



**BSR/ASHRAE/IES Addendum bq
to ANSI/ASHRAE/IES Standard 90.1-2016**

Public Review Draft

Proposed Addendum bq to Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings

**First Public Review (October 2018)
(Draft Shows Proposed Changes to Current Standard)**

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ASHRAE, 1791 Tullie Circle, NE, Atlanta GA 30329-2305

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(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

In response to a consensus proposal from ASHRAE TC8.6 Subcommittee on Standards and Codes, Table 6.8.1-7 has been updated for the 2019 Edition as follows:

- *Due to upcoming restrictions on the use of R-507A, the rating fluid for both axial and centrifugal fan evaporative condensers has been changed from R-507A to R-448A which has a substantially lower Global Warming Potential (GWP). The minimum efficiencies have been increased by approximately 1.9% to reflect the performance difference between R-448A and R-507A. No economic impact is anticipated based on this change in the rating fluid.*
- *The minimum efficiency for axial fan, air cooled fluid coolers, better known as dry coolers, has been added to the Table using CTI ATC-105DS, Acceptance Test Code for Dry Fluid Coolers, as the test standard. ATC-105DS has been added to Section 12. While dry coolers are referenced in the Standard in many places, no significant, measureable economic impact is anticipated based on this Addendum. However, the introduction of the Test Code will assist purchasers of dry coolers confirm the actual rated capacity that was specified in their system design.*
- *CTI STD 201 RS, Performance Rating of Evaporative Heat Rejection Equipment, was revised in 2017 and the listing has been so updated in Section 12. This updated Standard, referenced in Table 6.8.1-7 remains relevant for both open circuit and closed circuit cooling towers.*

Note that the minimum efficiency for axial fan closed circuit cooling towers was increased by 16.1% for the 2016 Standard.

TC 8.6 is the ASHRAE Technical Committee for Cooling Towers and Evaporative Condensers.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~striketrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

Addendum bq to 90.1-2016

Modify the standard as follows (IP Units)

Table 6.8.1-7 Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements (Continued)

Equipment Type	Total System Heat-Rejection Capacity at Rated Conditions	Subcategory or Rating Condition^h	Performance Required^{a,b,c,f,g}	Test Procedure^{d,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
<u>Propeller or axial fan dry coolers (air cooled fluid coolers)</u>	<u>All</u>	<u>115°F entering water 105°F leaving water 95°F entering db</u>	<u>≥4.5 gpm/hp</u>	<u>CTI ATC-105DS</u>
Propeller or axial fan evaporative condensers	All	R-448A 507A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥ 160,000 157,000 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 507A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥ 137,500 135,000 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 190°F entering gas temperature 15°F subcooling 95°F entering db	≥176,000 Btu/h-hp	AHRI 460

- a. 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 Table 6.8.1-7 divided by the fan motor nameplate power.
- b. For purposes of this table, closed-circuit cooling tower performance is defined as the process water flow rating of the tower at the thermal rating condition listed in Table 6.8.1-7 divided by the sum of the fan motor nameplate power and the integral spray pump motor nameplate power.
- c. 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 Table 6.8.1-7 divided by the total fan motor nameplate power of the unit. For purposes of this table, 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.
- d. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
- 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-448A507A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-448A507A must meet the minimum *efficiency* requirements listed above with R-448A507A 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.

Modify the standard as follows (SI Units)

Table 6.8.1-7 Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements (Continued)

Equipment Type	Total System Heat-Rejection Capacity at Rated Conditions	Subcategory or Rating Condition^h	Performance Required^{a,b,c,f,g}	Test Procedure^{d,e}
Propeller or axial fan open-circuit cooling towers	All	35.0°C entering water 29.4°C leaving water 23.9°C entering wb	≥3.40 L/s·kW	CTI ATC-105 and CTI STD-201 RS
Centrifugal fan open-circuit cooling towers	All	35.0°C entering water 29.4°C leaving water 23.9°C entering wb	≥1.7 L/s·kW	CTI ATC-105 and CTI STD-201 RS
Propeller or axial fan closed-circuit cooling towers	All	38.9°C entering water 32.2°C leaving water 23.9°C entering wb	≥1.36 L/s·kW	CTI ATC-105S and CTI STD-201 RS
Centrifugal closed-circuit cooling towers	All	38.9°C entering water 32.2°C leaving water 23.9°C entering wb	≥0.59 L/s·kW	CTI ATC-105S and CTI STD-201 RS
<u>Propeller or axial fan dry coolers (air cooled fluid coolers)</u>	<u>All</u>	<u>46.1°C entering water 40.6°C leaving water 35.0°C entering db</u>	<u>≥0.38 L/s·kW</u>	<u>CTI ATC-105DS</u>
Propeller or axial fan evaporative condensers	All	R-448A 507A test fluid 73.9°C entering gas temperature 40.6°C condensing temperature 23.9°C entering wb	≥ 62.8 64.6 COP _C	CTI ATC-106
Propeller or axial fan evaporative condensers	All	Ammonia test fluid 60.0°C entering gas temperature 35.7°C condensing temperature 23.9°C entering wb	≥52.6 COP _C	CTI ATC-106
Centrifugal fan evaporative condensers	All	R-448A 507A test fluid 73.9°C entering gas temperature 40.6°C condensing temperature 23.9°C entering wb	≥ 54.0 53.0 COP _C	CTI ATC-106
Centrifugal fan evaporative condensers	All	Ammonia test fluid 60.0°C entering gas temperature 35.7°C condensing temperature 23.9°C entering wb	≥43.2 COP _C	CTI ATC-106
Air cooled condensers	All	52.0°C condensing temperature 88.0°C entering gas temperature 8.0°C subcooling 35.0°C entering db	≥69 COP _C	AHRI 460

- a. 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 Table 6.8.1-7 divided by the fan motor nameplate power.
- b. For purposes of this table, closed-circuit cooling tower performance is defined as the process water flow rating of the tower at the thermal rating condition listed in Table 6.8.1-7 divided by the sum of the fan motor nameplate power and the integral spray pump motor nameplate power.
- c. 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 Table 6.8.1-7 divided by the total fan motor nameplate power of the unit. For purposes of this table, 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.
- d. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
- 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-448A507A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-448A507A must meet the minimum efficiency requirements listed above with R-448A507A 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.

Add CTI Acceptance Test Code (ATC) 105DS to Section 12 Normative References, as well as update date for CTI STD-201 RS (IP and SI versions):

Cooling Technology Institute (CTI)
3845 Cypress Creek Parkway, Suite 420, Houston, TX 77068; P.O. Box 681807

CTI ATC-105 (00)	Acceptance Test Code for Water Cooling Towers
<u>CTI ATC-105DS (18)</u>	<u>Acceptance Test Code for Dry Fluid Coolers</u>
CTI ATC-105S (11)	Acceptance Test Code for Closed-Circuit Cooling Towers
CTI ATC-106 (11)	Acceptance Test Code for Mechanical Draft Evaporative Vapor Condensers
CTI STD-201 RS (15 <u>17</u>)	Performance Rating of Evaporative Heat Rejection Equipment