

Proposed code change text: (Copy the existing text from the Integrated Draft, linked above, and then use underline for new text and ~~strikeout~~ for text to be deleted.)

black changes = approved TAG code changes to date

blue changes = my proposed changes

CHAPTER 4 [CE]

COMMERCIAL ENERGY EFFICIENCY

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:

1. Prescriptive Compliance. The prescriptive compliance option requires compliance with Sections C402 through C406, and Sections C408, C409, C410, C411, and C412.
2. ~~Total~~ Simulated Building Performance. The ~~total~~ simulated 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 section 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 C401.3.1 Item 2, 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, 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.~~

~~**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 water heating equipment, electric air-source heat pump water heating equipment, electric resistance water heating equipment, or a combination of these equipment types meeting the requirements of this section."~~
- ~~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 AECRRa.~~
- ~~4. **Table C406.2 – Efficiency measure credits.** Use Table C406.2(2) credit values in place of Table C406.2(1) 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 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 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(1) or Table C406.2(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(1) or Table C406.2(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.

**TABLE C401.3.3
ADDITIONAL CREDITS REQUIRED**

Measure Title	Applicable Section	Occupancy Group					
		Group R-1	Group R-2	Group B	Group E	Group M	All Other
New building—Additional efficiency credits required for space heating systems using the fossil fuel pathway	C401.3.3.1	7	24	101	38	111	56
New building—Additional efficiency credits required for service water heating systems using the fossil fuel pathway	C401.3.3.2	198	212	27	17	79	107
Building additions—Additional efficiency credits required for space heating systems using the fossil fuel pathway	C401.3.3.1	4	12	51	19	56	28
Building additions—Additional efficiency credits required for service water heating systems using the fossil fuel pathway	C402.3.3.2	99	106	14	9	40	54

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:

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

Where:

- CR = Additional credits required, rounded to the nearest whole number.
- A = Baseline HVAC heating credits from Table C401.3.3.
- B = Installed fossil fuel space heating capacity in kBtu/h of appliances that comply with any of the exceptions to Section C403.1.4.
- C = Total installed fossil fuel space heating capacity in kBtu/h of all

- HVAC heating appliances.
- D = Total capacity in kBTU/h of all types of space 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:

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

Where:

- CR = Additional credits required, rounded to the nearest whole number.
- A = Baseline credits from Table C401.3.3.
- B = Installed service water heating appliances capacity in kBTU/h of service water heating appliances that comply with any of the exceptions to Section C404.2.1.
- C = Total installed fossil fuel service water heating capacity in kBTU/h of all service water heating appliances.
- D = Total capacity in kBTU/h of all types of service water heating appliances.

C401.3.4 Renewable energy credit limit. No more than 80 percent of the efficiency credits required by Sections C401.3.3.1 and C401.3.3.2 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 Section 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 prorated 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 prorated on an area-weighted basis for each occupancy served.
2. Additional required credits for envelope systems shall be prorated 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 prorated 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 for each fossil fuel space heating or service water heating appliance installed:

1. Provide a spare electrical branch circuit conduit to the location of a future replacement heat pump appliance to support an equivalent heating capacity.
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 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 equipment is located in a transformer vault, that vault must include not only the space to support electrical service upgrade but also include accommodations for additional cooling for larger transformer(s).

C403.1.4 Use of electric resistance and fossil fuel-fired HVAC heating equipment. Primary space heating capacity shall be provided by either:

1. A fossil fuel system;
2. An air source heat pump; or
3. A ground source heat pump

HVAC heating energy shall not be provided by electric resistance or fossil fuel combustion appliances unless otherwise

specified. Primary space heating equipment must be included in section C406 space heating calculations for determining energy efficiency credit requirements unless excepted below. 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 or fossil fuel appliances. Areas of buildings less than 100 Square Feet are permitted to be heated by no larger than one 250 watt electrical resistance or 853 Btu/h fossil fuel appliance.
2. **Dwelling and sleeping units.** Dwelling or sleeping units are permitted to be heated using electric resistance or fossil fuel appliances as long as the installed HVAC heating capacity in any separate space is not greater than: specified in 2.1 through 2.3. Where a single dwelling unit includes multiple habitable spaces that are all heated with electric resistance or fossil fuel heat, individual spaces are permitted to have more electric resistance heating capacity than specified in 2.1 through 2.3, where the total heating capacity for the dwelling unit is less than or equal to the total allowed.
 - 2.1. Seven hundred fifty (750) watts (2,559 Btu/h) in Climate Zone 4, and 1000 watts (3,412 Btu/h) in Climate Zone 5 in each habitable space with fenestration.
 - 2.2. One thousand (1,000) watts (3,412 Btu/h) in Climate Zone 4, and 1300 watts (4,436 Btu/h) 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 (853 Btu/h) 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 (853 Btu/h) 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 or fossil fuel appliances.
4. **Defrost.** Heat pumps are permitted to utilize electric resistance or fossil fuel heating when a heat pump defrost cycle is required and is in operation.
5. **Air-to-air heat pumps.** Buildings are permitted to utilize ~~electric resistance~~ supplemental 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.

Exceptions to 5.2:

1. Packaged terminal heat pumps (PTHPs) that comply with the minimum heating efficiency requirements in Table C403.3.2(4) are exempt from heat pump controls capable of operating the compressor as the first stage of heating down to an outdoor air temperature of 17°F (-8°C) or lower.
2. Heat pumps whose minimum efficiency is regulated by NAECA and whose ratings meet the requirements shown in Table C403.3.2(2) and include all usage of internal electric resistance heating are exempt from heat pump controls capable of operating the compressor as the first stage of heating down to an outdoor air temperature of 17°F (-8°C) or lower.
- 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.

