



STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

Washington State Energy Code Development Standard Energy Code Proposal Form

May 2018

Log No. _____

Code being amended: Commercial Provisions Residential Provisions

Code Section # C403.1.4, C407, C503.4.1, C503.4.6

Brief Description: Provide heat pump space heating, rather than fossil fuel or electric space heating, for all buildings. Exceptions are provided to allow electric resistance heating for small loads and as supplementary heat for very cold weather.

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

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. For the purposes of this section, electric resistance HVAC heating appliances include but are not limited to electric baseboard, electric resistance fan coil and VAV electric resistance terminal reheat units and electric resistance boilers. For the purposes of this section, fossil fuel combustion HVAC heating appliances include but are not limited to appliances burning natural gas, heating oil, propane, or other fossil fuels.

Exceptions.

1. Low heating capacity. Buildings or areas of buildings, other than *dwelling units* or sleeping units, that meet the interior temperature requirements of IBC Chapter 12 with a total installed HVAC heating capacity no greater than 8.5 BTU/h (2.5 watts) per square foot of *conditioned space* are permitted to be heated using electric resistance appliances. For the purposes of this exception, overhead or wall-mounted radiant heating panels installed in an unheated or semi-heated space, insulated in compliance with Section C402.2.8 and controlled by occupant sensing devices in compliance with Section C403.11.1 need not be included as part of the HVAC heating energy calculation.

2. Dwelling and sleeping units. Dwelling or sleeping units having an installed HVAC heating capacity no greater than 750 watts in Climate Zone 4, and 1000 watts in Climate Zone 5, in any separate habitable room with exterior fenestration are permitted to be heated using electric resistance appliances.

2a. Corner rooms. A room within a dwelling or sleeping unit that has two primary walls facing different cardinal directions, each with exterior fenestration, is permitted to have an installed HVAC heating capacity no greater than 1000 watts in Climate Zone 4, and

1300 watts in Climate Zone 5. Bay windows and other minor offsets are not considered primary walls.

3. Small buildings. Buildings with less than 2,500 square feet of *conditioned floor area* are permitted to be heated using electric resistance appliances.

4. Defrost. Heat pumps are permitted to utilize electric resistance as the first stage of heating when a heat pump defrost cycle is required and is in operation.

5. Air-to-air heat pumps. Buildings are permitted to utilize internal electric resistance heaters to supplement heat pump heating for air-to-air heat pumps that meet all of the following conditions:

- a. 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.
- b. 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 or lower.
- c. The heat pump complies with one of the following:
 1. Controlled by a digital or electronic thermostat designed for heat pump use that energizes the supplemental heat only when the heat pump has insufficient capacity to maintain set point or to warm up the space at a sufficient rate,
 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.
 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.
- d. The heat pump rated heating capacity is sized to meet the heating load at an outdoor air temperature of 32°F or lower and has a rated heating capacity at 47°F no less than 2 times greater than supplemental internal electric resistance heating capacity in Climate Zone 4 and no less than the supplemental internal electric resistance heating capacity in Climate Zone 5, or utilizes the smallest available factory-available internal electric resistance heater.

6. Air-to-water heat pumps, up to 2,000 MBH. Buildings are permitted to utilize electric resistance auxiliary heating to supplement heat pump heating for hydronic heating systems that have air-to-water heat pump heating capacity no greater than 2000 kBTU/hr at 47°F, and that meet all of the following conditions:

- a. Controls for the auxiliary electric resistance heating are configured to lock out the supplemental heat when the outside air temperature is above 32°F, unless the hot water supply temperature setpoint to the building heat coils cannot be maintained for 20 minutes.
- b. 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 or lower except during startup or defrost operation.
- c. The heat pump rated heating capacity at 47°F is no less than 80% of the design heating load.

7. Air-to-water heat pumps, up to 3,000 MBH. Buildings are permitted to utilize electric resistance auxiliary heating to supplement heat pump heating for hydronic heating systems that have air-to-water heat pump heating capacity greater than 2000 kBTU/hr and no greater than 3000 kBTU/hr at 47°F, and that meet all of the following conditions:

- a. Controls for the auxiliary electric resistance heating are configured to lock out the supplemental

heat when the outside air temperature is above 36°F, unless the hot water supply temperature setpoint to the building heat coils cannot be maintained for 20 minutes.

