

(Effective until March 15, 2024)

**WAC 51-11C-40335 Section C403.3.5—Dedicated outdoor air systems.**

**C403.3.5 Dedicated outdoor air systems (DOAS).** For buildings with occupancies as shown in Table C403.3.5, outdoor air shall be provided to each occupied space by a dedicated outdoor air system (DOAS) which delivers 100 percent outdoor air without requiring operation of the heating and cooling system fans for ventilation air delivery.

EXCEPTIONS: 1. Occupied spaces that are not ventilated by a mechanical ventilation system and are only ventilated by a natural ventilation system in accordance with Section 402 of the *International Mechanical Code*.  
2. High efficiency variable air volume (VAV) systems complying with Section C403.6.10 for occupancy classifications other than Groups A-1, A-2 and A-3 as specified in Table C403.3.5, and high efficiency VAV systems complying with Section C403.12 for occupancy classification Groups A-1, A-2 and A-3 as specified in Table C403.3.5. This exception shall not be used as a substitution for a DOAS per Section C406.6.

**Table C403.3.5  
Occupancy Classifications Requiring DOAS**

Occupancy Classification <sup>a</sup>	Inclusions	Exempted
A-1	All occupancies not specifically exempted	Television and radio studios
A-2	Casinos (gaming area)	All other A-2 occupancies
A-3	Lecture halls, community halls, exhibition halls, gymnasiums, courtrooms, libraries, places of religious worship	All other A-3 occupancies
A-4, A-5		All occupancies excluded
B	All occupancies not specifically exempted	Food processing establishments including commercial kitchens, restaurants, cafeterias; laboratories for testing and research; data processing facilities and telephone exchanges; air traffic control towers; animal hospitals, kennels, pounds; ambulatory care facilities
F, H, I, R, S, U		All occupancies excluded
E, M	All occupancies included	

a. Occupancy classification from the *International Building Code* Chapter 3.

**C403.3.5.1 Energy recovery ventilation with DOAS.** The DOAS shall include *energy recovery ventilation*. The energy recovery system shall have a 60 percent minimum sensible recovery effectiveness or have 50 percent enthalpy recovery effectiveness in accordance with Section C403.7.6. For DOAS having a total fan system motor nameplate hp less than 5 hp, total combined fan power shall not exceed 1 W/cfm of outdoor air. For DOAS having a total fan system motor hp greater than or equal to 5 hp, refer to fan power limitations of Section C403.8.1. This fan power restriction applies to each dedicated outdoor air unit in the permitted project, but does not include the fan power associated with the zonal heating/cooling equipment. The airflow rate thresholds for energy recovery requirements in Tables C403.7.6(1) and C403.7.6(2) do not apply.

EXCEPTIONS: 1. Occupied spaces with all of the following characteristics: Complying with Section C403.7.6, served by equipment less than 5000 cfm, with an average occupant load greater than 25 people per 1000 square feet (93 m<sup>2</sup>) of floor area (as established in Table 403.3.1.1 of the *International Mechanical Code*) that include demand control ventilation configured to reduce outdoor air by at least 50 percent below design minimum ventilation rates when the actual occupancy of the space served by the system is less than the design occupancy.  
2. Systems installed for the sole purpose of providing makeup air for systems exhausting toxic, flammable, paint, or corrosive fumes or dust, dryer exhaust, or commercial kitchen hoods used for collecting and removing grease vapors and smoke.

**C403.3.5.2 Heating/cooling system fan controls.** Heating and cooling equipment fans, heating and cooling circulation pumps, and terminal unit fans shall cycle off and terminal unit primary cooling air shall be shut off when there is no call for heating or cooling in the zone.

EXCEPTION: Fans used for heating and cooling using less than 0.12 watts per cfm may operate when space temperatures are within the setpoint deadband (Section C403.4.1.2) to provide destratification and air mixing in the space.

**C403.3.5.3 Decoupled DOAS supply air.** The DOAS supply air shall be delivered directly to the occupied space or downstream of the terminal heating and/or cooling coils.

