ADDENDA

ANSI/ASHRAE/IES Addendum x to
ANSI/ASHRAE/IES Standard 90.1-2019

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by ASHRAE and the American National Standards Institute on December 9, 2021, and by the Illuminating Engineering Society on December 8, 2021.

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FOREWORD

Addendum x updates three requirements for chillers:

a. Section 6.4.1.2.1 K_{adj} cooling efficiency adjustment for centrifugal chillers.
b. Section 6.4.1.2.2 for chillers with a freeze-protection fluid
c. Addendum x standardizes use of the term "heat exchanger liquid" throughout the standard.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum x to Standard 90.1-2019

Modify Section 3.2, "Definitions" as shown (I-P).

integrated part-load value (IPLV.~~I-P~~IP): a single-number figure of merit based on part-load *EER, COP_C*, or *kW/kW* expressing part-load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the *equipment*.

[. . .]

nonstandard part-load value (NPLV.IP): a single-number part-load *efficiency* figure of merit calculated and referenced to conditions other than *IPLV.*IP conditions, for units that are not designed to operate at AHRI standard rating conditions.

Modify Section 3.3, "Definitions" as shown (I-P).

*IPLV.~~I-P~~*IP *integrated part-load value*

[. . .]

*NPLV.*IP *nonstandard part-load value*

Modify Section 6.4.1.1(c) as shown (I-P and SI).

c. Table 6.8.1-3, "~~Water~~Liquid-Chilling Packages—Minimum Efficiency Requirements" (See Section 6.4.1.2 for ~~water~~liquid-cooled centrifugal ~~water~~liquid-chilling packages that are designed to operate at nonstandard conditions.)

Modify Section 6.4.1.2.1 as shown (I-P).

6.4.1.2 Minimum Equipment Efficiencies—Listed Equipment—Nonstandard Conditions

6.4.1.2.1 ~~Water~~Liquid-Cooled Centrifugal Chilling Packages~~.~~ Cooling *~~Equipment~~ Efficiency* Adjustment. Liquid-cooled centrifugal chiller packages ~~*Equipment*~~ not designed for cooling operation at AHRI Standard 550/590 test and rating conditions of 44.00°F leaving and 54.00°F entering chilled-~~fluid~~liquid temperatures, and with 85.00°F entering and 94.30°F leaving condenser-~~fluid~~liquid temperatures, shall have maximum full-load *kW*/ton (FL) and part-load cooling energy *efficiency (IPLV.*IP) rating requirements, listed in Tables 6.8.1-3 and 6.8.1-16, adjusted using the following equations:

$$\text{~~FL}_{adj}\text{~~} = \text{FL}/\text{~~}K_{adj}\text{~~}\quad \text{FL.IP}_{adj} = \text{FL.IP}/K_{adj}$$

$$\text{~~PLV}_{adj}\text{~~} = \text{~~}IPLV\text{~~.IP}/\text{~~}K_{adj}\text{~~}\quad \text{PLV.IP}_{adj} = IPLV\text{.IP}/K_{adj}$$

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

where

FL.IP = full-load kW/ton value from Table 6.8.1-3 or 6.8.1-16

FL.IP_{adj} = maximum full-load kW/ton rating, adjusted for nonstandard conditions

IPLV.IP = *IPLV*.IP value from Table 6.8.1-3 or 6.8.1-16

PLV.IP$_{adj}$ = maximum *NPLV*.IP rating, adjusted for nonstandard conditions

A = $0.00000014592 \times (\text{LIFT})^4 - 0.0000346496 \times (\text{LIFT})^3 + 0.00314196 \times (\text{LIFT})^2 - 0.147199 \times (\text{LIFT}) + 3.93073$

B = $0.0015 \times \text{LvgEvap} + 0.934$

LIFT = LvgCond – LvgEvap

LvgCond = full-load condenser leaving ~~fluid~~liquid temperature (°F)

