

Chapter 51-11C WAC
STATE BUILDING CODE ADOPTION AND AMENDMENT OF THE 2021 EDITION OF
THE INTERNATIONAL ENERGY CONSERVATION CODE, COMMERCIAL

Added definition in Chapter 2:

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.

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WAC 51-11C-40100 Section C401—General.

C401.1 Scope. The provisions in this chapter are applicable to commercial buildings and their building sites.

C401.2 Application. Commercial buildings shall comply with the Fossil Fuel Compliance Path according to Section C401.3, or with one of the following:

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1. Prescriptive compliance. The prescriptive compliance option requires compliance with Sections C402 through C406, and Sections C408, C409, C410, C411, and C412.
2. Total building performance. The total building performance option requires compliance with Section C407.
3. When adopted by the local jurisdiction, the requirements of Appendix F, Outcome-Based Energy Budget, Sections C408, C409, C410, C411, C412 and any specific sections in Table C407.2 as determined by the local jurisdiction. The Proposed Total UA of the proposed building shall be no more than 20 percent higher than the Allowed Total UA as defined in Section C402.1.5.

C401.2.1 Application to existing buildings. Additions, alterations, repairs, and changes of space conditioning, occupancy, or use to existing buildings shall comply with Chapter 5.

C401.2.2 Application to process equipment. Energy using equipment used by a manufacturing, industrial, or commercial process other than for conditioning spaces or maintaining comfort and amenities for the occupants shall comply with Section C403.3.2, Tables C403.3.2(1) through (16) inclusive, Sections C403.3.4.1 through C403.3.4.3, C403.7.7, C403.9.2.1, C403.10.3, C403.11.2, C403.11.3, C404.2, Table C404.2, and Sections C405.8, C410, and C412.

C401.3 Fossil Fuel Compliance Path. Buildings complying with the Fossil Fuel Compliance Path shall comply with the prescriptive compliance path of this code as defined in Item 1 of Section C401.2, and as modified by this Section C401.3.

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Note that this and Kocher's 037 are mutually exclusive proposals. The MVE Committee voted to express for Duane Jonlin's version, but not unanimously.

C401.3.1 Modification of code requirements. For use of this compliance path only, the following changes shall be made to this code:

1. **Section C403.1.4 – space heating.** Strike the phrase “...or fossil fuel combustion...” from the first sentence of Section C403.1.4.
2. **Section C404.2.1 – service water heating.** Revise the first sentence of Section C404.2.1 to read: “Service hot water shall be provided by fossil fuel appliances or an electric air-source heat pump water heating (HPWH) system meeting the requirements of this section or any combination of the two.”

3. **Section C406.2.5 – renewable energy.** When determining renewable energy credits in Equation 4-17 of Section C406.2.5, strike the phrase “...limited to 50 percent of the required credits in Section C406.1” in the definition of the factor AEC_{RRa} .
4. **Table C406.2 – Efficiency Measure Credits.** Use Table C406.2(FF) credit values in place of Table C406.2 credit values.

C401.3.2 Fossil fuel equipment. Fossil fuel combustion appliances are permitted for HVAC heating, and shall comply with the applicable efficiency standards referenced in Section C403.3.3.2. Fossil fuel combustion appliances are permitted for service water heating, and shall comply with applicable efficiency standards referenced in Table C404.2.

C401.3.3 Additional efficiency credits. The number of additional efficiency credits required by Table C406.1 shall be increased by the number required in Table C401.3.3, modified as permitted in this section, and is in addition to the energy efficiency credits and load management credits required by Section C406.

Exception: The required number of space heating additional efficiency credits are permitted to be reduced in the following instances:

1. Low energy spaces in accordance with Section C402.1.1.1 and equipment buildings in accordance with Section C402.1.2 that are served by space heating systems shall ~~unconditioned spaces, open parking garages, and enclosed parking garages that~~ comply with sufficient measures from Table C406.2 to achieve a minimum of 50 percent of the efficiency credits required for new construction by Table C401.3.3, modified as permitted in this section.
2. Building additions that have less than 1,000 square feet of conditioned floor area and that comply with sufficient measures from Table C406.2 to achieve a minimum of 50 percent of the additional efficiency credits required for additions by Table C401.3.3, modified as permitted in this section.
3. Semi-heated spaces in accordance with Section C402.1.1.2 that comply with sufficient measures from Table C406.2 to achieve a minimum of 50 percent of the space heating additional efficiency credits required by Table C401.3.3, modified as permitted in this section.
4. Unconditioned spaces, open parking garages and unheated enclosed parking garages are not required to achieve the additional efficiency credits for space heating required by Table C401.3.3.

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**TABLE C401.3.3
ADDITIONAL CREDITS REQUIRED**

<u>Measure Title</u>	<u>Applicable Section</u>	<u>Occupancy Group</u>					
		<u>Group R-1</u>	<u>Group R-2</u>	<u>Group B</u>	<u>Group E</u>	<u>Group M</u>	<u>All other</u>
<u>HVAC heatingNew building—Additional efficiency credits required for space heating systems using the fossil fuel pathway</u>	<u>C401.3.3.1</u>	<u>7</u>	<u>24</u>	<u>101</u>	<u>38</u>	<u>111</u>	<u>56</u>
<u>Service water heatingNew building—Additional efficiency credits required for service water heating systems using the fossil fuel pathway</u>	<u>C401.3.3.2</u>	<u>198</u>	<u>212</u>	<u>27</u>	<u>17</u>	<u>79</u>	<u>107</u>
<u>Building additions—Additional efficiency credits required for space heating systems using the fossil fuel pathway</u>	<u>C401.3.3.1</u>	<u>4</u>	<u>12</u>	<u>51</u>	<u>19</u>	<u>56</u>	<u>28</u>
<u>Building additions—Additional efficiency credits required for service water heating systems using the fossil fuel pathway</u>	<u>C402.3.3.2</u>	<u>99</u>	<u>106</u>	<u>14</u>	<u>9</u>	<u>40</u>	<u>54</u>
<u>Total credits</u>		<u>205</u>	<u>236</u>	<u>177</u>	<u>55</u>	<u>190</u>	<u>163</u>

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C401.3.3.1 HVAC credit modification. The number of HVAC heating energy efficiency credits required by Table C401.3.3 is permitted to be decreased according to the following equation:

$$CR = A - (A \times B/C)$$

Where:

CR = additional credits required, rounded to the nearest whole number

A = baseline HVAC heating credits from Table C401.3.3

B = installed HVAC heating capacity in kBtu/h of HVAC heating appliances that comply with any of the exceptions to Section C403.1.4

C = total installed heating capacity in kBtu/h of all HVAC heating appliances

C401.3.3.2 Service water heating credit modification. The number of service water heating energy efficiency credits required by Table C401.3.3 is permitted to be decreased according to the following equation:

$$CR = A - (A \times B/C)$$

Where:

CR = additional credits required, rounded to the nearest whole number

A = baseline credits from Table C401.3.3

B = installed service water heating capacity in kBTU/h of service water heating appliances that comply with any of the exceptions to Section C404.2.1

C = total installed service water heating capacity in kBTU/h of all service water heating appliances

C401.3.4 Renewable energy credit limit. No more than 80 percent of the efficiency credits required by Sections C401.3.2.1 and C401.3.3.1 are permitted to be Renewable Energy credits defined in Section C406.2.5.

C401.3.5 Discrete area-weighting of additional required credits. In addition to the area-weighted credit requirements in C406.1.2, where a building includes multiple occupancies, the additional required credits per Table C401.3.3 shall be determined separately for each occupancy group. Additional required credits shall be pro-rated on an area-weighted basis for each occupancy group in the same manner as required project credits per Section C406.1.

1. Where a single space heating or service water heating system serves multiple occupancies, the number of additional required credits shall be pro-rated on an area-weighted basis for each occupancy served.
2. Additional required credits for envelope systems shall be pro-rated on an area-weighted basis for all occupancies.
3. Occupancies are permitted to be subdivided into discrete areas, with required and achieved credits for each area pro-rated on an area-weighted basis as required for the occupancy group.

C401.3.6 Electrification readiness. Additionally, the following provisions shall be required for new construction:

1. Provide a spare electrical branch circuit conduit to that appliance sized to support an equivalent heat pump appliance.
2. Provide spare electrical service entrance conduits for the purpose of upgrading the main electrical service to support all heat pump appliances throughout the building.
3. The main electrical room has sufficient space to accommodate increasing the main electrical service's size to support all heat pump appliances throughout the building.
4. Additional accommodations for the utility equipment comprised of transformer(s) and other equipment necessary to support an electrical service upgrade. These accommodations shall include adequate space on the site. If the utility equipment is located in a transformer vault, that vault must include not only the space but the additional cooling for larger transformer(s).

C401.4 Thermal envelope certificate. A permanent thermal envelope certificate shall be completed by an approved party. Such certificate shall be posted on a wall in the space where the space conditioning equipment is located, a utility room or other approved location. If located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit

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directory label, service disconnect label, or other required labels. A copy of the certificate shall also be included in the construction files for the project. The certificate shall include:

1. *R*-values of insulation installed in or on ceilings, roofs, walls, foundations and slabs, crawlspace walls and floors, and ducts outside *conditioned spaces*.
2. *U*-factors and *solar heat gain coefficients* (SHGC) of fenestration.
3. Results from any building envelope air leakage testing performed on the building.

Where there is more than one value for any component of the building envelope, the certificate shall indicate the area-weighted average value where available. If the area-weighted average is not available, the certificate shall list each value that applies to 10 percent or more of the total component area.

WAC 51-11C-40314 Section C403.1.4—HVAC heating equipment.

C403.1.4 Use of electric resistance and fossil fuel-fired HVAC heating equipment.

Commercial buildings shall comply with one of the following:

1. **Fossil Fuel Space Heating Pathway:** HVAC heating provided by a fossil fuel combustion appliance shall comply with Section C406.1.3. Fossil fuel combustion appliances are permitted for HVAC heating, and shall comply with the applicable efficiency standards referenced in Section C403.3.3.2. Additionally, the following provisions shall be required for new construction:

- 1.1. Provide a spare electrical branch circuit conduit to that appliance sized to support an equivalent heat pump appliance.
- 1.2. Provide spare electrical service entrance conduits for the purpose of upgrading the main electrical service to support all heat pump appliances throughout the building.
- 1.3. The main electrical room has sufficient space to accommodate increasing the main electrical service's size to support all heat pump appliances throughout the building.
- 1.4. Additional accommodations for the utility equipment comprised of transformer(s) and other equipment necessary to support an electrical service upgrade. These accommodations shall include adequate space on the site. Where the utility equipment is located in a transformer vault, that vault must include not only the space but the additional cooling for larger transformer(s).

4-2. **Heat Pump Space Heating Pathway:** HVAC heating energy shall not be provided by electric resistance or fossil fuel combustion appliances. For the purposes of this section, electric resistance HVAC heating appliances include, but are not limited to, electric baseboard, electric resistance fan coil and VAV electric resistance terminal reheat units and electric resistance boilers. For the purposes of this section, fossil fuel combustion HVAC heating appliances include, but are not limited to, appliances burning natural gas, heating oil, propane, or other fossil fuels.

Exceptions:

1. **Low heating capacity.** Buildings or areas of buildings, other than *dwelling units* or sleeping units, that meet the interior temperature requirements of Chapter 12 of the *International Building Code* with a total installed HVAC heating capacity no greater than 8.5 Btu/h (2.5 watts) per square foot of *conditioned space* are permitted to be heated using electric resistance appliances.

