

~~2. Fossil Fuel: A rated  $E_r$  of not less than 90 percent as determined by the applicable test procedure in Table C404.2.~~

- EXCEPTIONS:
1. Where not less than 25 percent of the annual service water heating requirement is provided from any of the following sources:
    - 1.1. Renewable energy generated on-site that is not being used to satisfy another requirement of this code; or
    - 1.2. Site-recovered energy that is not being used to satisfy other requirements of this code.
  2. Redundant equipment intended to only operate during equipment failure or periods of extended maintenance.
  3. Electric resistance heated systems installed as part of an alteration where the water heating equipment is installed at the grade level in a building with a height of four stories or greater.
  4. Hot water heat exchangers used to provide service water heating from a district utility (steam, heating hot water).
  5. Water heaters provided as an integral part of equipment intended to only heat or boost the heat of water used by that equipment.
  6. For electric heat systems, supplemental water heaters not meeting this criteria that function as auxiliary heating only when the outdoor temperature is below 32°F (0°C) or when a defrost cycle is required are not required to have a rated COP of 2.0. Such systems shall be sized and configured to lock out electric resistance or fossil fuel heating from operation when the outdoor temperature is above 32°F (0°C) unless the system is in defrost operation.

~~**C404.2.2 High input rated service water heating system for Group R-1 and R-2 occupancies.** In new buildings with over 1,000,000 Btu/h installed service water heating capacity serving Group R-1 and R-2 occupancies, at least 25 percent of annual water heating energy shall be provided from any combination of the following water heating sources:~~

1. Renewable energy generated on-site that is not being used to satisfy other requirements of this code; or
2. Site-recovered energy that is not being used to satisfy other requirements of this code.

- EXCEPTION:
- Compliance with this section is not required if the combined input capacity weighted average equipment rating for each service water heating fuel source type is not less than the following:
1. Electric Resistance: An electric resistance water heater with a rating of 105 percent of the rated efficiency of Table C404.2.
  2. Electric Heat Pump (10 C.F.R. Part 430): A heat pump water heater rated in accordance with 10 C.F.R. Part 430 with a rating of 105 percent of the rated efficiency of Table C404.2.
  3. Electric Heat Pump (not listed in accordance with 10 C.F.R. Part 430): A heat pump water heater not rated in accordance with 10 C.F.R. Part 430 shall have a COP of not less than 2.0. For air-source heat pump equipment the COP rating will be reported at the design leaving heat pump water temperature with an entering air temperature of 60°F (15.6°C) or less. Supplemental water heaters not meeting the above criteria that function as auxiliary heating only when the outdoor temperature is below 32°F (0°C) or when a defrost cycle is required are not required to have a rated COP of 2.0. Such systems shall be sized and configured to lock out electric resistance or fossil fuel heating from operation when the outdoor temperature is above 32°F (0°C) unless the system is in defrost operation.
  4. Fossil Fuels: A rated  $E_r$  of not less than 90 percent as determined by the applicable test procedures in Table C404.2.
  5. Hot water heat exchangers used to provide service water heating from a district utility (steam, heating hot water).))

~~**C404.2.1 Service water heating system type.** ~~Service water heating equipment shall not use fossil fuel combustion or electric resistance.~~ Service hot water shall be provided by an electric air-source heat pump water heating (HPWH) system meeting the requirements of this section. Supplemental service water heating equipment is permitted to use electric resistance in compliance with Section C404.2.1.4.~~

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

~~**C404.2.1.1 Primary heat pump system sizing.** The system shall include a primary service output of ~~100~~ percent load at 40°F (4°C) dry bulb or wet bulb outdoor air temperature for air-source heat pumps, or 44°F (7°C) ground temperature for ground-source heat pumps that provides sufficient hot water as calculated using the equipment manufacturer's selection criteria or another *approved* methodology. Electric air source heat pumps shall be sized to deliver no less than ~~50~~ percent of the calculated demand for hot water production during the peak demand period when entering dry bulb or wet bulb outdoor air temperature of 24°F (-4°C). The remaining primary service output may be met by fossil fuel, electric resistance, or heat pump water heating systems.~~

- EXCEPTION:
- ~~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.

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

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

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

2. For *multi-pass* HPWHs, *recirculated temperature maintenance* water is permitted to be returned to the primary water storage tanks for reheating.

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

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

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

1. *Temperature maintenance* of heated-water circulation systems, physically separate from the primary service water heating system. *Temperature maintenance* heating capacity shall be no greater than the primary water heating capacity at 40°F (4°C) dry bulb or wet bulb outdoor air temperature for air-source heat pumps or 44°F (7°C) ground temperature for ground-source heat pumps.

2. Defrost of compressor coils.

3. Heat tracing of piping for freeze protection or for *temperature maintenance* in lieu of recirculation of hot water.

4. Backup or low ambient temperature conditions, where all of the following are true:

4.1. The supplemental heating capacity is no greater than the primary service water heating capacity at 40°F (4°C) dry bulb or wet bulb outdoor air temperature for air-source heat pumps or 44°F (7°C) ground temperature for ground-source heat pumps.

4.2. During normal operations, the supplemental heating is controlled to operate only when the entering air temperature at the air-source HPWH is below 40°F (4°C), and the primary HPWH compressor continues to operate together with the supplemental heating ~~when the entering air temperature is between 17°F (-8°C) and 40°F (4°C).~~

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