Washington State Energy Code

2015 WSEC
COMMERCIAL UPDATE

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NEEC
NORTHWEST ENERGY EFFICIENCY COUNCIL

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SMART BUILDINGS CENTER A project of NEEC

The **Northwest Energy Efficiency Council** is a non-profit trade association of the energy efficiency industry. NEEC member companies provide energy efficiency products and services and assist in the development and implementation of energy efficiency programs. NEEC advocates an affordable, energy efficient future for commercial, industrial and residential customers by:

- Promoting energy efficient products and services as the cleanest and lowest cost energy resource;
- Serving as the voice of the industry in state and local program and policy issues;
- Providing members with the most up-to-date information within the industry.

- NEEC provides technical support to the design and construction industry for the WSEC Commercial Provisions.
- *Services we provide:*
  - Advocate for code language clarity
  - Inform industry about Code updates
  - Fact sheets on key topics
  - Compliance documentation forms
  - On-call technical support
    - wsec@putnamprice.com
    - Lisa Rosenow, Project Director
      (206) 624-0283
  - Training, training, training!

WSEC technical support services are made possible thanks to the generous support of the Northwest Energy Efficiency Alliance

Codes & Standards

Instituting long-term energy savings

More stringent codes and standards play an important role in helping the Northwest secure long-term energy savings. The Northwest Power and Conservation Council's 6th Power Plan estimates that over 40 percent of Northwest energy efficiency savings between now and 2030 will come from increased codes and standards.

Through aggregating and synthesizing knowledge, then convening and collaborating with our partners, NEEA gains an independent perspective. This helps us advance building energy codes and helped us provide training to more than 2000 building officials and trade allies around the region in 2011.

Through the following codes and standards initiatives, NEEA helps the region secure energy savings to help the Northwest meet its growing energy needs.

Codes

Helping to create new and more stringent building codes and providing technical support and training after adoption.

Standards

Serving as a technical expert during U.S. Department of Energy rulemaking process to encourage the adoption of optimal efficiency federal appliance and equipment standards.

www.neea.org

Related Resources

Washington Residential Energy Code Compliance

Idaho Residential Code Compliance

2011 Residential Codes Energy Use Savings

Conduit Spotlight

Energy Codes and Standards

The Codes & Standards Group is for people interested in building energy code development, adoption and implementation and in energy efficiency standards processes and progress. As a member of the group, you'll be notified periodically (not too often) of codes and standards news, including the nature of changes and upgrades, effective dates, expected regional energy savings, and how the changes may impact regional efficiency programs and initiatives. You'll be able to ask questions and provide feedback for the processes. Occasionally we might even ask you for help in providing data that's critical for enacting appropriate new codes and standards.

Join the conversation »

Success Story

NEEA Builds Market Capacity Enabling More Energy-Efficient Codes

Today's Topics

2015 WSEC Mechanical Highlights

- Status of the WA State Energy Code (WSEC)
- Reorganization of provisions
- Mandatory Requirements
  - HVAC equipment efficiency
  - Fan power allowance/fan efficiency grade/fan controls
  - Ventilation
  - Thermostatic controls
  - Kitchen hoods
- Prescriptive Requirements
  - Economizers
  - Dedicated Outside Air Systems (DOAS)
  - High Performance VAV
- Additional Efficiency Package Options

- Rulemaking
- State Building Code
- Forms
- Local Residential Amendments
- Other Laws & Publications

State Codes, Regulations & Guidelines

Energy Code

2015 Washington State Energy Code

WAC 51-11C (Commercial)

WAC 51-11R (Residential)

Appendix Chapters

Based on the 2015 IECC; "Residential" includes One- and Two-family dwellings, Townhouses and Group R-2 and R-3 buildings three stories or less "Commercial" includes all buildings not covered under "Residential"

(Effective July1, 2016)

