**279 Johnson Updated 6/10/25**

## NOTES

| Color Code | | |
|---|---|---|
| | **This Proposal's Changes** | **Other Proposals Changes** |
| Additions | red, underline | dark blue, underline |
| Deletions | ~~light orange, strike through~~ | ~~light blue, strike through~~ |

1. A workgroup will work closely with PNNL to define the assumptions and criteria that are used for modeling and calculations. Models and calculations will be used to develop the values in C406 tables.
2. The intent is to simplify where possible without penalizing any one system type.
3. Discrete levels of improvement for each measure contained in Table C406.2(X) is to be adjusted based upon modeling/calculation results.
4. System type definitions may be adjusted (added or combined) based upon modeling/calculation results.

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## 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. *Simulated Building Performance*. The *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 $AEC_{RRa}$.

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 | C401.3.3.2 | 99 | 106 | 14 | 9 | 40 | 54 |

| Measure Title | Applicable Section | Occupancy Group | | | | | |
|---|---|---|---|---|---|---|---|
| | | Group R-1 | Group R-2 | Group B | Group E | Group M | All Other |
| using the fossil fuel pathway | | | | | | | |

**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 Equation 4-1:

$$CR = A \times (C - B)/D \quad \textbf{(Equation 4-1)}$$

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 Equation 4-2:

$$CR = A \times (C - B)/D \quad \textbf{(Equation 4-2)}$$

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).

## SECTION C403
## MECHANICAL SYSTEMS

**C403.1 General.** Mechanical systems and equipment serving heating, cooling, ventilating, and other needs shall comply with this section.

**Exceptions**:

1. Energy using equipment used by a manufacturing, industrial or commercial process other than for conditioning spaces or maintaining comfort and amenities for the occupants are exempt from all Section C403 subsections except for Section C403.3.2, Tables C403.3.2(1) through (16) inclusive, Sections C403.3.4.1, C403.3.4.2, C403.3.4.3. C403.7.7, C403.9.2.1, C403.10.3, C403.11.2, and C403.11.3. Data center and computer room HVAC equipment is not covered by this exception.
2. *Data center systems* shall comply with Sections C403.1.2, C403.1.3 and C403.6 through C403.13.

**C403.1.1 HVAC total system performance ratio (*HVAC TSPR*).** For systems serving office (including medical office), retail, library and education occupancies and buildings, which are subject to the requirements of Section C403.3.5 without exceptions, and the dwelling units and residential common areas within Group R-2 multi-family buildings, the *HVAC total system performance ratio* (*HVAC TSPR*) of the *proposed design* HVAC system shall be greater than or equal to the *HVAC TSPR* of the *standard reference design* as calculated according to Appendix D, Calculation of HVAC Total System Performance Ratio.

**Exceptions:**

1. Buildings where the sum of the *conditioned floor area* of office, retail, education, library, and multifamily spaces is less than 5,000 square feet. Areas that are eligible for any of the exceptions below do not count towards the 5,000 square feet.
2. HVAC systems using district heating water, chilled water or steam.
3. HVAC systems connected to a *low-carbon district energy exchange system*.
4. HVAC systems not included in Table D601.10.1.
5. HVAC systems with chilled water supplied by absorption chillers, heat recovery chillers, water to water heat pumps, air to water heat pumps, or a combination of air and water cooled chillers on the same chilled water loop.
6. HVAC systems included in Table D601.10.1 with parameters in Table D601.10.2 not identified as applicable to that HVAC system type.
7. HVAC system served by heating water plants that include air to water or water to water heat pumps.
8. Underfloor air distribution and displacement ventilation HVAC systems.
9. Space conditioning systems that do not include *mechanical cooling*.
10. Alterations to existing buildings that do not substantially replace the entire HVAC system and are not serving initial build-out construction.
11. ~~HVAC systems meeting all the requirements of the *standard reference design* HVAC system in Table D602.11, Standard Reference Design HVAC Systems.~~ HVAC systems meeting all the requirements of the standard reference design HVAC system in Table D602.11, Standard Reference Design HVAC Systems. Heating and cooling efficiency shall meet the requirements from Tables C403.3.3.2(2) and C403.3.3.2(14) instead of the COPnf listed in Table D602.11.
12. Buildings or areas of medical office buildings that comply fully with ASHRAE Standard 170 including, but not limited to, surgical centers, or that are required by other applicable codes or standards to provide 24/7 air handling unit operation.
13. HVAC systems serving the following areas and spaces:
    - 13.1. Laundry rooms.
    - 13.2. Elevator machine rooms.
    - 13.3. Mechanical and electrical rooms.
    - 13.4. *Data centers* and *computer rooms*.
    - 13.5. Laboratories with fume hoods.
    - 13.6. Locker rooms with more than two showers.
    - 13.7. Natatoriums and rooms with saunas.
    - 13.8. Restaurants and commercial kitchens with total cooking capacity greater than 100,000 Btu/h.

**Commented [GJ1]:** 24-GP1-210 PNNL

13.9. Areas of buildings with commercial refrigeration equipment exceeding 100 kW of power input.

13.10. Cafeterias and dining rooms.

**C403.1.2 Calculation of heating and cooling loads.** Design loads associated with heating, ventilating and air conditioning of the building shall be determined in accordance with the procedures described in ANSI/ASHRAE/ACCA Standard 183 or by an *approved* equivalent computational procedure, using the design parameters specified in Chapter 3. Heating and cooling loads shall be adjusted to account for load reductions that are achieved where energy recovery systems are utilized in the HVAC system in accordance with the ASHRAE *HVAC Systems and Equipment Handbook* by an *approved* equivalent computational procedure.

**C403.1.3 Data centers**. *Data center systems* shall comply with Sections 6 and 8 of ASHRAE 90.4.

**C403.1.4 ~~Use of electric resistance and fossil fuel-fired~~ HVAC heating equipment.** HVAC heating energy shall not be provided by electric resistance ~~or fossil fuel combustion~~ appliances unless otherwise specified. 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. All primary space heating equipment shall be included in section C406 space heating calculations for determining energy efficiency credit requirements unless exempted below. 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 $m^2$) 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

**Commented [GJ2]:** 24-GP1-207 Gregory Johnson

**Commented [GJ3]:** This proposal (279) does not aim to change any portion of exceptions from previous adopted proposals. Inclusion for reference purpose only. SBCC staff to verify if language is correct.

**Commented [GJ4]:** 24-GP1-211 Diana Fisher

**Commented [GJ5]:** 24-GP1-249 Eric Vander Mey

**Commented [GJ6]:** 24-GP1-243 Ben Omura

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 setpoint 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 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 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.
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.~~ **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.
19. **Standby power generators.** Generators serving emergency power, legally required standby power, or optional standby power are permitted to use fossil fuels.
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:
    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.
    20.2. The electric heat pump controls are configured to use the compressor as the first stage of heating.
    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.
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.
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.

**Commented [GJ7]:** Why did Jonny propose eliminating this exception? Did I miss a proposal in my coordination?

**Commented [GJ8]:** 24-GP1-249 Eric Vander Mey

**Commented [GJ9]:** 24-GP1-249 Eric Vander Mey

**Commented [GJ10]:** 24-GP1-249 Eric Vander Mey

**Commented [GJ11]:** 24-GP1-249 Eric Vander Mey

**Commented [GJ12]:** 24-GP1-159 Carlos Herrera

**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(1) or

C403.10.3(2).

**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.~~
5. Strainers, control valves, and balancing valves associated with piping 1 inch (25 mm) or less in diameter.
6. Direct buried piping that conveys fluids at or below 60°F (15°C).
7. In radiant heating systems, section of piping intended by design to radiate heat.

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**TABLE C403.3.2(17)**
**GAS OPERATED AIR-SOURCE HEAT PUMPS—**
**MINIMUM EFFICIENCY REQUIREMENTS**

| Equipment Type | Size Category | Heating Section Type | Subcategory or Rating Condition | Minimum Efficiency | Test Procedure[a] |
|---|---|---|---|---|---|
| Gas heat pump | All | All | 17º F outdoor air temperature | 1.0 COP | ANSI Z21.40.4-CSA 2.94 |

## SECTION C404
## SERVICE WATER HEATING AND PRESSURE-BOOSTER SYSTEMS

**C404.1 General.** This section covers the minimum efficiency of, and controls for, service water-heating equipment and insulation of service hot water piping.

**Exception**: Energy using equipment used by a manufacturing, industrial or commercial process other than maintaining comfort and amenities for the occupants are exempt from all Section C404 subsections except Sections C402.2 and C404.13.

**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~~ design criteria.** Primary service hot water capacity ~~shall be~~ provided by an ~~electric~~ air-source source or ground-source heat pump water heating (HPWH) system shall be sized in accordance with Section C404.2.1.1. ~~to deliver no less than 50 percent of the calculated demand for service hot water production during the peak demand period meeting the requirements of this section~~. The HPWH system 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 any type of service water heating system. Supplemental service water heating equipment is permitted to use electric resistance or fossil fuel in compliance with Section C404.2.1.4.~~ Primary capacity provided by all other service water heating equipment types shall be sized per the equipment manufacturer's sizing criteria or an approved source. The system shall provide sufficient hot water capacity to satisfy the demand for service hot water production during the peak demand period. System design capacity is inclusive of internal storage capacity, and external storage capacity as applicable. All primary service water heating equipment ~~capacity~~ shall be included in the Section C406 service water heating calculations for determining ~~the required~~ energy efficiency credits ~~in accordance with Section C406~~ unless exempted below.

**Exceptions**:

1. A base site allowance of 24 kW (82 kBtu/h) plus 0.1 watt (0.3412 Btu/h) per square foot of the total building area is permitted for electric resistance or fossil fuel service water heating capacity per building. Where a building includes multiple tenants, the 24 kW (82 kBtu/h) 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.

**C404.2.1.1 Primary heat pump system sizing.** The primary heat pump service water heating system shall be sized to deliver no less than ~~50~~100 percent of the calculated demand for service hot water production during the peak demand period. Demand 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 ~~25~~50 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 water heating output capacity ~~may~~ is permitted to be met by ~~fossil fuel, electric resistance, or heat pump~~ any type of service water heating system ~~s~~ and be included as part of the HPWH system capacity.

**Exception:**

1. ~~Twenty-five~~ Fifty 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:
   a. Wastewater heat recovery systems that recover heat from wastewater of both cold and hot water plumbing fixtures and that utilize electric 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

**Commented [GJ14]:** 24-GP1-232V2 Rosenow as modified by Rosenow drafted 279 amendment (May 23, 2025)

**Commented [GJ15]:** Moved to C404.2.1.1

**Commented [lr16]:** Probably needs better wording for this...

**Commented [GJ17]:** Aside from moving the base site allowance back as exception 1 and appending it per Lisa/Jonny's request, this proposal (279) does not aim to change any portion of exceptions from previous adopted proposals. Inclusion for reference purpose only. SBCC staff to verify if language is correct.