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Please note that this and Jonlin's 037 are mutually exclusive and not compatible

2. **Dwelling and sleeping units.** Dwelling or sleeping units are permitted to be heated using electric resistance appliances as long as the installed HVAC heating capacity in any separate space is not greater than:
 - 2.1. Seven hundred fifty (750) watts in Climate Zone 4, and 1000 watts in Climate Zone 5 in each habitable space with fenestration.
 - 2.2. One thousand watts (1000) in Climate Zone 4, and 1300 watts in Climate Zone 5 for each habitable space that has two primary walls facing different cardinal directions, each with exterior fenestration. Bay windows and other minor offsets are not considered primary walls.
 - 2.3. Two hundred fifty (250) watts in spaces adjoining the *building thermal envelope* but without fenestration.
 - 2.4. For the purposes of this section, habitable space is as defined in the International Building Code. For buildings in locations with exterior design conditions below 4°F (-16°C), an additional 250 watts above that allowed for Climate Zone 5 is permitted in each space with fenestration.
3. **Small buildings.** Buildings with less than 2,500 square feet (232 m²) of *conditioned floor area* are permitted to be heated using electric resistance appliances.
4. **Defrost.** Heat pumps are permitted to utilize electric resistance heating when a heat pump defrost cycle is required and is in operation.
5. **Air-to-air heat pumps.** Buildings are permitted to utilize ~~internal electric resistance heaters to supplement~~ al heat pump heating heating sources for air-to-air heat pumps that meet all of the following conditions:
 - 5.1. Internal electric resistance heaters have controls that prevent supplemental heater operation when the heating load can be met by the heat pump alone during both steady-state operation and setback recovery.
 - 5.2. The heat pump controls are configured to use the compressor as the first stage of heating down to an outdoor air temperature of 17°F (-8°C) or lower except when in defrost.
 - 5.3. The heat pump complies with one of the following:
 - 5.3.1. Controlled by a digital or electronic thermostat designed for heat pump use that energizes the supplemental heat only when the heat pump has insufficient capacity to maintain set point or to warm up the space at a sufficient rate.
 - 5.3.2. Controlled by a multistage space thermostat and an outdoor air thermostat wired to energize supplemental heat only on the last stage of the space thermostat and when outdoor air temperature is less than 32°F (0°C) except when in defrost.
 - 5.3.3. The minimum efficiency of the heat pump is regulated by NAECA, its rating meets the requirements shown in Table C403.3.2(2), and its rating includes all usage of internal electric resistance heating.
 - 5.4. The heat pump rated heating capacity is sized to meet the heating load at an outdoor air temperature of 32°F (0°C) or lower and has a rated heating capacity at 47°F (8°C) no less than 2 times greater than supplemental ~~internal electric resistance~~ heating capacity in Climate Zone 4 and no less than the supplemental ~~internal electric resistance~~ heating capacity in Climate Zone 5, or utilizes the smallest available factory-available internal electric resistance heater.

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6. **Air-to-water heat pumps.** Buildings are permitted to utilize electric resistance (for Climate Zone 4 or 5) or fossil fuel-fired (for Climate Zone 5) auxiliary heating to supplement heat pump heating for hydronic heating systems that meet all of the following conditions:

- 6.1. Controls for the ~~internal auxiliary electric resistance or fossil fuel-fired heating~~ ~~auxiliary heating sources~~ are configured to lock out the supplemental heat when the outside air temperature is above 36°F (2°C), unless the hot water supply temperature setpoint to the building heat coils cannot be maintained for 20 minutes.
- 6.2. The heat pump controls are configured to use the compressor as the first stage of heating down to the lowest exterior design temperature for which the equipment is rated except during startup or defrost operation.
- 6.3. The heat pump rated heating capacity at 47°F (8°C) is no less than 75 percent of the design heating load at 29°F (-2°C).

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7. **Ground source heat pumps.** Buildings are permitted to utilize ~~electric resistance auxiliary heating to supplemental heating sources for~~ heat pump heating for hydronic heating systems with ground source heat pump equipment that meets all of the following conditions:

- 7.1. Controls for the ~~internal auxiliary resistance heating~~ ~~heating sources~~ are configured to lock out the supplemental heat when the equipment source-side entering water temperature is above 42°F (6°C), unless the hot water supply temperature setpoint to the building heat coils cannot be maintained for 20 minutes.
- 7.2. The heat pump controls are configured to use the compressor as the first stage of heating.
- 7.3. The ground source heat exchanger shall be sized so that the heat pump annual heating output is no less than 70 percent of the total annual heating output in the final year of a 30-year simulation using IGSHPA listed simulation software.

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- 8. **Small systems.** Buildings in which electric resistance or fossil fuel appliances, including decorative appliances, either provide less than 5 percent of the total building HVAC system heating capacity or serve less than 5 percent of the *conditioned floor area*.
- 9. **Specific conditions.** Portions of buildings that require fossil fuel or electric resistance space heating for specific conditions *approved* by the *code official* for research, health care, process or other specific needs that cannot practicably be served by heat pump or other space heating systems. This does not constitute a blanket exception for any occupancy type.
- 10. **Kitchen make-up air.** Make-up air for commercial kitchen exhaust systems required to be tempered by Section 508.1.1 of the *International Mechanical Code* is permitted to be heated by using fossil fuel in Climate Zone 5 or electric resistance in Climate Zone 4 or 5.
- 11. **District energy.** Steam or hot water district energy systems that utilize fossil fuels as their primary source of heat energy, that serve multiple buildings, and that were already in existence prior to the effective date of this code, including more energy-efficient upgrades to such existing systems, are permitted to serve as the primary heating energy source.
- 12. **Heat tape.** Heat tape is permitted where it protects water-filled equipment and piping located outside of the *building thermal envelope*, provided that it is configured and controlled to be automatically turned off when the outside air temperature is above 40°F (4°C).
- 13. **Temporary systems.** Temporary electric resistance heating systems are permitted where serving future tenant spaces that are unfinished and unoccupied, provided that the heating equipment is sized and controlled to achieve interior space temperatures no higher than 40°F (4°C).

14. **Pasteurization.** Electric resistance heat controls are permitted to reset the supply water temperature of hydronic heating systems that serve service water heating heat exchangers during pasteurization cycles of the service hot water storage volume. The hydronic heating system supply water temperature shall be configured to be 145°F (63°C) or lower during the pasteurization cycle.
15. **Freeze protection.** Heating systems sized for spaces with indoor design conditions of 45°F (7°C) and intended for freeze protection are permitted to use electric resistance. The building envelope of any such space shall be insulated in compliance with Section C402.1.
16. **DOAS ERV auxiliary heat.** Dedicated outdoor air systems with energy recovery ventilation are permitted to utilize fossil fuel for Climate Zone 5 or electric resistance in Climate Zone 4 or 5 for auxiliary heating to preheat outdoor air for defrost or as auxiliary supplemental heat to temper supply air to 55°F (13°C) or lower for buildings or portions of buildings that do not have hydronic heating systems.
17. **Low-carbon district energy systems.** Low-carbon district energy systems that meet the definitions of *low-carbon district energy exchange system* or *low-carbon district heating and cooling or heating only systems*.
18. **Essential facilities.** Groups I-2 and I-3 occupancies that by regulation are required to have in place redundant emergency backup systems.

WAC 51-11C-40402 Section C404.2—Service water-heating equipment performance efficiency.

C404.2 Service water-heating equipment performance efficiency. Water-heating equipment and hot water storage tanks shall meet the requirements of Table C404.2. The efficiency shall be verified through certification and *listed* under an *approved* certification program, or if no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Water-heating equipment intended to be used to provide space heating shall meet the applicable provisions of Table C404.2. Commercial buildings shall comply with one of the following:

1. Fossil Fuel Water Heater Pathway: Service water heating provided by a fossil fuel combustion appliance shall comply with Section 406.1.3. Additionally, the following provisions shall be required for new construction:
 - 1.1. Provide a spare electrical branch circuit conduit to that appliance sized to support an equivalent heat pump appliance.
 - 1.2. Provide spare electrical service entrance conduits for the purpose of upgrading the main electrical service to support all heat pump appliances throughout the building.
 - 1.3. The main electrical room has sufficient space to accommodate increasing the main electrical service's size to support all heat pump appliances throughout the building.
 - 1.4. Additional accommodations for the utility equipment comprised of transformer(s) and other equipment necessary to support an electrical service upgrade. These accommodations shall include adequate space on the site. Where the utility equipment is located in a transformer vault, that vault must include not only the space but the additional cooling for larger transformer(s).

4.2. Heat Pump Water Heater Pathway: Comply with section C404.2.1.

C404.2.1 Service water heating system type. Service hot water shall be provided by an electric air-source heat pump water heating (HPWH) system meeting the requirements of this

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Please note that this and Jonlin's 037 are mutually exclusive and not compatible

section. Supplemental service water heating equipment is permitted to use electric resistance or fossil fuel in compliance with Section C404.2.1.4.

Exceptions:

1. 24 kW plus 0.1 watts per square foot of building area of electric resistance service water heating capacity is allowed per building.
2. Solar thermal, wastewater heat recovery, other *approved* waste heat recovery, ground source heat pumps, water-source heat pump systems utilizing waste heat, and combinations thereof, are permitted to offset all or any portion of the required HPWH capacity where such systems comply with this code and the *Uniform Plumbing Code*.
3. Systems that comply with the Northwest Energy Efficiency Alliance (NEEA) Commercial Electric Advanced Water Heating Specification.
4. Service hot water systems served by a district energy system that serves multiple buildings and that was in service before the effective date of this code.
5. Commercial dishwashers, commercial food service equipment, and other *approved* process equipment are permitted to utilize electric booster heaters for supply water temperatures 120°F (49°C) or higher.
6. Systems connected to a *low-carbon district energy exchange system* or a *low-carbon district heating and cooling or heating only system*.
7. Essential facilities. Groups I-2 and I-3 occupancies that by regulation are required to have in place redundant emergency backup systems.

C404.2.1.1 Primary heat pump system sizing. The system shall include a primary service output of 50 percent load at 40°F (4°C) dry bulb or wet bulb outdoor air temperature for air-source heat pumps, or 44°F (7°C) ground temperature for ground-source heat pumps that provides sufficient hot water as calculated using the equipment manufacturer's selection criteria or another *approved* methodology. Electric air source heat pumps shall be sized to deliver no less than 25 percent of the calculated demand for hot water production during the peak demand period when entering dry bulb or wet bulb outdoor air temperature of 24°F (-4°C). The remaining primary service output may be met by fossil fuel, electric resistance, or heat pump water heating systems.

Exception: Twenty-five percent sizing at entering dry bulb or wet bulb air temperature of 24°F (-4°C) is not required for air-source heat pumps located in a below-grade enclosed parking structure or other ventilated and unconditioned space that is not anticipated to fall below 40°F (4°C) at any time.

C404.2.1.2 Primary hot water storage sizing. The system shall provide sufficient hot water to satisfy peak demand period requirements.

C404.2.1.3 System design. The service water heating system shall be configured to conform to one of the following provisions:

1. For *single-pass heat pump water heaters*, *temperature maintenance* heating provided for reheating return water from the building's heated water circulation system shall be physically decoupled from the primary service water heating system storage tank(s) in a manner that prevents destratification of the primary system storage tanks. *Temperature maintenance* heating is permitted to be provided by electric resistance, fossil fuel, or a separate dedicated heat pump system.
2. For *multi-pass heat pump water heaters*, *recirculated temperature maintenance* water is permitted to be returned to the primary water storage tanks for reheating.

3. For unitary heat pump water heaters, located in conditioned space, are permitted, where they are sized to meet all calculated service water heating demand using the heat pump compressor, and not supplementary heat.

C404.2.1.3.1 Mixing valve. A thermostatic mixing valve capable of supplying hot water to the building at the user temperature setpoint shall be provided, in compliance with requirements of the *Uniform Plumbing Code* and the HPWH manufacturer's installation guidelines. The mixing valve shall be sized and rated to deliver tempered water in a range from the minimum flow of the *temperature maintenance* recirculation system up to the maximum demand for the fixtures served.