EXCEPTIONS: 1. Active chilled beam systems.  
 2. Sensible only cooling terminal units with pressure independent variable airflow regulating devices limiting the DOAS supply air to the greater of latent load or minimum ventilation requirements.  
 3. Terminal heating and/or cooling units that comply with the low fan power allowance requirements in the exception of Section C403.3.5.2.

**C403.3.5.4 Impracticality.** Where the code official determines that full compliance with all the requirements of Sections C403.3.5.1 and C403.3.5.2 would be impractical, it is permissible to provide an approved alternate means of compliance that achieves a comparable level of energy efficiency. For the purposes of this section, impractical means that an HVAC system complying with Section C403.3.5 cannot effectively be utilized due to an unusual use or configuration of the building.

[Statutory Authority: RCW 19.27A.025, 19.27A.045 and chapter 19.27 RCW. WSR 20-21-080, § 51-11C-40335, filed 10/19/20, effective 2/1/21. Statutory Authority: RCW 19.27A.020, 19.27A.025, 19.27A.160 and chapter 19.27 RCW. WSR 19-24-040, § 51-11C-40335, filed 11/26/19, effective 7/1/20.]

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EXCEPTIONS: 1. Occupied spaces that are not ventilated by a mechanical ventilation system and are only ventilated by a natural ventilation system in accordance with Section 402 of the *International Mechanical Code*.  
 2. High efficiency variable air volume (VAV) systems complying with Section C403.6.10 for occupancy classifications other than Groups A-1, A-2 and A-3 as specified in Table C403.3.5, and high efficiency VAV systems complying with Section C403.12 for occupancy classification Groups A-1, A-2 and A-3 as specified in Table C403.3.5. This exception shall not be used as a substitution for a DOAS per Section C406.6.

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Occupancy Classification <sup>a</sup>	Inclusions	Exempted
E, M	All occupancies included	

a. Occupancy classification from the *International Building Code* Chapter 3.

**C403.3.5.1 DOAS with energy recovery ventilation.** The DOAS shall include energy recovery. The *energy recovery ventilation* system shall have a 68 percent minimum sensible recovery effectiveness of the energy recovery device as calculated in accordance with Equation 4-9 or provide an enthalpy recovery ratio of not less than 60 percent at design conditions in accordance with Section C403.7.6. The airflow rate thresholds in Section C403.7.6 that define when the energy recovery requirements in that section do not apply, are not applicable to this section. The return/exhaust air stream temperature for heat recovery device selection shall be 70°F (21°C) at 30 percent relative humidity, or as calculated by the registered design professional.

**(Equation 4-9)**

$$\text{Sensible Recovery Effectiveness} = \frac{T_{OA} - T_{SA}}{T_{OA} - T_{RA}}$$

Where:

- T<sub>OA</sub> = Design outdoor air dry bulb temperature entering the energy recovery device.
- T<sub>SA</sub> = Supply air dry bulb temperature leaving the energy recovery device at design temperatures and airflow conditions, as selected for the proposed DOAS unit(s).
- T<sub>RA</sub> = Design return air dry bulb temperature.

- EXCEPTIONS:
1. Systems installed for the sole purpose of providing makeup air for systems exhausting toxic, flammable, paint, or corrosive fumes or dust, dryer exhaust, or commercial kitchen hoods used for collecting and removing grease vapors and smoke.
  2. Heat recovery and energy recovery ventilators (H/ERV) that are rated and *listed* in accordance with HVI 920 can demonstrate compliance with the sensible recovery effectiveness requirement using the adjusted sensible recovery effectiveness (ASRE) rating of the equipment at 32°F test conditions. Applied flow rate for ASRE rating shall be no less than the design flow rate or the closest value interpolated between two listed flow rates.
  3. The energy recovery systems for Group R-2 occupancies are permitted to provide 60 percent minimum sensible heat recovery effectiveness in lieu of 68 percent sensible recovery effectiveness in accordance with Section C403.7.6. The return/exhaust air stream temperature for heat recovery device selection shall be 70°F (21°C) or as determined by an *approved* calculation procedure.