**Commented [GJ18]:** 24-GP1-268 Jonlin

**Commented [GJ19]:** 24-GP1-232V2 Rosenow (relocated from C404.2.1 to C404.2.1.1)

alternate wastewater temperature is *approved* by the *code official*.

b. Solar thermal systems.

c. Other electric water-source heat pump systems that utilize waste heat recovered from year-round mechanical cooling loads or other *approved* sources.

**C404.2.1.2 Primary hot water storage sizing.** The system ~~shall~~ design may include a combination of service water heating equipment capacity and storage necessary to provide sufficient hot water to satisfy peak demand period requirements.

**TABLE C404.2**
**MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT**

| Equipment Type | Size Category (input) | Subcategory or Rating Condition | Draw Pattern | Performance Required[a,j] | Test Procedure[b] |
|---|---|---|---|---|---|
| Electric table-top water ~~heaters~~[k] heaters[c] | ≤ 12 kW[e] | ≥ 20 gal<br>≤ 120 gal[d] | Very small<br>Low<br>Medium<br>High | UEF ≥ 0.6323 - (0.0058 × Vr)<br>UEF ≥ 0.9188 - (0.0031 × Vr)<br>UEF ≥ 0.9577 - (0.0023 × Vr)<br>UEF ≥ 0.9884 - (0.0016 × Vr) | DOE 10 C.F.R. Part 430 App. E |
| Electric storage water heaters[g,e,f] resistance and heat pump | ≤ 12 kW[e] | ≥ 20 gal<br>≤ 55 gal[f] | Very small<br>Low<br>Medium<br>High | UEF ≥ 0.8808 - (0.0008 × Vr)<br>UEF ≥ 0.9254 - (0.0003 × Vr)<br>UEF ≥ 0.9307 - (0.0002 × Vr)<br>UEF ≥ 0.9349 - (0.0001 × Vr) | DOE 10 C.F.R. Part 430 App. E |
| | ≤ 12 kW | > 55 gal<br>≤ 120 gal[f] | Very small<br>Low<br>Medium<br>High | UEF ≥ 1.9236 - (0.0011 × Vr)<br>UEF ≥ 2.0440 - (0.0011 × Vr)<br>UEF ≥ 2.1171 - (0.0011 × Vr)<br>UEF ≥ 2.2418 - (0.0011 × Vr) | DOE 10 C.F.R. Part 430 App. E |
| Electric storage water ~~heaters~~[g] heaters[e,f,m] | > 12 kW | -- | -- | (0.3 + 27/Vm), %/h | DOE 10 C.F.R. 431.106 App B. |
| Grid-enabled water heaters[g,i] | -- | > 75 gal[d] | Very small<br>Low<br>Medium<br>High | UEF ≥ 1.0136 - (0.0028 × Vr)<br>UEF ≥ 0.9984 - (0.0014 × Vr)<br>UEF ≥ 0.9853 - (0.0010 × Vr)<br>UEF ≥ 0.9720 - (0.0007 × Vr) | DOE 10 C.F.R. 430 Appendix E |
| Electric instantaneous water heater[h] | ≤ 12 kW | < 2 gal[d] | Very small<br>Low<br>Medium<br>High | UEF ≥ 0.91<br>UEF ≥ 0.91<br>UEF ≥ 0.91<br>UEF ≥ 0.92 | DOE 10 C.F.R. Part 430 |
| | > 12 kW & ≤ 58.6 ~~kW~~[e] kW[i] | ≤ 2 gal & ≤ 180°F | All | UEF ≥ 0.80 | DOE 10 C.F.R. Part 430 |
| Gas storage water ~~heaters~~[g] heaters[e,m] | ≤ 75,000 Btu/h | ≥ 20 gal & ≤ 55 ~~gal~~[f] gal[d] | Very small<br>Low<br>Medium<br>High | UEF ≥ 0.3456 - (0.0020 × Vr)<br>UEF ≥ 0.5982 - (0.0019 × Vr)<br>UEF ≥ 0.6483 - (0.0017 × Vr)<br>UEF ≥ 0.6920 - (0.0013 × Vr) | DOE 10 C.F.R. Part 430 App. E |
| | ≤ 75,000 Btu/h | > 55 gal & ≤ 100 ~~gal~~[f] gal[d] | Very small<br>Low<br>Medium<br>High | UEF ≥ 0.6470 - (0.0006 × Vr)<br>UEF ≥ 0.7689 - (0.0005 × Vr)<br>UEF ≥ 0.7897 - (0.0004 × Vr)<br>UEF ≥ 0.8072 - (0.0003 × Vr) | DOE 10 C.F.R. Part 430 App. E |
| | > 75,000 Btu/h and ≤ 105,000 Btu/h ~~[g]~~ [j,k] | ≤ 120 gal & ≤ 180°F | Very small<br>Low<br>Medium<br>High | UEF ≥ 0.2674-(0.0009 x Vr)<br>UEF ≥ 0.5362-(0.0012 x Vr)<br>UEF ≥ 0.6002-(0.0011 x Vr)<br>UEF ≥ 0.6597-(0.0009 x Vr) | DOE 10 C.F.R. Part 430 App. E |
| | > 105,000 Btu/h[d,g] | -- | -- | 80% $E_t$<br>SL ≤ (Q/800 +110√V), Btu/h | DOE 10 C.F.R. 431.106 |
| Gas instantaneous water ~~heater~~[h] heater[i] | > 50,000 Btu/h and < 200,000 Btu/h[k] | < 2 gal[d] | Very small<br>Low<br>Medium<br>High | UEF ≥ 0.80<br>UEF ≥ 0.81<br>UEF ≥ 0.81<br>UEF ≥ 0.81 | DOE 10 C.F.R. Part 430 App. E |
| | ≥ 200,000 Btu/h[d,g] | < 10 gal | -- | 80% $E_t$ | DOE 10 C.F.R. 431.106 |
| | ≥ 200,000 Btu/h ~~[j]~~ [k] | ≥ 10 gal | -- | 80% $E_t$<br>SL ≤ (Q/800 +110√V), Btu/h | |

| Equipment Type | Size Category (input) | Subcategory or Rating Condition | Draw Pattern | Performance Required[a,j] | Test Procedure[b] |
|---|---|---|---|---|---|
| Oil storage water ~~heaters~~[g]heaters[e,m] | ≤ 105,000 Btu/h | ≤ 50 gal | Very small<br>Low<br>Medium<br>High | UEF = 0.2509 – (0.0012 × Vr)<br>UEF = 0.5330 – (0.0016 × Vr)<br>UEF = 0.6078 – (0.0016 × Vr)<br>UEF = 0.6815 – (0.0014 × Vr) | DOE 10 C.F.R. Part 430 |
| | > 105,000 Btu/h and ≤ 140,000 Btu/h~~e~~[h,l] | ≤ 120 gal & ≤ 180°F | Very small<br>Low<br>Medium<br>High | UEF ≥ 0.2932-(0.0015 x Vr)<br>UEF ≥ 0.5596-(0.0018 x Vr)<br>UEF ≥ 0.6194-(0.0016 x Vr)<br>UEF ≥ 0.6740-(0.0013 x Vr) | DOE 10 C.F.R. Part 430 App. E |
| | > 140,000 Btu/h | All | -- | 80% $E_t$<br>SL ≤ (Q/800 +110√V), Btu/h | DOE 10 C.F.R. 431.106 |
| Oil instantaneous water ~~heater~~[h]heater[h,m] | ≤ 210,000 Btu/h | < 2 gal | -- | 80% $E_t$<br>EF ≥ 0.59 – (0.0005 x V) | DOE 10 C.F.R. Part 430 App. E |
| | > 210,000 Btu/h | < 10 gal | -- | 80% $E_t$ | DOE 10 C.F.R. 431.106 |
| | > 210,000 Btu/h | ≥ 10 gal | -- | 78% $E_t$<br>SL ≤ (Q/800 +110√V), Btu/h | DOE 10 C.F.R. 431.106 |
| Hot water supply boilers, gas and oil[h] | ≥ 300,000 Btu/h and < 12,500,000 Btu/h | < 10 gal | -- | 80% $E_t$ | DOE 10 C.F.R. 431.106 |
| Hot water supply boilers, ~~gas~~[h]gas[i,m] | ≥ 300,000 Btu/h and < 12,500,000 Btu/h | ≥ 10 gal | -- | 80% $E_t$<br>SL ≤ (Q/800 +110√V), Btu/h | DOE 10 C.F.R. 431.106 |
| Hot water supply boilers, oil[h,m] | ≥ 300,000 Btu/h and < 12,500,000 Btu/h | ≥ 10 gal | -- | 78% $E_t$<br>SL ≤ (Q/800 +110√V), Btu/h | DOE 10 C.F.R. 431.106 |
| Pool heaters, gas[d] | All | --[f] | -- | 82% $E_t$ | DOE 10 C.F.R. Part 430 App. P |
| Heat pump pool heaters | All | 50°F db & 44.2°F wb outdoor air 80.0°F entering water | -- | 4.0 COP | DOE 10 C.F.R. Part 430 App. P |
| Unfired storage tanks | All | -- | -- | Minimum insulation requirement R-12.5 (h-ft²-°F)/Btu | (none) |
| Gas heat pump | All | 50° F outdoor air temperature | | 1.0 COP | ANSI/ASHRAE 118.1 |

## 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. Alterations complying with C406 shall do so in accordance with Section C503.
5. Projects using discrete area credit weighting shall comply in accordance with Section C406.1.2.

**Exceptions:**

All areas qualifying for an exception that reduces energy efficiency credit requirements may only earn 50% of the space heating, space cooling, and service water heating credits listed in Tables C406.2(2) through C406.2(7) and are not eligible for the no space heating, no space cooling, and no service water heating credits.

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 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) 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.
4. Semi-heated spaces in accordance with Section C402.1.1.2 in F and S occupancies shall comply with sufficient measures from Table C406.2(X) to achieve a minimum of 50% of the efficiency credits required for new construction or building additions required by Table C406.1. Semi-heated F Occupancies under 25,000 square feet are exempt from the load management credit requirements in Table C406.1

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

| Required Credits for Projects | Section Reference | Occupancy Group | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ~~Group~~ R-1 R-4 I-1 | ~~Group~~ I-2 | ~~Group~~ R-2 | ~~Group~~ B | ~~Group~~ A-2 | ~~Group~~ M | ~~Group~~ E | ~~Group~~ S-1 S-2 | All other |
| New building energy efficiency credits | C406.2 | | | | | | | | | |
| Building addition energy efficiency credits | C406.2 | | | | | | | | | |
| Building alteration space heating energy efficiency credits | C406.2 | | | | | | | | | |
| Building alteration service water heating energy efficiency credits | C406.2 | | | | | | | | | |
| New building load management credits | C406.3 | | | | | | | | | |

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

**Commented [mi20]:** This addresses the fact that this 50% reduction previously applied only to C406 and space heating credits and now it is being applied to the combined credit. Also with the efficient space and water system credits being so large there is a fundamental disconnect between what is required and what can be earned which did not previously exist. Without this spaces get a 50% reduction in required credits and will be able to qualify for large credits for a tiny space heat heat pump and potentially for not having water heat. They would need no other credits where as now they need to comply with at least some measures

**Commented [mi21]:** Needs to be reflected in the equation reference to the table credits

**Commented [GJ22]:** 24-GP1-178 Conway

**Commented [mi23]:** these adjustment are apply to the base credits and/or heating credits in the existing code but are not applied to the water credits. As such this is a step back for any special conditioning project with water heat.

