

WA Code Potential Fossil Fuel Compliance Pathway

Kocher revised draft 8/28/23

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 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 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.

SECTION C406

EFFICIENCY PACKAGES

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 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.

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.

C406.1.3 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

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

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

Measure Title	Applicable 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	C406.2	12	15	27	15	13	26

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 406.1.3 shall use Table 406.2(2) to achieve credits.

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(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	<u>Heat</u>	NA	7	NA	NA	NA	NA
2. Improved HVAC TSPR ^a	C406.2.2.1	<u>Heat</u>	NA	8	11	17	22	NA
3. Improve cooling and fan efficiency	C406.2.2.2	<u>Heat</u>	<u>12</u> <u>2</u>	<u>8</u> <u>2</u>	<u>14</u> <u>3</u>	<u>8</u> <u>4</u>	<u>10</u> <u>3</u>	<u>10</u> <u>2</u>
4. Improve heating efficiency	C406.2.2.3	<u>Heat</u>	<u>1</u> <u>2</u>	<u>1</u> <u>3</u>	<u>3</u> <u>3</u>	<u>1</u> <u>10</u>	<u>4</u> <u>46</u>	<u>2</u> <u>7</u>
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	<u>Heat</u>	31	31	21	39	40	21/ (A) 40 ^c
8. Fault detection & diagnostics (FDD)	C406.2.2.7	<u>Heat</u>	2	2	2	6	9	4
9. 10% reduced lighting power	C406.2.3.1	<u>Heat</u>	7	4	18	16	20	15
10. 20% reduced lighting power ^d	C406.2.3.2	<u>Heat</u>	13	8	36	32	40	29
11. Lamp efficacy improvement	C406.2.3.3	<u>Heat</u>	5	6	NA	NA	NA	NA
12. Residential lighting control	C406.2.4.1	<u>Heat</u>	NA	8	NA	NA	NA	NA
13. Enhanced lighting control	C406.2.4.2	<u>Heat</u>	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	<u>SWH</u>	9	30	NA	3	NA	NA
16. Service water heat recovery	C406.2.6.2	<u>SWH</u>	35	111	13	14	(Grocery) 41 ^e	NA
17. Heat pump water heating (option 1)	C406.2.6.3	<u>SWH</u>	XX 84	XX 264	XX 47	XX 33	(Grocery) XX95 ^e	(A-2) XX95 ^f
18. Heat pump water heating (option 2)	C406.2.6.4	<u>SWH</u>	<u>135</u>	<u>163</u>	<u>16</u>	<u>7</u>	<u>68</u>	<u>78</u>
19. High efficiency service water heating, gas-fired	C406.2.6.5	<u>SWH</u>	NA	NA	NA	NA	NA	NA

Measure Title	Applicable Section	Pro Rating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
20. <u>High efficiency service water heating, gas heat pump</u>	<u>C406.2.6.6</u>	<u>SWH</u>	NA	NA	NA	NA	NA	NA
18- <u>21.</u> Heat trace system	C406.2.7.1	<u>SWH</u>	6	13	4	1	NA	6
19- <u>22.</u> Point of use water heater	C406.2.7.2	<u>SWH</u>	NA	NA	<u>10</u> 49	<u>3</u> 5	NA	NA
20- <u>23.</u> Service hot water distribution right sizing	C406.2.8		13	42	NA	NA	NA	NA
21- <u>24.</u> High performance service hot water temperature maintenance system	C406.2.9		6	13	4	1	NA	6
22- <u>25.</u> High efficiency service hot water circulation system	C406.2.10		3	6	2	1	NA	4
23- <u>26.</u> Low flow residential showerheads	C406.2.11	<u>SWH</u>	3	3	NA	NA	NA	NA
24- <u>27.</u> Enhanced envelope performance ^g	C406.2.12	<u>Heat</u>	24	20	13	5	19	14
25- <u>28.</u> Base reduced air leakage ^g	C406.2.13.2		29	24	6	3	9	11
26- <u>29.</u> Enhanced reduced air leakage ^g	C406.2.13.3	<u>Heat</u>	53	44	11	5	16	20
27- <u>30.</u> Enhanced commercial kitchen equipment	C406.2.14	<u>Heat</u>	30 ^h	18 ^h	18 ^h	30 ^h	30 ^h	31 ^h
28- <u>31.</u> Enhanced residential kitchen equipment	C406.2.15	<u>Heat</u>	12	19	NA	NA	NA	NA
29- <u>32.</u> Enhanced residential laundry equipment	C406.2.16	<u>Heat</u>	NA	6	NA	NA	NA	NA
30- <u>33.</u> Heat pump clothes dryers	C406.2.17	<u>Heat</u>	6	6	NA	NA	NA	NA
31- <u>34.</u> Efficient elevator equipment	C406.2.18	<u>Heat</u>	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 C406.2.11.