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Commented [GJ3]: 24-GP1-211 Diana Fisher

Commented [JK4R3]: Approved and incorporated

Commented [JK5]: Mike: What does this mean. Can I have 10 100sf "areas" right next to each other? Is it 100sf for the total permit? Does it have to be a room?

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Commented [GJ7]: 24-GP1-249 Eric Vander Mey

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Commented [JK9]: Mike: This is an exception the limitation on electric resistance. It is doing nothing and confusing unless the section is returned to its previous config of limiting electric and gas (preferred outcome IMO)

Commented [JK10R9]: This was approved in the TAG already as part of another proposal. I don't like it as well.

Commented [GJ11]: 24-GP1-243 Ben Omura

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- 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 heating capacity in Climate Zone 4 and no less than the supplemental 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 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).
7. **Ground source heat pumps.** Buildings are permitted to utilize electric resistance supplemental heating 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 auxiliary 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.
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 or electric resistance 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 or fossil fuel 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 or fossil fuel 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 or fossil fuel. The *building thermal envelope* of any such space shall be insulated in compliance with Section C402.1. Where the total heating capacity required to meet a maximum of 45°F (7°C) indoor temperature is less than 250 watts or 853 Btu/h, an electric resistance appliance no larger than 250 watts or fossil fuel appliance no larger than 853 Btu/h is permitted to be used.
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

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Commented [JK15]: Lisa: Section C403.1.4 Exception 10 Kitchen make-up air – What is the purpose of a fossil fuel exception when fossil fuel systems are no longer prohibited under this section? There are other similar instances in other sections where this is the case.

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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*.
17. 18. **Essential facilities.** Groups I-2 and I-3 occupancies that by regulation are required to have in place: redundant emergency-backup systems; **Standby HVAC heating equipment.** Standby HVAC heating equipment provided in addition to the primary heating system, and controlled such that it will only be used when the primary heating equipment is not available, is permitted to be electric resistance or fossil fuel.
18. 19. **Standby power generators.** Generators serving emergency power, legally required standby power, or optional standby power are permitted to use fossil fuels.
19. 20. **Wastewater heat recovery heat pumps.** Buildings are permitted to utilize electric resistance or fossil fuel auxiliary heating to supplement heat pump heating for hydronic heating systems with wastewater heat recovery or other approved waste heat recovery systems provided the electric heat pump equipment that meets all of the following conditions:
- 19.1. 20.1 Controls for the auxiliary resistance heating are configured to lock out the supplemental heat when the equipment source-side entering water temperature is above 42°F, unless the hot water supply temperature setpoint to the building heat coils cannot be maintained for 20 minutes.
- 19.2. 20.2 The electric heat pump controls are configured to use the compressor as the first stage of heating.
- 19.3. 20.3 The wastewater heat exchanger and electric heat pumps or other heat pump supplemental systems shall be sized so that the heat pump rated heating capacity at heat pump design entering water temperature conditions or other heat pump heating systems are no less than 75 percent of the design heating load at 29°F. Waste-water heat exchanger source side shall be sized for a design wastewater entering temperature of 55°F or lower.
20. 21. **Mechanical systems providing heating outside of the building thermal envelope.** Mechanical systems providing heat outside of the building thermal envelope that comply with Section C403.11 are permitted to utilize electric resistance or fossil fuel appliances. Snow- and ice-melt systems that comply with Section C403.11.2 are permitted to utilize electric resistance or fossil fuel heat to back up the primary electric heat pump heating system in accordance with Exceptions 6 and 7 of Section C403.1.4.
21. 22. **Garage Elevator Lobbies.** Elevator lobbies in parking garages are permitted to be served by electric resistance or fossil fuel appliances on forced air systems to heat outdoor air to no greater than 55°F. Electric resistance or fossil fuel appliances shall be selected at the minimum available appliance size to achieve and control to a maximum supply air temperature of 55°F.

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Commented [GJ23]: 24-GP1-249 Eric Vander Mey

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Commented [GJ25]: 24-GP1-159 Carlos Herrera

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C403.10.3 Piping insulation. All piping, other than field installed HVAC system refrigerant piping, serving as part of a heating or cooling system shall be thermally insulated in accordance with Table C403.10.3.

Exceptions:

1. Factory-installed piping within HVAC equipment tested and rated in accordance with a test procedure referenced by this code.
2. Factory-installed piping within room fan-coils and unit ventilators tested and rated according to AHRI 440 (except that the sampling and variation provisions of Section 6.5 shall not apply) and 840, respectively.
3. Piping that conveys fluids that have a design operating temperature range between 60°F (15°C) and 105°F (41°C).
4. ~~Piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.~~
4. ~~R5-~~ Strainers, control valves, and balancing valves associated with piping 1 inch (25 mm) or less in diameter.
5. ~~6-~~ Direct buried piping that conveys fluids at or below 60°F (15°C).
6. ~~7-~~ In radiant heating systems, section of piping intended by design to radiate heat.

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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.

C404.2.1 Service water heating system type. Primary ~~S~~service hot water capacity shall be provided by either:

1. Aan electric-air-source or ground source heat pump water heating (HPWH) system sized to deliver no less than 100 percent of the calculated demand for service hot water production during the peak demand period, meeting the requirements of this section. The HPWH shall be configured to provide the first stage of heating capacity. The remaining primary service water heating output capacity is permitted to be met by type of service water heating system any system type; or Supplemental service water heating equipment is permitted to use electric resistance

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Commented [JK31]: 24-GP1-268 Duane Jonlin

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or fossil fuel in compliance with Section C404.2.1.4.

