

(Effective until March 15, 2024)

WAC 51-11C-40332 Section C403.3.2—HVAC equipment performance requirements.

C403.3.2 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(12) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of Table C403.3.2(10). 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. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements herein.

Gas-fired and oil-fired forced air furnaces with input ratings $\geq 225,000$ Btu/h (65 kW) and all unit heaters shall also have an intermittent ignition or interrupted device (IID), and have either mechanical draft (including power venting) or a flue damper. A vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. All furnaces with input ratings $\geq 225,000$ Btu/h (65 kW), including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75 percent of the input rating.

C403.3.2.1 Chillers. Chilled water plants and buildings with more than 500 tons total capacity shall not have more than 100 tons provided by air-cooled chillers.

- EXCEPTIONS:
1. Where the designer demonstrates that the water quality at the building site fails to meet manufacturer's specifications for the use of water-cooled equipment.
 2. Air-cooled chillers with minimum efficiencies at least 10 percent higher than those listed in Table C403.3.2(7).
 3. Replacement of existing air-cooled chiller equipment.
 4. Air-to-water heat pump units that are configured to provide both heating and cooling and that are rated in accordance with AHRI 550/590. Where the air-to-water heat pumps are designed for a maximum supply leaving water temperature of less than 140°F, the efficiency rating will be calculated and reported at the maximum unit leaving water temperature for this test condition.

C403.3.2.2 Water-cooled centrifugal chilling package. Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44°F (7°C) leaving chilled-water temperature and 2.4 gpm/ton evaporator fluid flow and 85°F (29°C) entering condenser water temperature with 3 gpm/ton (0.054 L/s • kW) condenser water flow shall have maximum full-load kW/ton (FL) and *part-load* ratings adjusted using Equations 4-7 and 4-8.

$$FL_{adj} = FL/K_{adj}$$

(Equation 4-7)

$$PLV_{adj} = IPLV/K_{adj}$$

(Equation 4-8)

Where:

$$K_{adj} = A \times B$$

FL = Full-load kW/ton values as specified in Table C403.3.2(7)

- FL_{adj} = Maximum full-load kW/ton rating, adjusted for nonstandard conditions
- IPLV = Value as specified in Table C403.3.2(7)
- PLV_{adj} = Maximum NPLV rating, adjusted for nonstandard conditions
- A = $0.00000014592 \times (\text{LIFT})^4 - 0.0000346496 \times (\text{LIFT})^3 + 0.00314196 \times (\text{LIFT})^2 - 0.147199 \times \text{LIFT} + 3.9302$
- B = $0.0015 \times L_{vg}^{Evap} (\text{°F}) + 0.934$
- LIFT = $L_{vg}^{Cond} - L_{vg}^{Evap}$
- L_{vg}^{Cond} = Full-load condenser leaving fluid temperature (°F)
- L_{vg}^{Evap} = Full-load evaporator leaving temperature (°F)

The FL_{adj} and PLV_{adj} values are only applicable for centrifugal chillers meeting all of the following full-load design ranges:

1. Minimum evaporator leaving temperature: 36°F.
2. Maximum condenser leaving temperature: 115°F.
3. LIFT is not less than 20°F (11.1°C) and not greater than 80°F (44.4°C).

C403.3.2.3 Positive displacement (air- and water-cooled) chilling packages. Equipment with a leaving fluid temperature higher than 32°F (0°C) and water-cooled positive displacement chilling packages with a condenser leaving fluid temperature below 115°F (46°C) shall meet the requirements of Table C403.3.2(7) when tested or certified with water at standard rating conditions, in accordance with the referenced test procedure.

C403.3.2.4 Packaged electric heating and cooling equipment. Packaged electric equipment providing both heating and cooling with a total cooling capacity greater than 6,000 Btu/h shall be a heat pump.

EXCEPTION: Unstaffed equipment shelters or cabinets used solely for personal wireless service facilities.

C403.3.2.5 Humidification. If an air economizer is required on a cooling system for which humidification equipment is to be provided to maintain minimum indoor humidity levels, then the humidifier shall be of the adiabatic type (direct evaporative media or fog atomization type).

EXCEPTIONS:

1. Health care facilities licensed by the state where chapter 246-320 or 246-330 WAC requires steam injection humidifiers in duct work downstream of final filters.
2. Systems with water economizer.
3. 100 percent outside air systems with no provisions for air recirculation to the central supply fan.
4. Nonadiabatic humidifiers cumulatively serving no more than 10 percent of a building's air economizer capacity as measured in cfm. This refers to the system cfm serving rooms with stand alone or duct mounted humidifiers.

[Statutory Authority: RCW 19.27A.020, 19.27A.025, 19.27A.160 and chapter 19.27 RCW. WSR 19-24-040, § 51-11C-40332, 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-40332, filed 1/19/16, effective 7/1/16. Statutory Authority: RCW 19.27A.025, 19.27A.045, and 19.27.074. WSR 13-20-120, § 51-11C-40332, filed 10/1/13, effective 11/1/13. Statutory Authority: RCW 19.27A.020, 19.27A.025 and chapters 19.27 and 34.05 RCW. WSR 13-04-056, § 51-11C-40332, filed 2/1/13, effective 7/1/13.]

(Effective March 15, 2024)

WAC 51-11C-40332 Section C403.3.2—HVAC equipment performance requirements.

C403.3.2 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(16) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of AHRI 400. 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. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements herein.

C403.3.2.1 Gas-fired and oil-fired forced air furnaces. Forced air furnaces with input ratings $\geq 225,000$ Btu/h (65 kW) and all unit heaters shall also have an intermittent ignition or interrupted device (IID), and have either mechanical draft (including power venting) or a flue damper. A vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. All furnaces with input ratings $\geq 225,000$ Btu/h (65 kW), including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75 percent of the input rating.