**Commented [mi24]:** Earned credits need to be discounted by the same amount.
example: a low energy space with no water heat only needs to comply with 50% of the credits. They select the no water heat credit and satisfy almost their entire credit requirement.

**Commented [mi25]:** Strongly suggest this be separated into base, space heating and water heating credits to facilitate logical discounting for special cases

**Commented [mi26]:** Do not include the base credits here - only those associated with space and water heat. Could be separate space and water heat credits so alterations can opt out of one. Having the how table called out with base, space heat, and water heat credits will allow logical treatment of semi-conditioned space and alterations and minimize the number of credits that need to be addressed.

tenant spaces in accordance with Sections C406.1.1.1 and C406.1.1.2.

**Exceptions:**

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

**C406.1.1.1 Applicable envelope, renewable and elevator energy credits.** Where an entire building or building addition complies with Section C406.2.5, C406.2.12, C406.2.10, or C406.2.18, 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). 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 C406.2.2, C406.2.8, C406.2.9, orC406.2.10 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) if the tenant space includes the distribution system and equipment that the central HVAC systems or service water heating systems were designed to support.

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

1. Required project credits shall be prorated on an area-weighted basis for each occupancy group by multiplying the occupancy group floor area by the number of credits required, and then dividing this value by the total area of all the occupancy groups combined. Where one occupancy group is less than 10 percent of the floor area of the project, use the primary occupancy group for those credits.
2. 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.
3. Where envelope or lighting power credits in Section C406.2.3.1, C406.2.3.2, or C406.2.3.12 are applied, the lighting power or envelope UA percentage reduction shall be calculated for the project as a whole to determine achieved credits.
4. Determine total project credits achieved by area-weighting the achieved credits by occupancy group in the same manner as for required project credits.
5. A project complies when the achieved number of area-weighted energy and load management credits are equal to or greater than the required area-weighted number of credits.

**C406.2 Additional energy efficiency credit measures.** ~~Each~~ Energy efficiency credit measure used to meet credit requirements for the project shall ~~include~~ meet or exceed ~~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.~~ The section references in tables C406.2(X) detail the requirements that must be met to obtain all or part of the credit measure available for the noted occupancy group and climate zone. Linear interpolation is allowed.

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

~~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 equation 4-14:~~

~~$C_{SH} = CHP_{SH} \times B/C + CFF_{SH} \times (1 - B/C)$~~ **~~(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 equation 4-15:

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

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**

| Measure Title | Applicable Section | Prorating Flag | Occupancy Group | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Group R-1 | Group R-2 | Group B | Group E | Group M | All Other |
| 1. Dwelling unit HVAC control | C406.2.1 | Heat | NA | 7 | NA | NA | NA | NA |
| 2. Improved HVAC TSPR[a] | C406.2.2.1 | Heat | NA | 8 | 11 | 17 | 22 | NA |
| 3. Improve cooling and fan efficiency | C406.2.2.2 | Heat | 2 | 2 | 3 | 4 | 3 | 2 |
| 4. Improve heating efficiency | C406.2.2.3 | Heat | 2 | 3 | 3 | 10 | 16 | 7 |
| 5. Improved low-carbon district energy system (10% better) | C406.2.2.4 | | 3 | 3 | 4 | 11 | 17 | 8 |
| 6. Improved low-carbon district energy system (20% better)[b] | C406.2.2.5 | | 9 | 10 | 12 | 33 | 52 | 24 |
| 7. High performance DOAS | C406.2.2.6 | Heat | 31 | 31 | 21 | 39 | 40 | 21/ (A) 40[c] |
| 8. Fault detection & diagnostics (FDD) | C406.2.2.7 | Heat | 2 | 2 | 2 | 6 | 9 | 4 |
| 9. 10% reduced lighting power | C406.2.3.1 | Heat | 7 | 4 | 18 | 16 | 20 | 15 |
| 10. 20% reduced lighting power[d] | C406.2.3.2 | Heat | 13 | 8 | 36 | 32 | 40 | 29 |
| 11. Lamp efficacy improvement | C406.2.3.3 | Heat | 5 | 6 | NA | NA | NA | NA |
| 12. Residential lighting control | C406.2.4.1 | Heat | NA | 8 | NA | NA | NA | NA |
| 13. Enhanced lighting control | C406.2.4.2 | Heat | 1 | 1 | 6 | 6 | 11 | 6 |
| 14. Renewable energy | C406.2.5 | | 7 | 12 | 13 | 13 | 10 | 11 |
| 15. Shower drain heat recovery | C406.2.6.1 | SWH | 9 | 30 | NA | 3 | NA | NA |
| 16. Service water heat recovery | C406.2.6.2 | SWH | 35 | 111 | 13 | 14 | (Grocery) 41[e] | NA |
| 17. Heat pump water heating | C406.2.6.3 | SWH | 72 | 54 | 1 | 13 | (Grocery) 5[e] | 29[f] |
| 18. High efficiency service water heating, gas-fired | C406.2.6.4 | SWH | NA | NA | NA | NA | NA | NA |
| 19. Heat trace system | C406.2.7.1 | SWH | 6 | 13 | 4 | 1 | NA | 6 |
| 20. Point of use water heater | C406.2.7.2 | SWH | NA | NA | 19 | 5 | NA | NA |

*Continued*

**TABLE C406.2(1) - Continued**
**EFFICIENCY MEASURE CREDITS**

| Measure Title | Applicable Section | Prorating Flag | Occupancy Group | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Group R-1 | Group R-2 | Group B | Group E | Group M | All Other |
| 21. Service hot water distribution right sizing | C406.2.8 | | 13 | 42 | NA | NA | NA | NA |
| 22. High performance service hot water temperature maintenance system | C406.2.9 | | 6 | 13 | 4 | 1 | NA | 6 |
| 23. High efficiency service hot water circulation system | C406.2.10 | | 3 | 6 | 2 | 1 | NA | 4 |
| 24. Low flow residential showerheads | C406.2.11 | SWH | 3 | 3 | NA | NA | NA | NA |
| 25. Enhanced envelope performance[g] | C406.2.12 | Heat | 24 | 20 | 13 | 5 | 19 | 14 |
| 26. Base reduced air leakage[g] | C406.2.13.1 | | 29 | 24 | 6 | 3 | 9 | 11 |
| 27. Enhanced reduced air leakage[g] | C406.2.13.2 | Heat | 53 | 44 | 11 | 5 | 16 | 20 |
| 28. Enhanced commercial kitchen equipment | C406.2.14 | Heat | 30[h] | 18[h] | 18[h] | 30[h] | 30[h] | 31[h] |
| 29. Enhanced residential kitchen equipment | C406.2.15 | Heat | 12 | 19 | NA | NA | NA | NA |
| 30. Enhanced residential laundry equipment | C406.2.16 | Heat | NA | 6 | NA | NA | NA | NA |
| 31. Heat pump clothes dryers | C406.2.17 | Heat | 6 | 6 | NA | NA | NA | NA |
| 32. Efficient elevator equipment | C406.2.18 | Heat | 3 | 5 | 5 | 5 | 4 | 4 |

a. Projects using Item 2 shall not use Items 3, 4 or 7.

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 $ft^2$. 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 USE WITH FOSSIL FUEL COMPLIANCE PATH**

| Measure Title | Applicable Section | Prorating Flag | Occupancy Group | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Group R-1 | Group R-2 | Group B | Group E | Group M | All Other |
| 1. Dwelling unit HVAC control | C406.2.1 | Heat | NA | 8 | NA | NA | NA | NA |
| 2. Improved HVAC TSPR[a] | C406.2.2.1 | Heat | NA | 9 | 12 | 19 | 24 | NA |
| 3. Improve cooling and fan efficiency | C406.2.2.2 | Heat | 12 | 8 | 14 | 8 | 10 | 10 |
| 4. Improve heating efficiency | C406.2.2.3 | Heat | 2 | 3 | 3 | 11 | 18 | 8 |
| 5. Improved low-carbon district energy system (10% better) | C406.2.2.4 | | 3 | 3 | 4 | 12 | 19 | 9 |
| 6. Improved low-carbon district energy system (20% better)[b] | C406.2.2.5 | | 10 | 11 | 13 | 36 | 57 | 26 |
| 7. High performance DOAS | C406.2.2.6 | Heat | 34 | 34 | 23 | 43 | 44 | 23/ (A) 40[c] |
| 8. Fault detection & diagnostics (FDD) | C406.2.2.7 | Heat | 2 | 2 | 2 | 6 | 9 | 4 |
| 9. 10% reduced lighting power | C406.2.3.1 | Heat | 7 | 4 | 18 | 16 | 20 | 15 |
| 10. 20% reduced lighting power[d] | C406.2.3.2 | Heat | 13 | 8 | 36 | 32 | 40 | 29 |
| 11. Lamp efficacy improvement | C406.2.3.3 | Heat | 5 | 6 | NA | NA | NA | NA |
| 12. Residential lighting control | C406.2.4.1 | Heat | NA | 8 | NA | NA | NA | NA |
| 13. Enhanced lighting control | C406.2.4.2 | Heat | 1 | 1 | 6 | 6 | 11 | 6 |
| 14. Renewable energy | C406.2.5 | | 7 | 12 | 13 | 13 | 10 | 11 |
| 15. Shower drain heat recovery | C406.2.6.1 | SWH | 10 | 33 | NA | 3 | NA | NA |
| 16. Service water heat recovery | C406.2.6.2 | SWH | 35 | 111 | 13 | 14 | (Grocery) 41[e] | NA |
| 17. Heat pump water heating | C406.2.6.3 | SWH | 135 | 163 | 17 | 33 | (Grocery) 95[e] | (A-2) 95[f] |
| 18. High efficiency service water heating, gas-fired | C406.2.6.4 | SWH | 59 | 65 | 6 | 11 | 18 | 32 |
| 19. Heat trace system | C406.2.7.1 | SWH | 6 | 13 | 4 | 1 | NA | 6 |

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

| Measure Title | Applicable Section | Prorating Flag | Occupancy Group | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Group R-1 | Group R-2 | Group B | Group E | Group M | All Other |
| 20. Point of use water heater | C406.2.7.2 | SWH | NA | NA | 19 | 5 | NA | NA |
| 21. Service hot water distribution right sizing | C406.2.8 | | 13 | 42 | NA | NA | NA | NA |
| 22. High performance service hot water temperature maintenance system | C406.2.9 | | 6 | 13 | 4 | 1 | NA | 6 |
| 23. High efficiency service hot water circulation system | C406.2.10 | | 3 | 6 | 2 | 1 | NA | 4 |
| 24. Low flow residential showerheads | C406.2.11 | SWH | 3 | 3 | NA | NA | NA | NA |
| 25. Enhanced envelope performance[g] | C406.2.12 | Heat | 24 | 20 | 13 | 5 | 19 | 14 |
| 26. Base reduced air leakage[g] | C406.2.13.1 | | 29 | 24 | 6 | 3 | 9 | 11 |
| 27. Enhanced reduced air leakage[g] | C406.2.13.2 | Heat | 53 | 44 | 11 | 5 | 16 | 20 |
| 28. Enhanced commercial kitchen equipment | C406.2.14 | Heat | 30[h] | 18[h] | 18[h] | 30[h] | 30[h] | 31[h] |
| 29. Enhanced residential kitchen equipment | C406.2.15 | Heat | 12 | 19 | NA | NA | NA | NA |
| 30. Enhanced residential laundry equipment | C406.2.16 | Heat | NA | 6 | NA | NA | NA | NA |
| 31. Heat pump clothes dryers | C406.2.17 | Heat | 6 | 6 | NA | NA | NA | NA |
| 32. Efficient elevator equipment | C406.2.18 | Heat | 3 | 5 | 5 | 5 | 4 | 4 |

a. Projects using Item 2 shall not use Items 3,4 or 7.