2. A fossil fuel service water heating system

A base site allowance of 24 kW (82,000 kBtu/h) plus 0.1 watts (0.3412 Btu/h) per square foot of building area of electric resistance or fossil fuel service water heating capacity is allowed per building or tenant space. Where a building includes multiple tenants, the 24 kW allowance is permitted to be prorated according to the percentage of the total conditioned floor area occupied by each tenant, with a minimum of 6 kW permitted for each separately leased tenant space.

Exceptions:

1. 24 kW (82 kBtu/h) plus 0.1 watts (0.3412 BTU/h) per square foot of building area of electric resistance or fossil fuel service water heating capacity is allowed per building or tenant space.
2. 1. Solar thermal, wastewater heat recovery, other approved waste heat recovery, 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*.
The following sources of heat energy, and combinations thereof, are permitted to satisfy all or any portion of the required HPWH primary output capacity where such systems comply with this code and the *Uniform Plumbing Code*, and the same heat energy capacity is not used to demonstrate compliance with Sections C403.9, C406.2.5, C407, or C411:
 - 21.1 Solar thermal systems
 - 21.2 Heat recovery chillers
 - 21.3 Waste heat recovery from water-to-water heat pumps
 - 21.4 Wastewater heat recovery systems
 - 21.5 Condenser heat recovery
 - 21.6 Steam condensate water heat recovery
 - 21.7 Refrigeration condenser heat recovery
 - 21.8 Other approved sources of waste heat energy
3. 2. Systems that comply with the Northwest Energy Efficiency Alliance (NEEA) Commercial Electric Advanced Water Heating Specification. (AWHS). All specified equipment under this exception shall be products listed in the Qualified Products List (QPL) for commercial and Group R-2 occupancies. Project compliance documentation shall include a list of all applicable AWHS criteria and the project design elements that meet the specified criteria.
4. 3. 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, including more energy-efficient upgrades to such existing systems, are permitted to serve as the primary heating energy source.
5. 4. Commercial dishwashers, commercial food service equipment, and other approved process equipment are permitted to utilize electric or fossil fuel booster heaters for supply water temperatures 120°F (49°C) or higher.
6. 5. 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. Group I-2 and Group I-3 occupancy essential facilities that by regulation are required to have in place redundant emergency backup systems 6. Emergency back-up service water heating capacity provided in addition to the primary service water heating capacity is permitted in Group I-2 and Group I-3 essential facilities. This additional capacity is permitted to be met by any type of service water heating system and shall be controlled to operate only when the primary service water heating system is not available.
8. 7. Point of use instantaneous electric water heaters, serving fixtures no more than 8 feet of developed pipe length from the water heater, are permitted and do not contribute to the building combined water heating capacity calculation.
9. 8. For other than Group R and Group I occupancies, unitary electric air-source heat pump water heaters are permitted to extract heat from the conditioned space where the primary source of space heating is electric heat pump or where heat recovery of waste heat is available, and where they are sized to meet all calculated service water heating demand using the heat pump compressor, and not supplementary heat. For the purposes of this exception, "heat recovery of waste heat" is permitted to utilize heat from commercial cooking appliances, freezers, refrigerators, electronic equipment, machine rooms, and other approved internal heat sources with sufficient magnitude and consistency to provide the majority of the heat energy required by operation of the heat pump water heater.
10. 9. Standby service water heating equipment provided in addition to the primary as a redundant backup heating

Commented [JK35]: Lisa: Perhaps flip Items 1 and 2 so "fossil fuel system" is not the first item on the list.

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Commented [JK37R36]: Approved and incorporated

Commented [JG38]: 24-GP1-162 Dave Price (Not Yet Adopted)

Commented [JG39]: 24-GP1-232 Lisa Rosenow version of #2 (Not Yet Adopted)

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Commented [JG41]: 24-GP1-232 Lisa Rosenow (Not Yet Adopted)

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Commented [JK43]: Lisa: What does Exception 3 for the NEEA Advanced Water Heating Spec exception accomplish now with all the proposed changes to this section?

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Commented [JG45]: 24-GP1-277 Duane Jonlin (Not Yet Adopted)

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Commented [JK48]: 24-GP1-232 Lisa Rosenow

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Commented [JG50]: 24-GP1-253 Eric Vander Mey (Not Yet Adopted)
24-GP1-277 Duane Jonlin (Not Yet Adopted)

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24-GP1-277 Duane Jonlin (Not Yet Adopted)

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system, and controlled such that it will only be used when the primary heating equipment is not available, is permitted to be electric resistance or fossil fuel.

C404.2.1.1 Primary heat pump system sizing. Primary heat pump water heating systems shall comply with Sections C404.2.1.1.1 through C404.2.1.1.4.

C404.2.1.1.1 Primary heat pump system sizing. The primary heat pump service water heating system shall be sized to deliver no less than 50 percent of the calculated demand for service hot water production during the peak demand period. Demand The heat pump capacity shall be calculated using the equipment manufacturer's selection criteria or another *approved* methodology with entering dry bulb or wet bulb outdoor air temperature at 40°F (4°C) for air-source heat pumps, or 44°F (7°C) ground temperature for ground-source heat pumps. Electric air source heat pumps shall also be sized to deliver no less than 2550 percent of the calculated demand for service hot water production during the peak demand period when entering dry bulb or wet bulb outdoor air temperature is 24°F (-4°C). The remaining primary service output may be met by fossil fuel, electric resistance, or heat pump water heating systems.

Exceptions:

1. 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.
2. Any of the following system types are permitted to replace all or part of the primary heat pump service water heating system capacity:
 - 2.1. Wastewater heat recovery systems that recover heat from wastewater of both cold and hot water plumbing fixtures and that utilize water-source heat pumps. The heat pumps shall be sized for incoming wastewater temperatures of no higher than 70°F (21°C) for Group R and Group I occupancies, and no higher than 60°F (16°C) for all other occupancies, unless an alternate wastewater temperature is approved by the code official.
 - 2.2. Solar thermal systems.
 - 2.3. Other water-source heat pump systems that utilize waste heat recovered from year-round mechanical cooling loads or other approved sources.