C403.3.2.2 Hydronic and multiple-zone HVAC system controls and equipment. Hydronic and multiple-zone HVAC system controls and equipment shall comply with this section.

For buildings with a total equipment cooling capacity of 300 tons and above, the equipment shall comply with one of the following:

1. No one unit shall have a cooling capacity of more than 2/3 of the total installed cooling equipment capacity;
2. The equipment shall have a variable speed drive; or
3. The equipment shall have multiple compressors.

C403.3.2.3 Chillers. Chilled water plants and buildings with more than 500 tons total capacity shall not have more than 100 tons provided by air-cooled chillers.

- EXCEPTIONS:
1. Where the designer demonstrates that the water quality at the building site fails to meet manufacturer's specifications for the use of water-cooled equipment.
 2. Air-cooled chillers with minimum efficiencies at least 10 percent higher than those listed in Table C403.3.2(3).
 3. Replacement of existing air-cooled chiller equipment.
 4. Air-to-water heat pump units that are configured to provide both heating and cooling and that are rated in accordance with AHRI 550/590.

C403.3.2.4 Water-cooled centrifugal chilling packages. Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44.00°F (6.67°C) leaving and 54.00°F (12.22°C) entering chilled-water temperatures and with 85.00°F (29.44°C) entering and 94.30°F (34.61°C) leaving condenser-fluid temperatures, shall have maximum full-load kW/ton (FL) and *part-load* ratings adjusted using the following equations.

$$FL_{adj} = FL/K_{adj}$$

(Equation 4-7)

$$PLV_{adj} = IPLV.IP/K_{adj}$$

(Equation 4-8)

Where:

$$\begin{aligned} K_{adj} &= A \times B \\ FL &= \text{Full-load kW/ton values as specified in Table C403.3.2(7)} \\ FL_{adj} &= \text{Maximum full-load kW/ton rating, adjusted for nonstandard conditions} \\ IPLV.IP &= \text{Value as specified in Table C403.3.2(7)} \\ PLV_{adj} &= \text{Maximum NPLV rating, adjusted for nonstandard conditions} \\ A &= 0.00000014592 \times (LIFT)^4 - 0.0000346496 \times (LIFT)^3 + 0.00314196 \times (LIFT)^2 - 0.147199 \times LIFT + 3.93073 \\ B &= 0.0015 \times L_{vg}^{Evap} (\text{°F}) + 0.934 \\ LIFT &= L_{vg}^{Cond} - L_{vg}^{Evap} \\ L_{vg}^{Cond} &= \text{Full-load condenser leaving fluid temperature (°F)} \\ L_{vg}^{Evap} &= \text{Full-load evaporator leaving temperature (°F)} \end{aligned}$$

The FL_{adj} and PLV_{adj} values are applicable only for centrifugal chillers meeting all of the following full-load design ranges:

- $36.00^{\circ}\text{F} \leq L_{vg}^{Evap} \leq 60.00^{\circ}\text{F}$
- $L_{vg}^{Cond} \leq 115.00^{\circ}\text{F}$
- $20.00^{\circ}\text{F} \leq LIFT \leq 80.00^{\circ}\text{F}$

Manufacturers shall calculate the FL_{adj} and PLV_{adj} before determining whether to label the chiller. Centrifugal chillers designed to operate outside of these ranges are not covered by this code.

C403.3.2.5 Positive displacement (air- and water-cooled) chilling packages. Equipment with a leaving fluid temperature higher than 32°F (0°C) and water-cooled positive displacement chilling packages with a condenser leaving fluid temperature below 115°F (46°C) shall meet the requirements the tables in Section C403.3.2 when tested or certified with water at standard rating conditions, in accordance with the referenced test procedure.

C403.3.2.6 Packaged and split system electric heating and cooling equipment. Packaged and split system equipment providing both electric heating and cooling, and cooling-only equipment with electric heat in the main supply duct before VAV boxes, in each case with a total cooling capacity greater than 6,000 Btu/h shall be a heat pump configured to operate in heat pump mode whenever the outdoor air temperature is above 25°F (-3.9°C) and the unit is not in defrost. The unit shall have reverse-cycle demand defrost.

EXCEPTION: Unstaffed equipment shelters or cabinets used solely for personal wireless service facilities.

C403.3.2.7 Humidification. If an air economizer is required on a cooling system for which humidification equipment is to be provided to maintain minimum indoor humidity levels, then the humidifier shall be

of the adiabatic type (direct evaporative media or fog atomization type).

- EXCEPTIONS:
1. Health care facilities licensed by the state where chapter 246-320 or 246-330 WAC requires steam injection humidifiers in duct work downstream of final filters.
 2. Systems with water economizer.
 3. 100 percent outside air systems with no provisions for air recirculation to the central supply fan.
 4. Nonadiabatic humidifiers cumulatively serving no more than 10 percent of a building's air economizer capacity as measured in cfm. This refers to the system cfm serving rooms with stand alone or duct mounted humidifiers.

[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-40332, 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-40332, 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-40332, filed 1/19/16, effective 7/1/16. Statutory Authority: RCW 19.27A.025, 19.27A.045, and 19.27.074. WSR 13-20-120, § 51-11C-40332, filed 10/1/13, effective 11/1/13. Statutory Authority: RCW 19.27A.020, 19.27A.025 and chapters 19.27 and 34.05 RCW. WSR 13-04-056, § 51-11C-40332, filed 2/1/13, effective 7/1/13.]