## (Effective until July 1, 2020)

# WAC 51-11C-407051 Table C407.5.1(1)—Specifications for the standard reference and proposed design.

## Table C407.5.1(1)

## Specifications for the Standard Reference and Proposed Designs

Building Component Characteristics	Standard Reference Design	Proposed Design
Space use classification	Same as proposed	The space use classification shall be chosen in accordance with Table C405.4.2 for all areas of the building covered by this permit. Where the space use classification for a building is not known, the building shall be categorized as an office building.
Roofs	Type: Insulation entirely above deck	As proposed
	Gross area: Same as proposed	As proposed
	U-factor: From Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, above-grade	Type: Mass wall if proposed wall is mass; otherwise steel-framed wall	As proposed
	Gross area: Same as proposed	As proposed
	U-factor: From Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, below-grade	Type: Mass wall	As proposed
	Gross area: Same as proposed	As proposed
	U-Factor: From Table C402.1.4 with insulation layer on interior side of walls	As proposed
Floors, above-grade	Type: Joist/framed floor	As proposed
	Gross area: Same as proposed	As proposed
	U-factor: From Table C402.1.4	As proposed
Floors, slab-on-grade	Type: Unheated	As proposed
	<i>F</i> -factor: From Table C402.1.4	As proposed
Opaque Doors	Type: Swinging	As proposed
	Area: Same as proposed	As proposed
	U-factor: From Table C402.1.4	As proposed
Vertical Fenestration Other than opaque doors	Area	As proposed
	1. The proposed vertical fenestration area; where the proposed vertical fenestration area is less than 30 percent of above-grade wall area.	
	2. 30 percent of above-grade wall area; where the proposed vertical fenestration area is 30 percent or more of the above-grade wall area.	
	<i>U</i> -factor: From Table C402.4 for the same framing material as proposed	As proposed
	SHGC: From Table C402.4 except that for climates with no requirement (NR) SHGC = 0.40 shall be used	As proposed
	External shading and PF: None	As proposed

Building Component Characteristics	Standard Reference Design	Proposed Design
Skylights	Area 1. The proposed skylight area; where the proposed skylight area is less than 3 percent of gross area of roof assembly.	As proposed
	2. 3 percent of gross area of roof assembly; where the proposed skylight area is 3 percent or more of gross area of roof assembly.	
	U-factor: From Table C402.4	As proposed
	SHGC: From Table C402.4 except that for climates with no requirement (NR) SHGC = 0.40 shall be used	As proposed
Air leakage	For infiltration, the air leakage rate as determined below shall be modeled at 100% when the building fan system is off, and at 25% when the building fan system is on, unless otherwise approved by the building official for unusually pressurized buildings. Per PNNL Report 18898, Infiltration Modeling Guidelines for Commercial Building Energy Analysis, the building air leakage rates as determined in accordance with Section C402.5.1.2 at 0.30 in. w.g. (75 Pa) shall be converted for modeling in annual energy analysis programs by being multiplied by 0.112 unless other multipliers are approved by the building official (e.g., a tested air leakage of 0.40 cfm/ft <sup>2</sup> of total building envelope area at 0.30 in. w.g. (75 Pa) would be calculated at 0.045 cfm/ft <sup>2</sup> of building envelope area). The calculated infiltration rate shall be normalized to the input required by the modeling software.	The Proposed Design air-leakage rate shall be the same as the Standard Design.
Lighting, interior	The interior lighting power shall be determined in accordance with Table C405.4.2. As proposed when the occupancy of the space is not known.	As proposed; where the occupancy of the space is not known, the lighting power density shall be based on the space classification as offices in Table C405.4.2(1).
	Automatic lighting controls (e.g., programmable controls or automatic controls for daylight utilization) shall be modeled in <i>the standard reference design</i> as required by Section C405.	
Lighting, exterior	The lighting power shall be determined in accordance with Table C405.5.2(2). Areas and dimensions of tradable and nontradable surfaces shall be the same as proposed.	As proposed
Internal gains	Same as proposed	Receptacle, motor and process loads shall be modeled and estimated based on the space use classification. All end-use load components within and associated with the building shall be modeled to include, but not be limited to, the following: Exhaust fans, parking garage ventilation fans, exterior building lighting, swimming pool heaters and pumps, elevators, escalators, refrigeration equipment and cooking equipment.

Building Component Characteristics	Standard Reference Design	Proposed Design
Schedules	Same as proposed	Operating schedules shall include hourly profiles for daily operation and shall account for variations between weekdays, weekends, holidays and any seasonal operation. Schedules shall model the time- dependent variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads. The schedules shall be typical of the proposed building type as determined by the designer and approved by the jurisdiction.
Outdoor airflow rates	Same as proposed, or no higher than those allowed by Section C403.2.6 (without exception 1), whichever is less.	As proposed, in accordance with Section C403.2.6.
	Demand control ventilation: Shall be modeled as required by Section C403.6 including reduction to the minimum ventilation rate when unoccupied.	As proposed
Heating systems	Fuel type: Same as proposed design	As proposed
	Equipment type <sup>a</sup> : From Tables C407.5.1(2), C407.5.1(3), and C407.5.1(4)	As proposed
	Efficiency: From Tables C403.2.3(2), C403.2.3(3), C403.2.3(4) and C403.2.3(5)	As proposed
	Preheat coils: For HVAC system numbers 1 through 4, a preheat coil shall be modeled controlled to a fixed setpoint 20°F less than the design room heating temperature setpoint.	
	Capacity <sup>b</sup> : Sized proportionally to the capacities in the proposed design based on sizing runs, i.e., the ratio between the capacities used in the annual simulations and the capacities determined by the sizing runs shall be the same for both the proposed design and <i>standard reference design</i> , and shall be established such that no smaller number of unmet heating load hours and no larger heating capacity safety factors are provided than in the proposed design.	As proposed
	Weather conditions used in sizing runs to determine <i>standard reference design</i> equipment capacities may be based either on hourly historical weather files containing typical peak conditions or on design days developed using 99.6% heating design temperatures and 1% dry-bulb and 1% wet-bulb cooling design temperatures.	
Cooling systems	Fuel type: Same as proposed design	As proposed
	Equipment type <sup>c</sup> : From Tables C407.5.1(2), C407.5.1(3), and C407.5.1(4)	As proposed
	Efficiency: From Tables C403.2.3(1), C403.2.3(2) and C403.2.3(3). Chillers shall use Path A efficiency.	As proposed

Building Component Characteristics	Standard Reference Design	Proposed Design
	Capacity <sup>b</sup> : Sized proportionally to the capacities in the proposed design based on sizing runs, i.e., the ratio between the capacities used in the annual simulations and the capacities determined by the sizing runs shall be the same for both the proposed design and <i>standard reference design</i> , and shall be established such that no smaller number of unmet cooling load hours and no larger cooling capacity safety factors are provided than in the proposed design.	As proposed
	Economizer <sup>d</sup> : In accordance with Section C403.3. The high-limit shutoff shall be a dry-bulb switch with a setpoint as determined by Table C403.3.3.	As proposed
Energy recovery	<i>Standard reference design</i> systems shall be modeled where required in Section C403.5.	As proposed
Fan systems	Airflow rate: System design supply airflow rates for the <i>standard reference design</i> shall be based on a supply-air-to-room-air temperature difference of 20°F or the required ventilation air or makeup air, whichever is greater. If return or relief fans are specified in the proposed design, the <i>standard</i> <i>reference design</i> shall also be modeled with fans serving the same functions and sized for the <i>standard</i> <i>reference design</i> system supply fan air quantity less the minimum outdoor air, or 90% of the supply fan air quantity, whichever is larger.	As proposed
	Motor brake horsepower: System fan electrical power for supply, return, exhaust, and relief (excluding power to fan-powered VAV boxes) shall be calculated using the following formulas: For systems 5, 7, 8 and 10 in Table C407.5.1(4), Pfan = CFM <sub>s</sub> × 0.3 For all other systems, including DOAS, Pfan = bhp × 746/Fan Motor Efficiency Where: Pfan = Electric power to fan motor (watts) bhp = Brake horsepower of <i>standard reference</i> <i>design</i> fan motor from Table C403.2.12.1(1) – Option 2 Fan motor = The efficiency from Tables C405.8(1) through C405.8(4) for the efficiency next motor size greater than the bhp using the enclosed motor at 1800 rpm CFM <sub>s</sub> = The <i>standard reference design</i> system maximum design supply fan airflow rate in cfm.	As proposed
On-site renewable energy	No on-site renewable energy shall be modeled in the <i>standard reference design</i> .	As proposed
Shading from adjacent structures/terrain	Same as proposed.	For the <i>standard reference design</i> and the proposed building, shading by permanent structures and terrain shall be taken into account for computing energy consumption whether or not these features are located on the building site. A permanent fixture is one that is likely to remain for the life of the proposed design.
Service water heating	Fuel type: Same as proposed	As proposed

Building Component Characteristics	Standard Reference Design	Proposed Design
	Demand: Same as proposed	Service hot-water energy consumption shall be calculated explicitly based upon the volume of service hot water required and the entering makeup water and the leaving service hot water temperatures. Entering water temperatures shall be estimated based upon the location. Leaving temperatures shall be based upon the end-use requirements. Service water loads and usage shall be the same for both the <i>standard</i> <i>reference design</i> and the proposed design and shall be documented by the calculation procedures recommended by the manufacturer's specifications or generally accepted engineering methods.
	Where no service water hot water system exists or is specified in the proposed design, no service hot water heating shall be modeled.	As proposed
	Drain water heat recovery: Not required.	As proposed Drain water heat recovery modeling shall take into account manufacturer's rated efficiencies per C404.9, quantity of connected drains, the proportional flow rates between the waste stream and the preheated stream. Reductions in service water heating energy use for drain water heat recovery shall be demonstrated by calculations.

<sup>a</sup> Where no heating system exists or has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical in both the standard reference design and proposed design.

<sup>b</sup> The ratio between the capacities used in the annual simulations and the capacities determined by sizing runs shall be the same for both the standard reference design and proposed design.

c Where no cooling system exists or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal zone. The system characteristics shall be identical in both the standard reference design and proposed design.

<sup>d</sup> If an economizer is required in accordance with Section C403.3 and where no economizer exists or is specified in the proposed design, then an air economizer shall be provided in the standard reference design in accordance with Section C403.3.

[Statutory Authority: RCW 19.27A.025, 19.27A.045, 19.27A.160, and 19.27.074. WSR 16-24-070, § 51-11C-407051, filed 12/6/16, effective 5/1/17; WSR 16-13-089, § 51-11C-407051, filed 6/15/16, effective 7/16/16. Statutory Authority: RCW 19.27A.025, 19.27A.160, and 19.27.074. WSR 16-03-072, § 51-11C-407051, filed 1/19/16, effective 7/1/16. Statutory Authority: RCW 19.27A.020, 19.27A.025 and chapters 19.27 and 34.05 RCW. WSR 13-04-056, § 51-11C-407051, filed 2/1/13, effective 7/1/13.]

#### (Effective July 1, 2020)

## WAC 51-11C-407051 Tables for Section C407.5—Carbon emissions factors and building performance factors.

#### Table C407.3(1) Carbon Emissions Factors

Туре	CO2e (lb/unit)	Unit
Electricity	0.70	kWh
Natural Gas	11.7	Therm
Oil	19.2	Gallon
Propane	10.5	Gallon
Other <sup>a</sup>	195.00	mmBtu
On-site renewable energy	0.00	

<sup>a</sup> District energy systems may use alternative emissions factors supported by calculations approved by the *code official*.

#### Table C407.3(2) Building Performance Factors (BPF) to be used for Compliance with Section C407.3

Building Area Type	Building Performance Factor
Multifamily	0.58
Healthcare/hospital	0.54
Hotel/motel	0.64
Office	0.56
Restaurant	0.70
Retail	0.47
School	0.36
Warehouse	0.48
All others	0.54

[Statutory Authority: RCW 19.27A.020, 19.27A.025, 19.27A.160 and chapter 19.27 RCW. WSR 19-24-040, § 51-11C-407051, filed 11/26/19, effec-19.27A.025, tive 7/1/20. Statutory Authority: RCW 19.27A.045, 19.27A.160, and 19.27.074. WSR 16-24-070, § 51-11C-407051, filed 12/6/16, effective 5/1/17; WSR 16-13-089, § 51-11C-407051, filed 6/15/16, effective 7/16/16. Statutory Authority: RCW 19.27A.025, 19.27A.160, and 19.27.074. WSR 16-03-072, § 51-11C-407051, filed 1/19/16, effective 7/1/16. Statutory Authority: RCW 19.27A.02 19.27A.025 and chapters 19.27 and 34.05 RCW. WSR 13-04-056, 19.27A.020, S 51-11C-407051, filed 2/1/13, effective 7/1/13.]