

**WAC 51-11C-40334 Section C403.3.4—Boilers.**

**C403.3.4 Boiler requirements.** *Boiler systems* shall comply with the following:

**C403.3.4.1 Combustion air positive shut-off.** Combustion air positive shut-off shall be provided on all newly installed *boiler systems* as follows:

1. All *boiler systems* with an input capacity of 2,500,000 Btu/h and above, in which the boiler is designed to operate with a nonpositive vent static pressure.
2. All *boiler systems* where one stack serves two or more boilers with a total combined input capacity per stack of 2,500,000 Btu/h.

**C403.3.4.2 Boiler system oxygen concentration controls.** Boiler system combustion air fans with motors 10 horsepower or larger shall meet one of the following for newly installed boilers:

1. The fan motor shall be variable speed; or
2. The fan motor shall include controls that limit the fan motor demand to no more than 30 percent of the total design wattage at 50 percent of design air volume.

**C403.3.4.3 Boiler oxygen concentration controls.** Newly installed boilers with an input capacity of 5,000,000 Btu/h and greater and a steady state full-load combustion efficiency less than 90 percent shall maintain stack-gas oxygen concentrations not greater than the values specified in Table C403.3.4.3. Combustion air volume shall be controlled with respect to measured flue gas oxygen concentration. The use of a common gas and combustion air control linkage or jack shaft is prohibited.

EXCEPTION: These concentration limits do not apply where 50 percent or more of the boiler system capacity serves Group R-2 occupancies.

**Table C403.3.4.3  
Boiler Stack-Gas Oxygen Concentrations**

| <b>Boiler System Type</b>   | <b>Maximum Stack-Gas Oxygen Concentration<sup>a</sup></b> |
|---|---|
| Less than 10% of the boiler system capacity is used for process applications at design conditions | 5%  |
| All others  | 3%  |

<sup>a</sup> Concentration levels measured by volume on a dry basis over firing rates of 20 to 100 percent.

**C403.3.4.4 Boiler turndown.** *Boiler systems* with design input of greater than 1,000,000 Btu/h (293 kW) shall comply with the turndown ratio specified in Table C403.3.4.4.

The system turndown requirement shall be met through the use of multiple single input boilers, one or more *modulating boilers* or a combination of single input and modulating boilers.

**Table C403.3.4.4  
Boiler Turndown**

| Boiler System Design Input (Btu/h)               | Minimum Turndown Ratio |
|--|------------------------|
| ≥ 1,000,000 and less than or equal to 5,000,000  | 3 to 1                 |
| ≥ 5,000,000 and less than or equal to 10,000,000 | 4 to 1                 |
| ≥ 10,000,000                                     | 5 to 1                 |

**C403.3.4.5 Buildings with high-capacity space-heating gas boiler systems.** New buildings with gas hot water boiler systems for space heating with a total system input of at least 1,000,000 Btu/h but not more than 10,000,000 Btu/h shall comply with this section.

- EXCEPTIONS:
1. Where 25 percent of the annual space heating requirement is provided by site-recovered energy, or heat recovery chillers.
  2. Space heating boilers installed in individual dwelling units.
  3. Where 50 percent or more of the design heat load is served using perimeter convective heating, radiant ceiling panels, or both.
  4. Individual gas boilers with input capacity less than 300,000 Btu/h shall not be included in the calculations of the total system input or total system efficiency.

**C403.3.4.5.1 Boiler efficiency.** Gas hot water boilers shall have a minimum thermal efficiency (Et) of 90 percent when rated in accordance with the test procedures in Table C403.3.2(6). Systems with multiple boilers are allowed to meet this requirement if the space-heating input provided by equipment with thermal efficiency (Et) above and below 90 percent provides an input capacity-weighted average thermal efficiency of at least 90 percent. For boilers rated only for combustion efficiency, the calculation for the input capacity-weighted average thermal efficiency shall use the combustion efficiency value.

**C403.3.4.5.2 Hot water distribution system design.** The hot water distribution system shall be designed to meet all of the following:

1. Coils and other heat exchangers shall be selected so that at design conditions the hot water return temperature entering the boilers is 120°F (48.9°C) or less.
2. Under all operating conditions, the water temperature entering the boiler is 120°F (48.9°C) or less, or the flow rate of supply hot water that recirculates directly into the return system, such as three-way valves or minimum flow bypass controls, shall be no greater than 20 percent of the design flow of the operating boilers.

[Statutory Authority: RCW 19.27A.020, 19.27A.025, 19.27A.160 and chapters 19.27A and 19.27 RCW. WSR 22-14-091, 23-12-101, and 23-20-021, § 51-11C-40334, filed 7/1/22, 6/7/23, and 9/25/23, effective 3/15/24. Statutory Authority: RCW 19.27A.020, 19.27A.025, 19.27A.160 and chapter 19.27 RCW. WSR 19-24-040, § 51-11C-40334, filed 11/26/19, effective 7/1/20. Statutory Authority: RCW 19.27A.025, 19.27A.160, and 19.27.074. WSR 16-03-072, § 51-11C-40334, filed 1/19/16, effective 7/1/16.]