ADDENDA

ANSI/ASHRAE/IES Addendum dk to
ANSI/ASHRAE/IES Standard 90.1-2013

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by the ASHRAE Standards Committee on June 25, 2016; by the ASHRAE Technology Council on June 29, 2016; by the IES Board of Directors on June 27, 2016; and by the American National Standards Institute on June 30, 2016.

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FOREWORD

Minimum efficiencies for closed-circuit cooling towers were first included in Standard 90.1-2010. The market for closed-circuit cooling towers has now adapted to these new requirements, and the technology has advanced to the point where an increase in the minimum efficiency for axial (propeller) fan closed circuit-cooling towers can be justified.

As background, closed-circuit cooling towers, sometimes referred to as "fluid coolers," combine the function of an open-circuit cooling tower and a heat exchanger into a single unit. These devices keep the process fluid clean and contaminant-free in a closed loop. This creates two separate fluid circuits: (1) an external circuit in which spray water circulates over a coil using an integral pump and mixes with the outside air, and (2) an internal circuit in which the process fluid to be cooled circulates inside the coil. During operation, heat is transferred from the warm fluid in the coil to the spray water and then to the atmosphere as a portion of the water evaporates. In addition to chiller applications and industrial process cooling, closed-circuit cooling towers are often used in heat-pump loops, where closed loop heat rejection is preferred.

Addendum dk increases the minimum efficiency requirement for axial fan closed-circuit cooling towers as listed in Table 6.8.1-7, "Performance Requirements for Heat Rejection Equipment." The current value of 14.0 gpm/hp (1.18 L/s·kW) has been increased 15% to 16.1 gpm/hp (1.36 L/s·kW), based on the rating conditions of 102°F (38.9°C) entering temperature to the unit and 90°F (32.2°C) leaving temperature from the unit, with a 75°F (23.9°C) entering air wet-bulb temperature. Note that the denominator for this metric is the sum of the fan motor horsepower and the integral spray pump motor horsepower.

This proposal has the consensus support of the ASHRAE TC 8.6, Subcommittee on Standards and Codes. ASHRAE TC 8.6, the cognizant TC for cooling towers, is concerned with cooling towers, evaporative liquid coolers and condensers, spray ponds, and other contact-type liquid-to-air exchangers and their applications, including water treatment.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by <u>underlining</u> (for additions) and ~~strikethrough~~ (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 dk to 90.1-2013

Modify the standard as follows (I-P):

TABLE 6.8.1-7 Performance Requirements for Heat Rejection Equipment

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Condition[h]	Performance Required[a,b,c,d,f,g]	Test Procedure[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	≥~~14.0~~ <u>16.1</u> gpm/hp	CTI ATC-105S and CTI STD-201 RS

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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 evaporative condensers	All	R-507A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥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-507A test fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb	≥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, air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan motor nameplate power.

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-507A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-507A must meet the minimum efficiency requirements listed above with R-507A as the test fluid.

(The unmarked remainder of this table is not affected by this addendum.)

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Modify the standard as follows (SI):

TABLE 6.8.1-7 Performance Requirements for Heat Rejection Equipment

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Condition[h]	Performance Required[a,b,c,d,f,g]	Test Procedure[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	≥1.70 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	≥~~1.18~~ 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
Propeller or axial fan evaporative condensers	All	R-507A test fluid 73.9°C entering gas temperature 40.6°C condensing temperature 23.9°C entering wb	≥61.6 COP	CTI ATC-106
Propeller or axial fan evaporative condensers	All	Ammonia test fluid 60°C entering gas temperature 35.7°C condensing temperature 23.9°C entering wb	≥52.6 COP	CTI ATC-106
Centrifugal fan evaporative condensers	All	R-507A test fluid 73.9°C entering gas temperature 40.6°C condensing temperature 23.9°C entering wb	≥53.0 COP	CTI ATC-106
Centrifugal fan evaporative condensers	All	Ammonia test fluid 60°C entering gas temperature 35.7°C condensing temperature 23.9°C entering wb	≥43.2 COP	CTI ATC-106
Air cooled condensers	All	53°C condensing temperature 88°C entering gas temperature 8°C subcooling 35°C entering db	≥69 COP	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, air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan motor nameplate power.
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-507A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-507A must meet the minimum efficiency requirements listed above with R-507A as the test fluid.

(The unmarked remainder of this table is not affected by this addendum.)

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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