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 $ft^2$. Large mixed retail with full grocery and butcher sections shall achieve half the credits. This credit is not available where refrigeration recovery to heat service hot water is used to meet the requirements of Section C403.9.2.3.

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

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

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

**TABLE C406.2(1)**
**LIGHTING EFFICIENCY CREDIT MEASURES**

| Credit Measure Title | Applicable Section Reference | Occupancy Group (Climate Zone 4C / 5B) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Group R-1 R-4 I-1 | Group I-2 | Group R-2 | Group B | Group A-2 | Group M | Group E | Group S-1 S-2 | All other |
| 9. 10% reduced lighting power | C406.2.3.1 | | | | | | | | | |
| 10. 20% reduced lighting power[d] | C406.2.3.2 | | | | | | | | | |
| 9a. 5% reduced lighting power | C406.2.3.1 | / | / | / | / | / | / | / | / | / |
| 9b. 10% reduced lighting power | | / | / | / | / | / | / | / | / | / |
| 9c. 15% reduced lighting power | | / | / | / | / | / | / | / | / | / |
| 9d. 20% reduced lighting power | | / | / | / | / | / | / | / | / | / |
| 9e. 25% reduced lighting power | | / | / | / | / | / | / | / | / | / |
| 9f. 30% reduced lighting power | | / | / | / | / | / | / | / | / | / |
| 11. Lamp efficacy improvement | C406.2.3 3.2 | / | N/A | / | N/A | N/A | N/A | N/A | N/A | N/A |
| 12. Residential lighting control | C406.2.4.1 | N/A | N/A | / | N/A | N/A | N/A | N/A | N/A | N/A |
| 13. Enhanced lighting control | C406.2.4.2 | / | / | / | / | / | / | / | / | / |
| Lighting adjustment factor ($LTG_{adj}$) for use with Table C406.2(4) | C406.2.2.2 & 3 | / | / | / | / | / | / | / | / | / |

**TABLE C406.2(2)**
**ENVELOPE EFFICIENCY CREDIT MEASURES**

| Credit Measure Title | Applicable Section Reference | Occupancy Group (Climate Zone 4C / 5B) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Group R-1 R-4 I-1 | Group I-2 | Group R-2 | Group B | Group A-2 | Group M | Group E | Group S-1 S-2 | All other |
| 25. Enhanced envelope performance[g] | C406.2.12 | | | | | | | | | |
| 25a Total UA Improved 5% | C406.2.12 | / | / | / | / | / | / | / | / | / |
| 25b Total UA Improved 10% | | / | / | / | / | / | / | / | / | / |
| 25c Total UA Improved 15% | | / | / | / | / | / | / | / | / | / |
| 25d Total UA Improved 20% | | / | / | / | / | / | / | / | / | / |
| 25e Total UA Improved 25% | | / | / | / | / | / | / | / | / | / |
| 25f Total UA Improved 30% | | / | / | / | / | / | / | / | / | / |
| 25g Total UA Improved 35% | | / | / | / | / | / | / | / | / | / |
| 25h Total UA Improved 40% | | / | / | / | / | / | / | / | / | / |
| UA adjustment factor ($UA_{adj}$) for use | C406.2.2.2 & 3 | / | / | / | / | / | / | / | / | / |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| with Table C406.2(4) | | | | | | | | | | | |
| ~~26~~ | ~~Base reduced air leakage[g]~~ | ~~C406.2.13.1~~ | | | | | | | | | |
| ~~27~~ | ~~Enhanced reduced air leakage[g]~~ | ~~C406.2.13.2~~ | | | | | | | | | |
| 26a | Air Leakage Not Exceed 90% Max | C406.2.13 | / | / | / | / | / | / | / | / | / |
| 26b | Air Leakage Not Exceed 80% Max | | / | / | / | / | / | / | / | / | / |
| 26c | Air Leakage Not Exceed 70% Max | | / | / | / | / | / | / | / | / | / |
| 26d | Air Leakage Not Exceed 60% Max | | / | / | / | / | / | / | / | / | / |
| 26e | Air Leakage Not Exceed 50% Max | | / | / | / | / | / | / | / | / | / |
| 26f | Air Leakage Not Exceed 40% Max | | / | / | / | / | / | / | / | / | / |
| 26g | Air Leakage Not Exceed 30% Max | | / | / | / | / | / | / | / | / | / |
| 26h | Air Leakage Not Exceed 20% Max | | / | / | / | / | / | / | / | / | / |
| Air leakage adjustment factor ($LEAK_{adj}$) for use with Table C406.2(4) | | C406.2.2.2 & 3 | / | / | / | / | / | / | / | / | / |

## TABLE C406.2(3)
## VENTILATION SYSTEMS AND HVAC CONTROLS EFFICIENCY CREDIT MEASURES

| Credit Measure ~~Title~~ | | ~~Applicable~~ Section Reference | Occupancy Group (Climate Zone 4C / 5B) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ~~Group~~ R-1 R-4 I-1 | ~~Group~~ I-2 | ~~Group~~ R-2 | ~~Group~~ B | ~~Group~~ A-2 | ~~Group~~ M | ~~Group~~ E | ~~Group~~ S-1 S-2 | All other |
| 1. | Dwelling unit HVAC control | C406.2.1 | N/A | N/A | / | N/A | N/A | N/A | N/A | N/A | N/A |
| 3. | Improve ~~cooling and~~ fan efficiency | C406.2.2 ~~2~~.1 | / | / | / | / | / | / | / | / | / |
| 7. | High performance DOAS | C406.2.2.6 | / | / | / | / | / | / | / | / | / |
| 8. | Fault detection & diagnostics (FDD) | C406.2.2.7 | / | / | / | / | / | / | / | / | / |

## TABLE C406.2(4)
## SPACE HEATING EFFICIENCY CREDIT MEASURES

| Credit Measure ~~Title~~ | | ~~Applicable~~ Section Reference | Occupancy Group (Climate Zone 4C / 5B) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ~~Group~~ R-1 R-4 I-1 | ~~Group~~ I-2 | ~~Group~~ R-2 | ~~Group~~ B | ~~Group~~ A-2 | ~~Group~~ M | ~~Group~~ E | ~~Group~~ S-1 S-2 | All other |
| 2. | Improved HVAC TSPR[a] | C406.2.2.1 | | | | | | | | | |
| ~~4.~~ | ~~Improve heating efficiency~~ | ~~C406.2.2.3~~ | | | | | | | | | |
| 1 | No space heating | C406.2.2.3 | / | / | / | / | / | / | / | / | / |
| 2 | C403.1.4 Primary space heating exceptions | C406.2.2.3 | Same as min. efficiency air source heat pump (5a) | | | | | | | | |
| 3a | Fossil fuel boiler or furnace Min Eff | C406.2.2.3 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 |
| 3b | Fossil fuel boiler or furnace Imp. 5% | | / | / | / | / | / | / | / | / | / |
| 3c | Fossil fuel boiler or furnace Imp. 10% | | / | / | / | / | / | / | / | / | / |
| 3d | Fossil fuel boiler or furnace Imp. 15% | | / | / | / | / | / | / | / | / | / |
| 3e | Fossil fuel boiler or furnace Imp. 20% | | / | / | / | / | / | / | / | / | / |

**Commented [mi27]:** I am concerned about the various equipment / system types. Do we really want to spend resources determined whether hot water boilers are more or less efficient than furnaces? Maybe someone has conviction that one is decidedly better but as it sits it seems the modeling of specific cases will capture some difference but whether those cases really represent the average installed unit will not be known. I would be happier with less system types here, boilers and furnaces should be combined. I'm sort of okay with air source and ground source being separated but there are similar issues. The characteristics of Auxilliary boiler and the ground source field capacity have a large impact on the annual system efficiency, perhaps larger than the difference between air source and ground source, a single HP category could capture this.

In both air source and ground source cases there are unitary units but also air and ground source systems that generate hot water used in hydronic systems. The difference in annual efficiency between the air "destination" and water "destination" units is not captured here. Yes we can create an ever increasing number of cases but it would be equally good to just pick a not great minimum heat pump and have a single HP case.

