

COMPARISON OF VERY HIGH EFFICIENCY DOAS WITH WASHINGTON STATE ENERGY CODE DOAS REQUIREMENTS



	VERY HIGH EFFICIENCY DOAS	WASHINGTON STATE ENERGY CODE (2018) FOR DOAS	KEY TAKEAWAY
Definition	An alternative HVAC system for commercial buildings that use a very high efficiency heating/cooling system and a very high efficiency HRV to deliver heating and cooling separately from ventilation air so that the control and energy impacts of each can be managed optimally, resulting in significantly reduced whole-building energy consumption. Includes an integral economizer in the HRV.	An HVAC system that delivers 100% outside air without requiring operation of the heating/cooling system fans for ventilation air delivery. Heating/cooling systems and fans must cycle off when there is no call for heating or cooling in zone. Systems must include ERV complying with minimum efficiency and bypass (economizer) requirements. The ERV must provide a change in the enthalpy of the outdoor air of not less than 50 percent of the difference between the outdoor and return air.	Very high efficiency DOAS has more stringent requirements that lead to deepened energy efficiency as compared to WSEC-minimum installations.
Applications	Existing RTU replacement and new construction.	New construction and major renovations.	Similar applications.
Applicable Building Types	Generally for buildings 50,000 sq. ft. or less.	Limited to office, retail, education, libraries, and fire stations.	Very high efficiency DOAS is somewhat more flexible in its targeted applications.
Heat Recovery at Rated Conditions	Minimum Sensible Recovery Efficiency (SRE) of HRV/ERV: 82% sensible effectiveness at 75% of nominal full airflow.	C403.5 (Heat Recovery) requires minimum energy (enthalpy) recovery effectiveness of 50% or sensible recovery of 60%. C406.7 (High Performance DOAS Option) requires minimum sensible heat recovery effectiveness of 80%.	Very high efficiency DOAS requires higher sensible recovery effectiveness, depending on operation point of HRV/ERV.
Fan Efficacy at Rated Conditions	Minimum fan efficacy: PHI certified, or 1.4 cfm/watt at 0.5" w.g. at 75% of nominal full airflow.	C406.7 (High Performance DOAS Option) requires combined fan power less than 0.5 watt/cfm of outdoor air (2 cfm/watt), with no static pressure requirement. C403.3.5.1 Energy recovery ventilation with DOAS requires systems less than 5hp use no more than 1 watt/cfm. Fan power for systems greater than 5hp are covered by section C403.8.1.	Very high efficiency DOAS fan efficacy requirement is more clearly defined and slightly less stringent than the WSEC High Performance DOAS Option.

HRV Control Capabilities	HRV/ERV Control capabilities: DCV, by zone; control based on time, occupancy, CO ₂ , duct static pressure.	C403.3.5.2 (DOAS) has control requirements requiring cycling off heating and cooling supply air during non-heating hours. There is no requirement for DOAS fan scheduling. C403.7.1 requires DCV in DOAS if occupancy is ≥25 people per 1,000 sq. ft. and system OA is > 3,000 cfm. Systems with energy recovery are exempt. C403.7.2 requires OS control of outside air/primary air damper or fan in classrooms, conference rooms (over 500 sq. ft.), auditoriums and gyms unless they have DCV—no exceptions.	Very high efficiency DOAS requires variable fan control for DCV. The WSEC High Performance DOAS Option does not address this beyond standard code requirements.
Economizing	Must be capable of proportional economizer control through bypass, damper control, or via wheel-speed control when outside-air temperature is suitable to provide free cooling to offset or replace mechanical cooling.	C403.5 requires bypass where economizer is required but exempts DOAS systems from needing to provide economizing. C403.2.2.1 Allows an exception to the 150% outdoor-air rule for economizer or night-flush operation.	Very high efficiency DOAS encourages the use of economizer, as appropriate, whereas WSEC allows complete economizer exception.
Defrost	Variable defrost if required, with no recirculation allowed.	No requirements around defrost or recirculation.	To reduce unnecessary use of defrost and maintain indoor air quality, very high efficiency DOAS is more stringent than WSEC.
Crossflow Leakage	Crossflow leakage: less than 3%.	No requirements for crossflow leakage.	Crossflow leakage limitation is a key difference in very high efficiency DOAS, especially for enthalpy wheels.
Filtration	Minimum MERV 13 filters on outside-air intake and recommended MERV 8 filters on exhaust/return airstreams prior to the heat exchange medium.	No filtration requirement specified.	Very high efficiency DOAS is more stringent than WSEC to ensure premium indoor air quality.
Control Protocols	Option to incorporate BACNet and/or Modbus interface for connecting to DDC or other BMS.	No requirements for interface capability except in larger buildings (> 65 tons cooling). DDC and interface capability required.	To provide a greater level of visibility and control on DOAS performance, very high efficiency DOAS is more stringent than WSEC.

Installation Location	Products intended to be mounted outside must be rated for outdoor installations. Outdoor-mounted units must be PHI-certified or include casing insulation \geq R-8 and gasketed seams and doors.	No requirements around outdoor rating.	Very high efficiency DOAS focuses on outdoor insulation requirements to limit heat loss of units installed on rooftops.
CRITICAL SYSTEM DESIGN GUIDELINES			
Decoupled System Design	Ventilation and heating/cooling system must be controlled separately with independent ducting and zoning. Ventilation air must be delivered directly to the occupied space.	C403.3.5 requires complete separation of ventilation air controls from heating/cooling air controls. No requirements around zoning.	Both require decoupled systems.
Design Operating Conditions	<p>Equipment selection must indicate the following operating conditions are met at design airflows when calculated based on values provided by the manufacturer (or manufacturer-approved representative):</p> <ul style="list-style-type: none"> 2.1 Minimum HRV heat exchange of 75% sensible effectiveness at heating and cooling design temperatures. 2.2 Minimum fan efficacy rating of 1.3 cfm/watt 	The WSEC High Performance DOAS Option does not specify differences between operating condition and rated performance.	Very high efficiency DOAS clearly identifies both rated performance and operational performance requirements, while the WSEC High Performance DOAS Option allows room for interpretation as to how performance is rated.