



How to Comply with the Single Zone VAV ASHRAE Standard

Technical Article

ASHRAE 90.1 is in effect and has multiple implications across the HVAC industry.

This article will discuss the impact that **ASHRAE 90.1** has on Single Zone Variable Air Volume (VAV). Specifically, we address issues of Sensible Heat Ratio and Dehumidification, while also integrating Energy Savings and Equipment Longevity considerations.

The specific part of the **ASHRAE 90.1** Standard referred to as Single Zone VAV addresses Direct Expansion (DX) systems 10 tons and larger serving single zones. The Standard demands that all DX systems need to have their supply fans controlled by two speed motors or variable speed drives (thus Variable Air Volume serving a Single Zone).

ASHRAE 90.1 specifies that at low load conditions below 50% of design, the supply fan controls will be able to reduce the airflow down to 2/3 of full fan speed or at least down to a minimum volume of outdoor air to meet space ventilation requirements.

The nature of this Standard expands the role of these systems to operate at part-load more often than originally intended, or expected. This requires the refrigeration circuits of these Air Conditioning systems to be more flexible; able to modulate capacity to changing load conditions.

Sensible Heat Ratio

Engineers often reference Sensible Heat Ratio (SHR) which expresses the ratio between sensible heat and total heat {total= sensible + latent}.

There is much discussion of how, during the design phase, the sensible heat ratio of the direct expansion equipment should match the sensible heat ratio of the space/building to be conditioned.

But as we know, the SHR of *a building* changes regularly with occupancy, ventilation, and all the other factors that influence the load conditions. While the SHR of *the equipment* is also changing, it is doing so primarily in response to the indoor humidity level.

The **ASHRAE 90.1** Standard exacerbates the conflict of asking the equipment to match the constantly changing needs of the building.

Nonetheless, it is clear that the relationship between Sensible Heat Ratio of the equipment and the SHR of the space can only be addressed by enhancing capacity control of the equipment; (especially when ASHRAE 90.1 is concerned).

Dehumidification

Variable Air Volume capabilities will improve the dehumidification function of the system.

As airflow through a cooling coil is reduced, the benefit is more latent cooling. Essentially, the direct expansion evaporator coil gets proportionally larger in relation to the airflow, thus more dehumidification can be performed. This results in an increased need for system capacity control. To extend the run time of the unit to allow for more latent moisture removal, and without overcooling the space or freezing the coil, the refrigeration circuit must be able to modulate along with the airflow.

Tremendous flexibility *and greatly improved latent performance* is achievable by the combination of the variable airflow offered in the VAV control and refrigeration circuit modulation.

Energy Savings and Equipment Longevity

Along with these benefits to improved dehumidification, there are potential costs. Reducing airflow and related cooling load on the evaporator coil can cause significant stresses on the compressor and refrigeration circuit that will result in reducing the life expectancy of the equipment.

Part of the problem can result from attempting to use *unimproved constant volume systems* with either a two-speed airflow evaporator fan control or Variable Air Volume (VAV) control which leads to lowering the coil temperature below acceptable limits. This often causes liquid slugging and freezing the evaporator as a result of inadequate heat transfer across the coil. Balancing the benefits to IAQ and the concern about equipment longevity will need to be continually monitored and addressed by contractors, engineers, and facilities personnel.

The implementation of ASHRAE Standard 90.1, which is being adopted nationwide as an energy efficiency Standard (for state codes), *"will result in a double digit reduction of commercial building energy consumption when compared to design by earlier editions of the Standard (according to the Department of Energy)."*

Not all improvements expected from **ASHRAE 90.1** are to be gained from the HVAC systems, but the feeling is that these systems can contribute substantially when one considers that they account (on average) for more than a 1/3 of a building's energy consumption.

Energy savings are relatively easy to observe and quantify, better explained most directly by the fan and fan motor manufacturers, as energy inputs directly relate to fan speed. But additional benefits can be gained from reduced airflow across the coil.

APR Control

The Rawal Devices, Inc. APR Control offers a simple enhancement to the refrigeration circuit that will provide modulation to improve Single Zone VAV systems and functionality through the APR Control's Continuous Capacity.

When one combines the benefits to protecting systems and the way their operations further enhances the performance goals sought by the new Standard...The APR Control is clearly the cat's meow!



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If you or your customers are experiencing challenges achieving the Single Zone VAV ASHRAE 90.1 Standard, please don't hesitate to call us at 800-727-6447 or email at sales@rawal.com