There is also the issue of whether we have covered all possible systems.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3f | Fossil fuel boiler or furnace Imp. 25% | | / | / | / | / | / | / | / | / | / | |
| 4a | Air source heat pump Min Eff. | C406.2.2.3 | / | / | / | / | / | / | / | / | / | |
| 4b | Air source heat pump Imp. 10% | | / | / | / | / | / | / | / | / | / | |
| 4c | Air source heat pump Imp. 20% | | / | / | / | / | / | / | / | / | / | |
| 4d | Air source heat pump Imp. 30% | | / | / | / | / | / | / | / | / | / | |
| 4e | Air source heat pump Imp. 40% | | / | / | / | / | / | / | / | / | / | |
| 4f | Air source heat pump Imp. 50% | | / | / | / | / | / | / | / | / | / | |
| 4g | Air source heat pump Imp. 60% | | / | / | / | / | / | / | / | / | / | |
| 4h | Air source heat pump Imp. 70% | | / | / | / | / | / | / | / | / | / | |
| 4i | Air source heat pump Imp. 80% | | / | / | / | / | / | / | / | / | / | |
| 4j | Air source heat pump Imp. 90% | | / | / | / | / | / | / | / | / | / | |
| 5a | Ground source heat pump Min Eff. | C406.2.2.3 | / | / | / | / | / | / | / | / | / | |
| 5b | Ground source heat pump Imp. 10% | | / | / | / | / | / | / | / | / | / | |
| 5c | Ground source heat pump Imp. 20% | | / | / | / | / | / | / | / | / | / | |
| 5d | Ground source heat pump Imp. 30% | | / | / | / | / | / | / | / | / | / | |
| 5e | Ground source heat pump Imp. 40% | | / | / | / | / | / | / | / | / | / | |
| 5f | Ground source heat pump Imp. 50% | | / | / | / | / | / | / | / | / | / | |
| 5g | Ground source heat pump Imp. 60% | | / | / | / | / | / | / | / | / | / | |
| 5h | Ground source heat pump Imp. 70% | | / | / | / | / | / | / | / | / | / | |
| 5i | Ground source heat pump Imp. 80% | | / | / | / | / | / | / | / | / | / | |
| 5j | Ground source heat pump Imp. 90% | | / | / | / | / | / | / | / | / | / | |
| 6a | Gas heat pump Min Eff. | C406.2.2.3 | / | / | / | / | / | / | / | / | / | |
| 6b | Gas heat pump Imp. 10% | | / | / | / | / | / | / | / | / | / | |
| 6c | Gas heat pump Imp. 20% | | / | / | / | / | / | / | / | / | / | |
| 6d | Gas heat pump Imp. 30% | | / | / | / | / | / | / | / | / | / | |
| 6e | Gas heat pump Imp. 40% | | / | / | / | / | / | / | / | / | / | |
| 6f | Gas heat pump Imp. 50% | | / | / | / | / | / | / | / | / | / | |
| 6g | Gas heat pump Imp. 60% | | / | / | / | / | / | / | / | / | / | |
| 6h | Gas heat pump Imp. 70% | | / | / | / | / | / | / | / | / | / | |
| 6i | Gas heat pump Imp. 80% | | / | / | / | / | / | / | / | / | / | |
| 6j | Gas heat pump Imp. 90% | | / | / | / | / | / | / | / | / | / | |
| 7a | Water source heat pump heat Min Eff. | C406.2.2.3 | / | / | / | / | / | / | / | / | / | |
| 7b | Water source heat pump heat Imp. 10% | | / | / | / | / | / | / | / | / | / | |
| 7c | Water source heat pump heat Imp. 20% | | / | / | / | / | / | / | / | / | / | |
| 7d | Water source heat pump heat Imp. 30% | | / | / | / | / | / | / | / | / | / | |
| 7e | Water source heat pump heat Imp. 40% | | / | / | / | / | / | / | / | / | / | |
| 7f | Water source heat pump heat Imp. 50% | | / | / | / | / | / | / | / | / | / | |
| 7g | Water source heat pump heat Imp. 60% | | / | / | / | / | / | / | / | / | / | |
| 7h | Water source heat pump heat Imp. 70% | | / | / | / | / | / | / | / | / | / | |
| 7i | Water source heat pump heat Imp. 80% | | / | / | / | / | / | / | / | / | / | |
| 7j | Water source heat pump heat Imp. 90% | | / | / | / | / | / | / | / | / | / | |

**Commented [mi28]:** consider lumping this unless we really feel one is better than the other

**Commented [mi29]:** Need definitions for each equipment / system type. A PTAC, a air source HP with aux and a mini-split are all considered ASHP.

This should be a heat pump with aux in full compliance with C403.1.4- not this will allow unlimited FF aux but at least will put some limits on PTACs and the like.

**Commented [mi30]:** I'm okay with this as long as it is not making optimistic assumptions about the diversity of the loop. Note that common nomenclature call the boiler auxilliary even though in many cases it is the primary energy user. My first thought was to have a section saying the heat pumps and the boiler need to be declared primary bt this would prevent the back up boiler from being electric which in someplace like Port townsend without gas service is very punative. Quite confusing how to proper deal with this. Note that ground loops have the same issue but I think generally the boiler really is aux in that case.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | Improved low-carbon district Thermal energy network space heating system (Imp. 10% better) | C406.2.19 | / | / | / | / | / | / | / | / | / |
| [illegible] | Improved low-carbon district Thermal energy network space heating system (Imp. 20% better)[b] | | / | / | / | / | / | / | / | / | / |

## TABLE C406.2(5)
## SPACE COOLING EFFICIENCY CREDIT MEASURES

| Credit Measure Title | | Applicable Section Reference | Occupancy Group (Climate Zone 4C / 5B) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Group R-1 R-4 I-1 | Group I-2 | Group R-2 | Group B | Group A-2 | Group M | Group E | Group S-1 S-2 | All other |
| 1 | No space cooling | C406.2.2.2 | / | / | / | / | / | / | / | / | / |
| 2a | Direct expansion Min Eff. | C406.2.2.2 | / | / | / | / | / | / | / | / | / |
| 2b | Direct expansion Imp. 20% | | / | / | / | / | / | / | / | / | / |
| 2c | Direct expansion Imp. 40% | | / | / | / | / | / | / | / | / | / |
| 2d | Direct expansion Imp. 60% | | / | / | / | / | / | / | / | / | / |
| 2e | Direct expansion Imp. 80% | | / | / | / | / | / | / | / | / | / |
| 2f | Direct expansion Imp. 100% | | / | / | / | / | / | / | / | / | / |
| 2g | Direct expansion Imp. 120% | | / | / | / | / | / | / | / | / | / |
| 2h | Direct expansion Imp. 140% | | / | / | / | / | / | / | / | / | / |
| 2i | Direct expansion Imp. 160% | | / | / | / | / | / | / | / | / | / |
| 2j | Direct expansion Imp. 180% | | / | / | / | / | / | / | / | / | / |
| 3a | Chilled water Min Eff. | C406.2.2.2 | / | / | / | / | / | / | / | / | / |
| 3b | Chilled water Imp. 20% | | / | / | / | / | / | / | / | / | / |
| 3c | Chilled water Imp. 40% | | / | / | / | / | / | / | / | / | / |
| 3d | Chilled water Imp. 60% | | / | / | / | / | / | / | / | / | / |
| 3e | Chilled water Imp. 80% | | / | / | / | / | / | / | / | / | / |
| 3f | Chilled water Imp. 100% | | / | / | / | / | / | / | / | / | / |
| 3g | Chilled water Imp. 120% | | / | / | / | / | / | / | / | / | / |
| 3h | Chilled water Imp. 140% | | / | / | / | / | / | / | / | / | / |
| 3i | Chilled water Imp. 160% | | / | / | / | / | / | / | / | / | / |
| 3j | Chilled water Imp. 180% | | / | / | / | / | / | / | / | / | / |
| 6a | Water source heat pump cool Min Eff. | C406.2.2.2 | / | / | / | / | / | / | / | / | / |
| 6b | Water source heat pump cool Imp. 20% | | / | / | / | / | / | / | / | / | / |
| 6c | Water source heat pump cool Imp. 40% | | / | / | / | / | / | / | / | / | / |
| 6d | Water source heat pump cool Imp. 60% | | / | / | / | / | / | / | / | / | / |
| 6e | Water source heat pump cool Imp. 80% | | / | / | / | / | / | / | / | / | / |
| 6f | Water source heat pump cool Imp. 100% | | / | / | / | / | / | / | / | / | / |
| 6g | Water source heat pump cool Imp. 120% | | / | / | / | / | / | / | / | / | / |
| 6h | Water source heat pump cool Imp. 140% | | / | / | / | / | / | / | / | / | / |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6i | Water source heat pump cool Imp. 160% | | / | / | / | / | / | / | / | / | / |
| 6j | Water source heat pump cool Imp. 180% | | | | | | | | | | |
| ~~7~~ 7a | ~~Improved low-carbon district Thermal energy network cooling system (Imp. 10% better)~~ | ~~C406.2.19~~ | / | / | / | / | / | / | / | / | / |
| ~~8~~ 7b | ~~Improved low-carbon district Thermal energy network cooling system (Imp. 20% better)[b]~~ | | / | / | / | / | / | / | / | / | / |

## TABLE C406.2(6)
## SERVICE WATER USAGE EFFICIENCY CREDIT MEASURES

| ~~Credit~~ Measure ~~Title~~ | ~~Applicable~~ Section ~~Reference~~ | Occupancy Group (Climate Zone 4C / 5B) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ~~Group~~ R-1 ~~R-4~~ ~~I-1~~ | ~~Group~~ ~~I-2~~ | ~~Group~~ R-2 | ~~Group~~ B | ~~Group~~ ~~A-2~~ | ~~Group~~ M | ~~Group~~ E | ~~Group~~ ~~S-1~~ ~~S-2~~ | All other |
| 15. Shower drain heat recovery | C406.2.6.1 | | | | | | | | | |
| 16. Service water heat recovery | C406.2.6.2 | | | | | | [a] | | | |
| Service water recovery adjustment factor ($RCVRY_{adj}$) for use with Tables C406.2(7) | C406.2.6.3 | / | / | / | / | / | / | / | / | / |
| 19. Heat trace system | C406.2.7.1 | | | | | | N/A | | | |
| 20. Point of use water heater | C406.2.7.2 | | | | | | | | | |
| 21. Service hot water distribution right sizing | C406.2.8 | | | | | | | | | |
| 22. High performance service hot water temperature maintenance system | C406.2.9 | | | | | | | | | |
| 23. High efficiency service hot water circulation system | C406.2.10 | | | | | | | | | |
| 24. Low flow residential showerheads | C406.2.11 | | | | | | | | | |
| Service water use adjustment factor ($USE_{adj}$) for use with Tables C406.2(7) | C406.2.6.3 | / | / | / | / | / | / | / | / | / |

a. Service water heat recovery and heat pump water heating are available in Group M only for grocery stores larger than 10,000 $ft^2$. 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.