C404.2.1.1.2 Primary hot water storage sizing. The system shall provide sufficient hot water to satisfy peak demand period requirements.

C404.2.1.1.3 Heat pump 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.

C404.2.1.1.4.1 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.

C404.2.1.2.4.4 Supplemental water heating. Total supplemental water heating equipment shall not have an output capacity greater than shall not exceed the total summed capacity of all primary water heating equipment. Supplemental capacity is permitted to be provided by any type of service water heating system. For the purposes of determining this supplemental water heating allowance, the capacity of primary water heating equipment shall be evaluated at 40°F (4°C) entering dry bulb or wet bulb outdoor air temperature for air- source heat pumps, 44°F (7°C) ground temperature for ground-source heat pumps, and For other primary water heating system types, the capacity shall be based on the nameplate input rating of the equipment for other water heater system types. Sources of service

Commented [JG57]: 24-GP1-268 Duane Jonlin - Double min HP % not yet debated

Commented [JG58]: 24-GP1-232 Lisa Rosenow (Not Yet Adopted)

Commented [JK59R58]: Approved and incorporated

Commented [JK60]: Lisa: Section reconfiguration - I recommend grouping all sections that exclusively govern HPWHs together. So introduce a new section "C404.2.1.1 Heat pump water heating systems" with a charging statement, "Heat pump water heating systems shall comply with Sections C404.2.1.1.1 and C404.2.1.1.2.", then shift the HPHW section to be subsections C404.2.1.1.1 Primary heat pump system sizing and C404.2.1.1.2 Heat pump system design.

Commented [JK61]: Lisa Rosenow suggested this edit. Would change what was passed in 21-GP1-232 V2.

Commented [JK62]: 24-GP1-268 Duane Jonlin

Commented [JK63R62]: Approved and incorporated

Commented [JK64]: Mike: This seems odd in here now

Commented [JK65R64]: This was kept in here through all of the C404.2 code proposals. If you have suggested changes please let me know before Friday.

Commented [JG66]: 24-GP1-253 Eric Vander Mey (Not Yet Adopted)
24-GP1-268 Duane Jonlin (Not Yet Adopted)

Commented [JK67R66]: This portion of 253 has been approved and incorporated.

Commented [JK68]: Lisa: Is the intent of Sections C404.2.1.2 Primary hot water storage sizing and C404.2.1.3.1 Mixing valve to apply to all SWH system types? If so then the placement/indentation of C404.2.1.2 is fine, but the mixing valve section should be shifted to C404.2.1.3.

Commented [JK69R68]: For TAG consideration.

Commented [JG70]: 24-GP1-232 Lisa Rosenow (Not Yet Adopted)

Commented [JK71R70]: Approved and incorporated

hot water exempted under C404.2.1 shall not be included in the supplemental water heating allowance.

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.
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. 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.
 - 4.2. The primary water heating equipment cannot satisfy the system load due to equipment failure or entering air temperature below 40°F (4°C).

C404.2.1.35 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.

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) to achieve a minimum of 5020 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) to achieve a minimum of 5020 percent of the efficiency credits required for additions.
3. Warehouses are exempt from the load management credit requirements in Table C406.1.

Commented [JK72]: This would fall under Group S-1/S-2 now.

Commented [JK73]: This was reduced because Table C406.1 will likely increase significantly compared to what it was in 2021. Could be adjusted further by SBCC or MVE once PNNL numbers come back.

Commented [JK74]: This was reduced because Table C406.1 will likely increase significantly compared to what it was in 2021. Could be adjusted further by SBCC or MVE once PNNL numbers come back.

Commented [JK75]: This would fall under Group S-1/S-2 now.

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

Required Credits for Projects	Section	Occupancy Group							
		Group R-1	I-2	Group R-2 R-4 I-1	Group B	A-2	Group E	Group M	S-1 S-2 All Other
New building energy efficiency credit requirement	C406.2	TBD ⁵⁴	TBD	TBD ⁴⁴	TBD ⁴²	TBD	TBD ⁴⁸	TBD ⁷⁴	TBD
Building additions energy efficiency credit requirement	C406.2	TBD ²⁷	TBD	TBD ²⁰	TBD ²⁴	TBD	TBD ²³	TBD ³⁶	TBD

New building load management credit requirement	C406.3	12	TBD	15	27	TBD	15	13	0	26
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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 C406.2.12 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 C406.2.12 through C406.2.14 create or modify the table credits, the credits achieved shall be based upon the section calculations. [Buildings with high efficiency space heating and/or service water heating systems that comply with the requirements of Section C406.2.1 shall achieve the number of credits based on the calculations of this section.](#)

Projects that choose to comply with the fossil fuel pathway in Section C401.3 shall use Table C406.2(2) to achieve credits.

[Buildings that only use high efficiency space heating equipment that comply with the requirements of Section C406.2.1 shall use Table C406.2\(1\) for credit values. Buildings that use no space heating systems that comply with the requirements of Section C406.2.1 shall use Table C406.2\(2\) for credit values. For buildings that use a mix of space heating systems in compliance with Section C406.2.1, the number of space heating energy efficiency credits available for measures with a prorating flag "Heat" are calculated using Equation 4-14:](#)

$$CR_{SH} = CFF_{SH} \times FF_{SH}/C_{SH} + CHP_{SH} \times (1 - FF_{SH}/C_{SH}) \quad \text{Equation 4-14}$$

Where:

CR_{SH}	=	Blended credit measures for mixed fuel systems.
CHP_{SH}	=	Credits available in Table C406.2(1).
CFF_{SH}	=	Credits available in Table C406.2(2).
FF_{SH}	=	Installed primary fossil fuel space heating capacity in Btu/h that does not comply with any of the exceptions in Section C403.1.4.
C_{SH}	=	Total installed heating capacity in kBtu/h of all primary space heating appliances.