- b. 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 or lower except during startup or defrost operation.
- c. The heat pump rated heating capacity at 47°F is no less than 75% of the design heating load.

8. Air-to-water heat pumps, over 3,000 MBH. Buildings are permitted to utilize electric resistance auxiliary heating to supplement heat pump heating for hydronic heating systems that have air-to-water heat pump heating capacity greater than 3000 kBTU/hr at 47°F and that meet all of the following conditions:

- a. Controls for the auxiliary resistance heating are configured to lock out the supplemental heat when the outside air temperature is above 40°F unless the hot water supply temperature setpoint to the building heat coils cannot be maintained for 20 minutes.
- b. 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 or lower except during startup or defrost operation.
- c. The heat pump rated heating capacity at 47°F is no less than 70% of the design heating load.

9. Ground source heat pumps. Buildings are permitted to utilize electric resistance auxiliary heating to supplement heat pump heating for hydronic heating systems with ground source heat pump equipment that meets all of the following conditions:

- a. Controls for the auxiliary resistance heating are configured to lock out the supplemental heat when the outdoor air temperature is above 32°F, unless the hot water supply temperature setpoint to the building heat coils cannot be maintained for 20 minutes.
- b. The heat pump controls are configured to use the compressor as the first stage of heating
- c. The heat pump rated heating capacity at 32°F entering water conditions is no less than 70% of the design heating load.

10. 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*.

11. 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.

12. Kitchen exhaust. 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 using electric resistance appliances.

13. 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.

14. 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.

15. Temporary systems. Temporary electric resistance heating systems are permitted where serving future tenant spaces that are unfinished and unoccupied, provided that the heating equipment is sized and controlled to achieve interior space temperatures no higher than 40°F.

16. Emergency generators. Emergency generators are permitted to use fossil fuels.

17. Pasteurization. Electric resistance heat controls are permitted to reset the supply water temperature of hydronic heating systems that serve service water heating heat exchangers during pasteurization cycles of the service hot water storage volume. The hydronic heating system supply water temperature shall be configured to be 145°F or lower during the pasteurization cycle.

Table C407.2

MANDATORY COMPLIANCE MEASURES FOR TOTAL BUILDING PERFORMANCE METHOD

Section	Title	Comments
Envelope		
C402.5	Air Leakage	
Mechanical		
C403.1.2	Calculation of heating and cooling loads	
C403.1.3	Data centers	
C403.1.4	<u>Use of electric resistance and fossil fuel-fired HVAC heating equipment</u>	
C403.2	System design	
C403.3.1	Equipment and system sizing	
C403.3.2	HVAC equipment performance requirements	
C403.3.6	Ventilation for Group R occupancy	
C403.4	HVAC system controls	
C403.4.1	Thermostatic controls	Except for C403.4.1.4
C403.4.2	Off-hour controls	Except for Group R
C403.4.7	Combustion heating equipment controls	
C403.4.8	Group R-1 hotel/motel guestrooms	See Section C403.7.4

C403.4.9	Group R-2 and R-3 dwelling units	
C403.4.10	Group R-2 sleeping units	
C403.4.11	Direct digital control systems,	
C403.5.5	Economizer fault detection and diagnostics (FDD)	
C403.7	Ventilation and exhaust systems	Except for C403.7.6
C403.8	Fan and fan controls	
C403.9.1.1	Variable flow controls	For cooling tower fans ≥ 7.5 hp
C403.9.1.2	Limitation on centrifugal fan cooling towers	For open cooling towers
C403.10	Construction of HVAC elements	
C403.11	Mechanical systems located outside of the building thermal envelope	
Service Water Heating		
C404	Service Water Heating	
Lighting and Electrical		
C405.1	General	
C405.2	Lighting controls	
C405.3	Exit signs	
C405.4	Interior lighting power	
C405.5	Exterior building lighting power	
C405.6	Electrical transformers	
C405.7	Dwelling unit energy consumption	
C405.8	Electric motor efficiency	
C405.9	Vertical and horizontal transportation	
C405.10	Controlled receptacles	
C405.11	Voltage drop in feeders	
Other Requirements		
C407	Total Building Performance	
C408	System commissioning	

C409	Energy metering	
C410	Refrigeration requirements	
C411	Solar readiness	

C503.4.1 New mechanical systems. All new mechanical systems in existing buildings, including packaged unitary equipment and packaged split systems shall comply with Section C403, except as noted in the subsections below.