C404.2.1.4 Supplemental water heating. Total supplemental water heating equipment shall not have an output capacity greater than the primary water heating equipment at 40°F (4°C) entering dry bulb or wet bulb outdoor air temperature for air-source heat pumps or 44°F (7°C) ground temperature for ground-source heat pumps. Supplemental heating is permitted for the following uses:

1. *Temperature maintenance* of heated-water circulation systems, physically separate from the primary service water heating system. *Temperature maintenance* heating capacity shall be no greater than the primary water heating capacity at 40°F (4°C) dry bulb or wet bulb outdoor air temperature for air-source heat pumps or 44°F (7°C) ground temperature for ground-source heat pumps.
2. Defrost of compressor coils.
3. Heat tracing of piping for freeze protection or for *temperature maintenance* in lieu of recirculation of hot water.
4. Backup or low ambient temperature conditions, where all of the following are true:
 - 4.1. The supplemental heating capacity is no greater than the primary service water heating capacity at 40°F (4°C) dry bulb or wet bulb outdoor air temperature for air-source heat pumps or 44°F (7°C) ground temperature for ground-source heat pumps.
 - 4.2. During normal operations, the supplemental heating is controlled to operate only when the entering air temperature at the air-source HPWH is below 40°F (4°C), and the primary HPWH compressor continues to operate together with the supplemental heating.
 - 4.3. The primary water heating equipment cannot satisfy the system load due to equipment failure or entering air temperature below 40°F (4°C).

C404.2.1.5 System fault detection. The control system shall be capable of and configured to send automatic error alarms to building or maintenance personnel upon detection of equipment faults, low leaving water temperature from primary storage tanks, or low hot water supply delivery temperature to building distribution system.

WAC 51-11C-40600 Section C406—Efficiency and load management measures.

C406.1 Additional energy efficiency and load management measures credit requirements.

The project as defined in the building permit shall meet the following requirements as applicable:

1. New buildings, changes in *space conditioning category*, change of occupancy group, and building additions in accordance with Chapter 5 shall comply with sufficient measures from Section C406.2 so as to achieve the minimum number of required efficiency credits shown in Table C406.1.

2. New buildings greater than 5000 gross square feet of floor area shall comply with sufficient measures from Section C406.3 so as to achieve the minimum number of required load management credits shown in Table C406.1.
3. Tenant spaces shall comply in accordance with Section C406.1.1.
4. Projects using discrete area credit weighting shall comply in accordance with Section C406.1.2.

Exceptions:

1. Low energy spaces in accordance with Section C402.1.1.1, equipment buildings in accordance with Section C402.1.2, unconditioned spaces, open parking garages, and enclosed parking garages that comply with sufficient measures from Table C406.2(1) or Table C406.2(2) to achieve a minimum of 50 percent of the efficiency credits required for new construction. Such projects shall be exempt from the load management requirements in Table C406.1.
2. Building additions that have less than 1,000 square feet of *conditioned floor area* that comply with sufficient measures from Table C406.2(1) or Table C406.2(2) to achieve a minimum of 50 percent of the efficiency credits required for additions.
3. Warehouses are exempt from the load management credit requirements in Table C406.1.

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**TABLE C406.1
ENERGY MEASURE CREDIT REQUIREMENTS**

Required Credits for Projects	Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
New building energy efficiency credit requirement	C406.2	54	41	42	48	74	49
Building additions energy efficiency credit requirement	C406.2	27	20	21	23	36	21
New building load management credit requirement	C406.3	12	15	27	15	13	26

C406.1.1 Tenant spaces. An initial tenant improvement shall comply with sufficient measures from Table C406.2 to achieve a minimum of efficiency credits required in Table C406.1 and are not required to achieve any load management credits. In projects with multiple tenant spaces, each tenant space is permitted to apply for different measures provided the weighted average of all areas in the project comply with the overall efficiency credit requirement in Table C406.1. Whole building or addition energy credits shall be allocated to tenant spaces in accordance with Sections C406.1.1.1 and C406.1.1.2.

Exceptions:

1. An initial tenant improvement where the core and shell building complied via Section C407 in 2018 or later edition of the Washington State Energy Code.
2. Previously occupied tenant spaces in existing buildings that comply with this code in accordance with Section C501.

C406.1.1.1 Applicable envelope, renewable and elevator energy credits. Where an entire building or building addition complies with Section C406.2.4, C406.2.9, C406.2.10, or C406.2.14, under an initial tenant improvement permit, tenant spaces within the building qualify for the number of credits assigned to the occupancy group of the tenant space in accordance with Table C406.2(1) or Table C406.2(2). Where prior energy credits were achieved under the 2018 Washington State Energy Code, they shall be multiplied by 6 for applicability to this code.

C406.1.1.2 Applicable HVAC and service water heating credits. Where HVAC and service water heating systems and services are installed and comply with Section C406.2.4, C406.2.9, C406.2.10, or C406.2.14 under an initial tenant improvement permit, those systems and services shall be considered a part of the tenant space. Tenant spaces qualify for the credits assigned to the occupancy group of the tenant space in accordance with Table C406.2(1) or Table C406.2(2) if the tenant space includes the distribution system and equipment that the central HVAC systems or service water heating systems were designed to support.

C406.1.2 Discrete area-weighted project compliance. Discrete building areas shall be permitted to select different packages of measures provided that the whole project complies with both the energy and load management credit requirements. Compliance shall be determined as follows:

1. Project credit requirement shall be the individual occupancy group requirements from Table C406.1 for each discrete area weighted by discrete area conditioned floor

Commented [BK(19): [Kocher's 037](#)

Commented [BK(20): Note that this section is under review by a workgroup to determine if there is a conflict with the new mixed fuel calculations in C406.2

Commented [BK(21R20): [Workgroup results](#) shown in section

~~area~~ Required project credits shall be pro-rated on an area-weighted basis for each occupancy group by multiplying the occupancy group floor area by the number of credits required, and then dividing this value by the total area of all the occupancy groups combined. Where one occupancy group is less than 10 percent of the floor area of the project, use the primary occupancy group for all credits.

~~1-2.~~ Occupancies are permitted to be subdivided into discrete areas, with required and achieved credits for each area pro-rated on an area-weighted basis as required for the occupancy group.

~~2-3.~~ Determine the energy and load management credits achieved for each discrete area based on its occupancy group. Where envelope or lighting power credits in Section C406.2.3.1, C406.2.3.2, or C406.2.3.12 are ~~used~~ applied, the lighting power or envelope UA percentage reduction shall be calculated for the project as a whole to determine achieved credits.

~~3-4.~~ Determine total project credits achieved by ~~area-weighting individual discrete area credits by discrete area conditioned floor area~~ the achieved credits by occupancy group in the same manner as for required project credits.

~~4-5.~~ A project complies when ~~both the achieved number of area-weighted energy and load management credits are equal to or greater than the required area-weighted project requirement~~ number of credits.

C406.1.3 Fossil Fuel Pathways Buildings that are choosing the fossil fuel pathway in Section C403.1.4, shall comply with C406.1.3.3 and shall achieve additional credits in Table C406.1 in accordance with Section 406.1.3.1. Buildings that are choosing the fossil fuel pathway in Section C404.2.1, shall comply with C406.1.3.3 and achieve additional credits Table C406.1 in accordance with Section 406.1.3.2.

Commented [BK(22): Kocher's 037] Please note that this and Jonlin's 037 are mutually exclusive and not compatible

C406.1.3.1 Fossil fuel space heating baseline normalization. The number of energy efficiency credits required shall be increased according to the following equation:

$$CR = A - (A \times B/C)$$

Where:

CR = additional credits required, rounded to the nearest whole number

A = baseline credits from Table C406.1.3.1

B = installed space heating capacity in kBtu/h of space heating appliances that comply with any of the exceptions to Section C403.1.4

C = total installed space heating capacity in kBtu/h of all space heating appliances

**TABLE C406.1.3.1
FOSSIL FUEL SPACE HEATING BASELINE NORMALIZATION**

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
Additional baseline credits required for space heating systems using the fossil fuel pathway	C406.1.3.1	7	22	101	38	111	56

C406.1.3.2 Fossil fuel service water heating baseline normalization. The number of energy efficiency credits required shall be increased according to the following equation:

$$CR = A - (A \times B/C)$$

Where:

CR = additional credits required, rounded to the nearest whole number

A = additional baseline credits from Table C406.1.3.2

B = installed service water heating capacity in kBTU/h of service water heating appliances that comply with any of the exceptions to Section C404.2.1

C = total installed service water heating capacity in kBTU/h of all service weather heating appliances

**TABLE C406.1.3.2
FOSSIL FUEL SERVICE WATER HEATING BASELINE NORMALIZATION**

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
Additional baseline credits required for service water heating systems using the fossil fuel pathway	C406.1.3.2	198	204	27	17	79	105

WAC 51-11C-40620 Section C406.2—Additional energy efficiency credit measures.

C406.2 Additional energy efficiency credit measures. Each energy efficiency credit measure used to meet credit requirements for the project shall include efficiency that is greater than the energy efficiency required for the building type and configuration requirements in Sections C402 through C405. Measures installed in the project that meet the requirements in Sections C406.2.1 through C406.2.14 shall achieve the credits listed for the measure and occupancy group in Table C406.2(1) or Table C406.2(2) or where calculations required by Sections C406.2.1 through C406.2.14 create or modify the table credits, the credits achieved shall be based upon the section calculations. Projects that chose to comply with either fossil fuel pathway in Section C406.1.3 shall use Table C406.2(2) to achieve credits.

Commented [BK(23): Kochev's 037]

For mixed fuel space heating systems, the number of space heating energy efficiency credits available for measures with a pro-rating flag "Heat" are calculated using the following equation:

$$C_{SH} = CHP_{SH} \times B/C + CFF_{SH} \times (1 - B/C)$$

Where:

C_{SH} = Blended credits for mixed fuel systems

CHP_{SH} = Credits available in Table 406.2(1)

CFF_{SH} = Credits available in Table 406.2(2)

B = installed space heating capacity in kBTU/h of space heating appliances that comply with any of the exceptions to Section C403.1.4

C = total installed space heating capacity in kBTU/h of all space heating appliances

For mixed fuel service water heating systems, the number of service water heating energy efficiency credits available for measures with a pro-rating flag "SWH" are calculated using the following equation:

$$C_{WH} = CHP_{WH} \times B/C + CFF_{WH} \times (1 - B/C)$$

Where:

C_{WH} = Blended credits for mixed fuel systems

CHP_{WH} = Credits available in Table 406.2(1)

CFF_{WH} = Credits available in Table 406.2(2)

B = installed service water heating capacity in kBTU/h of service water heating appliances that comply with any of the exceptions to Section C404.2.1

C = total installed service water heating capacity in kBTU/h of all service weather heating appliances

**TABLE C406.2
EFFICIENCY MEASURE CREDITS**

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
1. Dwelling unit HVAC control	C406.2.1	NA	7	NA	NA	NA	NA
2. Improved HVAC TSPR ^a	C406.2.2.1	NA	8	11	17	22	NA
3. Improve cooling and fan efficiency	C406.2.2.2	2	2	3	4	3	2
4. Improve heating efficiency	C406.2.2.3	2	3	3	10	16	7
5. Improved low-carbon district energy system (10% better)	C406.2.2.4	3	3	4	11	17	8
6. Improved low-carbon district energy system (20% better) ^b	C406.2.2.5	9	10	12	33	52	24
7. High performance DOAS	C406.2.2.6	31	31	21	39	40	21/ (A) 40 ^c
8. Fault detection & diagnostics (FDD)	C406.2.2.7	2	2	2	6	9	4
9. 10% reduced lighting power	C406.2.3.1	7	4	18	16	20	15
10. 20% reduced lighting power ^d	C406.2.3.2	13	8	36	32	40	29

Commented [BK(24)]: This table is retained in Jonlin's 037 but is replaced with C406.2(1) in Kocher's 037

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
11. Lamp efficacy improvement	C406.2.3.3	5	6	NA	NA	NA	NA
12. Residential lighting control	C406.2.4.1	NA	8	NA	NA	NA	NA
13. Enhanced lighting control	C406.2.4.2	1	1	6	6	11	6
14. Renewable energy	C406.2.5	7	12	13	13	10	11
15. Shower drain heat recovery	C406.2.6.1	9	30	NA	3	NA	NA
16. Service water heat recovery	C406.2.6.2	35	111	13	14	(Grocery) 41 ^e	NA
17. Heat pump water heating	C406.2.6.3	81	261	17	33	(Grocery) 95 ^e	(A-2) 95 ^f
18. Heat trace system	C406.2.7.1	6	13	4	1	NA	6
19. Point of use water heater	C406.2.7.2	NA	NA	19	5	NA	NA
20. Service hot water distribution right sizing	C406.2.8	13	42	NA	NA	NA	NA
21. High performance service hot water temperature maintenance system	C406.2.9	6	13	4	1	NA	6
22. High efficiency service hot water circulation system	C406.2.10	3	6	2	1	NA	4
23. Low flow residential showerheads	C406.2.11	3	3	NA	NA	NA	NA
24. Enhanced envelope performance ^g	C406.2.12	24	20	13	5	19	14
25. Base reduced air leakage ^g	C406.2.13.2	29	24	6	3	9	11
26. Enhanced reduced air leakage ^g	C406.2.13.3	53	44	11	5	16	20
27. Enhanced commercial kitchen equipment	C406.2.14	30 ^h	18 ^h	18 ^h	30 ^h	30 ^h	31 ^h