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

<u>Measure Title</u>	<u>Applicable Section</u>	<u>Pro Rating Flag</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>1. Dwelling unit HVAC control</u>	<u>C406.2.1</u>	<u>Heat</u>	<u>NA</u>	<u>14</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>2. Improved HVAC TSPR^a</u>	<u>C406.2.2.1</u>	<u>Heat</u>	<u>NA</u>	<u>10</u>	<u>14</u>	<u>22</u>	<u>29</u>	<u>NA</u>
<u>3. Improve cooling and fan efficiency</u>	<u>C406.2.2.2</u>	<u>Heat</u>	<u>10</u>	<u>6</u>	<u>12</u>	<u>8</u>	<u>8</u>	<u>9</u>
<u>4. Improve heating efficiency</u>	<u>C406.2.2.3</u>	<u>Heat</u>	<u>1</u>	<u>2</u>	<u>8</u>	<u>3</u>	<u>9</u>	<u>5</u>
<u>5. Improved low-carbon district energy system (10% better)</u>	<u>C406.2.2.4</u>		<u>3</u>	<u>3</u>	<u>4</u>	<u>11</u>	<u>17</u>	<u>8</u>
<u>6. Improved low-carbon district energy system (20% better)^b</u>	<u>C406.2.2.5</u>		<u>9</u>	<u>10</u>	<u>12</u>	<u>33</u>	<u>52</u>	<u>24</u>
<u>7. High performance DOAS</u>	<u>C406.2.2.6</u>	<u>Heat</u>	<u>40</u>	<u>40</u>	<u>27</u>	<u>51</u>	<u>52</u>	<u>27/ (A) 52^c</u>
<u>8. Fault detection & diagnostics (FDD)</u>	<u>C406.2.2.7</u>	<u>Heat</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>8</u>	<u>12</u>	<u>5</u>
<u>9. 10% reduced lighting power</u>	<u>C406.2.3.1</u>	<u>Heat</u>	<u>6</u>	<u>3</u>	<u>15</u>	<u>14</u>	<u>17</u>	<u>13</u>
<u>10. 20% reduced lighting power^d</u>	<u>C406.2.3.2</u>	<u>Heat</u>	<u>11</u>	<u>7</u>	<u>31</u>	<u>27</u>	<u>34</u>	<u>25</u>
<u>11. Lamp efficacy improvement</u>	<u>C406.2.3.3</u>	<u>Heat</u>	<u>4</u>	<u>5</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>12. Residential lighting control</u>	<u>C406.2.4.1</u>	<u>Heat</u>	<u>NA</u>	<u>7</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>13. Enhanced lighting control</u>	<u>C406.2.4.2</u>	<u>Heat</u>	<u>1</u>	<u>1</u>	<u>5</u>	<u>5</u>	<u>9</u>	<u>5</u>
<u>14. Renewable energy</u>	<u>C406.2.5</u>		<u>7</u>	<u>12</u>	<u>13</u>	<u>13</u>	<u>10</u>	<u>11</u>
<u>15. Shower drain heat recovery</u>	<u>C406.2.6.1</u>	<u>SWH</u>	<u>23</u>	<u>75</u>	<u>NA</u>	<u>8</u>	<u>NA</u>	<u>NA</u>
<u>16. Service water heat recovery</u>	<u>C406.2.6.2</u>	<u>SWH</u>	<u>88</u>	<u>278</u>	<u>33</u>	<u>35</u>	<u>(Grocery) 103^e</u>	<u>NA</u>
<u>17. Heat pump water heating (option 1)</u>	<u>C406.2.6.3</u>	<u>SWH</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>18. Heat pump water heating (option 2)</u>	<u>C406.2.6.4</u>	<u>SWH</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
<u>19. High efficiency service water heating, gas-fired</u>	<u>C406.2.6.5</u>	<u>SWH</u>	<u>59</u>	<u>65</u>	<u>6</u>	<u>11</u>	<u>18</u>	<u>32</u>

Measure Title	Applicable Section	Pro Rating Flag	Occupancy Group					
			Group R-1	Group R-2	Group B	Group E	Group M	All Other
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 ^a	C406.2.12	Heat	31	26	17	7	25	18
28. Base reduced air leakage ^a	C406.2.13.2		29	24	6	3	9	11
29. Enhanced reduced air leakage ^a	C406.2.13.3	Heat	53	44	11	5	16	20
30. Enhanced commercial kitchen equipment	C406.2.14	Heat	26 ^h	15 ^h	15 ^h	26 ^h	26 ^h	26 ^h
31. Enhanced residential kitchen equipment	C406.2.15	Heat	10	16	NA	NA	NA	NA
32. Enhanced residential laundry equipment	C406.2.16	Heat	NA	5	NA	NA	NA	NA
33. Heat pump clothes dryers	C406.2.17	Heat	5	5	NA	NA	NA	NA
34. Efficient elevator equipment	C406.2.18	Heat	3	4	4	4	3	3

- 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 C406.3(2), shall be calculated according to Section C406.2.11.

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.

(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.

EEC_5 = Section C406.2.2.2 credits from Table C406.2(1) or Table C406.2(2).

(Equation 4-16)

Where:

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

EEC_{HEH} = Energy efficiency credits for heating efficiency improvement.

EEC_5 = Section C406.2.2.2 credits from Table C406.2(1) or Table C406.2(2).

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(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.

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
5. Sections C406.2.6.5 or C406.2.6.6.

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

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 re-sistance 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.

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.

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.

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.

(Equation 4-19)

$$AEEC_K = 20 \times \frac{Area_K}{Area_B}$$

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.

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).