C503.4.6 New and replacement HVAC heating system equipment. *Where a building mechanical heating appliance is augmented or replaced, the building shall comply with Section C403.1.4.*

Exceptions:

1. See exceptions to C403.1.4
2. Where only one heating appliance is failing and is replaced by another having the same or lesser heating capacity and the same or higher efficiency. This exception cannot be used within the same building more than once in a 24-month period.

Purpose of code change:

Heat pump space heating eliminates a significant source of fossil fuel combustion in buildings, and is generally 2-4x more energy efficient than either fossil fuel or electric resistance heating. This proposal aligns with [State policy to increase energy efficiency](#) by 70% by 2031. Additionally, this proposal will significantly reduce emissions and is aligned with [State policy to achieve the broader goal](#) of building zero fossil-fuel greenhouse gas emission homes and buildings by the year 2031. According to analysis done using data from the 2021 Washington State Energy Strategy, we need to reduce the commercial buildings sector emissions by 38% to keep on track to meet our 2050 climate goals. To achieve this, the State will need to quadruple the proportion of annual sales of heat pumps from 11% of all commercial space heating equipment in 2020 to 40% by 2030. To get to this increase in market penetration of heat pumps, the Washington State Energy Code should require heat pump space heating in the 2021 code cycle. See Supplemental Attachment for further details on emissions and market penetration.

Your amendment must meet one of the following criteria. Select at least one:

- | | |
|--|---|
| <input type="checkbox"/> Addresses a critical life/safety need. | <input type="checkbox"/> Consistency with state or federal regulations. |
| <input type="checkbox"/> The amendment clarifies the intent or application of the code. | <input type="checkbox"/> Addresses a unique character of the state. |
| <input checked="" type="checkbox"/> Addresses a specific state policy or statute.
(Note that energy conservation is a state policy) | <input type="checkbox"/> Corrects errors and omissions. |

Check the building types that would be impacted by your code change:



STATE OF WASHINGTON

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- Single family/duplex/townhome Multi-family 4 + stories Institutional
 Multi-family 1 – 3 stories Commercial / Retail Industrial

Your name Jonny Kocher Email address jkocher@rmi.org

Your organization RMI Phone number 619-459-4267

Other contact name Denise Grab; dgrab@rmi.org

Instructions: Send this form as an email attachment, along with any other documentation available, to: sbcc@des.wa.gov. For further information, call the State Building Code Council at 360-407-9278.

Economic Impact Data Sheet

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants and businesses.

Construction costs for heat pump space heating are often, but not always, higher than for conventional natural gas or electric resistance heating. Annual energy costs for heat pumps are much lower than for electric resistance heating, but the same or slightly higher when compared with gas heating, at current rates (World Bank long term forecasts indicate an increase of over 80% in gas prices over the coming decade.) When including the Washington State social cost of carbon, heat pump space heating is more cost effective than both gas heating and electric resistance heating over the life cycle analysis horizon.

Benefits to building owners, tenants, and businesses include early alignment with HB1257 (to avoid future performance compliance penalties) and reduced life cycle cost (especially when considering the potential increases to the Social Cost of Carbon). Given the state's climate goals and policy, this Energy Code proposal will help ensure new assets permitted beginning July 1, 2023 will not need to be immediately retrofitted.

Provide your best estimate of the construction cost (or cost savings) of your code change proposal? (See OFM Life Cycle Cost [Analysis tool](#) and [Instructions](#); use these [Inputs](#). [Webinars on the tool can be found Here and Here](#))

The average net present value capital cost increase for this proposal will be around \$0.24/square foot. The average life cycle cost savings of \$0.70/square foot and \$2.70/square foot when including the social cost of carbon. See "WA Code Change -Heat Pump Space Heating Proposal - Cost Analysis Supplemental" for more details.

Provide your best estimate of the annual energy savings (or additional energy use) for your code change proposal?

The average energy savings for this proposal will be around 9.1 KBTU/ square foot. See "Heat Pump Space Heating Supplemental Cost & Energy Data" for more details on the data.

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

No increase in plan review or inspection time.

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.