LvgEvap = full-load evaporator leaving liquid temperature (°F)

The FL.IP$_{adj}$ and PLV.IP$_{adj}$ values are only applicable for centrifugal ~~chillers~~chilling packages meeting all of the following full-load design ranges:

- 36.00 °F ≤ LvgEvap ≤ ~~60.00~~70.00°F and
- 60.00 °F≤ LvgCond ≤~~115.00~~135.00 °F and
- 20.00°F ≤LIFT ≤ 80.00°F

Manufacturers shall calculate the FL.IP$_{adj}$ and PLV.IP$_{adj}$ before determining whether to label the chiller per Section 6.4.1.5. Compliance with 90.1-2007, 2010, 2013, 2016, 2019, 2022 or combinations thereof, shall be *labeled* on ~~chillers~~ chilling packages within the scope of the standard.

Centrifugal ~~chillers~~ chilling packages designed to operate outside of these ranges are not covered by this standard.

~~**Example (Section 6.4.1.2.1)**~~

~~Path A 600-ton centrifugal chiller Table 6.8.1-3:~~

~~FL = 0.5600 *kW*/ton~~

~~*IPLV*.IP = 0.5000 *kW*/ton~~

~~LvgCond = 91.16°F~~

~~LvgEvap = 42.00°F~~

~~LIFT = 91.16 – 42 = 49.16°F~~

~~$A = 0.00000014592 \times (49.16)^4 - 0.0000346496 \times (49.16)^3 + 0.00314196 \times (49.16)^2 - 0.147199 \times (49.16) + 3.93073 = 1.02331$~~

~~$B = 0.0015 \times 42.00 + 0.934 = 0.99700$~~

~~$K_{adj} = 1.02331 \times 0.99700 = 1.02024$~~

~~FL$_{adj}$ = 0.5600/1.02024 = 0.5489 *kW*/ton~~

~~PLV$_{adj}$ = 0.5000/1.02024 = 0.4901 *kW*/ton~~

Modify Section 6.4.1.2.2 as shown (I-P).

6.4.1.2.2 ~~Positive Displacement (Air- and Water-Cooled) Chilling Packages~~ Chilling Packages Employing Freeze-Protection Liquids. ~~Equipment with an evaporator leaving fluid temperature higher than 32.00°F and water-cooled positive displacement chilling packages with a condenser leaving fluid temperature below 115.00°F shall show compliance with Table 6.8.1-3 when tested or certified with water at standard rating conditions, per the referenced test procedure.~~ Electrically operated chilling packages that employ freeze-protection liquids in any heat exchanger with an application cooling duty evaporator liquid leaving temperature or heating operation source liquid temperature above 32.00°F shall show *efficiency* compliance in accordance with the applicable requirements in Sections 6.4.1.2.2.1 through 6.4.1.2.2.4.

Absorption chilling packages with freeze-protection liquids are exempt from the *efficiency* requirements listed in Table 6.8.1-3 and shall only show compliance when applied with water.

6.4.1.2.2.1 All electrically operated cooling-only air-cooled and electrically operated positive displacement liquid-cooled chilling packages shall show compliance with the cooling *efficiency* requirements listed in Table 6.8.1-3 when applied within the operating limits of AHRI 550/590 at AHRI 550/590 standard rating conditions when tested or rated with water used as a heat transfer liquid.

6.4.1.2.2.2 All liquid-cooled electrically operated cooling-only centrifugal chilling packages shall show compliance with the cooling *efficiency* requirements listed in Table 6.8.1-3 when applied within the operating limits defined in AHRI 550/590, at the application rating conditions for a cooling *efficiency*, adjusted using K_{adj} as defined in Section 6.4.1.2.1, when tested or rated with water used as a heat transfer liquid.