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
28. Enhanced residential kitchen equipment	C406.2.15	12	19	NA	NA	NA	NA
29. Enhanced residential laundry equipment	C406.2.16	NA	6	NA	NA	NA	NA
30. Heat pump clothes dryers	C406.2.17	6	6	NA	NA	NA	NA
31. Efficient elevator equipment	C406.2.18	3	5	5	5	4	4

- a. Projects using Item 2 shall not use Items 3 through 5.
- b. Projects using C406.2.2.5 shall not use C406.2.2.4.
- c. For C406.2.2.6, occupancy Group A achieves 40 credits while other occupancy groups within the "all other" category achieve 21 credits.
- d. Projects using C406.2.3.2 shall not use C406.2.3.1.
- e. Service water heat recovery and heat pump water heating are available in Group M only for grocery stores larger than 10,000 ft². Large mixed retail with full grocery and butcher sections shall achieve half the credits. This credit is not available where refrigeration recovery to heat service hot water is used to meet the requirements of Section C403.9.2.3.
- f. Heat pump water heating efficiency credits are available in the "all other" category only for Group A-2.
- g. Buildings or building areas that are exempt from the thermal envelope requirements in accordance with Sections C402.1.1 and C402.1.2, do not qualify for this package.
- h. Additional energy efficiency credits, up to the maximum shown in Table C406.2, shall be calculated according to Section C406.2.4+14.

TABLE C406.2(FF)
EFFICIENCY MEASURE CREDITS
FOR USE WITH FOSSIL FUEL COMPLIANCE PATH

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
1. Dwelling unit HVAC control	C406.2.1	NA	8	NA	NA	NA	NA
2. Improved HVAC TSPR ^a	C406.2.2.1	NA	9	12	19	24	NA
3. Improve cooling and fan efficiency	C406.2.2.2	12	8	14	8	10	10
4. Improve heating efficiency	C406.2.2.3	2	3	3	11	18	8
5. Improved low-carbon district energy system (10% better)	C406.2.2.4	3	3	4	12	19	9
6. Improved low-carbon district energy system (20% better) ^b	C406.2.2.5	10	11	13	36	57	26

Commented [BK(25): Jonlin's 037

Commented [BK(26R25): Correlated with Kocher's 037 credit values on 9/11/23, rows 3 and 17

Measure Title	Applicable Section	Occupancy Group						All Other
		Group R-1	Group R-2	Group B	Group E	Group M		
7. High performance DOAS	C406.2.2.6	34	34	23	43	44	23/ (A) 40 ^c	
8. Fault detection & diagnostics (FDD)	C406.2.2.7	2	2	2	6	9	4	
9. 10% reduced lighting power	C406.2.3.1	7	4	18	16	20	15	
10. 20% reduced lighting power ^d	C406.2.3.2	13	8	36	32	40	29	
11. Lamp efficacy improvement	C406.2.3.3	5	6	NA	NA	NA	NA	
12. Residential lighting control	C406.2.4.1	NA	8	NA	NA	NA	NA	
13. Enhanced lighting control	C406.2.4.2	1	1	6	6	11	6	
14. Renewable energy	C406.2.5	7	12	13	13	10	11	
15. Shower drain heat recovery	C406.2.6.1	10	33	NA	3	NA	NA	
16. Service water heat recovery	C406.2.6.2	35	111	13	14	(Grocery) 41 ^e	NA	
17. Heat pump water heating	C406.2.6.3	135	163	17	33	(Grocery) 95 ^e	(A-2) 95 ^f	
18. Heat trace system	C406.2.7.1	6	13	4	1	NA	6	
19. Point of use water heater	C406.2.7.2	NA	NA	19	5	NA	NA	
20. Service hot water distribution right sizing	C406.2.8	13	42	NA	NA	NA	NA	
21. High performance service hot water temperature maintenance system	C406.2.9	6	13	4	1	NA	6	
22. High efficiency service hot water circulation system	C406.2.10	3	6	2	1	NA	4	
23. Low flow residential showerheads	C406.2.11	3	3	NA	NA	NA	NA	
24. Enhanced envelope performance ^g	C406.2.12	24	20	13	5	19	14	
25. Base reduced air leakage ^g	C406.2.13.2	29	24	6	3	9	11	
26. Enhanced reduced air leakage ^g	C406.2.13.3	53	44	11	5	16	20	
27. Enhanced commercial kitchen equipment	C406.2.14	30 ^h	18 ^h	18 ^h	30 ^h	30 ^h	31 ^h	
28. Enhanced residential kitchen equipment	C406.2.15	12	19	NA	NA	NA	NA	
29. Enhanced residential laundry equipment	C406.2.16	NA	6	NA	NA	NA	NA	

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
30. Heat pump clothes dryers	C406.2.17	6	6	NA	NA	NA	NA
31. Efficient elevator equipment	C406.2.18	3	5	5	5	4	4

- a. Projects using Item 2 shall not use Items 3 through 5.
- b. Projects using C406.2.2.5 shall not use C406.2.2.4.
- c. For C406.2.2.6, occupancy Group A achieves 40 credits while other occupancy groups within the "all other" category achieve 21 credits.
- d. Projects using C406.2.3.2 shall not use C406.2.3.1.
- e. Service water heat recovery and heat pump water heating are available in Group M only for grocery stores larger than 10,000 ft². Large mixed retail with full grocery and butcher sections shall achieve half the credits. This credit is not available where refrigeration recovery to heat service hot water is used to meet the requirements of Section C403.9.2.3.
- f. Heat pump water heating efficiency credits are available in the "all other" category only for Group A-2.
- g. Buildings or building areas that are exempt from the thermal envelope requirements in accordance with Sections C402.1.1 and C402.1.2, do not qualify for this package.
- h. Additional energy efficiency credits, up to the maximum shown in Table C406.2(FF), shall be calculated according to Section C406.2.14.

TABLE C406.2(1)
EFFICIENCY MEASURE CREDITS FOR HEAT PUMP PATHWAYS

Measure Title	Applicable Section	Pro Rating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
1. Dwelling unit HVAC control	C406.2.1	Heat	NA	7	NA	NA	NA	NA
2. Improved HVAC TSPR ^a	C406.2.2.1	Heat	NA	8	11	17	22	NA
3. Improve cooling and fan efficiency	C406.2.2.2	Heat	12 2	8 2	14 3	8 4	10 3	10 2
4. Improve heating efficiency	C406.2.2.3	Heat	1 2	1 2	3 2	1 10	4 16	2 7
5. Improved low-carbon district energy system (10% better)	C406.2.2.4		3	3	4	11	17	8
6. Improved low-carbon district energy system (20% better) ^b	C406.2.2.5		9	10	12	33	52	24
7. High performance DOAS	C406.2.2.6	Heat	31	31	21	39	40	21/ (A) 40 ^c
8. Fault detection & diagnostics (FDD)	C406.2.2.7	Heat	2	2	2	6	9	4

Commented [BK(27): Kocher's 037]
Note: the highlighted portions are changes from the original C402 table. There is still some modeling work being completed for some of the credit options, shown as XX

Measure Title	Applicable Section	Pro Rating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
9. 10% reduced lighting power	C406.2.3.1	Heat	7	4	18	16	20	15
10. 20% reduced lighting power ⁹	C406.2.3.2	Heat	13	8	36	32	40	29
11. Lamp efficacy improvement	C406.2.3.3	Heat	5	6	NA	NA	NA	NA
12. Residential lighting control	C406.2.4.1	Heat	NA	8	NA	NA	NA	NA
13. Enhanced lighting control	C406.2.4.2	Heat	1	1	6	6	11	6
14. Renewable energy	C406.2.5		7	12	13	13	10	11
15. Shower drain heat recovery	C406.2.6.1	SWH	9	30	NA	3	NA	NA
16. Service water heat recovery	C406.2.6.2	SWH	35	111	13	14	(Grocery 41°)	NA
17. Heat pump water heating (option 1)	C406.2.6.3	SWH	XX 81	XX 264	XX 17	XX 33	(Grocery XX95°)	(A-2) XX95
18. Heat pump water heating (option 2)	C406.2.6.4	SWH	135	163	16	7	68	78
19. High efficiency service water heating, gas-fired	C406.2.6.5	SWH	NA	NA	NA	NA	NA	NA
20. High efficiency service water heating, gas heat pump	C406.2.6.6	SWH	NA	NA	NA	NA	NA	NA
18- 21. Heat trace system	C406.2.7.1	SWH	6	13	4	1	NA	6
19- 22. Point of use water heater	C406.2.7.2	SWH	NA	NA	10 19	3 5	NA	NA
20- 23. Service hot water distribution right sizing	C406.2.8		13	42	NA	NA	NA	NA
24- 24. High performance service hot water temperature maintenance system	C406.2.9		6	13	4	1	NA	6
22- 25. High efficiency service hot water circulation system	C406.2.10		3	6	2	1	NA	4
23- 26. Low flow residential showerheads	C406.2.11	SWH	3	3	NA	NA	NA	NA
24- 27. Enhanced envelope performance ⁹	C406.2.12	Heat	24	20	13	5	19	14
25- 28. Base reduced air leakage ⁹	C406.2.13.2		29	24	6	3	9	11
26- 29. Enhanced reduced air leakage ⁹	C406.2.13.3	Heat	53	44	11	5	16	20

Measure Title	Applicable Section	Pro Rating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
<u>27- 30. Enhanced commercial kitchen equipment</u>	<u>C406.2.14</u>	Heat	30 ^h	18 ^h	18 ^h	30 ^h	30 ^h	31 ^h
<u>28- 31. Enhanced residential kitchen equipment</u>	<u>C406.2.15</u>	Heat	12	19	NA	NA	NA	NA
<u>29- 32. Enhanced residential laundry equipment</u>	<u>C406.2.16</u>	Heat	NA	6	NA	NA	NA	NA
<u>30- 33. Heat pump clothes dryers</u>	<u>C406.2.17</u>	Heat	6	6	NA	NA	NA	NA
<u>34- 34. Efficient elevator equipment</u>	<u>C406.2.18</u>	Heat	3	5	5	5	4	4

- ^a Projects using Item 2 shall not use Items 3 through 5.
- ^b Projects using C406.2.2.5 shall not use C406.2.2.4.
- ^c For C406.2.2.6, occupancy Group A achieves 40 credits while other occupancy groups within the "all other" category achieve 21 credits.
- ^d Projects using C406.2.3.2 shall not use C406.2.3.1.
- ^e Service water heat recovery and heat pump water heating are available in Group M only for grocery stores larger than 10,000 ft². Large mixed retail with full grocery and butcher sections shall achieve half the credits. This credit is not available where refrigeration recovery to heat service hot water is used to meet the requirements of Section C403.9.2.3.
- ^f Heat pump water heating efficiency credits are available in the "all other" category only for Group A-2.
- ^g Buildings or building areas that are exempt from the thermal envelope requirements in accordance with Sections C402.1.1 and C402.1.2, do not qualify for this package.
- ^h Additional energy efficiency credits, up to the maximum shown in Table C406.2(1), shall be calculated according to Section C406.2.14.

