

(Effective March 15, 2024)

WAC 51-11C-403327 Table C403.3.2(7)—Heat rejection equipment—Minimum efficiency requirements.

**Table C403.3.2(7)
Heat Rejection Equipment—Minimum Efficiency Requirementsⁱ**

Equipment Type ^a	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Condition ^h	Performance Required ^{b,c,d,f,g}	Test Procedure ^{a,e}
Propeller or axial fan open-circuit cooling towers	All	95°F Entering Water 85°F Leaving Water 75°F Entering wb	≥ 40.2 gpm/hp	CTI ATC-105 and CTI STD-201 RS
Centrifugal fan open circuit cooling towers	All	95°F Entering Water 85°F Leaving Water 75°F Entering wb	≥ 20.0 gpm/hp	CTI ATC-105 and CTI STD-201 RS
Propeller or axial fan closed-circuit cooling towers	All	102°F Entering Water 90°F Leaving Water 75°F Entering wb	≥ 16.1 gpm/hp	CTI ATC-105S and CTI STD-201 RS
Centrifugal closed-circuit cooling towers	All	102°F Entering Water 90°F Leaving Water 75°F Entering wb	≥ 7.0 gpm/hp	CTI ATC-105S and CTI STD-201 RS
Propeller or axial fan dry coolers (air-cooled fluid coolers)	All	115°F Entering Water 105°F Leaving Water 95°F Entering wb	≥ 4.5 gpm/hp	CTI ATC-106
Propeller or axial fan evaporative condensers	All	R-448A Test Fluid 165°F Entering Gas Temperature 105°F Condensing Temperature 75°F Entering wb	≥ 160,000 Btu/h • hp	CTI ATC-106
Propeller or axial fan evaporative condensers	All	Ammonia Test Fluid 140°F Entering Gas Temperature 96.3°F Condensing Temperature 75°F Entering wb	≥ 134,000 Btu/h • hp	CTI ATC-106
Centrifugal fan evaporative condensers	All	R-448A Test Fluid 165°F Entering Gas Temperature 105°F Condensing Temperature 75°F Entering wb	≥ 137,000 Btu/h • hp	CTI ATC-106
Centrifugal fan evaporative condensers	All	Ammonia Test Fluid 140°F Entering Gas Temperature 96.3°F Condensing Temperature 75°F Entering wb	≥ 110,000 Btu/h • hp	CTI ATC-106
Air cooled condensers	All	125°F Condensing Temperature R-22 Test Fluid 190°F Entering Gas Temperature 15°F Subcooling 95°F Entering db	≥ 176,000 Btu/h • hp	AHRI 460

For SI: °C = [(°F) - 32]/1.8, L/s • kW = (gpm/hp)/(11.83), COP = (Btu/h • hp)/(2550.7).

db = dry-bulb temperature, °F.

wb = wet-bulb temperature, °F.

^a Chapter 6 contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.

- b For purposes of this table, open-circuit cooling tower performance is defined as the water-flow rating of the tower at the thermal rating condition listed in the table divided by the fan motor nameplate power.
- c For purposes of this table, closed-circuit cooling tower performance is defined as the water-flow rating of the tower at the thermal rating condition divided by the sum of the fan motor nameplate power and the integral spray pump motor nameplate power.
- d For purposes of this table, dry-cooler performance is defined as the process water-flow rating of the unit at the thermal rating condition listed in the table divided by the total fan motor nameplate power of the unit, and air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the total fan motor nameplate power of the unit.
- e The efficiencies and test procedures for both open- and closed-circuit cooling towers are not applicable to hybrid cooling towers that contain a combination of separate wet and dry heat exchange sections. The certification requirements do not apply to field-erected cooling towers.
- f All cooling towers shall comply with the minimum efficiency listed in the table for that specific type of tower with the capacity effect of any project-specific accessories and/or options included in the capacity of the cooling tower.
- g For purposes of this table, evaporative condenser performance is defined as the heat rejected at the specified rating condition in the table, divided by the sum of the fan motor nameplate power and the integral spray pump nameplate power.
- h Requirements for evaporative condensers are listed with ammonia (R-717) and R-448A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-448A must meet the minimum efficiency requirements listed above with R-448A as the test fluid. For ammonia, the condensing temperature is defined as the saturation temperature corresponding to the refrigerant pressure at the condenser entrance. For R-448A, which is a zeotropic refrigerant, the condensing temperature is defined as the arithmetic average of the dew point and the bubble point temperatures corresponding to the refrigerant pressure at the condenser entrance.
- i This table is a replica of ASHRAE 90.1 Table 6.8.1-7 Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements.

[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-403327, filed 7/1/22, 6/7/23, and 9/25/23, effective 3/15/24.]