity at 55% RH. **However, with 350 cfm of return air bypassed around the evaporator coil, the system can control to 50% zone relative humidity.**



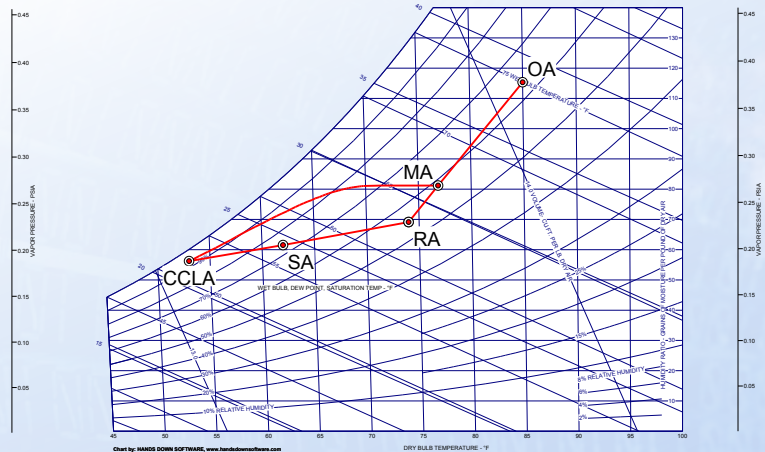
Sensible Design Application with Return Air Bypass

Outside Air - 95°F DB/75°F WB
 Zone Conditions/Return Air - 74°F DB/50% RH (W=0.0089 lbw/lba)
 Mixed Air - 78°F DB/64°F WB (W=0.0095 lbw/lba)
 Cooling Coil Leaving Air - 51°F DB/50°F WB
 Supply Air - 55°F DB/52°F WB

Latent Design Application

A zone is served by a constant volume system, at the latent design ambient conditions of 85°F MCDB/75°F WB. It requires 2,000 cfm of supply air and 300 cfm of ventilation outside air (15%) and includes 27 MBtu/h of sensible zone load and 10 MBtu/h of latent zone load (0.73 SHR). The desired zone conditions are 74°F DB and 50-55% RH.

At the latent design load the constant volume system can directly control the zone temperature to the desired 74°F DB, however, the system cannot indirectly control the relative humidity and the resulting zone relative humidity is 68% RH. **With 850 cfm of return air bypassed around the evaporator coil the system can control to the desired maximum zone relative humidity at 55% RH.**



Latent Design Application with Return Air Bypass

Outside Air - 85°F DB/75°F WB
 Zone Conditions/Return Air - 74°F DB/55% RH (W=0.0098 lbw/lba)
 Mixed Air - 77°F DB/67°F WB (W=0.011 lbw/lba)
 Cooling Coil Leaving Air - 53°F DB/52°F WB
 Supply Air = 62°F DB/57°F WB

For more information on AAON products, contact your local AAON sales representative.
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