**TABLE C406.2(2)
EFFICIENCY MEASURE CREDITS FOR FOSSIL FUEL PATHWAYS**

Measure Title	Applicable Section	Pro Rating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
<u>1. Dwelling unit HVAC control</u>	<u>C406.2.1</u>	Heat	NA	14	NA	NA	NA	NA
<u>2. Improved HVAC TSPR^a</u>	<u>C406.2.2.1</u>	Heat	NA	10	14	22	29	NA
<u>3. Improve cooling and fan efficiency</u>	<u>C406.2.2.2</u>	Heat	10	6	12	8	8	9
<u>4. Improve heating efficiency</u>	<u>C406.2.2.3</u>	Heat	1	2	8	3	9	5
<u>5. Improved low-carbon district energy system (10% better)</u>	<u>C406.2.2.4</u>		3	3	4	11	17	8
<u>6. Improved low-carbon district energy system (20% better)^b</u>	<u>C406.2.2.5</u>		9	10	12	33	52	24
<u>7. High performance DOAS</u>	<u>C406.2.2.6</u>	Heat	40	40	27	51	52	27/ (A) 52 ^c

Commented [BK(28): Kocher's 037]
Note: there is still some modeling to be completed for the credits for gas heat pumps

Measure Title	Applicable Section	Pro Rating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
8. Fault detection & diagnostics (FDD)	C406.2.2.7	Heat	3	3	3	8	12	5
9. 10% reduced lighting power	C406.2.3.1	Heat	6	3	15	14	17	13
10. 20% reduced lighting power ^d	C406.2.3.2	Heat	11	7	31	27	34	25
11. Lamp efficacy improvement	C406.2.3.3	Heat	4	5	NA	NA	NA	NA
12. Residential lighting control	C406.2.4.1	Heat	NA	7	NA	NA	NA	NA
13. Enhanced lighting control	C406.2.4.2	Heat	1	1	5	5	9	5
14. Renewable energy	C406.2.5		7	12	13	13	10	11
15. Shower drain heat recovery	C406.2.6.1	SWH	23	75	NA	8	NA	NA
16. Service water heat recovery	C406.2.6.2	SWH	88	278	33	35	(Grocery) 103 ^e	NA
17. Heat pump water heating (option 1)	C406.2.6.3	SWH	NA	NA	NA	NA	NA	NA
18. Heat pump water heating (option 2)	C406.2.6.4	SWH	NA	NA	NA	NA	NA	NA
19. High efficiency service water heating, gas-fired	C406.2.6.5	SWH	59	65	6	11	18	32
20. High efficiency service water heating, gas heat pump	C406.2.6.6	SWH	XX	XX	XX	XX	XX	XX
21. Heat trace system	C406.2.7.1	SWH	15	33	10	3	NA	15
22. Point of use water heater	C406.2.7.2	SWH	NA	NA	25	8	NA	NA
23. Service hot water distribution right sizing	C406.2.8		13	42	NA	NA	NA	NA
24. High performance service hot water temperature maintenance system	C406.2.9		6	13	4	1	NA	6
25. High efficiency service hot water circulation system	C406.2.10		3	6	2	1	NA	4
26. Low flow residential showerheads	C406.2.11	SWH	8	8	NA	NA	NA	NA
27. Enhanced envelope performance ^g	C406.2.12	Heat	31	26	17	7	25	18
28. Base reduced air leakage ^g	C406.2.13.2		29	24	6	3	9	11
29. Enhanced reduced air leakage ^g	C406.2.13.3	Heat	53	44	11	5	16	20

Measure Title	Applicable Section	Pro Rating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
<u>30. Enhanced commercial kitchen equipment</u>	<u>C406.2.14</u>	<u>Heat</u>	<u>26^h</u>	<u>15^h</u>	<u>15^h</u>	<u>26^h</u>	<u>26^h</u>	<u>26^h</u>
<u>31. Enhanced residential kitchen equipment</u>	<u>C406.2.15</u>	<u>Heat</u>	<u>10</u>	<u>16</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>32. Enhanced residential laundry equipment</u>	<u>C406.2.16</u>	<u>Heat</u>	<u>NA</u>	<u>5</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>33. Heat pump clothes dryers</u>	<u>C406.2.17</u>	<u>Heat</u>	<u>5</u>	<u>5</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>34. Efficient elevator equipment</u>	<u>C406.2.18</u>	<u>Heat</u>	<u>3</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>3</u>	<u>3</u>

^a Projects using Item 2 shall not use Items 3 through 5.

^b Projects using C406.2.2.3 shall not use C406.2.2.4.

^c For C406.2.2.6, occupancy Group A achieves 40 credits while other occupancy groups within the "all other" category achieve 21 credits.

^d Projects using C406.2.3.2 shall not use C406.2.3.1.

^e Service water heat recovery and heat pump water heating are available in Group M only for grocery stores larger than 10,000 ft². Large mixed retail with full grocery and butcher sections shall achieve half the credits. This credit is not available where refrigeration recovery to heat service hot water is used to meet the requirements of Section C403.9.2.3.

^f Heat pump water heating efficiency credits are available in the "all other" category only for Group A-2.

^g Buildings or building areas that are exempt from the thermal envelope requirements in accordance with Sections C402.1.1 and C402.1.2, do not qualify for this package.

^h Additional energy efficiency credits, up to the maximum shown in Table C406.2(2), shall be calculated according to Section C406.2.14.

C406.2.2.1 Improved HVAC TSPR. For systems required to comply with Section C403.1.1, the HVAC TSPR shall exceed the minimum requirement by five percent. If improvement is greater, the credits in Table C406.2(1) or Table C406.2(2) are permitted to be prorated up to a 20 percent improvement.

C406.2.2.2.2 Cooling equipment efficiency. Equipment shall exceed the minimum cooling efficiency requirements listed in the tables in Section C403.3.2 by at least 5 percent. Where equipment exceeds the minimum annual cooling efficiency and heat rejection efficiency requirements by more than 5 percent, energy efficiency credits for cooling shall be determined using Equation 4-15, rounded to the nearest whole number.

(Equation 4-15)

$$EEC_{HEC} = EEC_5 \times \left[1 + \frac{CEI - 0.05}{0.05} \right]$$

Where:

- EEC_{HEC} = Energy efficiency credits for cooling efficiency improvement.
- EEC₅ = Section C406.2.2.2 credits from Table C406.2(1) or Table C406.2(2).
- CEI = The lesser of the improvement above minimum cooling efficiency requirements, minimum heat rejection efficiency requirements, or 20 percent (0.20). Where cooling efficiency varies by system, use the capacity weighted average efficiency improvement for all cooling equipment combined. The CEI expressed as a fraction shall be determined one of the following ways:

For metrics that increase as efficiency increases, CEI shall be calculated as follows:

$$CEI = \frac{CM_{DES}}{CM_{MIN}} - 1$$

For metrics that decrease as efficiency increases, CEI shall be calculated as follows:

$$CEI = \frac{CM_{MIN}}{CM_{DES}} - 1$$

Where:

- CM_{DES} = Design cooling efficiency metric, part-load or annualized where available.

CM_{MIN} = Minimum required cooling efficiency metric, part-load or annualized where available from Section C403.3.2.

For data centers using ASHRAE 90.4, CEI shall be calculated as follows:

$$CEI = \frac{AMLC_{MAX}}{AMLC_{DES}} - 1$$

Where:

$AMLC_{DES}$ = As-designed annualized mechanical load component calculated in accordance with ASHRAE 90.4 Section 6.5.

$AMLC_{MAX}$ = Maximum annualized mechanical load component from ASHRAE 90.4 Table 6.5.

C406.2.4.2 Enhanced digital lighting controls. Measure credits shall be achieved where no less than 50 percent of the gross floor area within the project has luminaires and lighting controls that include high end trim in compliance with Section C405.2.8.3 and either *luminaire-level lighting controls* in compliance with Section C405.2.8.1 or networked lighting controls in accordance with Section C405.2.8.2. Where *general lighting* in more than 50 percent of the gross floor area complies, the base credits from Table C406.2(1) or Table C406(2) shall be prorated as follows:

$$[\text{Floor area with high end trim, \%}] \times [\text{Base energy credits for C406.2.4.2}] / 50\%$$

C406.2.5 On-site and off-site renewable energy. Projects installing on-site or off-site renewable energy systems with a capacity of at least 0.1 watts per gross square foot (1.08 W/m²) of building area in addition to the renewable energy capacity required elsewhere in this code shall achieve energy credits for this measure. Renewable energy systems achieving energy credits shall not be used to satisfy other requirements of this code. Off-site renewable energy systems shall comply with Sections C411.2.2 and C411.2.3. Credits shall be prorated from the table value in accordance with Equation 4-17.

(Equation 4-17)

$$AEC_{RRa} = AEC_b \times \frac{\sum(REF \times RR_t) - RR_r}{RR_b \times PGFA}$$

Where:

AEC_{RRa} = Section C406.2.5 achieved energy credits for this project as calculated in accordance with Equation 4-17, limited to 50 percent of the required credits in Section C406.1.

Exception: Up to 80 percent of the additional efficiency credits required by Table C406.1.3.1 and Table C406.1.3.2 are permitted to be Renewable Energy credits defined in Section C406.2.5.

RR_t = Actual total rating of on-site and off-site renewable energy systems (W) for each type of renewable energy source in Table C411.2.1.

RR_r = Rating of renewable energy systems required by Section C411.1, other sections in this code, or used to qualify for exceptions in this code (W).

RR_b = 0.1 W/square foot (1.08 W/m²)

$PGFA$ = Project gross floor area, square feet (m²).

$AEC_{0.1}$ = Section C406.2.5 base credits from Table C406.2(1) or Table C406.2(2).

REF = Renewable Energy Factor from Table C411.2.1.

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Informative Note: On-site renewable energy may include thermal service water heating or pool water heating, in which case ratings in Btu/h can be converted to W where $W = \text{Btu/h} / 3.413$.

C406.2.6 Reduced energy use in service water heating. Buildings with service hot water heating equipment that serves the whole building, building addition or tenant space shall achieve credits through compliance with:

1. Section C406.2.6.1, C406.2.6.2, ~~or~~ C406.2.6.3, or C406.2.6.4.
2. Sections C406.2.6.1 and C406.2.6.2.
3. Sections C406.2.6.1 and C406.2.6.3.
4. Sections C406.2.6.1 and C406.2.6.4.
- ~~3-5.~~ Section C406.2.6.5 or C406.2.6.6.

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C406.2.6.3 Heat pump service water heating (Option 1). Projects shall achieve credits through compliance with Section C406.2.6.3.1.

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C406.2.6.3.1 Heat pump water heater. Credit shall be achieved where service hot water system capacity is 82,000 Btu/h (24kW) or less and is served using heat pump technology with no more than 4.5 kW of resistance supplemental heating and meets one of the following:

1. The COP rating shall be a minimum COP of 3.0 reported at the design leaving heat pump water temperature with an entering air temperature of 60°F (16°C) or lower. For water-source equipment, the COP rating will be reported at the design leaving load water temperature with an entering load water temperature of 74°F (23°C) or lower.
2. The uniform energy factor (UEF) shall be a minimum of 3.40 rated based on U.S. Department of Energy requirements.

C406.2.6.4 Heat Pump Water Heating (Option 2) Projects shall achieve credits through compliance with Section C406.2.6.4.1.

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C406.2.6.4.1 Heat pump water heater. Credit shall be achieved where service hot water system meets one of the following:

1. The COP rating shall be a minimum COP of 3.0 reported at the design leaving heat pump water temperature with an entering air temperature of 60°F (16°C) or lower. For water-source equipment, the COP rating will be reported at the design leaving load water temperature with an entering load water temperature of 74°F (23°C) or lower.
2. The uniform energy factor (UEF) shall be a minimum of 3.40 rated based on U.S. Department of Energy requirements.

C406.2.6.5 High efficiency service water heating, gas-fired. The credit achieved shall be from Table C406.2(2) where hot water is supplied by gas-fired equipment with minimum efficiency of 0.91 UEF.

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C406.2.6.6 High efficiency service water heating, gas heat pump. The credit achieved shall be from Table C406.2(2) where hot water is supplied by gas-fired equipment with minimum efficiency of 1.29 UEF.

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C406.2.7.1 Self-regulated heat trace system. The credit achieved shall be from Table C406.2(1) or Table C406.2(2). This system shall include self-regulating electric heat cables, connection kits and electronic controls. The cable shall be installed directly on the hot water supply pipes underneath the insulation to replace standby losses.

C406.2.7.2. Point of use water heater. The credit achieved shall be from Table C406.2(1) or Table C406.2(2) where any fixtures requiring hot water shall be supplied from a localized electric source of hot water with no recirculation or heat trace and limited to 2 kW and 6 gallons of storage. The supply pipe length from the point of use water heater to the termination of the fixture supply pipe shall be no more than 20 feet.

C406.2.14 Enhanced commercial kitchen equipment. For buildings or areas designated as Group A-2, or facilities whose primary business type involves the use of a commercial kitchen with at least one gas or electric fryer, all fryers, dishwashers, steam cookers and ovens shall comply with all of the following:

1. Achieve the ENERGY STAR label in accordance with the specifications current as of January 1, 2022.
2. Be installed prior to the issuance of the certificate of occupancy.
3. Have the ENERGY STAR qualified model number listed on the construction documents submitted for permitting.

Energy efficiency credits for efficient commercial kitchen equipment shall be determined based on Equation 4-18, rounded to the nearest whole number.

(Equation 4-18)

$$AEEC_K = 20 \times \frac{\text{Area}_K}{\text{Area}_B}$$

Where:

- $AEEC_K$ = Section C406.2.14 table credits, to a maximum of those allowed in Table C406.2(1) or Table C406.2(2) for this option.
- Area_K = Floor area of full-service kitchen (ft² or m²).
- Area_B = Gross floor area of building (ft² or m²).

C411.1.1 Additional efficiency credits. Buildings which qualify for one of the exceptions in Section C411.1 to omit installation of on-site renewable energy must achieve an additional 18 efficiency package credits from Table C406.2(1) or Table C406.2(2). The additional 18 credits can be reduced based on a prorated fraction of renewable capacity that is installed on-site.

On-site renewable energy installations of lower than required capacity can be counted proportionally toward achievement of required or additional efficiency credits in Section C411.1.1 based on the capacity of renewable energy installed compared to the requirements of Section C411.1.

WAC 51-11C-40702 Section C407.2—Mandatory requirements.

C407.2 Mandatory requirements. Compliance with Section C407 also requires compliance with those sections shown in Table C407.2.

The building permit application for projects utilizing this method shall include in one submittal all building and mechanical drawings and all information necessary to verify that the building envelope and mechanical design for the project corresponds with the annual energy analysis. If credit is proposed to be taken for lighting energy savings, then an electrical permit application shall also be submitted and approved prior to the issuance of the building permit. If credit is proposed to be taken for energy savings from other components, then the corresponding permit application (e.g., plumbing, boiler, etc.) shall also be submitted and approved prior to the building permit application. Otherwise, components of the project that would not be approved as part of a building permit application shall be modeled in the baseline in accordance with ANSI/ASHRAE/IESNA 90.1 Appendix G and in the proposed model in accordance with the requirements of the Washington State Energy Code.

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

Section ^a	Title	Comments
Envelope		
C401.3	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	

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Section ^a	Title	Comments
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 ≥ 7.5 hp
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	Except for C404.2.1
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.

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WAC 51-11C-40703 Section C407.3—Performance-based compliance.

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 are required to be met, instead of those of Section G1.2.1a of ANSI/ASHRAE/IESNA 90.1.
2. Compliance with Section C407 requires meeting both an emissions and a regulated site energy target and a total site energy reduction target in accordance with the following:
 - 2.1. Carbon emissions-Regulated site energy target. The carbon-emissions-regulated site energy 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 carbon emissions calculated by multiplying site energy consumption by the carbon emission factor from Table C407.3(1) site energy use. 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 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).
3. Documentation requirements in Section G1.3.2.d shall be replaced by a list showing compliance with the mandatory provisions of Table C407.2.
4. Forms demonstrating compliance with Appendix G developed by the U.S. Department of Energy shall be completed and submitted to the *code official*. The forms are available at energycodes.gov/ashrae-standard-901-performance-based-compliance-form.
5. References to yet-to-be-designed future building components in the Proposed Building Performance column of Table G3.1 shall be modified to reference the corresponding sections of the Washington State Energy Code in lieu of the requirements of ANSI/ASHRAE/IESNA 90.1 in the following sections of the table:
 - 5.1. No. 1, Design Model, subclause c.
 - 5.2. No. 6, Lighting, subclause c.
 - 5.3. No. 11, Service Water Heating System, subclause c.
 - 5.4. No. 12, Receptacle and Other Loads, subclause b.
6. HVAC systems, subclauses c and d of Table G3.1, shall meet the following requirements:
 - 6.1. For yet-to-be-designed systems in office, retail, library, education, and multifamily buildings and occupancies subject to the TSPR requirements of Section C403.1.1, the system type and efficiency parameters in the proposed model shall meet but not exceed those shown in Table D602.11 Standard Reference Design HVAC Systems.

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- 6.2. For all other buildings and occupancies, the system type shall be the same as the system modeled in the baseline design and shall comply with but not exceed the requirements of Section C403 in lieu of ANSI/ASHRAE/IESNA 90.1.
- 6.3. For HVAC systems serving future tenant spaces, where the current building permit applies to only a portion of an HVAC system, and future components will receive HVAC services from systems included in the current building permit, those future components shall be modeled as the type required to complete the HVAC system portions under the current permit and shall meet but not exceed the requirements found in Section C403.
- 7. The requirements for proposed and baseline building lighting system shall be modified in accordance with Addendum af to ANSI/ASHRAE/IESNA 90.1.
- 8. Energy modeler qualifications. The energy analyst in responsible charge of the Section C407 submittal shall meet at least one of the following:
 - 8.1. ASHRAE Building Energy Modeling Professional (BEMP) certification.
 - 8.2. Association of Energy Engineer's Building Energy Simulation Analyst (BESA) certification.
 - 8.3. Successful completion of at least five projects modeled following any version of ANSI/ASHRAE/IESNA 90.1 Appendix G within the last three years that were reviewed and approved by a *code official* or rating authority.

C407.3.1 Limits on nonmandatory measures. The Proposed Total UA of the proposed building shall be no more than 20 percent higher than the Allowed Total UA as defined in Section C402.1.5.

C407.3.2 On-site and off-site renewable energy accounting for use with Appendix G. Qualifying on-site and off-site renewable energy delivered or credited to the building project to comply with Section C407.3 item 2.2 shall meet the requirements of Section C411.2.

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, ~~with carbon emission factors from Table C407.3(1) comparing energy use to determine compliance.~~
 - 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, with carbon emission factors from Table C407.3(1).
- 2. Any heating or cooling energy provided by the *low-carbon district heating and cooling or heating only system* shall utilize ~~footnote a of Table C407.3(1) for the district system~~

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~~carbon emission factor in the proposed model~~ a calculated energy use reduction factor acceptable to the code official to account for a carbon emissions reduction from those end uses.

3. ~~Carbon emission~~ Energy "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 ~~carbon emissions~~ energy "credit" is subtracted from the total proposed design ~~carbon emissions~~ energy use 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 ~~carbon emissions~~ energy use if they are already accounted for in the calculation of ~~emissions~~ energy use 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 ~~footnote a of Table C407.3(1) for the district system carbon emission factors~~ a calculated energy use reduction factor acceptable to the code official to account for the reduction in the proposed model.
3. ~~Carbon emission~~ Energy use "credit" for any waste/recoverable heating exported to the *low-carbon district energy exchange system* shall be accounted for in the proposed

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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 energy use~~ "credit" is subtracted from the total proposed design ~~carbon emissions energy use~~ 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 ~~carbon emissions energy use~~ if they are already accounted for in the calculation of ~~emissions energy use~~ from the district heating or cooling plant as a 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.

C407.3.4 Credit for improvements in unregulated loads when using Appendix G. When calculating savings for site energy targets in accordance with Section C407.3 item 2.2, but not when calculating savings for emissions targets in accordance with Section C407.3 item 2.1, differences in the simulation of unregulated loads and equipment modeled in the baseline building design from those in the *proposed design* shall be approved by the *code official* based on documentation that the equipment installed in the *proposed design* represents a significant verifiable departure from documented current conventional practice. All unregulated equipment for which savings is claimed must be installed by the time of final inspection. The burden of this documentation is to demonstrate that accepted conventional practice would result in baseline building equipment different from that installed in the *proposed design*. Occupancy and occupancy schedules shall not be changed.

TABLE C407.3(1)
CARBON EMISSIONS FACTORS ~~RESERVED~~

Type	CO2e (lb/unit)	Unit
Electricity	0.44	kWh
Natural gas	11.7	Therm
Oil	19.2	Gallon
Propane	10.5	Gallon
Other*	195.00	mmBtu
On-site renewable energy	0.00	

a.—~~District energy systems may use alternative emissions factors supported by calculations approved by the code official.~~

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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>
Health care/hospital	0.74 <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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**TABLE C407.3(3)
SITE ENERGY PERFORMANCE TARGETS
TO BE USED FOR COMPLIANCE WITH SECTION C407.3**

Building Area Type	Site Energy Performance Targets
Multifamily	0.59
Health care/hospital	0.72
Hotel/motel	0.62
Office	0.58
Restaurant	0.59
Retail	0.46
School	0.52
Warehouse	0.29
All others	0.55

WAC 51-11C-50300 Section C503—Alterations.

C503.1 General. Alterations to any building or structure shall comply with the requirements of Section C503 and the code for new construction. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall be such that the existing building or structure is no less conforming with the provisions of this code than the existing building or structure was prior to the alteration. The additional energy efficiency credit requirements in Section C406.1 and the renewable energy requirements in Section C411 do not apply to alterations.

Exception: The following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.

2. Surface applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided the code does not require the glazing fenestration to be replaced.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are insulated to full depth with insulation having a minimum nominal value of R-3.0 per inch installed per Section C402.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. *Roof recover*.
6. *Air barriers* shall not be required for *roof recover* and roof replacement where the *alterations* or renovations to the building do not include *alterations*, renovations or *repairs* to the remainder of the building envelope.
7. Replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided however that an existing vestibule that separates a conditioned space from the exterior shall not be removed.

C503.2 Reserved.

C503.3 Building envelope. New building envelope assemblies that are part of the alteration shall comply with Sections C402.1 through C402.5 and Sections C503.3.1 through C503.3.3.

Exception: Air leakage testing is not required for alterations and repairs, unless the project includes a change in space conditioning according to Section C503.2 or a change of occupancy or use according to Section C505.1.

C503.3.1 Roof replacement. *Roof replacements* shall comply with Table C402.1.3 or C402.1.4 where the existing roof assembly is part of the *building thermal envelope* and contains no insulation or the insulation is located entirely above the roof deck. In no case shall the *R*-value of the roof insulation be reduced or the *U*-factor of the roof assembly be increased as part of the *roof replacement*.

C503.3.2 Vertical fenestration. Alterations that include the addition of new vertical fenestration area shall comply with the following:

1. Where the addition of new *vertical fenestration* area results in a total building vertical fenestration area less than or equal to the maximum allowed by Section C402.4.1, the alteration shall comply with Section C402.4.
2. Where the addition of new *vertical fenestration* area result in a total building *vertical fenestration* area greater than the maximum allowed by Section C402.4.1 (regardless of the ratio prior to the addition), the alteration shall comply with one of the following:
 - 2.1. Vertical fenestration alternate in accordance with Section C402.1.3 for the new vertical fenestration added.
 - 2.2. Vertical fenestration alternate in accordance with Section C402.4.1.1 for the area adjacent to the new vertical fenestration added.
 - 2.3. Existing building and alteration areas are combined to demonstrate compliance with the component performance alternate in accordance with Section C402.1.5 for the whole building. *U*-factors applied to existing envelope assemblies in the UA calculation shall comply with Section C501.2.1. The Proposed Total UA is allowed to be up to 110 percent of the Allowed Total UA.
 - 2.4. Total building performance in accordance with Section C407 for the whole building. The total annual carbon emissions from energy consumption of the proposed

design is allowed to be up to 110 percent of the annual carbon emissions from energy consumption allowed in accordance with Section C407.3.

