

Kocher revised draft 8/24/23

**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 406.1.3. Fossil fuel combustion appliances are permitted for HVAC heating, and shall comply with the applicable efficiency standards referenced in Section C403.3.3.2. Dedicated circuits at the main building panel shall be provided with sufficient power to support future conversion of all fossil fuel-fired HVAC heating to electric heat pump appliances.
  
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.
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~~ 1000 watts 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.

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 m<sup>2</sup>) 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 supplemental heating sources~~ heat pump heating 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.
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 heating 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).

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 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.
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.

**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. Dedicated circuits at the main building panel shall be provided with sufficient power to support future conversion of all fossil fuel-fired service water heating appliances to electric heat pump appliances.
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 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.

**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.

**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**

<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>Additional baseline credits required for space heating systems using the fossil fuel pathway</u>	<u>C406.1.3.1</u>	<u>7</u>	<u>22</u>	<u>147</u>	<u>37</u>	<u>108</u>	<u>64</u>

**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**

<b><u>Measure Title</u></b>	<b><u>Applicable Section</u></b>	<b><u>Occupancy Group</u></b>					
		<b><u>Group R-1</u></b>	<b><u>Group R-2</u></b>	<b><u>Group B</u></b>	<b><u>Group E</u></b>	<b><u>Group M</u></b>	<b><u>All Other</u></b>
<u>Additional baseline credits required for service water heating systems using the fossil fuel pathway</u>	<u>C406.1.3.2</u>	<u>195</u>	<u>228</u>	<u>30</u>	<u>18</u>	<u>79</u>	<u>110</u>

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

<b>Measure Title</b>	<b>Applicable Section</b>	<b>Occupancy Group</b>					
		<b>Group R-1</b>	<b>Group R-2</b>	<b>Group B</b>	<b>Group E</b>	<b>Group M</b>	<b>All Other</b>
New building energy efficiency credit requirement	C406.2	XX 54	XX 44	XX 42	XX 48	XX 74	XX 49
Building additions energy efficiency credit requirement	C406.2	XX 27	XX 20	XX 24	XX 23	XX 36	XX 24
New building load management credit requirement	C406.2	XX 42	XX 45	XX 27	XX 45	XX 43	XX 26

**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	XX 7	NA	NA	NA	NA
2. Improved HVAC TSPR <sup>a</sup>	C406.2.2.1	NA	XX 8	XX 11	XX 17	XX 22	NA
3. Improve cooling and fan efficiency	C406.2.2.2	XX 2	XX 2	XX 3	XX 4	XX 3	XX 2
4. Improve heating efficiency	C406.2.2.3	XX 2	XX 3	XX 3	XX 10	XX 16	XX 7
5. Improved low-carbon district energy system (10% better)	C406.2.2.4	XX 3	XX 3	XX 4	XX 11	XX 17	XX 8
6. Improved low-carbon district energy system (20% better) <sup>b</sup>	C406.2.2.5	XX 9	XX 10	XX 12	XX 33	XX 52	XX 24
7. High performance DOAS	C406.2.2.6	XX 34	XX 34	XX 21	XX 39	XX 40	XX/ (A) XX <sup>c</sup> 21/ (A) 40 <sup>e</sup>
8. Fault detection & diagnostics (FDD)	C406.2.2.7	XX 2	XX 2	XX 2	XX 6	XX 9	XX 4
9. 10% reduced lighting power	C406.2.3.1	XX 7	XX 4	XX 18	XX 16	XX 20	XX 15
10. 20% reduced lighting power <sup>d</sup>	C406.2.3.2	XX 13	XX 8	XX 36	XX 32	XX 40	XX 29
11. Lamp efficacy improvement	C406.2.3.3	XX 5	XX 6	NA	NA	NA	NA
12. Residential lighting control	C406.2.4.1	NA	XX 8	NA	NA	NA	NA
13. Enhanced lighting control	C406.2.4.2	XX 4	XX 4	XX 6	XX 6	XX 11	XX 6
14. Renewable energy	C406.2.5	XX 7	XX 12	XX 13	XX 13	XX 10	XX 11
15. Shower drain heat recovery	C406.2.6.1	XX 9	XX 30	NA	XX 3	NA	NA
16. Service water heat recovery	C406.2.6.2	XX 35	XX 111	XX 13	XX 14	(Grocery) XX41 <sup>e</sup>	NA
17. Heat pump water heating	C406.2.6.3	XX 84	XX 261	XX 17	XX 33	(Grocery) XX95 <sup>e</sup>	(A-2) XX95 <sup>f</sup>
18. Heat trace system	C406.2.7.1	XX 6	XX 13	XX 4	XX 4	NA	XX 6
19. Point of use water heater	C406.2.7.2	NA	NA	XX 19	XX 5	NA	NA

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
20. Service hot water distribution right sizing	C406.2.8	XX <del>13</del>	XX <del>42</del>	NA	NA	NA	NA
21. High performance service hot water temperature maintenance system	C406.2.9	XX <del>6</del>	XX <del>13</del>	XX <del>4</del>	XX <del>4</del>	NA	XX <del>6</del>
22. High efficiency service hot water circulation system	C406.2.10	XX <del>3</del>	XX <del>6</del>	XX <del>2</del>	XX <del>4</del>	NA	XX <del>4</del>
23. Low flow residential showerheads	C406.2.11	XX <del>3</del>	XX <del>3</del>	NA	NA	NA	NA
24. Enhanced envelope performance <sup>g</sup>	C406.2.12	XX <del>24</del>	XX <del>20</del>	XX <del>13</del>	XX <del>5</del>	XX <del>19</del>	XX <del>14</del>
25. Base reduced air leakage <sup>g</sup>	C406.2.13.2	XX <del>29</del>	XX <del>24</del>	XX <del>6</del>	XX <del>3</del>	XX <del>9</del>	XX <del>11</del>
26. Enhanced reduced air leakage <sup>g</sup>	C406.2.13.3	XX <del>53</del>	XX <del>44</del>	XX <del>11</del>	XX <del>5</del>	XX <del>16</del>	XX <del>20</del>
27. Enhanced commercial kitchen equipment	C406.2.14	XX <del>30</del> <sup>h</sup>	XX <del>18</del> <sup>h</sup>	XX <del>18</del> <sup>h</sup>	XX <del>30</del> <sup>h</sup>	XX <del>30</del> <sup>h</sup>	XX <del>31</del> <sup>h</sup>
28. Enhanced residential kitchen equipment	C406.2.15	XX <del>42</del>	XX <del>19</del>	NA	NA	NA	NA
29. Enhanced residential laundry equipment	C406.2.16	NA	XX <del>6</del>	NA	NA	NA	NA
30. Heat pump clothes dryers	C406.2.17	XX <del>6</del>	XX <del>6</del>	NA	NA	NA	NA
31. Efficient elevator equipment	C406.2.18	XX <del>3</del>	XX <del>5</del>	XX <del>5</del>	XX <del>5</del>	XX <del>4</del>	XX <del>4</del>

<sup>a</sup> Projects using Item 2 shall not use Items 3 through 5.

<sup>b</sup> Projects using C406.2.2.5 shall not use C406.2.2.4.

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

<sup>d</sup> Projects using C406.2.3.2 shall not use C406.2.3.1.

<sup>e</sup> Service water heat recovery and heat pump water heating are available in Group M only for grocery stores larger than 10,000 ft<sup>2</sup>. 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.

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

<sup>g</sup> 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.

<sup>h</sup> Additional energy efficiency credits, up to the maximum shown in Table C406.2, shall be calculated according to Section C406.2.11.

**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/m<sup>2</sup>) 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.