New documents posted April 14th, 2016

https://fortress.wa.gov/ga/apps/sbcc/Page.aspx?nid=14

Reorganization of Provisions

- Chapter 1 – Scope and Administration
- Chapter 2 – Definitions
- Chapter 3 – General Requirements
- Chapter 4 – Commercial Energy Efficiency
- NEW! Chapter 5 – Existing Buildings
- Chapter 6 – Reference Standards
- Appendix Chapters

Chapter 4 Commercial Energy Efficiency

- Discipline specific provisions
  - C401 – Compliance Options
  - C402 – Building envelope
  - C403 – Mechanical systems
  - C404 – Service water heating systems
  - C405 – Electrical power and lighting
  - NEW! C406 – Additional efficiency package options
  - C407 – Total building performance
  - C408 – Commissioning
  - C409 – Energy metering
  - NEW! C410 – Refrigerated spaces

Equipment Efficiency Tables

- Tables with updated efficiency values ~
  - Table C403.2.3(1)A – Unitary Air Conditioners & Condensing Units
  - New VRF standards effective January 1, 2017:
    - Table C403.2.3(1)B – Variable Refrigerant Flow Air Conditioners
    - Table C403.2.3(1)C – Variable Refrigerant Flow Air-to-Air & Applied Heat Pumps, only VRF air-cooled equipment updated
  - Table C403.2.3(2) – Unitary and Applied Heat Pumps
  - Table C403.2.3(3) – PTACs & PTHPs, SPVACs & SPVHPs and Room AC & AC Heat Pumps
  - Table C403.2.3(5) – Gas- and Oil-Fired Boilers
  - Table C403.2.3(7) – Water Chilling Packages
  - Table C403.2.3(8) – Heat Rejection Equipment
- Remaining tables are unchanged (some only moved)

Electric Motor Efficiency Tables

- C405.8 Electric motor efficiency
  - Electric motor efficiency tables cover motors ¼ hp and up.
  - Fractional hp fan motors (1/12 – 1 hp) shall have ECM motors or minimum 70% motor efficiency, unless they are covered under Tables C405.8(3) or C405.8(4)
  - Minimum nominal full load efficiency tables ~
    - Table C405.8(1) – 60 Hz NEMA General Purpose Electric Motors (Subtype I) Rated 600 Volts or Less (Random Wound)
    - Table C405.8(2) – General Purpose Electric Motors (Subtype II) and All Design B Motors Greater Than 200 Horsepower
  - Minimum average full load efficiency tables (1/4 – 3 hp) ~
    - Table C405.8(3) – Polyphase Small Electric Motors
    - Table C405.8(4) – Capacitor-Start Capacitor-Run & Capacitor-Start Induction-Run Small Electric Motors

Fan System Efficiency

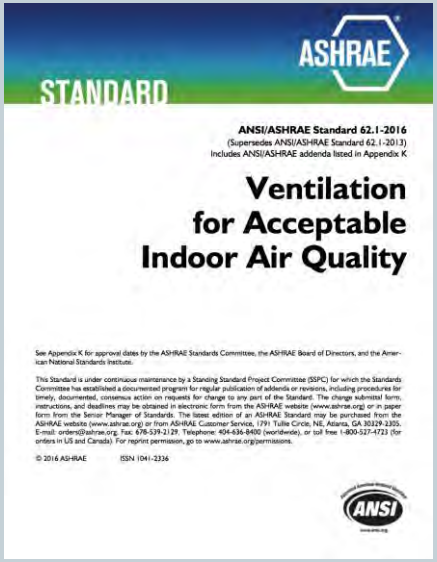
- C403.2.11.3 Fan efficiency
  - FAN EFFICIENCY GRADE (FEG). A numerical rating identifying the fan's aerodynamic ability to convert shaft power, or impeller power in the case of a direct-driven fan, to air power.
  - Fan Rating – Fans shall have an FEG rating of 67 or higher based on manufacturer's data per AMCA 205.
  - Fan Selection – Fan efficiency at design operation shall be within 15% of the FEG rating of the fan.
  - Exceptions
    - Single fans 5 hp or less.
    - Multiple fans in series or parallel that combined are 5 hp or less.
    - Fans integral to package equipment.