Exception: Where *approved* by the *code official*, additional *fenestration* is permitted where sufficient envelope upgrades beyond those required by other sections of this code are included in the project so that the addition of new *vertical fenestration* does not cause an increase in the overall energy use of the building.

C503.3.2.1 Replacement fenestration. Where some or all of an existing *fenestration* unit is replaced with a new *fenestration* product, including sash and glazing, the replacement *fenestration* unit shall meet the applicable requirements for *U*-factor and *SHGC* in Table C402.4.

Exception: An area-weighted average of the *U*-factor of replacement fenestration products being installed in the building for each fenestration product category listed in Table C402.4 shall be permitted to satisfy the *U*-factor requirements for each fenestration product category listed in Table C402.4. Individual fenestration products from different product categories listed in Table C402.4 shall not be combined in calculating the area-weighted average *U*-factor.

C503.3.3 Skylights. Alterations that include the addition of new skylight area shall comply with the following:

1. Where the addition of new *skylight* area results in a total building skylight area less than or equal to the maximum allowed by Section C402.4.1, the alteration shall comply with Section C402.4.
2. Where the addition of new *skylight* area results in a total building skylight area greater than the maximum allowed by Section C402.4.1 (regardless of the ratio prior to the addition), the alteration shall comply with one of the following:
 - 2.1. Existing building and alteration area are combined to demonstrate compliance with the component performance alternative with target area adjustment in accordance with Section C402.1.5 for the whole building. *U*-factors applied to existing envelope assemblies in the UA calculation shall comply with Section C501.2.1. The Proposed Total UA is allowed to be up to 110 percent of the Allowed Total UA.
 - 2.2. Total building performance in accordance with Section C407 for the whole building. The annual carbon emissions from energy consumption of the proposed design is allowed to be up to 110 percent of the annual carbon emissions from energy consumption allowed in accordance with Section C407.3.

Exception: Additional envelope upgrades are included in the project so the addition of new skylights does not cause a reduction in overall building energy efficiency, as *approved* by the *code official*.

C503.4 Building mechanical systems. Components of existing mechanical systems that are altered or replaced shall comply with Section C403 [for 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.

Exceptions:

1. Existing mechanical systems are not required to be modified to comply with Section C403.3.5 where mechanical cooling capacity is not added to a system that did not have cooling capacity prior to the alteration.
2. Compliance with Section C403.1.4 is not required where the alteration does not include replacement of a heating appliance.

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3. Alternate mechanical system designs that are not in full compliance with this code may be approved when the code official determines that existing building constraints including, but not limited to, available mechanical space, limitations of the existing structure, or proximity to adjacent air intakes or exhausts makes full compliance impractical. Alternate designs shall include additional energy saving strategies not prescriptively required by this code for the scope of the project including, but not limited to, demand control ventilation, energy recovery, or increased mechanical cooling or heating equipment efficiency above that required by Tables C403.3.2(1) through C403.3.2 (16).
4. Only those components of existing HVAC systems that are altered or replaced shall be required to comply with Section C403.8.1. Section C403.8.1 does not require the removal and replacement of existing system ductwork. Additional fan power allowances are available when determining the fan power budget (Fan kW_{budget}) as specified in Table C503.4. These values can be added to the fan power allowance values in Tables C403.8.1.1(1) and C403.8.1.1(2) when calculating a new Fan kW_{budget} for the fan system being altered. The additional fan power allowance is not applicable to alterations that add or change passive components which do not increase the fan system static pressure.

**TABLE C503.4
ADDITIONAL FAN POWER ALLOWANCES (W/CFM)**

Airflow	Multi-Zone VAV Systems ^a ≤5,000 cfm	Multi-Zone VAV Systems ^a >5,000 and ≤10,000 cfm	Multi-Zone VAV Systems ^a >10,000 cfm	All Other Fan Systems ≤5,000 cfm	All Other Fan Systems >5,000 and ≤10,000 cfm	All Other Fan Systems >10,000 cfm
Supply Fan System additional allowance	0.135	0.114	0.105	0.139	0.120	0.107
Supply Fan System additional allowance in unit with adapter curb	0.033	0.033	0.043	0.000	0.000	0.000
Exhaust/ Relief/ Return/ Transfer Fan System additional allowance	0.070	0.061	0.054	0.070	0.062	0.055
Exhaust/ Relief/ Return/ Transfer Fan System additional allowance with adapter curb	0.016	0.017	0.220	0.000	0.000	0.000

a. See definition of FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV).

C503.4.1 New building mechanical systems. All new mechanical systems and equipment in existing buildings shall comply with Sections C403, C408.2, C409.5, and C501.6.

C503.4.2 Addition of cooling capacity. Where mechanical cooling is added to a space that was not previously cooled, the mechanical system shall comply with either Section C403.3.5 or C403.5.

Exceptions:

1. Qualifying small equipment: Economizers are not required for cooling units and split systems serving one zone with a total cooling capacity rated in accordance with

Section C403.3.2 of less than 33,000 Btu/h (hereafter referred to as qualifying small systems) provided that these are high-efficiency cooling equipment with SEER and EER values more than 15 percent higher than minimum efficiencies listed in Tables C403.3.2 (1), (2), (4), (8), (9), and (14), in the appropriate size category, using the same test procedures. Equipment shall be listed in the appropriate certification program to qualify for this exception. The total capacity of all qualifying small equipment without economizers shall not exceed 72,000 Btu/h per building, or 5 percent of the building total air economizer capacity, whichever is greater.

Notes and exclusions for Exception 1:

- 1.1. The portion of the equipment serving Group R occupancies is not included in determining the total capacity of all units without economizers in a building.
 - 1.2. Redundant units are not counted in the capacity limitations.
 - 1.3. This exception shall not be used for the initial tenant improvement of a shell-and-core building or space, or for Total Building Performance in accordance with Section C407.
 - 1.4. This exception shall not be used for unitary cooling equipment installed outdoors or in a mechanical room adjacent to the outdoors.
2. Chilled water terminal units connected to systems with chilled water generation equipment with IPLV values more than 25 percent higher than minimum part load equipment efficiencies listed in Table C403.3.2 (3), in the appropriate size category, using the same test procedures. Equipment shall be listed in the appropriate certification program to qualify for this exception. The total capacity of all systems without economizers shall not exceed 480,000 Btu/h per building, or 20 percent of the building total air economizer capacity, whichever is greater.

Notes and exclusions for Exception 2:

- 2.1. The portion of the equipment serving Group R occupancy is not included in determining the total capacity of all units without economizers in a building.
- 2.2. This exception shall not be used for the initial tenant improvement of a shell-and-core building or space, or for total building performance in accordance with Section C407.

C503.4.3 Alterations or replacement of existing cooling systems. Alterations to, or replacement of, existing mechanical cooling systems shall not decrease the building total economizer capacity unless the system complies with either Section C403.3.5 or C403.5. System alterations or replacement shall comply with Table C503.4.3 when either the individual cooling unit capacity or the building total capacity of all cooling equipment without economizer does not comply with the exceptions in Section C403.5. Equipment replacements that include space heating shall also comply with Section C503.4.3.

**TABLE C503.4.3
ECONOMIZER COMPLIANCE OPTIONS FOR MECHANICAL ALTERATIONS**

	Option A	Option B (alternate to A)	Option C (alternate to A)	Option D (alternate to A)
Unit Type	Any alteration with new or replacement equipment	Replacement unit of the same type with the same or smaller output capacity	Replacement unit of the same type with a larger output capacity	New equipment added to existing system or replacement unit of a different type
1. Packaged Units	Efficiency: min. ^a Economizer: C403.5 ^b	Efficiency: min. ^a Economizer: C403.5 ^b	Efficiency: min. ^a Economizer: C403.5 ^b	Efficiency: min. ^a Economizer: C403.5 ^b
2. Split Systems	Efficiency: min. ^a Economizer: C403.5 ^b	For units ≤ 60,000 Btuh, comply with two of two measures: 1. Efficiency: + 10% ^e 2. Economizer: shall not decrease existing economizer capability	For units ≤ 60,000 Btuh replacing unit installed prior to 1991 comply with at least one of two measures: 1. Efficiency: + 10% ^e 2. Economizer: 50% ^f	Efficiency: min. ^a Economizer: C403.5 ^b
		For all other capacities: Efficiency: min. ^a Economizer: C403.5 ^b	For all other capacities: Efficiency: min. ^a Economizer: C403.5 ^b	
3. Water Source Heat Pump	Efficiency: min. ^a Economizer: C403.5 ^b	For units ≤ 72,000 Btuh, comply with at least two of three measures: 1. Efficiency: +10% ^e 2. Flow control valve ^g 3. Economizer: 50% ^f	For units ≤ 72,000 Btuh, comply with at least three of three measures: 1. Efficiency: +10% ^e 2. Flow control valve ^g 3. Economizer: 50% ^f (except for certain pre-1991 systems ^q)	Efficiency: min. ^a Economizer: C403.5 ^b (except for certain pre-1991 systems ^q)
		For all other capacities: Efficiency: min. ^a Economizer: C403.5 ^b	For all other capacities: Efficiency: min. ^a Economizer: C403.5 ^b	
4. Water Economizer using Air-Cooled Heat Rejection Equipment (Dry Cooler)	Efficiency: min. ^a Economizer: C403.5 ^b	Efficiency: + 5% ^d Economizer: shall not decrease existing economizer capacity	Efficiency: min. ^a Economizer: C403.5 ^b	Efficiency: min. ^a Economizer: C403.5 ^b
5. Air-Handling Unit (including fan coil units) where the system has an air-cooled chiller	Efficiency: min. ^a Economizer: C403.5 ^b	Economizer: shall not decrease existing economizer capacity	Efficiency: min. ^a Economizer: C403.5 ^b (except for certain pre-1991 systems ^q)	Efficiency: min. ^a Economizer: C403.5 ^b (except for certain pre-1991 systems ^q)
6. Air-Handling Unit (including fan coil units) and Water-cooled Process Equipment, where the	Efficiency: min. ^a Economizer: C403.5 ^b	Economizer: shall not decrease existing economizer capacity	Efficiency: min. ^a Economizer: C403.5 ^b (except for certain pre-1991 systems ^q and certain 1991-2016 systems ^l)	Efficiency: min. ^a Economizer: C403.5 ^b (except for certain pre-1991 systems ^q and certain 1991-2016 systems ^l)

	Option A	Option B (alternate to A)	Option C (alternate to A)	Option D (alternate to A)
Unit Type	Any alteration with new or replacement equipment	Replacement unit of the same type with the same or smaller output capacity	Replacement unit of the same type with a larger output capacity	New equipment added to existing system or replacement unit of a different type
system has a water-cooled chiller ¹⁰				
7. Cooling Tower	Efficiency: min. ^a Economizer: C403.5 ^b	No requirements	Efficiency: min. ^a Economizer: C403.5 ^b	Efficiency: min. ^a Economizer: C403.5 ^b
8. Air-Cooled Chiller	Efficiency: min. ^a Economizer: C403.5 ^b	Efficiency: + 10% ^k Economizer: shall not decrease existing economizer capacity	Efficiency: Comply with two of two measures: 1. + 10% ^{k,l} and 2. Multistage compressor(s) Economizer: shall not decrease existing economizer capacity	Efficiency: min. ^a Economizer: C403.5 ^b
9. Water-Cooled Chiller	Efficiency: min. ^a Economizer: C403.5 ^b	Efficiency: Comply with at least one of two measures: 1. Part load IPLV + 15% ⁿ or 2. Plate frame heat exchanger ^o Economizer: shall not decrease existing economizer capacity	Efficiency: Comply with two of two measures: 1. Part load IPLV + 15% ⁿ 2. Plate-frame heat exchanger ^o Economizer: shall not decrease existing economizer capacity	Efficiency: min. ^a Economizer: C403.5 ^b
10. Package Terminal Air Conditioner	Efficiency: min. ^a Economizer: C403.5 ^b	Efficiency: + 5% ^a Economizer: shall not decrease existing economizer capacity	Efficiency: + 5% ^a Economizer: shall not decrease existing economizer capacity	Efficiency: min. ^a Economizer: C403.5 ^b
11. Package Terminal Heat Pump	Efficiency: min. ^a Economizer: C403.5 ^b	Cooling efficiency: + 5% ^d Heating efficiency: + 10% ^e Shall not decrease existing economizer capacity	Cooling efficiency: + 5% ^d Heating efficiency: + 10% ^e Shall not decrease existing economizer capacity	Efficiency: min. ^a Economizer: C403.5 ^b

- ^a Minimum equipment efficiency shall comply with Section C403.3.2 and the tables in Section C403.3.2.
- ^b All separate new equipment and replacement equipment shall have air economizer complying with Section C403.5 including both the individual unit size limits and the total building capacity limits on units without economizer. It is acceptable to comply using one of the exceptions to Section C403.5.
- ^c Reserved.
- ^d Equipment shall have a capacity-weighted average cooling system efficiency that is 5% better than the requirements in the tables in Section C403.3.2 (1.05 x values in the tables).
- ^e Equipment shall have a capacity-weighted average cooling system efficiency that is 10% better than the requirements in the tables in Section C403.3.2 (1.10 x values in the tables).
- ^f Minimum of 50% air economizer that is ducted in a fully enclosed path directly to every heat pump unit in each zone, except that ducts may terminate within 12 inches of the intake to an HVAC unit provided that

they are physically fastened so that the outside air duct is directed into the unit intake. If this is an increase in the amount of outside air supplied to this unit, the outside air supply system shall be configured to provide this additional outside air and be equipped with economizer control.

- g Water-source heat pump systems shall have a flow control valve to eliminate flow through the heat pumps that are not in operation and variable speed pumping control complying with Section C403.4.3 for that heat pump.
- When the total capacity of all units with flow control valves exceeds 15% of the total system capacity, a variable frequency drive shall be installed on the main loop pump.
 - As an alternate to this requirement, the capacity-weighted average cooling system efficiency shall be 5% better than the requirements in footnote ^g for water-source heat pumps (i.e., a minimum of 15% greater than the requirements in Table C403.3.2(14)).
- h Water economizer equipment shall have a capacity-weighted average cooling system efficiency that is 10% better than the requirements in Tables C403.3.2(7), C403.3.2(10), and C403.3.2(16) (1.10 × values in Tables C403.3.2(7), C403.3.2(10), and C403.3.2(16)).
- i Air economizer is not required for systems installed with water economizer plate and frame heat exchanger complying with previous codes between 1991 and June 2016, provided that the total fan coil load does not exceed the existing or added capacity of the heat exchangers.
- j For water-cooled process equipment where the manufacturers specifications require colder temperatures than available with waterside economizer, that portion of the load is exempt from the economizer requirements.
- k The air-cooled chiller shall have an IPLV efficiency that is a minimum of 10% greater than the IPLV requirements in EER in Table C403.3.2(3) (1.10 × IPLV values in EER in Table C403.3.2(3)).
- l The air-cooled chiller shall be multistage with a minimum of two compressors.
- m The water-cooled chiller shall have full load and part load IPLV efficiency that is a minimum of 5% greater than the IPLV requirements in Table C403.3.2(3).
- n The water-cooled chiller shall have an IPLV value that is a minimum of 15% lower than the IPLV requirements in Table C403.3.2(3) (1.15 × IPLV values in Table C403.3.2 (3)). Water-cooled centrifugal chillers designed for nonstandard conditions shall have an NPLV value that is at least 15% lower than the adjusted maximum NPLV rating in kW per ton defined in Section C403.3.2.3 (1.15 × NPLV).
- o Economizer cooling shall be provided by adding a plate-frame heat exchanger on the waterside with a capacity that is a minimum of 20% of the chiller capacity at standard AHRI rating conditions.
- p Reserved.
- q Systems installed prior to 1991 without fully utilized capacity are allowed to comply with Option B, provided that the individual unit cooling capacity does not exceed 90,000 Btuh.

C503.4.4 Controls for cooling equipment replacement. When space cooling equipment is replaced, controls shall comply with all requirements under Section C403.3.5 and related subsections, and Section C403.5.1 for integrated economizer control.

C503.4.5 Mechanical equipment relocation. Existing equipment currently in use may be relocated within the same floor or same tenant space if removed and reinstalled within the same permit.

C503.4.6 Addition or replacement of heating appliances. Where a mechanical heating appliance is added or replaced, the added or replaced appliance shall comply with Section [C401.3](#), [C403.1.4](#), or with an alternate compliance option in Table C503.4.6.

Exceptions:

1. Terminal unit equipment including, but not limited to, hydronic VAV boxes, electric resistance VAV boxes, electric duct heaters, water source heat pumps, fan coils, or VRF indoor units that are served by an unaltered central system.
2. Air handling equipment with hydronic coils.
3. Air handling equipment designed for 100 percent outdoor air that is not subject to the requirements in Section C403.3.5 or that qualifies for an exception to Section C403.3.5.
4. Replacement of existing oil-fired boilers.

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5. Replacement of existing steam boilers with steam distribution to terminal units and the associated boiler feed equipment.
6. Where compliance with Section C403.1.4 would trigger an unplanned utility electrical service upgrade based on the NEC 220.87 method for determining existing loads.
7. ~~Like-for-like replacement of a single heating appliance is permitted where that appliance is failing, requires immediate replacement, and where no other HVAC work is planned~~ Replacement of like-for-like heating appliances where the rated capacity of the new equipment does not exceed the rated capacity of the existing equipment.

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**TABLE C503.4.6
COMPLIANCE OPTIONS FOR MECHANICAL HEATING EQUIPMENT ALTERATIONS**

	Proposed Heating Equipment Type ^a	Heating Efficiency Table Reference	Alternate Compliance Options to Section C403.1.4
1	Air-Cooled Unitary Heat Pumps	Table C403.3.2(2)	1. Compliance with C403.1.4, except heat pump rated capacity in accordance with Section C403.1.4 exception 5d is permitted to be sized equal to the supplemental internal resistance heating capacity in Climate Zone 4 or 5 ^c 2. Compliance with C403.1.4, except electric resistance mixed air preheat is permissible ^c
2	Packaged terminal, single-package vertical, and room air-conditioner heat pumps	Table C403.3.2(4)	1. Compliance with C403.1.4, except heat pump rated capacity in accordance with Section C403.1.4 Exception 5d is permitted to be sized equal to the supplemental internal resistance heating capacity in Climate Zone 4 or 5
3	Furnaces, duct furnaces, and unit heaters	Table C403.3.2(5)	1. Efficiency: + 10% 5% ^b
4	Gas-fired hot water boilers with fewer than 80% of served coils replaced	Table C403.3.2(6)	1. Efficiency: + 10% 5% ^b
5	Variable refrigerant flow air-to-air and applied heat pumps	Table C403.3.2(9)	No alternate compliance option
6	DX-DOAS equipment	Table C403.3.2(12) and Table C403.3.2(13)	1. DX-DOAS is provided with heat recovery if not required by C403.3.5.1.
7	Water-source heat pumps	Table C403.3.2(14)	No alternate compliance option

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^a Includes replacement of equipment with a unit that is the same type or higher efficiency and the same or lower capacity, or a replacement of one equipment type with a different equipment type.

^b Equipment shall have a capacity-weighted average heating system efficiency that is 10 percent better than that shown in the reference table (~~1.10~~ 1.05 x values in reference table).

^c Option 1 and Option 2 can be combined.

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C503.4.6.1 Hydronic system alteration supply water temperature. Hydronic heating coils and appliances subject to Section C503.4.5 or Section C503.4.6 shall comply with Section C403.3.7.2.

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 Sections [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.

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Exception: The following equipment is not required to comply with [Section C401.3](#) or [C404.2.1](#) as applicable:

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1. Replacement of ~~a single electric resistance or fuel-fired~~ service water heating appliances with ~~a unit equipment~~ 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.

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C503.6 Pools and permanent spas. All new systems and equipment serving pools and permanent spas and components of existing systems that are altered or replaced, shall comply with Sections [C404.11](#), [C408.3](#), [C409.5](#), and [C501.6](#). Additions or alterations shall not be made to an existing system serving a pool or spa that will cause the existing system to become out of compliance.

C503.7 Electrical power and lighting systems and motors. Alterations or the addition of lighting, receptacles and motors shall comply with Sections [C503.7.1](#) through [C503.7.7](#). Additions or alterations shall not be made to an existing lighting or electrical system that will cause the existing system to become out of compliance.

C503.7.1 New lighting systems and controls. All new interior and exterior lighting systems within an existing building site shall be provided with lighting controls in accordance with Section [C405.2](#) and shall comply with [C408.4](#), [C409.5](#), and [C501.6](#).

C503.7.2 Luminaire additions and alterations. Alterations that add or replace 20 percent or more of the luminaires in a space enclosed by walls or ceiling-height partitions, replace 20 percent or more of parking garage luminaires, or replace 20 percent or more of the total installed wattage of exterior luminaires shall comply with Sections [C405.4](#) and [C405.5](#). Exterior power allowance shall be determined using the specific area allowances for the areas altered and shall not include the base site allowance. Where less than 20 percent of the fixtures in an interior space enclosed by walls or ceiling-height partitions or in a parking garage are added or replaced, or less than 20 percent of the installed exterior wattage is replaced, the installed lighting wattage shall be maintained or reduced.

C503.7.3 Rewiring and recircuiting. Where new wiring is being installed to serve added fixtures and/or fixtures are being relocated to a new circuit, lighting controls shall comply with all applicable requirements in accordance with Sections [C405.2.1](#), [C405.2.3](#), [C405.2.4](#), [C405.2.5](#), [C405.2.6](#), [C405.2.7](#), [C405.2.8](#), [C408.4](#), and [C501.6](#).

C503.7.4 New or moved lighting panel. Where a new lighting panel (or a moved lighting panel) with all new raceway and conductor wiring from the panel to the fixtures is being

installed, lighting controls shall also comply with, in addition to the requirements of Section C503.7.3, all remaining requirements in Sections C405.2, C408.4, and C501.6.

C503.7.5 Newly-created rooms. Where new walls or ceiling-height partitions are added to an existing space and create a new enclosed space, but the lighting fixtures are not being changed, other than being relocated, the new enclosed space shall have lighting controls that comply with all applicable requirements in accordance with Sections C405.2.1, C405.2.2, C405.2.3, C405.2.4, C405.2.5, C405.2.6, C408.4 and C501.6.

C503.7.6 Motors. Motors that are altered or replaced shall comply with Section C405.8.

C503.7.7 Controlled receptacles. Where electric receptacles are added or replaced, controlled receptacles shall be provided in accordance with Section C405.10 and shall comply with Sections C408.4 and C501.6.

Exceptions:

1. Where an alteration project impacts an area smaller than 5,000 square feet, controlled receptacles are not required.
2. Where existing systems furniture or partial-height relocatable office cubical partitions are reconfigured or relocated within the same area, controlled receptacles are not required in the existing systems furniture or office cubicle partitions.
3. Where new or altered receptacles meet the exception to Section C405.10, they are not required to be controlled receptacles or be located within 12 inches of noncontrolled receptacles.

C503.8 Refrigeration systems. Components of existing refrigeration systems that are altered or replaced shall comply with Sections C408.7, C410 and C501.6. Additions or alterations shall not be made to an existing refrigeration system that will cause the existing system to become out of compliance. All new refrigerated spaces and refrigeration systems and equipment in existing buildings, including new refrigerated display cases, shall comply with Sections C408.7, C409.5, C410 and C501.6.

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 C407.1D201
Annual heating and cooling load	=	sum of the annual heating and cooling loads met by the building HVAC system in thousands of Btus.

Commented [BK(53): Kocheer's 036

**TABLE C407.3(1)D201 (REPRINTED FROM CHAPTER 4)
CARBON EMISSIONS FACTORS**

Type	CO ₂ e (lb/unit)	Unit
Electricity	0.44	kWh
Natural gas	11.70	Therm
Oil	19.2	Gallon
Propane	10.5	Gallon
Other ^a	195.00	mmBtu
On-site renewable energy ^b	0.00	

- a. District energy systems may use alternative emissions factors supported by calculations approved by the *code official*.
- b. Not applicable to TSPR calculation in Appendix D.