

Zone Control using CaptiveAire Supply Duct

Project Overview

The goal of this case study is to compare the zone level control results for two HVAC design approaches in applications where a single HVAC unit serves multiple isolated zones:

1. CaptiveAire Paragon HVAC with CaptiveAire Supply Duct
2. CaptiveAire Paragon HVAC with Multi Zone Variable Air Volume (MZVAV) system

Project Details

CaptiveAire Supply Duct is factory built round duct that delivers tempered air through laser-cut holes along the length of the duct.

CaptiveAire's high-induction supply duct eliminates the common comfort issues associated with traditional diffusers, such as hot and cold drafts while the system is operating. It has a continuous mix with high air turnover rates providing a consistent level of comfort throughout the entire building.

This system configuration also offers meaningful advantages in cost and simplicity. Compared to an MZVAV approach, a Paragon HVAC with *CaptiveAire* supply duct design results in a substantially lower initial equipment cost, a less complex installation with no zone-level control wiring and no moving mechanical parts.

The Multi Zone Variable Air Volume System consists of duct mounted Variable Air Volume boxes equipped with modulating dampers and heating coils which regulate airflow and reheat supply air as needed for each zone.



Figure 1 - CaptiveAire Supply Duct



Figure 2 - MZVAV Box - one per zone

CaptiveAire serves School A in Holly Springs, NC with CaptiveAire Paragon HVAC units and CAS Supply Duct for the entire building. Several isolated zones with similar internal loads are served by a single Paragon HVAC unit. Duct runs are designed such that each zone receives the required amount of air to meet its load.

CaptiveAire serves School B in West Des Moines, IA utilizing Paragon HVAC units that supply air for Variable Air Volume (VAV) units. Several zones are served by a single Paragon HVAC unit. Each zone has its own VAV box and thermostat.

Operations were analyzed over a full year to compare the space temperature and humidity in each room with respect to the target temperature and humidity set points. The Paragon units at School A use the average of the sensors in each room the unit serves as the overall room temperature reference. School B uses thermostats in each zone as its individual VAV room temperature reference. The Paragon units use dew point set points for humidity control, but the differential is expressed in the analysis as relative humidity for the sake of clarity.

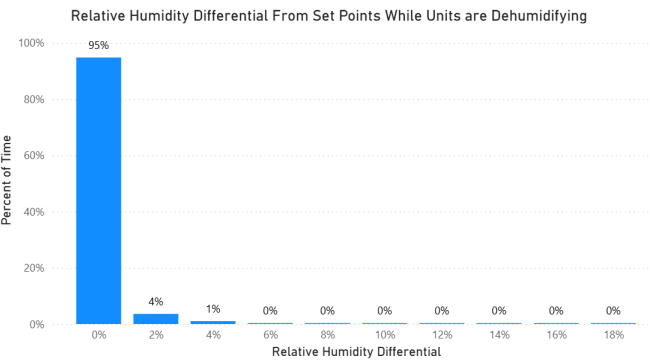
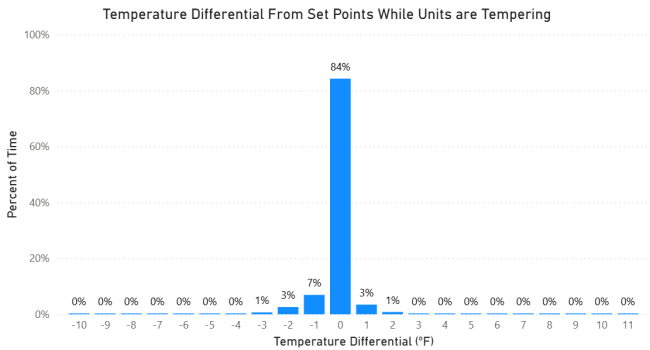
Aggregated data shows that the temperature differential between the rooms and their setpoint at School A are on average smaller than those at School B. School B also displays higher positive differentials due to the reheat-only VAV boxes minimum turndown.

The Relative Humidity differential shows School A is more often closer to set point than School B.

Conclusion

The findings of this case study demonstrate that pairing a Paragon HVAC system with CaptiveAire supply ductwork can exceed the zone level control capabilities of an MZVAV system while avoiding the cost and complexity of the downstream VAV boxes, their associated controls, and their commissioning. A passive mechanical supply duct design has no moving parts and will work for the life of the building without further maintenance.

School A with Paragon HVAC units with CaptiveAire Supply Ductwork:



School B with Paragon HVAC and VAV boxes:

