

**SECTION C202
GENERAL DEFINITIONS**

DISTRICT ENERGY EFFICIENCY FACTOR. Ratio of site energy input at the district plant required to produce a unit of heating or cooling at the project site on an annual basis, supported by calculations approved by the code official.

**TABLE C407.2
MANDATORY COMPLIANCE MEASURES FOR TOTAL BUILDING PERFORMANCE
METHOD**

Section ^a	Title	Comments
Envelope		
C401	Thermal envelope certificate	
C402.2.7	Airspaces	
C402.5	Air leakage	
Mechanical		
C403.1.2	Calculation of heating and cooling loads	
C403.1.3	Data centers	
C403.1.4	Use of electric resistance and fossil fuel fired HVAC heating equipment	
C403.2	System design	
C403.3.1	Equipment and system sizing	
C403.3.2	HVAC equipment performance requirements	
C403.3.3	Hot gas bypass limitation	
C403.3.4.4	Boiler turndown	
C403.3.6	Ventilation for Group R occupancy	
C403.4.1	Thermostatic controls	
C403.4.2	Off-hour controls	
C403.4.7	Combustion heating equipment controls	
C403.4.8	Group R-1 hotel/ motel guestrooms	See Section C403.7.4
C403.4.9	Group R-2 and R-3 dwelling units	
C403.4.10	Group R-2 sleeping units	
C403.4.11	Direct digital control systems	
C403.5.5	Economizer fault detection and diagnostics (FDD)	
C403.7	Ventilation and exhaust systems	Except for C403.7.6.2
C403.8	Fan and fan controls	
C403.9.1.1	Variable flow controls	For cooling tower fans \geq 7.5 hp

Section ^a	Title	Comments
C403.9.1.2	Limitation on centrifugal fan cooling towers	For open cooling towers
C403.10	Construction of HVAC elements	
C403.11	Mechanical systems located outside of the building thermal envelope	
C403.14	Commissioning	
Service Water Heating		
C404	Service Water Heating	<u>Except for C404.2.1</u>
Lighting and Electrical		
C405	Electrical power and lighting systems	
Other Requirements		
C407	Total Building Performance	
C408	System commissioning	
C409	Energy metering	
C410	Refrigeration requirements	
C411 ^b	Renewable energy	
C412	Compressed air systems	

a. Reference to a code section includes all the relative subsections except as indicated in the table.

b. Compliance with any of these sections includes compliance with any exception to that section.

C407.3 Performance-based compliance. Compliance with this section requires compliance with ASHRAE Standard 90.1 Appendix G, Performance Rating Method, in accordance with Standard 90.1 Section 4.2.1 with the following modifications.

1. The mandatory requirements of the Washington State Energy Code as required to be met, instead of those of Section G1.2.1a of Standard 90.1.
2. Compliance with Section C407 requires meeting ~~both an emissions and~~ both a regulated site energy target and a total site energy target in accordance with the following:
 - 2.1. Regulated site energy ~~Carbon emission~~ target. The regulated site energy ~~carbon emissions~~ target is focused on regulated load energy efficiency, thus shall be met only via regulated load savings without consideration of the contribution of on-site or off-site renewable energy or unregulated load savings. Adjustments to the PCI, to account for the contribution of renewable energy found in ANSI/ASHRAE/IESNA 90.1 Section 4.2.1.1 shall not be used. References to energy cost in Section 4.2.1.1 and Appendix G shall be replaced by site energy use ~~carbon emissions~~ calculated by multiplying site energy consumption by the ~~carbon emission factor from Table C407.3(1)~~. **Heating or cooling energy provided by a district energy system may utilize coefficient of performance (COP) ratios acceptable to the code official for the respective district energy sources.** The building performance factors in Table 4.2.1.1 of ANSI/ASHRAE/IESNA 90.1 shall be replaced with those in Table C407.3(2).
 - 2.2. Total ~~s~~Site energy target. The total site energy performance target shall be met including the contributions of on-site or off-site renewable energy as described in Section C411.2 as well as the contributions of improvements in unregulated loads as allowed by Section C407.3.4. The annual on-site and off-site renewable energy production (as adjusted by the factors in Table C411.2.1) shall be

subtracted from the proposed building annual site energy use. Compliance with the site energy performance target requires that the proposed building site energy use/baseline building site energy use is less than or equal to the site energy performance target from Table C407.3(3).

**TABLE C407.3(1)
CARBON EMISSIONS FACTORS**

Type	CO2e (lb/unit)	Unit
Electricity	0.44	kWh
Natural Gas	11.7	Therms
Oil	19.2	Gallon
Propane	10.5	Gallon
Other ^a	195.00	mmBtu
On-site renewable energy	0.00	

a. ~~District energy systems may use alternative emission 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	0.55 <u>0.51</u>
Healthcare/hospital	0.71 <u>0.70</u>
Hotel/motel	0.53 <u>0.51</u>
Office	0.45 <u>0.44</u>
Restaurant	0.35 <u>0.33</u>
Retail	0.41 <u>0.41</u>
School	0.36 <u>0.35</u>
Warehouse	0.19 <u>0.18</u>

All Others	0.44 <u>0.43</u>
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C407.3.3 Low-carbon district energy use with Appendix G. Qualifying low-carbon district heating and cooling or heating only systems and low-carbon district energy exchange systems shall meet the requirements of Section C407.3.3.1 or C407.3.3.2, as applicable.

C407.3.3.1 Utilization of low-carbon district heating and cooling or heating only systems. Applicable if heating and cooling or heating only is provided to the proposed building from a low-carbon district heating and cooling or heating only system that is fully operational prior to the final inspection. Proposed model shall account for all on-site HVAC and service hot water related equipment, such as circulation pump energy and heat-exchanger efficiency.

1. The following modifications shall be applied to Appendix G of ANSI/ASHRAE/IESNA 90.1 in addition to what is described in Section C407.3:
 - 1.1. For low-carbon district heating and cooling systems, strike the text of Sections G3.1.1.1, G3.1.1.2, G3.1.1.3.1, G3.1.1.3.3, and G3.1.1.3.4. Baseline system shall be selected based on unmodified versions of Tables G3.1.1-3 and G3.1.1-4, comparing energy use to determine compliance with carbon emission factors from Table C407.3(1).
 - 1.2. For low-carbon district heating only systems, strike the text of Sections G3.1.1.1, G3.1.1.3.1, and G3.1.1.3.4. Baseline system shall be selected based on unmodified versions of Tables G3.1.1-3 and G3.1.1-4.
2. Any heating or cooling energy provided by the low-carbon district heating and cooling or heating only system shall utilize a calculated energy use reduction factor acceptable to the code official to footnote a of Table C407.3(1) for the district system carbon emission factor in the proposed model to account for a carbon emissions reduction ~~carbon emissions~~ from those end uses.
3. Energy ~~Carbon emission~~ "credit" for any waste/recoverable heat exported to the low-carbon district heating and cooling or heating only systems shall be accounted for in the proposed design by multiplying the quantity of heat exported by the Carbon Emissions Factor established in footnote a of Table C407.3(1) ~~multiplied by the appropriate seasonal utilization factor in Items 3.1 and 3.2 below~~. This energy ~~carbon emissions~~ "credit" is subtracted from the total proposed design energy use ~~carbon emissions~~ calculated in accordance with ASHRAE 90.1 Section 4.2.1.1.
 - 3.1. Fifty percent of the waste heat exported to the low-carbon district heating and cooling or heating only systems during the months of October through December and January through March.
 - 3.2. Twenty-five percent of the waste heat exported to the low-carbon district heating and cooling or heating only systems during the months of April through September.

Exception: Waste heat exported from the building to the low-carbon district heating and cooling or heating only system shall not be subtracted from the proposed design energy use ~~carbon emissions~~ if they are already accounted for in the calculation of energy use ~~emissions~~ from the district heating or cooling plant as part of the district energy efficiency factor.

Documentation for the low-carbon district system that is operational prior to the final inspection shall be provided to demonstrate the following:

1. Distribution losses must be accounted for and may not exceed 10 percent of the annual load delivered to buildings served by the system.
2. Twenty-five percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat or renewable energy resources and no more than 25 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources, or not more than 10 percent of the system annual heat input to the system comes from fossil fuel or electric-resistance sources.

C407.3.3.2 Utilization of low-carbon district energy exchange systems. Applicable if heating or cooling is provided to the proposed building from a low-carbon district energy exchange system that is fully operational prior to the final inspection. Proposed model shall account for all on-site HVAC and service hot water related equipment, such as circulation pump energy and heat-exchanger efficiency.

1. The following modifications shall be applied to Appendix G of ANSI/ASHRAE/IESNA 90.1 in addition to what is described in Section C407.3:
 - 1.1. Strike the text of Sections G3.1.1.1, G3.1.1.2, G3.1.1.3, G3.1.1.3.1, G3.1.1.3.2, G3.1.1.3.3, and G3.1.1.3.4. Baseline system shall be selected based on unmodified versions of Tables G3.1.1-3 and G3.1.1-4., ~~with carbon emission factors from Table C407.3(1).~~
2. Any heating or cooling energy provided by a low-carbon district energy exchange system shall utilize a calculated energy use reduction factor acceptable to the code official to account for the footnote a of Table C407.3(1) for the district system carbon emission reduction factor in the proposed model.
3. ~~Energy use Carbon emission~~ "credit" for any waste/recoverable heating exported to the low-carbon district energy exchange system shall be accounted for in the proposed design by multiplying the quantity of heat exported ~~by the Carbon Emissions Factor established in footnote a of Table C407.3(1) multiplied~~ by the appropriate seasonal utilization factor in Items 3.1 and 3.2 below. This carbon emissions "credit" is subtracted from the total proposed design carbon emissions calculated in accordance with ASHRAE 90.1 Section 4.2.1.1.
 - 3.1. Fifty percent of the waste heat exported to the low-carbon district energy exchange system during the months of October through December and January through March.
 - 3.2. Twenty-five percent of the waste heat exported to the low-carbon district energy exchange system during the months of April through September.

Exception: Waste heat exported from the building to the low-carbon district heating and cooling or heating only system shall not be subtracted from the proposed design ~~energy use carbon emissions~~ if they are already accounted for in the calculation of ~~energy use emissions~~ from the district heating or cooling plant as part of the district energy efficiency factor.

Documentation for the low-carbon district system that is operational prior to the final inspection shall be provided to demonstrate that the definition of low-carbon district energy exchange system is satisfied.

C503.4 Building mechanical systems. Components of existing mechanical systems that are altered or replaced shall comply with Section C403 or Section C407, unless specifically exempted in this section, and Sections C408.2, C409.5, C501.2.2, C501.6, and C503.4.2 through C503.4.5. Additions or alterations shall not be made to an existing mechanical system that will cause the existing system to become out of compliance.

C503.5 Service water heating equipment. All new service water heating systems, equipment, and components of existing systems that are altered or replaced shall comply with Section C407 or Section C404, C408.3, C409.5, and C501.6. Additions or alterations shall not be made to an existing service water heating system that will cause the existing system to become out of compliance.

Exception: The following equipment is not required to comply with Section C404.2.1:

1. Replacement of a single electric resistance or fuel-fired service water heating appliance with a unit that is the same type and has the same or higher efficiency and the same or lower capacity, provided there are no other alterations made to the existing service water heating system size or configuration.
2. Replacement of any of the following water heater appliances:
 - 2.1. Electric water heaters with an input of 12 kW or less.
 - 2.2. Gas storage water heaters with an input of 75,000 Btu/h or less.
 - 2.3. Gas instantaneous water heaters with an input of 200,000 Btu/h or less and 2 gallons or less of storage.
3. Where it has been determined by the code official that existing building constraints including, but not limited to, available floor space or ceiling height, limitations of the existing structure, or electrical service capacity, make compliance technically infeasible.

D201 Compliance. Compliance based on HVAC total system performance ratio requires that the provisions of Section C403.3 are met and the HVAC total system performance ratio of the proposed design is more than or equal to the HVAC total system performance ratio of the standard reference design. The HVAC TSPR is calculated according to the following formula:

$$\text{HVAC TSPR} = \frac{\text{annual heating and cooling load}}{\text{annual carbon emissions from energy consumption of the building HVAC systems}}$$

Where:

Annual carbon emissions from energy consumption of the building HVAC systems = sum of the annual carbon emissions in pounds for heating, cooling, fans, energy recovery, pumps, and heat rejection calculated by multiplying site energy consumption by the carbon emission factors from ~~Table C407.1~~[Table D201](#)

Annual heating and cooling load = sum of the annual heating and cooling loads met by the building HVAC system in thousands of Btus.

**APPENDIX D
CALCULATION OF HVAC TOTAL SYSTEM PERFORMANCE RATIO**

**TABLE ~~D201C407.3(1)~~ (Reprint from Chapter 4)
CARBON EMISSIONS FACTORS**

Type	CO₂e (lb/unit)	Unit
Electricity	0.44	kWh
Natural Gas	11.7	Therms
Oil	19.2	Gallon
Propane	10.5	Gallon
Other ^a	195.00	mmBtu
On-site renewable energy	0.00	

- a. District energy systems may use alternative emission factors supported by calculations approved by the code official.