Tech Note # 110

DOAS Design for VAV system

Keywords: VAV, Variable DOAS

Introduction

The refrigeration system of a D/X based Dedicated Outside Air System (DOAS) requires constant supply air volume due to the wide range of ambient loads the refrigeration system will encounter. A Variable Air Volume (VAV) system requires the outside air volume to change to meet the zone's internal load changes if the system is to achieve the highest level of energy savings. These two objectives are in conflict with each other, so an alternative design is required by the designing engineer in order to meet the energy objective. A method to achieve this can be to use a constant volume DOAS unit with a mixing box to modulate the volume of outside air and a by-pass duct system to recalculate the excess supply air volume not being required by the VAV systems.

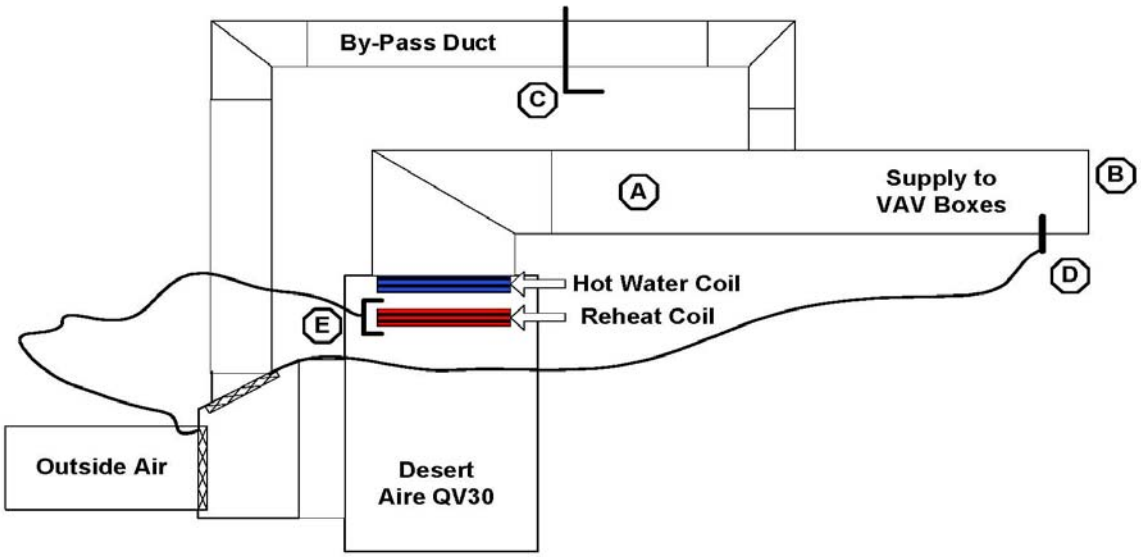

Figure 1 – VAV Duct Layout

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Basic Design Values & Sequence

1. AHU – 1 & 2 will provide a constant supply air cfm at the discharge of the unit at point “A”

2. The By-Pass duct CFM will vary from a value of zero to the maximum outside air requirement

3. The Outside Air Duct will vary from a minimum code ventilation value as dictated by ASHRAE 62.1 to the maximum outside air requirement.

4. The sensor located at point “D” will measure the static pressure in the supply duct approximately ¾’s of the way down stream of the unit. As this duct static increases the By-pass duct will modulate open to provide a lesser value of air volume downstream of the By-pass branch duct.

5. The sensor at location “E” will measure the pressure drop across the Condenser Reheat Coil. This pressure drop will vary the position of the outside air damper to maintain the constant discharge air volume as the position of the by-pass damper changes.

6. The unit includes a Room Reset control Option. If the room sensor’s see an increase in space temperature the reheat valve will modulate to the cooling position and provide sensible cooling to the space. If the space sensor see’s a call for space heating and the compressor is running the reheat valve will move off the SAT set point and modulate to a maximum of a 87°F SAT. If the outside air dew point is below set point and heat is required the hot water valve will modulate to provide a maximum SAT of 87°F.

Initial Air Balance and Set-up

1. At initial start-up the By-pass damper must be in the closed position and the manual balancing damper must be closed. All VAV boxes and duct branches downstream of the By-pass duct must be in the Open Position. The Outside Air damper is to be in the Open Position.

2. A traverse of the supply duct should be taken and motor sheaves adjusted to provide the design maximum air volume. The static pressure drop across the Condenser Reheat Coil at location “E” should be recorded and compared to the Factory value.

3. Once the unit fan has been setup for the design maximum air volume the static pressure at location “D” should also be recorded. This value will need to be entered into the unit controller. This will be the starting point of the By-pass damper closed position. Any value increase at location “D” the by-pass damper will start to modulate to the open position.

4. All VAV boxes should be set to the minimum air flow value as specified.

5. A traverse of the By-pass duct should now be recorded and the Manual Balancing damper set for the maximum design of the difference between the design maximum air volume and the minimum code ventilation value.