2008 Title 24
VAV Single Zone Unit Controls

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Overview of Proposal

- Create a new prescriptive requirement for VAV single zone systems as follows:
  - Either 2-speed motors or VSDs for units 7-1/2 tons to 12 tons in capacity
  - VSDs or equivalent for units 12 tons and greater in capacity
- Units 7-1/2 tons and above typically have 2 stages of cooling
Background – Unit Sales by Size

AC Unit Distribution by Size
PG&E Commercial End Use Survey Database 1999

- <7.5 t: 9%
- 7.5 t to 12 t: 5%
- 12 t to 20 t: 19%
- >20 t: 68%
Table 1 - AC Unit Manufacturers with Existing Unitary VAV DX Equipment

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Minimum VAV Unit Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trane</td>
<td>20 ton</td>
</tr>
<tr>
<td>McQuay</td>
<td>15 ton</td>
</tr>
<tr>
<td>Carrier</td>
<td>20 ton</td>
</tr>
<tr>
<td>York</td>
<td>25 ton</td>
</tr>
<tr>
<td>Dunham Bush</td>
<td>15 ton</td>
</tr>
<tr>
<td>Aaon</td>
<td>2 tons (they have digital scroll compressors)</td>
</tr>
</tbody>
</table>
Analysis

- Five zone office building run in eQuest on 16 California Climate Zones
- Units had packaged cooling and furnace heating
- 2-Speed motors simulated with low speed enabled
  - Whenever the coil load was less than 50% of the design capacity (to simulate two equally sized compressors) and the economizer was at minimum position, and
  - When the economizer could provide 100% of the cooling
## Analysis Results
(Summary of 16 Zones)

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>67% Fan</th>
<th>50% Fan</th>
<th>67% Fan</th>
<th>50% Fan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>$0.76</td>
<td>$0.95</td>
<td>$2,300.00</td>
<td>$2,800.00</td>
</tr>
<tr>
<td>Minimum</td>
<td>$0.34</td>
<td>$0.43</td>
<td>$1,000.00</td>
<td>$1,300.00</td>
</tr>
<tr>
<td>Average</td>
<td>$0.49</td>
<td>$0.61</td>
<td>$1,468.75</td>
<td>$1,837.50</td>
</tr>
</tbody>
</table>

Table threshold costs are based on 400 ft2 per ton. Note that at $500/ton these threshold costs represent approximately a 50% premium for the unit (base costs are $3,750 for a 7-1/2 ton unit).
144(x) Variable air volume control for single zone systems. All unitary and air-handling units with cooling serving single zones shall be designed for variable air volume as follows:

1. Units with a cooling capacity greater than or equal to 7.5 tons to less than 12 tons shall have 2-speed motors, variable speed drives or equivalent.

2. Units with a cooling capacity greater than or equal to 12 tons shall have variable speed drives or equivalent.
What is required to meet this proposed requirement?

- 2-stage thermostat (standard equipment)
- 2-speed mMotor with 2-speed starter (standard equipment)
- Several relays (standard equipment)
- Extra potentiometer for 2 different minimum positions for OSA (standard equipment)
Survey Results

- Survey sent to product managers in Trane, McQuay, Carrier and York
- Prior to submission of the proposal three of the four replied. All three supported the proposed requirement to a certain extent
  - One supports the measure as written
  - One supports a VSD measure down to 12 tons that takes effect on 1/1/2009
  - The third supports the proposal down to 15 tons on 1/1/2008 and down to 7-1/2 tons by 1/1/2009
Summary

- Huge potential energy savings if implemented
- One custom manufacturer has equipment that would meet this requirement today
- The 4 major AC unit manufacturers have equipment today that would meet this requirement down to 25 tons today
- 2 out of the 4 major AC unit manufacturers would support this measure if it were delayed in implementation until 1/1/2009
- 3 out of 4 major AC unit manufacturers would support this measure if the floor was 12 tons with VSDs
Questions