[Buildings that only use high efficiency service water heating equipment that comply with the requirements of Section C406.2.1 shall use Table C406.2\(1\) for credit values. Buildings that use no service water heating systems that comply with the requirements of Section C406.2.1 shall use Table C406.2\(2\) for credit values. For buildings that use a mix of service water heating systems in compliance with Section C406.2.1, the number of service water heating energy efficiency credits available for measures with a prorating flag "SWH" are calculated using Equation 4-15:](#)

$$CR_{WH} = CFF_{WH} \times FF_{WH}/C_{WH} + CHP_{WH} \times (1 - FF_{WH}/C_{WH}) \quad \text{Equation 4-15}$$

Where:

CR_{WH}	=	Blended credit measures for mixed fuel systems.
CHP_{WH}	=	Credits available in Table C406.2(1).
CFF_{WH}	=	Credits available in Table C406.2(2).
FF_{WH}	=	Installed primary fossil fuel service water heating capacity in Btu/h that does not comply with any of the exceptions to Section C404.2.1.
C_{WH}	=	Total installed heating capacity in kBtu/h of all primary service water heating appliances.

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

$$C_{SH} = CHP_{SH} \times B/C + CFF_{SH} \times (1 - B/C) \text{----- Equation 4-14}$$

Where:

- C_{SH} = Blended credits for mixed-fuel systems.
- CHP_{SH} = Credits available in Table C406.2(1).
- CFF_{SH} = Credits available in Table C406.2(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 prorating flag "SWH" are calculated using the following equation 4-15:

$$C_{WH} = CHP_{WH} \times B/C + CFF_{WH} \times (1 - B/C) \text{----- Equation 4-15}$$

Where:

- C_{WH} = Blended credits for mixed-fuel systems.
- CHP_{WH} = Credits available in Table C406.2(1).
- CFF_{WH} = Credits available in Table C406.2(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 water heating appliances.

TABLE C406.2(1)
EFFICIENCY MEASURE CREDITS FOR BUILDINGS SERVED BY HIGH EFFICIENCY HEATING SYSTEMS

Measure Title	Applicable Section	Prorating Flag	Occupancy Group								
			Group R-1	I-2	Group R-2 R-4 I-1	A-2	Group B	Group E	S-1 S-2	Group M	All Other
1. Dwelling unit HVAC control	C406.2.2	Heat	NA	TBD	7	TBD	NA	NA	TBD	NA	NA
2. Improved HVAC TSPR ^a	C406.2.2.1	Heat	NA	TBD	8	TBD	11	17	TBD	22	NA
3. Improve cooling and fan efficiency	C406.2.2.2	Heat	2	TBD	2	TBD	3	4	TBD	3	2
4. Improve heating efficiency	C406.2.2.3	Heat	2	TBD	3	TBD	8 3	3 4	TBD	9 6	5 7
5. Improved low-carbon district energy system (10% better)	C406.2.2.4		3	TBD	3	TBD	4	11	TBD	17	8
6. Improved low-carbon district energy system (20% better) ^b	C406.2.2.5		9	TBD	10	TBD	12	33	TBD	52	24
7. High performance DOAS	C406.2.2.6	Heat	31	TBD	31	4 0	21	39	TBD	40	21/(A) 40 ^c
8. Fault detection & diagnostics (FDD)	C406.2.2.7	Heat	2	TBD	2	TBD	2	6	TBD	9	4
9. 10% reduced lighting power	C406.2.3.1	Heat	7	TBD	4	TBD	18	16	TBD	20	15
10. 20% reduced lighting power ^d	C406.2.3.2	Heat	13	TBD	8	TBD	36	32	TBD	40	29
11. Lamp efficacy improvement	C406.2.3.3	Heat	5	TBD	6	TBD	NA	NA	TBD	NA	NA
12. Residential lighting control	C406.2.4.1	Heat	NA	TBD	8	TBD	NA	NA	TBD	NA	NA
13. Enhanced lighting control	C406.2.4.2	Heat	1	TBD	1	TBD	6	6	TBD	11	6
14. Renewable energy	C406.2.5			TBD	12	TBD	13	13	TBD	10	11
15. Shower drain heat recovery	C406.2.6.1	SWH	9	TBD	30	TBD	NA	3	TBD	NA	NA
16. Service water heat recovery	C406.2.6.2	SWH	35	TBD	111	TBD	13	14	TBD	Grocery 41 ^e	NA
17. Heat pump water heating	C406.2.6.3	SWH	72	TBD	54	2 9	1	13	TBD	Grocery 5 ^e	NA 29 ^f
18. High efficiency service water heating, gas-fired	C406.2.6.4	SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA
19. Heat trace system	C406.2.7.1	SWH	6	TBD	13	TBD	4	1	TBD	NA	6
20. Point of use water heater	C406.2.7.2	SWH	NA	TBD	NA	TBD	19	5	TBD	NA	NA

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TABLE C406.2(1) Continued
EFFICIENCY MEASURE CREDITS FOR BUILDINGS SERVED BY HIGH EFFICIENCY HEATING SYSTEMS