Variable fan flow control

- C403.2.11.5 Fan airflow control
- DX>65,000 btu/h and chilled water ≥5 hp fan motor
  - Cooling units that control capacity of cooling directly based on space temperature:
    - Shall have at least 2 stages of fan control.
    - Minimum speed setting shall be 66% or less than full speed, and shall draw not more than 40% of full speed fan power.
  - Cooling units that control space temperature by adjusting airflow:
    - Shall have modulating fan control.
    - Minimum speed setting shall be 50% or less than full speed, and shall draw not more than 30% of full speed fan power.
  - Exceptions
    - Modulating fan control required for ventilation air systems that cycle with the load and are 1 hp or less.
    - Minimum speed may be increased to that required for ventilation.

Ventilation

- C403.2.6 Ventilation
  - Minimum ventilation rates per 2015 IMC Section C403
  - 2015 IMC Section C403.2 Outdoor air required
    - IMC Table 403.3 Minimum Ventilation Rates
    - WA State Amendment allows ASHRAE 62.1 as an alternate method.
  - Requires ventilation calculations



- *New in WSEC -* Shall be *configured to* provide no greater than *150%* of minimum ventilation rate to each zone per 2015 IMC or other applicable code (OSHA, WAC), whichever is greater.

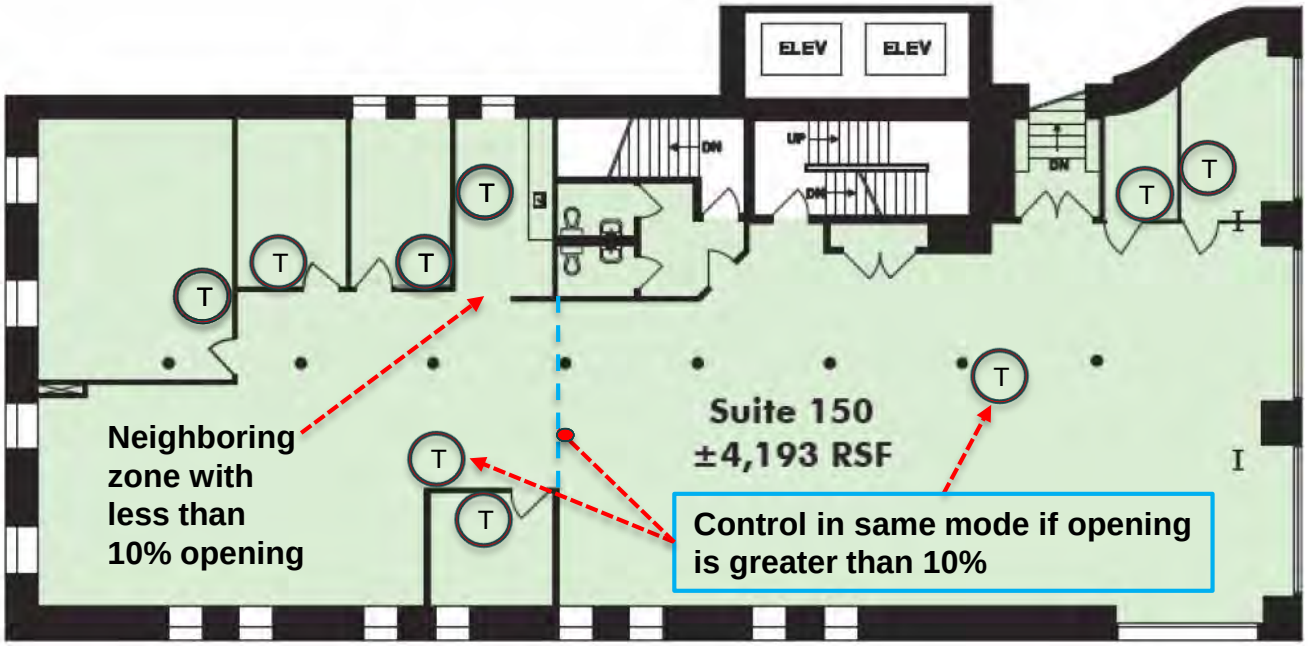
Ventilation

- Purpose of 150% limit
  - Systems can serve a variety of spaces with different ventilation requirements.
  - Zone with the highest ventilation requirement often defines the overall rate, potentially leading to over-ventilation.
  - Promotes outside airflow monitoring and zone level DDC control to properly ventilate all zones served by the system.
- May temporarily exceed ventilation limit during:
  - particulate or VOC dilution
  - economizer operation
  - night flushing
  - dehumidification
  - pressurization
  - exhaust make-up
  - process air delivery
- Exemptions
  - Group R-1, R-2 or I-2
  - Alterations replacing less than 50% of total heating & cooling capacity of system
  - Systems with energy recovery

Thermostatic Controls

- C403.2.4.1 Thermostatic controls
  - New language states that systems serving the same zone or neighboring zones must have controls that keep all systems in the same mode, either heating or cooling.
  - Avoids neighboring zones fighting each other by simultaneously being in heating and cooling mode.
  - Definition of a "neighboring zone" – Zones connected by openings larger than 10% of the floor area of either zone.