**C403.3.5.2 DOAS fan power.** For a DOAS that does not have at least one fan or fan array with fan electrical input power ≥ 1 kW, the total combined fan power shall not exceed 1 watt per cfm of outdoor air as calculated in accordance with Equation 4-10 using design maximum airflows and external static pressures. For a DOAS with at least one fan or fan array with fan electrical input power ≥ 1 kW, the DOAS shall comply with the fan power limitations of Section C403.8.1. DOAS total combined fan power shall include all supply, exhaust and other fans utilized for the purpose of ventilation. This fan power restriction applies to each DOAS in the permitted project, but does not include the fan power associated with the zonal heating and cooling equipment.

**(Equation 4-10)**

$$\text{DOAS Total Combined Fan Power} \left( \frac{\text{Watts}}{\text{CFM}} \right) = \sum \left( \frac{\text{Fan bhp}}{\eta_m} \right) \times \frac{746}{\text{CFM}_{\text{supply}}}$$

Where:

Fan bhp	=	Brake horsepower for each supply, exhaust and other fan in the system at design maximum airflow rate.
$\eta_m$	=	Fan motor efficiency including all motor, drive and other losses for each fan in the system.
CFM <sub>supply</sub>	=	Design maximum airflow rate of outdoor (supply) air.

**C403.3.5.3 Heating and cooling system fan controls.** Heating and cooling equipment fans, heating and cooling circulation pumps, and terminal unit fans shall cycle off and terminal unit primary cooling air shall be shut off when there is no call for heating or cooling in the zone.

EXCEPTION: Fans used for heating and cooling using less than 0.12 watts per cfm may operate when space temperatures are within the setpoint deadband (Section C403.4.1.2) to provide destratification and air mixing in the space.

**C403.3.5.4 Decoupled DOAS supply air.** The DOAS supply air shall be delivered directly to the occupied space or downstream of the terminal heating and/or cooling coils.

EXCEPTIONS:

1. Active chilled beam systems.
2. Sensible only cooling terminal units with pressure independent variable airflow regulating devices limiting the DOAS supply air to the greater of latent load or minimum ventilation requirements.
3. Terminal heating and/or cooling units that comply with the low fan power allowance requirements in the exception of Section C403.3.5.3.

**C403.3.5.5 Supplemental heating and cooling.** Supply air stream heating in the DOAS system shall comply with Section C403.7.3. Cooling is permitted for dehumidification only. Cooling coil shall be sized to meet peak dehumidification requirement at design outdoor temperatures, and no larger. Cooling coil shall be controlled to maintain supply air relative humidity or zone relative humidity.

EXCEPTION: Heating permitted for defrost control shall be locked out when outside air temperatures are above 35°F (2°C). Supplemental heating for defrost shall modulate to 10 percent of the peak capacity, and shall be sized to prevent frost/damage damage to the unit at design temperatures and provide supply air less than or equal to 55°F (13°C).

**C403.3.5.6 Impracticality.** Where the *code official* determines that full compliance with one or more of the requirements in Sections C403.3.5.1 through C403.3.5.5 is impractical, it is permissible to provide an approved alternate means of compliance that achieves a comparable level of energy efficiency as the requirement(s) deemed impractical. For the purposes of this section, impractical means that an HVAC system complying with all requirements in Section C403.3.5 cannot effectively be utilized due to an unusual use or configuration of the building.

[Statutory Authority: RCW 19.27A.020, 19.27A.025, 19.27A.160 and chapters 19.27A and 19.27 RCW. WSR 22-14-091, 23-12-101, and 23-20-021, § 51-11C-40335, filed 7/1/22, 6/7/23, and 9/25/23, effective 3/15/24. Statutory Authority: RCW 19.27A.025, 19.27A.045 and chapter 19.27 RCW. WSR 20-21-080, § 51-11C-40335, filed 10/19/20, effective 2/1/21. Statutory Authority: RCW 19.27A.020, 19.27A.025, 19.27A.160 and chapter 19.27 RCW. WSR 19-24-040, § 51-11C-40335, filed 11/26/19, effective 7/1/20.]