Measure Title	Applicable Section	Prorating Flag	Occupancy Group								
			Group R-1	I-2	Group R-2 R-4 I-1	A-2	Group B	Group E	S-1 S-2	Group M	All Other
21. Service hot water distribution right sizing	C406.2.8	<u>13</u>	<u>13</u>	<u>TBD</u>	42	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
22. High performance service hot water temperature maintenance system	C406.2.9	<u>6</u>	<u>6</u>	<u>TBD</u>	13	<u>TBD</u>	4	1	<u>TBD</u>	NA	6
23. High efficiency service hot water circulation system	C406.2.10	<u>3</u>	<u>3</u>	<u>TBD</u>	6	<u>TBD</u>	2	1	<u>TBD</u>	NA	4
24. Low flow residential showerheads	C406.2.11	SWH	3	<u>TBD</u>	3	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
25. Enhanced envelope performance ^g	C406.2.12	Heat	24	<u>TBD</u>	20	<u>TBD</u>	13	5	<u>TBD</u>	19	14
26. Base reduced air leakage ^g	C406.2.13.1	<u>Heat</u>	29	<u>TBD</u>	24	<u>TBD</u>	6	3	<u>TBD</u>	9	11
27. Enhanced reduced air leakage ^g	C406.2.13.2	Heat	53	<u>TBD</u>	44	<u>TBD</u>	11	5	<u>TBD</u>	16	20
28. Enhanced commercial kitchen equipment	C406.2.14	Heat	30 ^h	<u>TBD</u>	18 ^h	<u>TBD</u>	18 ^h	30 ^h	<u>TBD</u>	30 ^h	31 ^h
29. Enhanced residential kitchen equipment	C406.2.15	Heat	12	<u>TBD</u>	19	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
30. Enhanced residential laundry equipment	C406.2.16	Heat	NA	<u>TBD</u>	6	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
31. Heat pump clothes dryers	C406.2.17	Heat	6	<u>TBD</u>	6	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
32. Efficient elevator equipment	C406.2.18	Heat	3	<u>TBD</u>	5	<u>TBD</u>	5	5	<u>TBD</u>	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 BUILDINGS NOT SERVED BY HIGH EFFICIENCY HEATING SYSTEMS USE
WITH FOSSIL-FUEL COMPLIANCE PATH

Measure Title	Applicable Section	Prorating Flag	Occupancy Group								
			Group R-1	I-2	Group R-2 R-4 I-1	A-2	Group B	Group E	S-1 S-2	Group M	All Other
1. Dwelling unit HVAC control	C406.2.2	Heat	NA	<u>TBD</u>	<u>148</u>	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
2. Improved HVAC TSPR ^a	C406.2.2.1	Heat	NA	<u>TBD</u>	<u>109</u>	<u>TBD</u>	<u>1412</u>	<u>2219</u>	<u>TBD</u>	<u>2924</u>	NA
3. Improve cooling and fan efficiency	C406.2.2.2	Heat	<u>1012</u>	<u>TBD</u>	<u>68</u>	<u>TBD</u>	<u>1314</u>	<u>88</u>	<u>TBD</u>	<u>819</u>	<u>919</u>
4. Improve heating efficiency	C406.2.2.3	Heat	2	<u>TBD</u>	3	<u>TBD</u>	<u>83</u>	<u>311</u>	<u>TBD</u>	<u>918</u>	<u>58</u>
5. Improved low-carbon district energy system (10% better)	C406.2.2.4		3	<u>TBD</u>	3	<u>TBD</u>	4	<u>1112</u>	<u>TBD</u>	<u>1719</u>	<u>89</u>
6. Improved low-carbon district energy system (20% better) ^b	C406.2.2.5		<u>919</u>	<u>TBD</u>	<u>1011</u>	<u>TBD</u>	<u>1213</u>	<u>3336</u>	<u>TBD</u>	<u>5257</u>	<u>2426</u>
7. High performance DOAS	C406.2.2.6	Heat	<u>4034</u>	<u>TBD</u>	<u>4034</u>	<u>TBD</u>	<u>2723</u>	<u>5113</u>	<u>TBD</u>	<u>5244</u>	<u>2723/</u> <u>(A) 52°</u> <u>40</u>
8. Fault detection & diagnostics (FDD)	C406.2.2.7	Heat	<u>32</u>	<u>TBD</u>	<u>32</u>	<u>TBD</u>	<u>32</u>	<u>86</u>	<u>TBD</u>	<u>129</u>	<u>54</u>
9. 10% reduced lighting power	C406.2.3.1	Heat	<u>67</u>	<u>TBD</u>	<u>34</u>	<u>TBD</u>	<u>1518</u>	<u>1416</u>	<u>TBD</u>	<u>1720</u>	<u>1315</u>
10. 20% reduced lighting power ^d	C406.2.3.2	Heat	<u>1113</u>	<u>TBD</u>	<u>78</u>	<u>TBD</u>	<u>3136</u>	<u>2732</u>	<u>TBD</u>	<u>3440</u>	<u>2529</u>
11. Lamp efficacy improvement	C406.2.3.3	Heat	<u>45</u>	<u>TBD</u>	<u>56</u>	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
12. Residential lighting control	C406.2.4.1	Heat	NA	<u>TBD</u>	<u>78</u>	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
13. Enhanced lighting control	C406.2.4.2	Heat	1	<u>TBD</u>	1	<u>TBD</u>	<u>56</u>	<u>56</u>	<u>TBD</u>	<u>911</u>	<u>56</u>
14. Renewable energy	C406.2.5		7	<u>TBD</u>	12	<u>TBD</u>	13	13	<u>TBD</u>	10	11
15. Shower drain heat recovery ⁱ	C406.2.6.1	SWH	<u>2319</u>	<u>TBD</u>	<u>7533</u>	<u>TBD</u>	NA	<u>83</u>	<u>TBD</u>	NA	NA
16. Service water heat recovery ⁱ	C406.2.6.2	SWH	<u>8835</u>	<u>TBD</u>	<u>2781</u> <u>11</u>	<u>TBD</u>	<u>3313</u>	<u>3514</u>	<u>TBD</u>	Grocery <u>10341</u> ^e	NA
17. Service water heating equipment efficiency Heat pump water heating	C406.2.6.3	SWH	<u>1351</u> <u>8</u>	<u>TBD</u>	<u>1632</u> <u>9</u>	<u>10</u>	<u>172</u>	<u>331</u>	<u>TBD</u>	Grocery <u>956</u> ^e	(A-2) <u>NA95</u> ^f
18. High efficiency service water heating, gas-fired	C406.2.6.4	SWH	59	<u>TBD</u>	65	<u>TBD</u>	6	11	<u>TBD</u>	18	32
18. Heat trace system ⁱ	C406.2.7.1	SWH	<u>156</u>	<u>TBD</u>	<u>3313</u>	<u>TBD</u>	<u>104</u>	<u>31</u>	<u>TBD</u>	NA	<u>156</u>