## TABLE C406.2(7)
## SERVICE WATER HEATING EFFICIENCY CREDIT MEASURES

| ~~Credit~~ Measure ~~Title~~ | ~~Applicable~~ Section ~~Reference~~ | Occupancy Group (Climate Zone 4C / 5B) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ~~Group~~ R-1 ~~R-4~~ ~~I-1~~ | ~~Group~~ ~~I-2~~ | ~~Group~~ R-2 | ~~Group~~ B | ~~Group~~ ~~A-2~~ | ~~Group~~ M | ~~Group~~ E | ~~Group~~ ~~S-1~~ ~~S-2~~ | All other |
| 15 No service water heating | C406.2.6.3 | / | / | / | / | / | / | / | / | / |
| 16 C404.2.1 Primary service water heating exceptions | C406.2.6.3 | Same as min. efficiency heat pump water heating (17a) | | | | | | | | |
| ~~17. Heat pump water heating~~ | ~~C406.2.6.3~~ | | | | | | | | | |
| 17a Heat pump water heating Min Eff. | C406.2.6.3 | / | / | / | / | / | / | / | / | / |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17b | Heat pump water heating Imp. 10% | | / | / | / | / | / | / | / | / | / |
| 17c | Heat pump water heating Imp. 20% | | / | / | / | / | / | / | / | / | / |
| 17d | Heat pump water heating Imp. 30% | | / | / | / | / | / | / | / | / | / |
| 17e | Heat pump water heating Imp. 40% | | / | / | / | / | / | / | / | / | / |
| 17f | Heat pump water heating Imp. 50% | | / | / | / | / | / | / | / | / | / |
| 17g | Heat pump water heating Imp. 60% | | / | / | / | / | / | / | / | / | / |
| 17h | Heat pump water heating Imp. 70% | | / | / | / | / | / | / | / | / | / |
| 17i | Heat pump water heating Imp. 80% | | / | / | / | / | / | / | / | / | / |
| 17j | Heat pump water heating Imp. 90% | | / | / | / | / | / | / | / | / | / |
| ~~18.~~ | ~~High efficiency service water heating, gas-fired~~ | ~~C406.2.6.4~~ | ~~N/A~~ | | ~~N/A~~ | ~~N/A~~ | | ~~N/A~~ | ~~N/A~~ | | ~~N/A~~ |
| 18a | Gas water heater Min Eff | C406.2.6.4 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 | 0 / 0 |
| 18b | Gas water heater Imp. 5% | | / | / | / | / | / | / | / | / | / |
| 18c | Gas water heater Imp. 10% | | / | / | / | / | / | / | / | / | / |
| 18d | Gas water heater Imp. 15% | | / | / | / | / | / | / | / | / | / |
| 18e | Gas water heater Imp. 20% | | / | / | / | / | / | / | / | / | / |
| 18f | Gas water heater Imp. 25% | | / | / | / | / | / | / | / | / | / |
| 19a | Gas heat pump Min Eff. | C406.2.2.3 | / | / | / | / | / | / | / | / | / |
| 19b | Gas heat pump Imp. 10% | | / | / | / | / | / | / | / | / | / |
| 19c | Gas heat pump Imp. 20% | | / | / | / | / | / | / | / | / | / |
| 19d | Gas heat pump Imp. 30% | | / | / | / | / | / | / | / | / | / |
| 19e | Gas heat pump Imp. 40% | | / | / | / | / | / | / | / | / | / |
| 19f | Gas heat pump Imp. 50% | | / | / | / | / | / | / | / | / | / |
| 19g | Gas heat pump Imp. 60% | | / | / | / | / | / | / | / | / | / |
| 19h | Gas heat pump Imp. 70% | | / | / | / | / | / | / | / | / | / |
| 19i | Gas heat pump Imp. 80% | | / | / | / | / | / | / | / | / | / |
| 19j | Gas heat pump Imp. 90% | | / | / | / | / | / | / | / | / | / |
| ~~18.~~ ~~19~~ | ~~Improved low-carbon district Thermal energy network service water heating system (Imp. 10% better)~~ | ~~C406.2.19~~ | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ |
| ~~18.~~ ~~19~~ | ~~Improved low-carbon district Thermal energy network service water heating system (Imp. 20% better)[b]~~ | | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ | ~~/~~ |

**TABLE C406.2(8)**
**RENEWABLE ENERGY CREDIT MEASURES**

| **Credit Measure** ~~Title~~ | ~~Applicable~~ **Section** Reference | **Occupancy Group (Climate Zone 4C / 5B)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ~~Group~~ **R-1 R-4 I-1** | ~~Group~~ **I-2** | ~~Group~~ **R-2** | ~~Group~~ **B** | ~~Group~~ **A-2** | ~~Group~~ **M** | ~~Group~~ **E** | ~~Group~~ **S-1 S-2** | **All other** |
| 14. Renewable energy | C406.2.5 | / | / | / | / | / | / | / | / | / |

**TABLE C406.2(9)**
**OTHER EFFICIENCY CREDIT MEASURES**

| Credit Measure ~~Title~~ | ~~Applicable~~ Section Reference | Occupancy Group (Climate Zone 4C / 5B) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ~~Group~~ R-1 R-4 I-1 | ~~Group~~ I-2 | ~~Group~~ R-2 | ~~Group~~ B | ~~Group~~ A-2 | ~~Group~~ M | ~~Group~~ E | ~~Group~~ S-1 S-2 | All other |
| 28. Enhanced commercial kitchen equipment | C406.2.14 | / | / | / | / | / | / | / | / | / |
| 29. Enhanced residential kitchen equipment | C406.2.15 | / | / | / | N/A | N/A | N/A | N/A | N/A | N/A |
| 30. Enhanced residential laundry equipment | C406.2.16 | N/A | N/A | / | N/A | N/A | N/A | N/A | N/A | N/A |
| 31. Heat pump clothes dryers | C406.2.17 | / | / | / | N/A | N/A | N/A | N/A | N/A | N/A |
| 32. Efficient elevator equipment | C406.2.18 | / | / | / | / | / | / | / | / | / |

**C406.2.1 Dwelling unit HVAC controls.** HVAC systems serving *dwelling units* or *sleeping units* shall be controlled with a programmable *thermostat* that is configured to automatically activate a setback condition of at least 5°F (3°C) for both heating and cooling. The programmable *thermostat* shall be configured to provide setback during occupied sleep periods. The unoccupied setback mode shall be configured to operate in conjunction with one of the following:

1. A manual main control device by each *dwelling unit* main entrance that initiates setback for all HVAC units in the *dwelling unit* and is clearly identified as "Heating/Cooling Master Setback."
2. Occupancy sensors in each room of the *dwelling unit* combined with a door switch to initiate setback for all HVAC units in the dwelling within 20 minutes of all spaces being vacant immediately following a door switch operation. Where separate room HVAC units are used, an individual occupancy sensor on each unit that is configured to provide setback shall meet this requirement.
3. An advanced learning thermostat that senses occupant presence and automatically creates a schedule for occupancy and provides a dynamic setback schedule based on when the spaces are generally unoccupied.
4. An automated control and sensing system that uses geographic sensing connected to the *dwelling unit* occupants' cell phones and initiates the setback condition when all occupants are away from the building.

**C406.2.2 More efficient HVAC system performance.** All heating and cooling systems shall meet the minimum requirements of Section C403 and efficiency improvements shall be referenced to the minimum efficiency requirements listed in the tables in Section C403.3.2. Where multiple efficiency requirements are listed, equipment shall meet the seasonal efficiencies including SEER, EER/IEER, IPLV or AFUE. Equipment that is larger than the maximum capacity range indicated in the tables in Section C403.3.2 shall utilize the values listed for the largest capacity equipment for the associated equipment type shown in the table. Where multiple individual heating or cooling systems serve the project, the improvement shall be the weighted average improvement based on individual system capacity.

~~For occupancies and systems required to comply with Section C403.1.1, credits are permitted to be achieved by meeting the requirements of Section C406.2.2.1. Other~~ Systems are permitted to achieve credits by meeting the requirements of ~~either:~~ any following subsection combination.

~~1. Section C406.2.2.2, More efficient HVAC equipment cooling and fan performance.~~

~~2. Section C406.2.2.3, More efficient HVAC equipment heating performance.~~

~~3. Section C406.2.2.6, High performance dedicated outdoor air system (DOAS).~~

~~4. Any combination of Sections C406.2.2.2, C406.2.2.3, and C406.2.2.6.~~

~~In addition, energy credits are permitted to be achieved for Section C406.2.2.7, Fault detection and diagnostics, where not otherwise required by Section C403.2.3 or C403.6.10(15).~~

**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) are permitted to be prorated up to a 20 percent improvement.

~~**C406.2.2.2 More efficient HVAC equipment cooling and fan performance.** No less than 90 percent of the total HVAC capacity serving the total *conditioned floor area* of the entire building, building addition or tenant space in accordance with Section C406.1.1 shall comply with Sections C406.2.2.2.1 through C406.2.2.2.3. Where individual equipment efficiencies vary, weigh them based on capacity.~~

~~**C406.2.2.2.1 HVAC system selection.** Equipment installed shall be types that are listed in the tables in Section C403.3.2.~~

**C406.2.2.2~~.2~~ Cooling equipment efficiency.** Primary cooling equipment shall exceed the minimum cooling efficiency requirements listed in the tables in Section C403.3.2 by ~~at least 5~~ the percent noted in table C406.2(5). ~~Where equipment exceeds the minimum annual cooling efficiency and heat rejection efficiency requirements by more than 5 percent, energy efficiency credits for cooling shall be determined using~~ Available credits noted in table C406.2(5) shall be reduced by other selected efficiency credit measures and comprise of the summation of the prorated credits assigned to each system type within a mixed cooling system using Equation 4-16, rounded to the nearest whole number. Where individual equipment efficiencies of the same system type vary, weigh them based on capacity.

**(Equation 4-16)**

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

~~Where:~~

~~$EEC_{HEC}$ = Energy efficiency credits for cooling efficiency improvement~~

~~$EEC_s$ = Section C406.2.2.2 credits from Table C406.2(1)~~

~~CEI = The lesser of the improvement above minimum cooling efficiency requirements, minimum heat rejection efficiency requirements, or 20 percent (0.20). Where cooling efficiency varies by system, use the capacity weighted average efficiency improvement for all cooling equipment combined. The CEI expressed as a fraction shall be determined one of the following ways:~~

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

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

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

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

~~Where:~~

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

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

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

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

~~Where:~~

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

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

$$C_{cool.i} = TBL_{cool} \times \left(\frac{EQPM_{cool}}{TOT_{cool}}\right)$$

$$\sum_{i=1}^{n} C_{cool} = C_{cool.1} + C_{cool.2} + \cdots + C_{cool.n}$$

| | | |
|---|---|---|
| $C_{cool}$ | = | Credits for space cooling equipment. |
| $C_{cool.i}$ | = | Credits for space cooling equipment of noted systems type. |
| $TBL_{cool}$ | = | Credits noted in Table C406.2(5). |
| $EQPM_{cool}$ | = | Installed primary space cooling capacity of this system type in kBTU/h. |
| $TOT_{cool}$ | = | Total installed primary space cooling capacity in kBTU/h. |

**C406.2.2 ~~2.3~~.4 Minimum fan efficiency.** Where fan energy is not included in packaged equipment rating or it is and the fan size has been increased from the as-rated equipment condition, fan power or horsepower shall be less than 95 percent of the allowed fan power in Section C403.8.1.

~~**C406.2.2.3 More efficient HVAC equipment heating performance.** No less than 90 percent of the total HVAC capacity serving the total *conditioned floor area* of the entire building, building addition or tenant space in accordance with Section C406.1.1 shall comply with Sections C406.2.2.3.1 through C406.2.2.3.2.~~

~~**C406.2.2.3.1 HVAC system selection.** Equipment installed shall be types that are listed in the tables in Section C403.3.2. Electric resistance heating shall be limited to 20 percent of system capacity, with the exception of heat pump supplemental heating.~~

**C406.2.2.3 ~~2~~ Heating equipment efficiency.** Primary heating equipment shall exceed the minimum heating efficiency requirements ~~of~~ listed in the tables in Section C403.3.2 by ~~at least 5~~ the percent noted in table C406.2(4). ~~Where equipment exceeds the minimum annual heating efficiency requirements by more than 5 percent, energy efficiency credits for heating shall be determined using~~ Available credits noted in table C406.2(4) shall be reduced by other selected efficiency credit measures and comprise of the summation of the prorated credits assigned to each system type within a mixed heating system using Equation 4-17, rounded to the nearest whole number. Where individual equipment efficiencies of the same system type vary, weigh them based on capacity.