- Thermostatic Zone Controls
  - Intent is to control all zones in the same mode unless physically separated from each other by walls or doors.
  - Enclosed spaces have individual controls.
  - Multiple systems serving open areas are all controlled in the same mode of operation (heating or cooling).



Thermostatic Controls

- C403.2.4.1 Thermostatic controls, Exceptions
  - Exception 1 – Independent perimeter systems designed to offset only envelope related loads are permitted as long as the:
    - Perimeter system has at least one control zone for each building exposure.
    - Perimeter system is controlled by a t-stat in the zone it serves.
    - Controls are configured to prevent the perimeter system from operating in a different heating or cooling mode that other systems within the same or neighboring zones.
  - Proposed revised language for Exception 2:

    Where an interior zone is open to a neighboring perimeter zone, cooling in the interior zone is permitted to operate at times when the perimeter zone is in heating if the interior zone temperature is at least 5°F higher than the perimeter zone temperature.

Economizer Exceptions

- The following exceptions are new or revised:
  - NEW – Systems complying with C403.6 DOAS that serve spaces with internal loads for lighting and equipment less than 5 watts/sf.
  - REVISED – VRF system exception no longer limited to buildings 60,000 sf or less.
  - NEW – Equipment used to cool Controlled Plant Growth Environments that have SEER, EER or IEER ratings that are 20% better than WSEC minimum efficiency.
  - NEW – Equipment used to cool spaces with year-round cooling loads greater than 5 watts/sf if measures for energy recovery are provided that use waste heat for space heating or service water heating. Requires prior approval by the Code Official.

Economizer Exceptions

- The following exceptions are new or revised:
  - NEW – Unitary or packaged systems serving a single zone that meets or exceeds the efficiency requirements in Table C403.3.

TABLE C403.3
EQUIPMENT EFFICIENCY PERFORMANCE EXCEPTION FOR ECONOMIZERS

Climate Zone	Efficiency Improvement[a]
4C	64%
5B	59%

Integrated Economizer

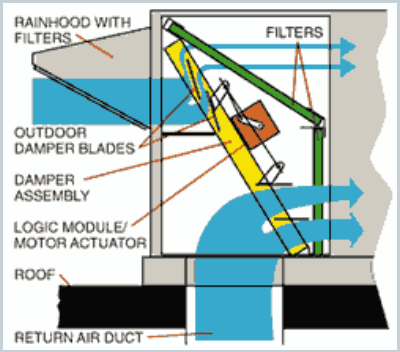
- C403.3.1 Integrated economizer - Multiple stages of cooling
  - Cooling units that control capacity of cooling directly based on space temperature shall have at least 2 stages of cooling.
  - All other cooling units, including those that control space temperature by modulating airflow, shall comply with Table C403.3.1.

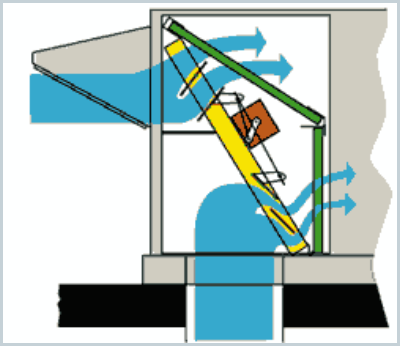
TABLE C403.3.1
DX COOLING STAGE REQUIREMENTS FOR MODULATING AIRFLOW UNITS

Rating Capacity	Minimum Number of Mechanical Cooling Stages	Minimum Compressor Displacement[a]
≥ 65,000 Btu/h and < 240,000 Btu/h	3 stages	≤ 35% of full load
≥ 240,000 Btu/h	4 stages	≤ 25% of full load

Economizer Operation Monitoring

- C403.2.4.7 Economizer fault detection & diagnostics (FDD)
  - An FDD system is required for air-cooled unitary DX equipment with capacity equal to or greater than 54,000 Btu/h.
  - FDD system shall include:
    - Temperature monitoring sensors on outside air, supply & return
    - Refrigerant pressure sensors
    - System status of operational variables
    - Manual initiation of each operating mode so compressors, economizers, fans and heating systems can be tested.
    - Fault reporting application accessible to building operations and service personnel.

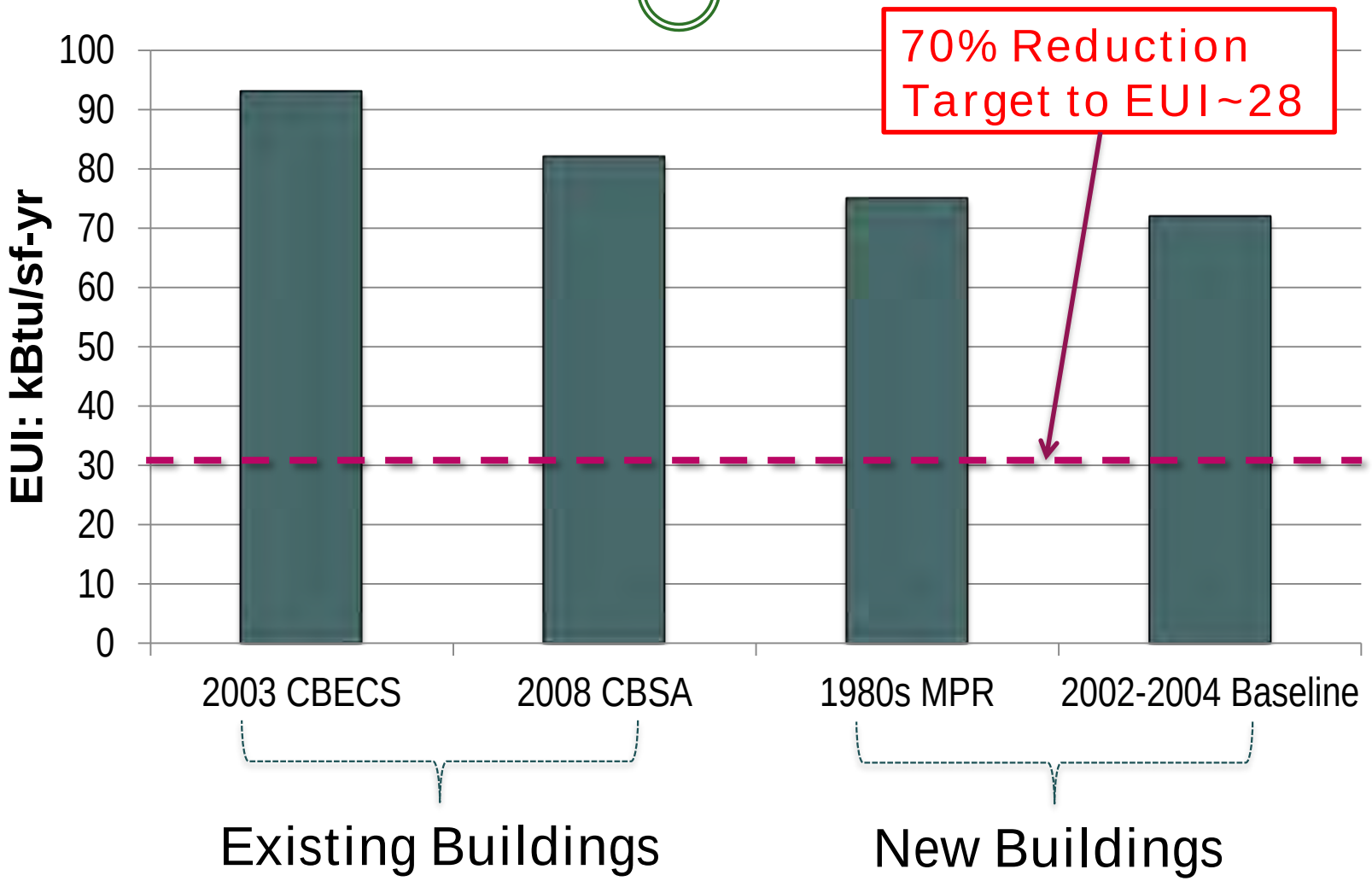




NEW Design Provisions

- Incremental savings approach
  - The WSEC has historically been focused on incremental improvements to equipment efficiency and controls.
- Design approach
  - New prescriptive provisions in the WSEC take a different approach and start to mandate the type of equipment and designs that can be applied in different applications.
  - Includes:
    - Dedicated outdoor air systems
    - High performance VAV systems

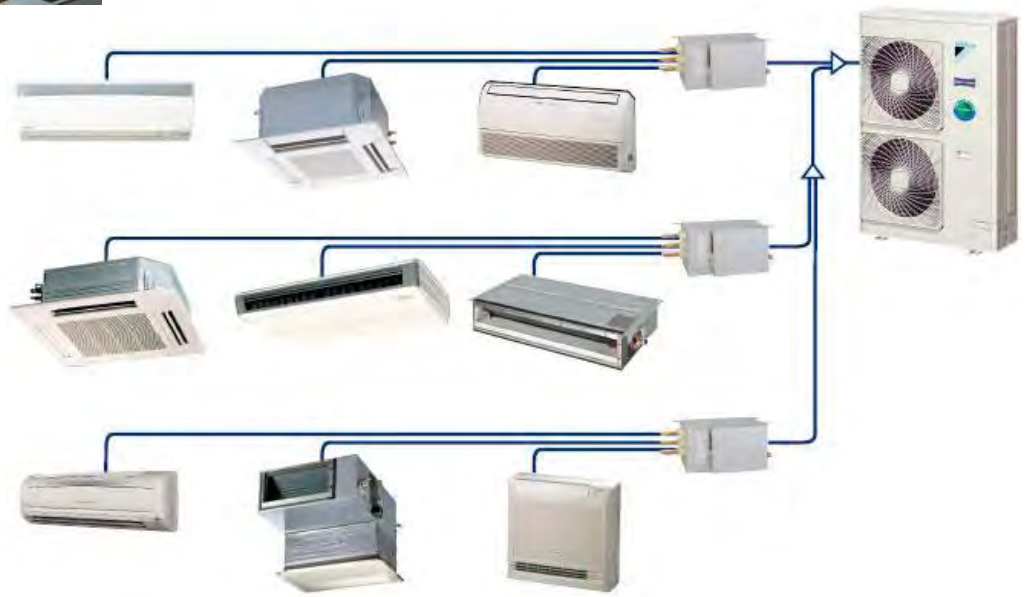
Office Buildings - EUI



NEW Design Provision - DOAS

- C403.6 Dedicated outdoor air systems
  - Decoupled system - A ventilation system which delivers of 100% outside air directly to an occupied space independently from the heating and cooling system.
  - Required for Retail, Office, Education, Libraries, and Fire Stations
  - C403.6.1 Energy recovery ventilation with DOAS
    - Typical occupancy spaces can meet this requirement with an energy recovery ventilator.
    - High occupancy spaces can use demand controlled ventilation.
  - DOAS can be effectively paired with common zonal systems such as ductless heat pumps, VRF and 4-pipe fan coils. Also combines well with radiant or chilled beam systems.
  - Economizer exception available for DOAS systems, simplifying compliance for common zonal systems.

Zonal Systems



NEW Design Provision - DOAS

- C403.6 Exceptions and alternatives
  - C403.7 High efficiency variable air volume (VAV) systems are an approved alternative to DOAS.
  - C403.6.3 Impracticality clause allows Code Official to approve alternate method of compliance that achieves a comparable level of energy efficiency as a DOAS system.
- Delayed adoption
  - The DOAS provision is optional through 6/30/2017.
  - It becomes a prescriptive requirement on 7/1/2017.

NEW Design Provisions - HPVAV

- C403.7 High efficiency variable air volume systems
  - This provision provides a prescriptive alternative to the DOAS requirements under C403.6, Exception 2.
  - There are 16 requirements under this provision for HPVAV.
  - *Why so many variables compared to DOAS?*
    - VAV systems can be complicated to operate efficiently compared to a DOAS system with heating and cooling that cycles based directly on the loads.
    - The requirements in the HPVAV provision increase the likelihood of a higher efficiency VAV design.

Optimizing VAV Systems

- HPVAV systems are used to provide heating, cooling and ventilation.
- To optimize, pay close attention to the following parameters:
  1. Fan Energy
  2. Ventilation Energy
  3. Reheat Energy
  4. Central Plant Efficiency
  5. Fault Detection & Diagnostics

Optimizing VAV Systems

- Optimize Fan Energy
  - Item #9 requires compliance with the Fan Power provision based on brake horsepower. Must be within 90% of the allowable bhp.
  - This requires careful sizing and layout of the distribution system and potentially larger duct systems (lower static).
  - Many VAV systems use fan powered terminals operating at constant airflow. Item #10 requires ECM motors for both Series and Parallel VAV air terminals to modulate when zone ventilation rates allow turndown.
  - Item #7 limits the maximum inlet air duct velocity. Requires proper sizing of inlet air valves for the anticipated zone airflow.

Optimizing VAV Systems

- Optimize Ventilation Energy
  - VAV systems are often set up to over-ventilate the building to meet the ventilation requirement of the zone with the highest ventilation requirement.
  - Items #2, #3 and #4 require DDC controls and outside airflow monitoring to properly ventilate all zones using ASHRAE 62.1 multiple space ventilation equation.
  - Item #13 requires ventilation setpoint reset for high occupancy spaces such as conference rooms.

Optimizing VAV Systems

- Limit Reheat Energy
  - One zone with a high cooling demand can drive the supply air temperature down, requiring reheat for all the other zones.
  - Item #6 requires all interior cooling driven zones to be sized for a higher supply air temperature than the perimeter zones when they are in cooling mode.
  - This supports effective supply air temperature reset capability.

Optimizing VAV Systems

- Provide Economizer Monitoring and Diagnostics
  - Airside economizers dampers often fail. Item #16 requires a fault detection and diagnostics (FDD) system to monitor operation.
  - Common problem with VAV is the inlet valves at terminal unit also fail. This can increase both fan and reheat energy, even without comfort complaints since terminal unit heaters are often oversized.
  - FDD tests system to make sure inlet valves are working properly.
- Central Plant Efficiency
  - Item #15 requires a high efficiency cooling or heating central plant.
  - For heating ~ High efficiency boilers, air-to-water heat pump, or heat recovery chillers are required. Electric VAV is not allowed.
  - For cooling ~ High efficiency chillers are required. DX package units are not allowed.

NEW! Section C406

Additional Efficiency Package Options

- Buildings shall comply with no less than *two* of the following options:
  - Enhanced envelope performance
  - Reduced air infiltration
  - More efficient HVAC performance
  - Dedicated outside air system (DOAS)
  - High efficiency service water heating
  - Reduced lighting power density
  - Enhanced lighting controls
  - On-site renewable energy

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