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Table C406.2(2) - continued
EFFICIENCY MEASURE CREDITS FOR BUILDINGS NOT SERVED BY HIGH EFFICIENCY HEATING SYSTEMS
USE WITH FOSSIL FUEL COMPLIANCE PATH

Measure Title	Applicable Section	Prorating Flag	Occupancy Group								
			Group R-1	I-2	Group R-2 R-4 I-1	A-2	Group B	Group E	S-1 S-2	Group M	All Other
1920. Point of use water heater ^f	C406.2.7.2	SWH	NA	<u>TBD</u>	NA	<u>TBD</u>	48 49	<u>135</u>	<u>TBD</u>	NA	NA
2024. Service hot water distribution right sizing	C406.2.8		13	<u>TBD</u>	42	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
212. High performance service hot water temperature maintenance system	C406.2.9		6	<u>TBD</u>	13	<u>TBD</u>	4	1	<u>TBD</u>	NA	6
223. High efficiency service hot water circulation system	C406.2.10		3	<u>TBD</u>	6	<u>TBD</u>	2	1	<u>TBD</u>	NA	4
234. Low flow residential showerheads	C406.2.11	SWH	<u>83</u>	<u>TBD</u>	<u>83</u>	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
245. Enhanced envelope performance ^{g,1}	C406.2.12	Heat	<u>3124</u>	<u>TBD</u>	<u>2620</u>	<u>TBD</u>	<u>1743</u>	<u>75</u>	<u>TBD</u>	<u>2549</u>	<u>1844</u>
256. Base reduced air leakage ^g	C406.2.1 3.1	<u>Heat</u>	29	<u>TBD</u>	24	<u>TBD</u>	6	3	<u>TBD</u>	9	11
267. Enhanced reduced air leakage ^g	C406.2.1 3.2	Heat	53	<u>TBD</u>	44	<u>TBD</u>	11	5	<u>TBD</u>	16	20
278. Enhanced commercial kitchen equipment	C406.2.14	Heat	<u>3026^h</u>	<u>TBD</u>	<u>4815^h</u>	<u>TBD</u>	<u>4815²_{g^h}</u>	<u>3026^h</u>	<u>TBD</u>	<u>3026^h</u>	<u>3426^h</u>
289. Enhanced residential kitchen equipment	C406.2.15	Heat	<u>1042</u>	<u>TBD</u>	<u>1649</u>	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
2930. Enhanced residential laundry equipment	C406.2.16	Heat	NA	<u>TBD</u>	<u>56</u>	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
304. Heat pump clothes dryers	C406.2.17	Heat	<u>56</u>	<u>TBD</u>	<u>56</u>	<u>TBD</u>	NA	NA	<u>TBD</u>	NA	NA
312. Efficient elevator equipment	C406.2.18	Heat	3	<u>TBD</u>	<u>45</u>	<u>TBD</u>	<u>45</u>	<u>45</u>	<u>TBD</u>	<u>34</u>	<u>34</u>

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

C406.2.1 High efficiency space heating and service water heating equalization credits. Buildings that comply with one of the following are permitted to claim credits per Table C406.2.1:

1. Heat pump space heating systems in compliance with C403.1.4. Water source heat pump systems seeking this credit cannot be configured to operate in a loop with a gas boiler.
2. Electric heat pump water heating systems in compliance with Section C404.2.1
3. Gas heat pump space heating systems in compliance with C403.1.4.
4. For buildings using a mix of equipment that comply with this section, partial credit can be claimed per Sections C406.2.1.1 and C406.2.1.2

Commented [JK76]: Mike: This should reference C403.1.4 exception 6 – which itself needs to be redone.

Commented [JK77R76]: My understanding is that Exception 6 is for an air to water heat pump, which is different than a water source heat pump.

TABLE C406.2.1

HIGH EFFICIENCY HEATING AND SERVICE WATER HEATING EQUALIZATION CREDITS

Measure Title	Occupancy Group								
	R-1	I-2	R-2 R-4 I-1	A-2	B	E	S-1 S-2	M	All Other
New building – electric heat pump space heating system	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
New building – gas heat pump space heating system	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
New building – electric heat pump water heating system	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Building additions – electric heat pump space heating system	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Building additions – gas heat pump space heating system	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Building additions – electric heat pump water heating system	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Commented [JK78]: PNNL to calculate credits for each system type: electric heat pump water heater, electric heat pump space heater, gas heat pump space heater.

When determining which electric heat pump space heating device to use, PNNL should reference the IECC 2024 HVAC system mapping Table to choose the most appropriate system given the default system in the fossil fuel prototype. PNNL should also use professional judgement when this does not make sense.

