2013FACTL-M201-300GreeningYour CurriculumSteveBraselHAC240.doc

Demand Controlled Ventilation For Commercial Buildings

Traditional ventilation for commercial buildings has relied on a percentage of outside air (OA) passing through an adjustable outside air damper (OAD) in order to maintain 15 cubic feet of air per square foot of occupied space (15CFM/Sq.Ft). This is the traditional ASHRAE (American Association of Heating Ventilating Air Conditioning Engineers) Indoor Air Quality ventilation code that the City of Chicago has adopted and uses. The use of this standard results in a set percentage of outside air being introduced into the buildings regardless of how many people are in the buildings at any one time. The net result is the buildings tend to be over ventilated, which results in wasted energy since that set percentage of outside air needs to be cooled down in the summer or heated up in the winter in order to keep the building occupants comfortable.

Demand controlled ventilation looks at this problem in a different way. People exhale CO2. The levels of CO2 within a building will vary according to how many people are in the building. Demand controlled ventilation attempts to modulate the OAD (outside air damper) to introduce enough outside air to dilute the levels of CO2 accumulated in the building to acceptable standards for the health and safety of the people in the building. Co2 levels are read with a CO2 meter, a relatively low cost meter that any HVAC (heating/ventilation/air conditioning) technician can purchase at any supply house.

The levels of CO2 must be kept below a maximum range for the health and safety of the building occupants. Symptoms of lethargy, headaches and fatigue are indicative of too much CO2 concentration build up. Think back on meetings you may have attended where many people were in a room with closed doors. After a while you probably got tired and sleepy, maybe with a slight headache. That's CO2 building up in the room from people exhaling and not being sufficiently diluted by fresh air. Increased levels beyond that can and does become a documented occupational health hazard (see articles on "Sick Building Syndrome"). While it is true that the outside air contains a certain level of CO2 in it, that level is well below the safe levels needed in a building.

1. NAME of Workshop: GYC FA2013 M201-300

2. Stevan Brasel HAC 240

3. Demand Controlled Ventilation by CO2 Measurement

4. Learning Outcomes

a. Students will learn to look up resource material on the internet

b. Students will learn to measure CO2 levels within a building

c. Students will learn to make adjustments to the OAD

d. Students will learn to calculate the new savings of energy in KWH and Therms of gas, and calculate the dollars saved.

e. Students will learn to approach a problem and think of a creative solution that is not “standard”.

5. Critical thinking skills: the students will learn that the accepted standard way is not necessarily the best way, and that there are multiple solutions of a problem.

6. This assignment is relevant to the lives of the student because it will teach them how to reduce the energy needed to heat and cool the building which in turn reduces the carbon footprint of the building.

7. Method of Assessment will be via a measured reduction in the amount of outside air introduced into a model building, Calculate the energy saved. Successful completion will be to save the building energy. A = 10% or more energy saving; B= 5% to 9% energy savings; C= 2 to 4% energy savings. D= 1% energy savings; F= anything less than 1% energy savings.

Assignment

The Braselarium Office Building is located in downtown Chicago. It is a 100,000 square foot building. Peak building occupancy is from 9am to 5 pm Monday through Friday with 1 person per 100 square feet. Week nights, and weekends the building is occupied at 25 percent of the full load of people. The building is closed during the traditional 3rd shift of midnight to 8am.
The building engineer set OA dampers for the ventilation units are set at 25% “open” in order to give the building his best guess of 15 CFM per square foot. The heating cooling equipment is sized to provide 1.25 cfm of supply air (SA) per square foot of building space, of which the OA dampers will introduce their percentage of OA into the airstream. SA plus OA equals the amount of air introduced into the system that must be heated and cooled during occupied hours.

1. Calculate the amount of CFM that is introduced into the SA by the OA dampers. Then calculate the amount of CFM of OA that is introduced through the OA damper.

Show it here:

SA CFM =

OA only CFM =

2. Look up on the Internet the ASHREA 62 document related to Ventilation guidelines, ands list below the ASHREA recommended OA ventilation rate per square foot for commercial buildings. Write it below:

3. Look at your amount of OA CFM calculated above. Compare it with the amount of CFM per square foot recommended at 15 CFm/sq.ft. Do you need to increase or decrease the percentage of OA coming into the A dampers? If so, by how many CFM?

4. Look up on the internet the following article: www.healthyfacilitiesinstitute.com/a_43_Why_Measure_Carbon_Dioxide_Inside_Buildings<http://www.healthyfacilitiesinstitute.com/a_43_Why_Measure_Carbon_Dioxide_Inside_Buildings>

Use that article to discover the recommended CO2 levels in PPM for commercial buildings. List it below:

5. Look at your occupancy schedule in #1 above. Assume Demand Control Ventilation allows you to modulate the OA dampers to mimic your occupancy load. If that is the case, figure out how many people occupy the building each shift. Assume, for arguments sake (you can actually measure this with a CO2 meter to get exact results) that you are able to reduce the amount of OA coming in through the OA dampers by the same percentage that the occupancy load changes from day to evening and weekends.

Show your percentage change below, and the impact that would have on the amount of OA taken in through the OA dampers:

6. Look at the first OA intake result calculated previously when the OA dampers were set at 25 % and forgotten about. Then look at the change in OA CFM when you calculated the OA needed for 15 CRM per square foot. Finally, look at the amount of OA needed if the dampers followed the occupancy load.

List the CFM's here:

Original 25% OA CFM:

Increase or decrease in OA CFM needed for 15 CFM per square foot:

CFM OA needed if following occupancy schedule:

7. Using the Yearly Energy Energy Cost Cycle Analysis discussed previously in this class, calculate the annual savings in energy usage during the heating and the cooling season based on the reduced amount of OA needed using Demand Ventilation. List it below: