WSEC-2015 C403.7 - High Efficiency Variable Air Volume

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C403.7 - High eff VAV systems Effective July 1, 2017

- For HVAC systems subject to the requirements of Section C403.6 but utilizing Exception 2 of that section, a high performance VAV system may be provided without a separate parallel DOAS when the system is designed, installed, and configured to comply with all of the following criteria (this exception shall not be used as a substitution for a DOAS per Section C406.6 or as a modification to the requirements for Standard Reference Design per Section C407)
- Effective July 1, 2017
- Must meet all 16 requirements
- Office, retail, education, libraries and fire stations

What brought us here?

- A single system is being used for heating, cooling and ventilation the energy performance is being optimized by paying attention to the following:
 - ► Fan energy
 - Ventilation energy
 - Reheat energy
 - Central plant efficiency
 - ► Fault Detection & Diagnostics

Fan Energy

- Requirement 7 limits the maximum inlet air duct velocity air terminal units with a min primary airflow setpoint of 50% or greater of max primary airflow sized with inlet velocity of no greater than 900 fpm
- Requirement 9 allowable fan motor hp not exceed 90% of allowable HVAC fan system bhp
- Requirement 10 all fan powered terminal units series or parllel require ECM and terminal units modulate whenever the zone ventilation rates allow turndown

Ventilation Energy

- Requirement 2 DDC system required
- Requirement 3 multiple zone VAV systems with min OA requirement of 2500 cfm or greater - equipped with device to measure OA intake and system can increase or reduce outdoor airflow based on feedback from VAV terminal units (ASHRAE 62.1 multiple space ventilation equation)
- Requirement 4 multiple zone VAV systems with min OA requirement of 2500 cfm or greater - equipped with a device to measure supply airflow to the VAV terminal units
- Requirement 13 spaces larger than 150 sq feet and occupant load greater than 25 people per 1000 sq feet must have
 - Dedicated VAV terminal unit to control space temp
 - DCV that uses a CO2 sensor
 - Occupancy sensor

Reheat Energy

Requirement 6 - primary max cooling air for the VAV terminal units serving interior cooling load driven zones - sized for supply air temp that is min of 5 deg F greater than the supply air temp for exterior zones in cooling

Central Plant Efficiency

- Requirement 15 requires either a high efficiency cooling or heating central plant
 - VAV terminal units with hydronic heating coils connected to systems with hot water generation equipment (gas fired hydronic boilers with thermal eff of 90%+, air-towater heat pumps or heat recovery chillers)

► OR

Chilled water VAV AHU connected to system with chilled water generation equipment with IPLV values more than 25% higher efficiency than those listed in Table C403.2.3(7)

Fault Detection & Diagnostics -Requirement 16

- Requirement 16 DDC system include FDD to comply with the following:
 - Temp sensors installed (OA, SA, RA)
- AHU controller configured to provide status of (free cooling available, economizer enabled, compressor enabled, heating enabled, mix air low limit cycle active, current value of each sensor)
- VAV AHU unit controller capable of manually initiating each operating mode so that the operation of compressors, economizers, fans and heating system can be independently tested and verified
- VAV AHU unit configured to report faults to a fault management application accessible by day-to-day operating or service personnel or annunciated locally on zone thermostat

Requirement 16 Continued

- VAV terminal unit configured to report the VAV inlet valve has failed by performance the following diagnostic check at a max interval of once a month
 - Command VAV terminal unit primary air inlet valve closed and verify primary airflow = zero
 - Command VAV terminal unit primary air inlet valve to design airflow and verify that unit is controlling within 10% of design airflow
- VAV terminal unit configured to report and trend when the zone is driving the AHU reset sequences. Operator can exclude zones used in the reset sequences from the DDC
 - Supply air temp setpoint reset to lowest supply air temp setpoint for cooling
 - Supply air duct static pressure setpoint reset for the highest duct static pressure setpoint allowable

Requirement 16 Continued

- FDD system configured to detect the following
 - Air temperature sensor failure/fault
 - Not economizing when the unit should be economizer
 - Economizing when the unit should not be economizing
 - Outdoor air or return air damper not modulating
 - Excess outdoor air
 - VAV terminal unit primary air valve failure

Requirement 8

DDC systems designed and configured per the guidelines set by High Performance Sequences of Operation for HVAC Systems (ASHRAE GPC 36, RP-1455)

Requirement 12

When in occupied heating or in occupied deadband between heating and cooling all fan powered VAV terminal units - configured to reset the primary air supply setpoint - based on VAV air handling unit outdoor air vent fraction, to the min ventilation airflow required per *International Mechanical Code*

Requirement 14

- Dedicated server rooms, electronic equip rooms, telecomm rooms, or similar spaces with cooling loads greater than 5 watts/square foot - provided with separate, independent HVAC systems to allow the VAV AHU to turn off during unoccupied hours
- EXCEPTION VAV AHU and VAV terminal units may be used for secondary backup cooling when there is a failure of the primary HVAC system
- These types of rooms require an airside economizer
 - EXCEPTION Heat recovery per exception 9 of 403.3 may be in lieu of airside economizer for the independent HVAC system