**(Equation 4-17)**

$$EEC_{HEH} = EEC_{5} \times \left[1 + \frac{HEI - 0.05}{0.05}\right]$$

~~Where:~~

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

~~$EEC_{5}$ = Section C406.2.2.2 credits from Table C406.2(1).~~

~~HEI = The lesser of the improvement above minimum heating efficiency requirements or 20 percent (0.20). Where heating efficiency varies by system, use the capacity weighted average percentage for all heating equipment combined. For metrics that increase as efficiency increases, HEI shall be calculated as follows:~~

$$HEI = \frac{HM_{DES}}{HM_{MIN}} - 1$$

~~Where:~~

~~$HM_{DES}$ = Design heating efficiency metric, part-load or annualized where available.~~

~~$HM_{MIN}$ = Minimum required heating efficiency metric, part-load or annualized where available from Section C403.3.2.~~

~~**Exception:** In low energy spaces complying with Section C402.1.1 and *semi-heated spaces* complying with Section C402.1.1.2, no less than 90 percent of the installed heating capacity is provided by electric infrared or gas-fired radiant heating equipment for localized heating applications. Such spaces shall achieve credits for $EEC_{5}$.~~

$$C_{heat.i} = TBL_{heat} \times (1 - (UA_{cr} \times UA_{adj}) - (LEAK_{cr} \times LEAK_{adj}) + (LTG_{cr} \times LTG_{adj})) \times \left(\frac{EQPM_{heat}}{TOT_{heat}}\right)$$

$$\sum_{i=1}^{n} C_{heat} = C_{heat.1} + C_{heat.2} + \cdots + C_{heat.n}$$

| | | |
|---|---|---|
| $C_{heat}$ | = | Credits for space heating equipment. |
| $C_{heat.i}$ | = | Credits for space heating equipment of noted systems type. |
| $TBL_{heat}$ | = | Credits noted in Table C406.2(4). |
| $UA_{cr}$ | = | Improved UA credits obtained via Table C406.2(2) |
| $UA_{adj}$ | = | Adjustment factor for improved UA obtained via Table C406.2(2) |
| $LEAK_{cr}$ | = | Reduced air leakage credits obtained via Table C406.2(2) |
| $LEAK_{adj}$ | = | Adjustment factor for reduced air leakage obtained via Table C406.2(2) |
| $LTG_{cr}$ | = | Improved lighting credits obtained via Table C406.2(1) |
| $LTG_{adj}$ | = | Adjustment factor for improved lighting obtained via Table C406.2(1) |
| $EQPM_{heat}$ | = | Installed primary space heating capacity of this system type in kBTU/h. Excluding primary space heat covered under a Section C403.1.4 exception except when evaluating exceptions. |
| $TOT_{heat}$ | = | Total installed primary space heating capacity in kBTU/h including any of the exceptions in Section C403.1.4. |

**C406. 2.~~2~~ 4.19 ~~Improved low-carbon district energy~~ Thermal energy network systems. ~~(10 percent better).~~** ~~Not less than 90 percent of the annual service hot water and space heating load, or not less than 90 percent of the annual service hot water, space heating, and space cooling load shall meet the criteria of Section C406.2.2.4.1 or C406.2.2.4.2 based on which loads are connected to the compliant thermal energy network.~~ The portion of space heating, space cooling and/or service water heating provided by a ~~*low-carbon district energy exchange system*~~ *thermal energy network energy exchange systems, thermal energy network heating and cooling systems, or thermal energy network heating only systems* shall be treated as if the thermal energy network equipment were located on site, using the annual heating and/or cooling thermal energy load by each type of equipment in lieu of equipment capacity, with a derate factor applied for the associated pumping and distribution losses of the connected thermal energy network system. Credits shall be reduced and pro-rated in accordance to C406.2.2.2 (space cooling), C406.2.2.3 (space heating) and C406.2.6.3 (service water heating).

**(Equation 4-22)**

$$\sum_{i=1}^{n} C_{TEN} = (C_{eqpm.1} + C_{eqpm.2} + \cdots + C_{eqpm.n}) \times (100\% - L_{pump} - L_{dist})$$

| | | |
|---|---|---|
| $C_{TEN}$ | = | Final credits obtained from a thermal energy network. |
| $C_{eqpm.i}$ | = | Credits obtained from thermal energy network equipment before loss derate. |
| $L_{pump}$ | = | Pumping losses (%). |
| $L_{dist}$ | = | Distribution losses (%) |

Documentation for the ~~low-carbon district~~ thermal energy network system that is operational prior to the final inspection shall be provided to demonstrate that the ~~definition as modified in Section C406.2.2.4.1 or C406.2.2.4.2 of~~ ~~*low-carbon district energy exchange system*~~ *thermal energy network energy exchange systems, thermal energy network heating and cooling systems, or thermal energy network heating only systems* is satisfied.

**Exception:** For new district energy systems being constructed to serve the building, documentation may

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be provided from an energy model as approved by the ~~AHJ~~ *code official*.

Commented [GJ32]: 24-GP1-230R Corix

~~**C406.2.2.4.1 Improved low-carbon district thermal energy network, energy exchange systems (10 percent better).** Low-carbon district Thermal energy network, energy exchange systems must demonstrate the following:~~

1. ~~Forty-five percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources; and~~
2. ~~No more than 25 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources.~~

~~**C406.2.2.4.2 Improved low-carbon district thermal energy network heating and cooling or heating only systems (10 percent better).** Distribution losses must be accounted for and may not exceed 5 percent of the annual load delivered to buildings served by the system. *Low-carbon district Thermal energy network heating and cooling or heating only systems* must demonstrate the following:~~

1. ~~Forty-five percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources and no more than 25 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources; or~~
2. ~~No more than 10 percent of the system annual heat input to the system comes from fossil fuels or electric-resistance sources. The remaining annual heat input must be provided using heat pump technology with a minimum annual operating COP of 3.0.~~

~~**C406.2.2.5 Improved low-carbon district energy systems (20 percent better).** Not less than 90 percent of the annual service hot water and space heating load, or not less than 90 percent of the annual service hot water, space heating, and space cooling load shall meet the criteria of Section C406.2.2.5.1 or C406.2.2.5.2.~~

~~Documentation for the low-carbon district system that is operational prior to the final inspection shall be provided to demonstrate that the definition as modified in Section C406.2.2.4.1 or C406.2.2.4.2 of *low-carbon district energy exchange system* is satisfied.~~

~~**C406.2.2.5.1 Improved low-carbon district thermal energy network, energy exchange systems (20 percent better).** Low-carbon district Thermal energy network, energy exchange systems must demonstrate the following:~~

1. ~~Fifty percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources; and~~
2. ~~No more than 10 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources.~~

~~**C406.2.2.5.2 Improved low-carbon district thermal energy network heating and cooling or heating only systems (20 percent better).** Distribution losses must be accounted for and may not exceed 5 percent of the annual load delivered to buildings served by the system. *Low-carbon district Thermal energy network heating and cooling or heating only systems* must demonstrate the following:~~

1. ~~Fifty percent of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources and no more than 10 percent of the annual heat input to the system comes from fossil fuel or electric-resistance sources; or~~
2. ~~No more than 10 percent of the system annual heat input to the system comes from fossil fuels or electric-resistance sources. The remaining annual heat input must be provided using heat pump technology with a minimum annual operating COP of 4.0.~~

**C406.2.2.6 High performance dedicated outdoor air system (DOAS).** No less than 90 percent of the total conditioned floor area of the whole project, excluding floor area of unoccupied spaces that do not require ventilation as specified by the *International Mechanical Code*, shall be served by DOAS installed in accordance with Section C403.3.5 with the following adjustments:

1. Minimum heat recovery sensible effectiveness of 80 percent, calculated in accordance with Section C403.3.5.1.

2. Where design outdoor airflow is greater than 500 cfm (250 L/s), the DOAS shall be equipped with an economizer bypass, damper control, or wheel speed control that is active between 55°F (13°C) and 75°F (24°C) outdoor air temperature and minimizes energy recovery or maintains an appropriate DOAS leaving air temperature when the building is generally in cooling, based either on outdoor air temperature or a DDC zone-based cooling system reset.
3. DOAS total combined fan power shall be less than either:
   3.1. 0.769 W/cfm (1.55 W/L/s) when calculated in accordance with Section C403.3.5.2.
   3.2. Eighty percent of fan power allowance for a constant volume system when calculated in accordance with Section C403.8.1.

This option is not available to areas served by systems utilizing Section C403.2.2.1 exception 5.

**C406.2.2.7 Fault detection and diagnostics system.** A project not required to comply with Section C403.2.3 or C403.6.10(16) shall achieve energy credits for installing a fault detection and diagnostics system to monitor the HVAC system's performance and automatically identify faults. The installed system shall comply with items 1 through 6 in Section C403.2.3.

**C406.2.3 Reduced lighting power.** Interior lighting within the whole project ~~shall~~ may achieve credits by complying with Section C406.2.3.1 or C406.2.3.2. In Group R-1 and Group R-2 occupancies, dwelling and sleeping units shall comply with Section C406.2.3.~~3~~.2 and all other areas shall comply with section C406.2.3.1 ~~or C406.2.3.2~~. Credits apply to the whole Group R-1 or Group R-2 area.

**C406.2.3.1 Reduced lighting power ~~option 1~~.** The total connected interior lighting power calculated in accordance with Section C405.4.1 shall be ~~90 percent or less of~~ the lighting power values specified in Table C405.4.2(1) reduced by the percent noted in Table C406.2(1) times the floor area for the building types, or ~~90 percent or less of~~ the total interior lighting power allowance calculated in accordance with Section C405.4.2 reduced by the percent noted in Table C406.2(1).

~~**C406.2.3.2 Reduced lighting power option 2.** The total connected interior lighting power calculated in accordance with Section C405.4.1 shall be 80 percent or less of the lighting power values specified in Table C405.4.2(1) times the floor area of the building types, or 80 percent or less of the total interior lighting power allowance calculated in accordance with Section C405.4.2.~~

**C406.2.3.~~3~~.2 Lamp efficacy.** No less than 95 percent of the permanently installed light fixtures in dwelling units and sleeping units shall be provided by lamps with a minimum efficacy of 90 lumens per watt.

**C406.2.4 Lighting controls.** For buildings with nontransient *dwelling units* and *sleeping units*, energy credits shall be achieved by installation of systems that comply with the requirements of Section C406.2.4.1. All other buildings shall achieve energy credits by complying with Section C406.2.4.2. For buildings with mixed occupancies, credits shall be prorated based on floor area.

**C406.2.4.1 Residential building lighting control.** In buildings with nontransient dwelling units and sleeping units, lighting controls shall be configured to meet the following:

1. Each *dwelling unit* or *sleeping unit* shall have a main control by the main entrance that turns off all the lights and switched receptacles in the unit. The main control shall be permitted to have two controls, one for permanently wired lighting and one for switched receptacles. The main controls shall be clearly identified as "lights master off" and "switched outlets master off."
2. Switched receptacles shall be clearly identified and all switched receptacles shall be located within 12 inches of an unswitched receptacle. Each room shall have a minimum of two switched receptacles except bathrooms, kitchens, and closets.