C406.2.1.1 Mixed efficiency HVAC systems credit modification. For mixed efficiency HVAC systems, the number of HVAC heating energy efficiency credits earned by Table C406.2.1 shall be modified according to the following equation:

$$CE = A \times (1 - B_{SH}/C_{SH})$$

Where:

CE = Additional credits earned, rounded to the nearest whole number.

A = High efficiency heating credits earned from Table C406.2.1.

B_{SH} = Installed primary space heating capacity in Btu/h of space heating appliances that don't comply with Section C406.1.1, excluding any capacity that complies with any of the exceptions to Section C403.1.4.

C_{SH} = Total primary installed space heating capacity in Btu/h of all space heating appliances.

C406.2.1.2 Mixed efficiency service water heating systems credit modification. For mixed efficiency service water heating systems, the number of service water heating energy efficiency credits earned by Table C406.1.1 shall be modified according to the following equation:

$$CE = A \times (1 - B_{WH}/C_{WH})$$

Where:

CE = Additional credits earned, rounded to the nearest whole number.

A = High efficiency service water heating credits earned from Table C406.1.1.

B_{WH} = Installed primary service water heating capacity in Btu/h of service water heating appliances that don't comply with Section C406.1.1, excluding any capacity that complies with any of the exceptions to Section C404.2.1.

C_{WH} = Total primary installed service water heating capacity in Btu/h of all water heating appliances.

C406.2.6.3 Heat pump water heating. 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 the primary heat pump service water heating system is sized to deliver no less than 100 percent of the net calculated demand for service water production during the peak demand period with entering dry bulb or wet bulb outdoor air temperatures at 40°F (4°C) for air-source heat pumps, or 44°F (7°C) ground temperature for ground-source heat pumps, as calculated using the equipment manufacturer's selection criteria or another *approved* methodology. For this credit, the net calculated demand shall be the gross building demand less any portion of the demand complying with the exceptions to Section C404.2.1. Supplemental heating is permitted in accordance with Section C404.2.1, but cannot use fossil fuels. Heat pump water heaters shall comply with 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.

Commented [JK79]: Mike: One edge case here is a systems that doesn't comply with C404.2.1 because the heat pump only hits 40% of the load. Need to be clear that the heat pump cap can be match with non hp cap and the non-complying cap is the remainder (20%) rather than saying 100% doesn't comply because the HP didn't reach 50%.

Commented [JK80]: This credit needs to be changed now that Duane's proposal to make the HPWH 100 percent passed.

TABLE C407.3(2)
BUILDING PERFORMANCE FACTORS (BPF) TO BE USED FOR COMPLIANCE WITH SECTION C407.3

Building Area Type	Building Performance Factor
Multifamily	0.51TBD
Healthcare/hospital	0.70TBD
Hotel/motel	0.51TBD
Office	0.44TBD
Restaurant	0.33TBD
Retail	0.41TBD
School	0.35TBD
Warehouse	0.48TBD
All Others	0.43TBD

TABLE C407.3(3)
SITE ENERGY PERFORMANCE TARGETS TO BE USED FOR COMPLIANCE WITH SECTION C407.3

Building Area Type	Building Performance Factor
Multifamily	0.59TBD
Healthcare/hospital	0.72TBD
Hotel/motel	0.62TBD

Office	0.58TBD
Restaurant	0.59TBD
Retail	0.46TBD
School	0.52TBD
Warehouse	0.29TBD
All Others	0.55TBD

C503.4.76 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](#), Section C403.1.4, or with an alternate compliance option in Table C503.4.67. ~~Where use of heat pump equipment for space heating is required by this section, it is permissible to utilize the Fossil Fuel Compliance Path in Section C401.3 to attain the credits required for building additions shown in Table C401.3.3.~~

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.
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. Replacement of heating equipment with equipment that is the same type as where the rated capacity of the new equipment does not exceed the rated capacity of the existing equipment.

TABLE C503.4.67
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 5 ^d 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 or fossil fuel 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)	Efficiency: +5% ^b
4	Gas-fired hot water boilers with fewer than 80% of served coils replaced	Table C403.3.2(6)	Efficiency: +5% ^b

Commented [JK81]: 24-GP1-207 Greg Johnson

Commented [JK82R81]: Approved and incorporated

Commented [JK83]: 24-GP1-207 Greg Johnson

Commented [JK84R83]: Approved and incorporated

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

- 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 five percent better than that shown in the reference table (1.05 x values in reference table).
- c. Option 1 and Option 2 can be combined.

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 C404.2, 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. ~~Where use of heat pump equipment for service water heating is required by this section, it is permissible to utilize the Fossil Fuel Compliance Path in Section C401.3 to attain the credits required for building additions shown in Table C401.3.3.~~

Exceptions:

1. ~~The following equipment is not required to comply with Section C401.3 or Section C404.2.1, as applicable:~~
 - 1.1. ~~Replacement of service water heating appliances with 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.~~
 - 1.2. ~~Replacement of any of the following water heater appliances:~~
 - 1.2.1. ~~Electric water heaters with an input of 12 kW or less.~~
 - 1.2.2. ~~Gas storage water heaters with an input of 75,000 Btu/h or less.~~
 - 1.2.3. ~~Gas instantaneous water heaters with an input of 200,000 Btu/h or less and 2 gallons or less of storage.~~
 - 1.3. ~~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.~~
2. ~~Systems included in Section C403.5 that serve individual dwelling units and sleeping units~~

Commented [JK85]: Lisa: By striking all like-for-like appliance and small water heater exceptions, does this mean existing electric water heaters have to be replaced with a HPWH or fossil fuel appliance (unless eligible for a C404.2.1 exception), including existing electric water heaters in Group R dwelling units? Is this really the direction we want to force SWH alterations go? IMO it should still include a like-for-like replacement exception for situations where existing building constraints make compliance with the new C404 requirements technically infeasible.