ASHRAE Compliance Using Modern Air Handlers

INTRODUCTION

Meeting the ASHRAE 62 ventilation code in existing buildings has become a common requirement in the move to improve indoor air quality. The need for design engineers and building owners to conform to this code in order to help eliminate "sick building syndrome" has been well documented.

An interesting paradox is created, however, when this code ventilation is applied to buildings in humid areas of the country. The new or existing air handler is modified to bring in more outside air to dilute the internal contaminants. Typically, however, the modern air handler cannot deal with the additional latent load from the warm, moist outside air. Just oversizing the system will cause short-cycling and increase the moisture problem. The air inside the building becomes excessively moist, creating a new indoor air quality problem as mold, mildew, and other moisture-loving organisms begin to thrive in this environment. Dealing with one indoor air quality problem gives rise to another.

This Technical Bulletin will explain why existing air handlers generally lack the capacity to handle the additional latent load that results from increasing ventilation to meet ASHRAE 62. In comparison, it will show that, in most cases, the unit's capacity will be sufficient if the outside air is pretreated by a dehumidifier.

AIR HANDLER PERFORMANCE WITH CODE VENTILATION

Over the last few years there has been a push to specify and manufacture air conditioners with high SEER (System Energy Efficiency Ratio) ratings which improve the energy efficiency of the systems by increasing their sensible capacity and reducing the compressor's power consumption. This performance shift in modern air handlers has come, however, at the expense of the unit's ability to remove the latent energy component.

Table 1 shows how the performance of a typical newer 10 HP (ton) rooftop package degrades under increased introduction of humid outside air. Note that, while the old ventilation code of 5 cfm per person generally resulted in a ≈10% outside air requirement, the increased ventilation demanded by ASHRAE 62 usually results in 30% or more outside air required.

	Percent Outside Air Introduced			
	0% Cfm	10% 400	20% 800	30% 1200
Heat Removed				
Sensible (MBH)	78.3	79.8	60.6	62.2
Latent (MBH)	29.0	29.3	50.8	51.3
Total (MBH)	107.3	109.1	111.4	113.5
Sensible/Total	0.739	0.731	0.544	0.548
% of Total Capacity Required for O/A	0%	27%	50%	69%
Leaving Air Dewpoint (°F)	57.7	59.3	60.4	61.8

Table 1) Performance of 10 HP Rooftop package

Assumptions
Ambient design 95°Fdb /78°Fwb
R/A conditions 78°Fdb / 55% RH
S/A volume: 4000 cfm

There are three significant problems with the conventional approach of treating all of the outside air with the air handler.

- **Sensible capacity is decreased**
- **Leaving air dewpoint is too high**
- **Compressor must run 100% of occupied time**

Table 1 clearly shows how sensible heat removal decreases as the percentage of outside air is increased. The air handler's ability to continue to meet the internal space sensible load is diminished as more of the unit's capacity is consumed by the outside air load. The air handler may no longer meet the original design requirements for cooling the space, and the occupants and equipment inside may overheat. The primary heating/cooling unit cannot be oversized to meet both elements (interior and outside air loads) since it will just short-cycle on part load days, not removing the required moisture.

Furthermore, the Table shows that the air handler cannot maintain a leaving air dewpoint below the typical maximum level of 60°F. Again, the occupants will find this objectionable. In addition, a significant new concern is introduced in that the high moisture levels provide the final ingredient required for mold, mildew and viruses to thrive and multiply. (See Figure 1.)

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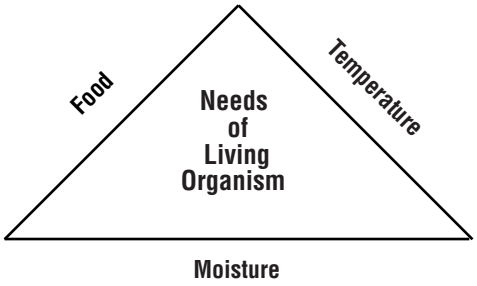

Figure 1) Required components of a living organism

Finally, using the conventional approach to ASHRAE 62 compliance with modern air handlers results in the unit's compressor running non-stop when outside air is being introduced during the summer months. If the compressor were to turn off, all of the humidity contained in the outside air would be introduced untreated to the space.

How much moisture is involved? In our example, an additional 800 cfm of outside air (moving from 10% to 30%) would introduce up to 4.2 gallons per hour (35 lb/hr) into the space. Under the conventional approach, the only way to avoid this large introduction of moisture is to keep the compressor running during occupancy, resulting in greatly increased wear and tear on an essential system component.

PERFORMANCE OF AIR HANDLER WITH PRECONDITIONED OUTSIDE AIR

What is the solution? How can high SEER rating air handlers be used to meet ASHRAE 62 ventilation requirements without causing a new set of problems?

An easy but effective solution is to precondition the outside air so that it is similar to return air or neutral conditions. Any of several different technologies can be used to dehumidify the outside air to a level below the 60°F dewpoint. (The target is a 55°F dewpoint at design conditions.) In this way, the air handler can continue to do its job as designed while maintaining high efficiency and not requiring new energy to reheat the air when the system overcools the space.

Table 2 shows the impact on the air handler when outside air has been preconditioned to a 55°F dewpoint. The simple addition of dehumidification allows the air handler to do the job it was originally installed to do.

Figure 2 plots the impact of introducing additional humid outside air on the leaving air dewpoint of an air handler with and without preconditioning.

	Percent Outside Air Introduced		
	20%	30%	40%
	Cfm 800	1200	1600
Heat Removed			
Sensible (MBH)	82.1	80.4	81.0
Latent (MBH)	23.7	25.5	24.5
Total (MBH)	105.8	105.9	105.5
Sensible/Total	0.78	0.76	0.77
Leaving Air Dewpoint (°F)	57.0	56.6	56.3

Table 2) Performance of 10 HP Rooftop package with preconditioned outside air

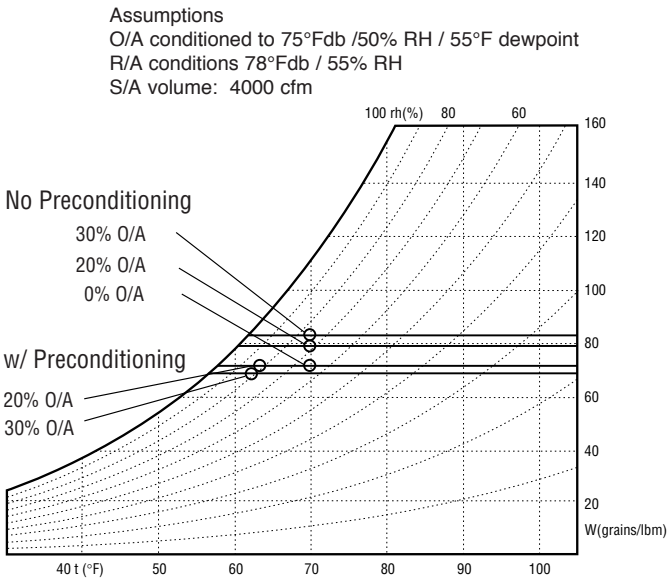

Figure 2) Psychrometric plot

CONCLUSION

Existing and new air handlers cannot properly maintain internal space humidity for the vast majority of North American locations, where design summer moisture values are greater than 70°Fwb. A simple but effective solution is to precondition the outside air to eliminate the moisture before it reaches the air handler or the space.

(Please refer to Desert Aire Technical Bulletins 15 and 16 for detailed sizing and application information for dehumidifiers.)

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