**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) shall be prorated as follows:

[Floor area with high end trim, %] x [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/m$^2$) 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 4-18.

**(Equation 4-18)**

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

Where:

| | | |
|---|---|---|
| $AEC_{RRa}$ | = | Section C406.2.5 achieved energy credits for this project as calculated in accordance with Equation 4-18, limited to 50 percent of the required credits in Section C406.1. |
| $RR_t$ | = | 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/m$^2$) |
| PGFA | = | Project gross floor area, square feet (m$^2$) |
| $AEC_b$ | = | Section C406.2.5 base credits from Table C406.2. |
| REF | = | Renewable Energy Factor from Table C411.2.1. |

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

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

~~1. Section C406.2.6.1, C406.2.6.2, or C406.2.6.3.~~

~~2. Sections C406.2.6.1 and C406.2.6.2.~~

~~3. Sections C406.2.6.1 and C406.2.6.3.~~

**C406.2.6.1 Shower drain heat recovery.** Shower drain heat recovery units shall comply with Section C404.10 and preheat cold water supply to the showers. Potable waterside pressure loss shall be less than 10 psi (69 kPa) at maximum design flow. The efficiency of drain water heat recovery units shall be 54 percent in accordance with CSA B55.1. Full credits are applicable to the following building use types: Multi-family, hotel, motel, dormitory, and schools with locker room showers. Where not all showers in the project have drain heat recovery, the credit is adjusted based on the following:

[Section C406.2.6.1 table credits] x [Showers with drain recovery] / [Total number of showers]

**C406.2.6.2 Service water heating energy recovery.** Not less than 30 percent of the annual service hot water heating energy use, or not less than 70 percent of the annual service hot water heating energy use in buildings with condenser water systems subject to the requirements of Section C403.9.2.1 or qualifying for one of its exceptions, shall be provided by one or more of the following:

1. Waste heat recovery from service hot water, heat recovery chillers, building equipment, process equipment, or other *approved* system. Qualifying heat recovery must be above and beyond heat recovery required by other sections of this code.
2. On-site renewable energy water-heating systems where not used to meet other requirements or to obtain other energy credits.

**C406.2.6.3 ~~Heat pump~~ Service water heating equipment efficiency.** ~~Projects shall achieve credits through compliance with Section C406.2.6.3.1.~~ Primary service water heating equipment shall exceed the minimum heating efficiency requirements listed in the tables in Section C404.2.1 by the percent noted in table C406.2(7). Available credits noted in table C406.2(7) shall be reduced by other selected efficiency credit measures and comprise of the summation of the prorated credits assigned to each system type within a mixed service water heating system using Equation 4-19, rounded to the nearest whole number. Where individual equipment efficiencies of the same system type vary, weigh them based on capacity.

**(Equation 4-19)**

$$C_{water.i} = TBL_{water} \times (1 - (RCVRY_{cr} \times RCVRY_{adj}) - (USE_{cr} \times USE_{adj})) \times \left(\frac{EQPM_{water}}{TOT_{water}}\right)$$

$$\sum_{i=1}^{n} C_{water} = C_{water.1} + C_{water.2} + \cdots + C_{water.n}$$

| | | |
|---|---|---|
| $C_{water}$ | = | Credits for service water heating equipment. |
| $C_{water.i}$ | = | Credits for service water heating equipment of noted systems type. |
| $TBL_{water}$ | = | Credits noted in Table C406.2(7). |
| $RCVRY_{cr}$ | = | Service hot water heat recovery credits obtained via Table C406.2(6) |
| $RCVRY_{adj}$ | = | Adjustment factor for service hot water heat recovery credits obtained via Table C406.2(6) |
| $USE_{cr}$ | = | Reduced service hot water heat use credits obtained via Table C406.2(6) |
| $USE_{adj}$ | = | Adjustment factor for reduced service hot water heat use credits obtained via Table C406.2(6) |
| $EQPM_{water}$ | = | Installed primary service water heating capacity of this system type in kBTU/h. Excluding primary service water heating covered under a Section C404.2.1 exception except when evaluating exceptions. |
| $TOT_{water}$ | = | Total installed primary space heating capacity in kBTU/h including any of the exceptions in Section C404.2.1. |

~~**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 suing 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.~~

~~**C406.2.6.4 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.~~

**C406.2.7 Improved service hot water temperature maintenance.** For buildings with gross floor area greater than 10,000 square feet, credit shall be achieved when hot water temperature maintenance is installed in accordance with Section C406.2.7.1 or C406.2.7.2.

**C406.2.7.1 Self-regulated heat trace system.** ~~The credit achieved shall be from Table C406.2(1).~~ 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) where~~ Any fixtures requiring hot water shall be supplied from a localized ~~electric~~ source of hot water with no recirculation or heat trace and limited to 2 kW and 6 gallons of storage. The supply pipe length from the point of use water heater to the termination of the fixture supply pipe shall be no more than 20 feet.

**C406.2.8 Service hot water distribution right sizing.** To achieve this credit, where Group R-1 and R-2 occupancies are served by a central service hot water system, the distribution system serving *dwelling units*,

*sleeping units* and guestrooms shall be sized using Appendix M of the *Uniform Plumbing Code*.

**C406.2.9 High performance service hot water temperature maintenance system.** Systems with multiple riser service hot water circulation systems shall use only heat pump technology for temperature maintenance. The heat pump technology shall have a minimum COP of 3.0 or UEF of 3.4. For air-source equipment, the COP rating will be reported at the design leaving heat pump water temperature with an entering dry bulb air temperature of 60°F (16°C) or lower and a relative humidity of 50 percent or lower. For water-source equipment, the COP rating will be reported at the design leaving load side water temperature with an entering source side water temperature of 74°F (23°C) or lower. The system shall comply with the requirements of Section C404.7.1.

**C406.2.10 High efficiency service hot water circulation system.** Multiple riser service hot water circulation systems shall use a variable volume circulation pump controlled to vary the pump speed based on system demand and shall include self-actuated thermostatic balancing valves to control the system flow at each riser.

**C406.2.11 Low flow showerheads for Group R-1 and R-2 occupancies.** All showerheads installed in Group R-1 and R-2 *dwelling units* or *sleeping units* shall have a maximum listed flowrate of 1.25 gallons per minute or less at 80 psi operating pressure for fixed showerheads and a maximum listed flowrate of 1.50 gallons per minute or less at 80 psi operating pressure for handheld showerheads. When a shower is served by more than one showerhead, including handheld showerheads, the combined flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 1.25 gallons per minute or less for fixed or 1.5 gallons per minute or less for handheld, or the shower shall be designed to allow only one shower outlet to be in operation at a time.

**C406.2.12 Enhanced envelope performance.** The Proposed Total UA of the thermal envelope of the project shall be ~~15~~ the percent noted in Table C406.2(2) lower than the Allowable Total UA determined in accordance with Section C402.1.5 and Equation 4-3. Buildings or building areas exempt from thermal envelope requirements in Sections C402.1.1 and C402.1.2, do not qualify for these credits.

**C406.2.13 Reduced air leakage.** Energy credits shall be achieved where measured air leakage of the total *conditioned floor area* of the whole building, fully isolated building addition or tenant space is determined in accordance with Section C402.5.1~~.2~~ and ~~complies with~~ exceeds the maximum leakage in ~~either~~ Section ~~C406.2.13.1 or C406.2.13.2~~ C402.5.2 by the percentage noted in table C406.2(2). Buildings or building areas exempt from thermal envelope requirements in Sections C402.1.1 and C402.1.2, do not qualify for these credits.

~~**C406.2.13.1 Base reduced air leakage.** Measured air leakage shall not exceed 68 percent of the maximum leakage allowed by Section C402.5.1.2.~~

~~**C406.2.13.2 Enhanced reduced air leakage.** Measured air leakage shall not exceed 33 percent of the maximum leakage allowed by Section C402.5.1.2.~~

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

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

Energy efficiency credits for efficient commercial kitchen equipment shall be determined based on Equation 4-~~19~~20, rounded to the nearest whole number.

**(Equation 4-~~19~~20)**

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

Where:

$AEEC_K$ = Section C406.2.14 table credits, to a maximum of those allowed in Table C406.2(~~1~~9) for this option.

$Area_K$ = Floor area of full-service kitchen ($ft^2$ or $m^2$).

$Area_B$ = Gross floor area of building ($ft^2$ or $m^2$).

**C406.2.15 Residential kitchen equipment.** For projects with Group R-1 and R-2 occupancies, energy credits shall be achieved where not less than 90 percent of dishwashers, refrigerators, and freezers comply with all of the following:

1. Achieve the ENERGY STAR Most Efficient label in accordance with the 2021 specifications.
2. Be installed prior to the issuance of the certificate of occupancy.

For Group R-1 where only some guestrooms are equipped with both refrigerators and dishwashers, the table credits shall be prorated as follows:

[Section C406.2.15 table credits] x [Floor area of guestrooms with kitchens] / [Total guestroom floor area]

**C406.2.16 Residential laundry appliances.** For projects with Group R-2 occupancies, energy credits shall be achieved where not less than 90 percent of clothes washers and dryers in the project meet the following requirements:

1. Each dwelling unit contains in-unit washing washer and dryer equipment that meets the following requirements:
   1.1. Achieve the ENERGY STAR Most Efficient label in accordance with the 2021 specifications.
   1.2. Be installed prior to the issuance of the certificate of occupancy.
2. Where only some dwelling units are equipped with both washers and dryers, the table credits shall be prorated as follows:

[Section C406.2.16 table credits] x [Floor area of dwelling units with laundry] / [Total dwelling unit floor area]

**C406.2.17 Heat pump clothes dryers.** Not less than 90 percent of domestic clothes dryers located in Group R-1 and R-2 of the whole project are ENERGY STAR rated heat pump dryers. Credit applies only to buildings where laundry facilities are provided either within each residential dwelling or sleeping units or grouped together in central multi-family use laundry rooms, or a mix of the two.

To claim this credit, the building permit drawings shall specify the appliance type and provide documentation of ENERGY STAR compliance. At the time of inspection, all appliances shall be installed and connected to utilities.

**C406.2.18 Efficient elevator equipment.** Qualifying elevators in the building shall be Energy Efficient Class A in accordance with ISO 25745-2, Table 7. Only buildings three or more floors above grade shall be permitted to use this credit. Credits shall be prorated based on Equation 4-20~~1~~, rounded to the nearest whole credit. Projects with a compliance ratio ($CR_e$ ~~in Equation 4-18~~) below 0.5 do not qualify for this credit.

**(Equation 4-20~~1~~)**

$$EC_e = EC_t \times CR_e$$

Where:

$EC_e$ = Elevator energy credit achieved for building.

$EC_t$ = Section C406.2.18 table energy credit.

$CR_e = \frac{F_A}{F_B}$

$F_A$ = Sum of floors served by Class A elevators.

$F_B$ = Sum of floors served by all building elevators and escalators.