6.4.1.2.2.3 All electrically operated air-source and electrically operated positive displacement liquid-source heat pump and heat recovery chilling packages shall show compliance with the cooling *efficiency* requirements listed in Table 6.8.1-16 when applied within the operating limits of AHRI 550/590 at AHRI 550/590 standard rating conditions when tested or rated with water used as a heat transfer liquid. They also shall show compliance with the heating *efficiency* requirements listed in Table 6.8.1-16 at one of the AHRI 550/590 standard heating rating conditions when tested or rated with water used as a heat transfer liquid. Heating-only chilling packages shall meet the *efficiency* requirements at one of the AHRI 550/590 heating liquid temperature rating conditions and are not required to meet the cooling *efficiency* requirements of Table 6.8.1-16.

6.4.1.2.2.4 All liquid-source centrifugal heat pump and heat recovery chilling packages shall show compliance with the cooling *efficiency* requirements listed in Table 6.8.1-16 when applied within the operating limits defined in AHRI 550/590 at the application rating conditions for cooling *efficiency*, adjusted using K_{adj} as defined in Section 6.4.1.2.1, when tested or rated with water. They also shall show compliance with the heating *efficiency* requirements in Table 6.8.1-16 at one of the AHRI 550/590 standard rating conditions when tested or rated with water used as a heat-transfer liquid. Heating-only chilling packages shall meet the heating *efficiency* requirements at one of the AHRI 550/590 heating liquid temperature rating conditions and are not required to meet the cooling *efficiency* requirements of Table 6.8.1-16.

Modify Table 6.8.1-3 to change "water" to "liquid" and correct some of the significant figures in the table to align with the requirements defined in AHRI 550/590 which requires 4 significant figures for efficiency metrics (I-P).

Table 6.8.1-3 ~~Water~~Liquid-Chilling Packages—Minimum *Efficiency* Requirements [a,b,e,f]

Equipment Type	Size Category	Units	Path A	Path B	Test Procedure[c]
Air-cooled ~~chillers~~	<150 tons	*EER* (Btu/Wh)	≥10.10~~0~~ FL	≥9.700 FL	AHRI 550/590
			≥13.70~~0~~ *IPLV*.IP	≥15.80~~0~~ *IPLV*.IP	
	≥150 tons		≥10.10~~0~~ FL	≥9.700 FL	
			≥14.00~~0~~ *IPLV*.IP	≥16.10~~0~~ *IPLV*.IP	
Air-cooled without condenser, electrically operated	All capacities	*EER* (Btu/Wh)	Air-cooled ~~chillers~~ without condensers must be rated with matching condensers and comply with air-cooled chiller *efficiency* requirements		AHRI 550/590

a. The requirements for centrifugal ~~chillers~~ chilling packages shall be adjusted for nonstandard rating conditions per Section 6.4.1.2.1 and are only applicable for the range of conditions listed there. The requirements for air-cooled, ~~water~~liquid-cooled positive displacement and absorption ~~chillers~~ chilling packages are at standard rating conditions defined in the reference test procedure.

b. Both the full-load and *IPLV*.IP requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.

c. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

d. NA means the requirements are not applicable for Path B, and only Path A can be used for compliance.

e. FL is the full-load performance requirements, and *IPLV*.IP is for the part-load performance requirements.

f. Electrically operated chilling packages employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

Table 6.8.1-3 ~~Water~~Liquid-Chilling Packages—Minimum *Efficiency* Requirements [a,b,e,f]

Equipment Type	Size Category	Units	Path A	Path B	Test Procedure[c]
~~Water~~Liquid-cooled, electrically operated positive displacement	<75 tons	kW/ton	≤0.750 FL	≤0.780 FL	AHRI 550/590
			≤0.600 *IPLV*.IP	≤0.500 *IPLV*.IP	
	≥75 tons and <150 tons		≤0.720 FL	≤0.750 FL	
			≤0.560 *IPLV*.IP	≤0.490 *IPLV*.IP	
	≥150 tons and <300 tons		≤0.660 FL	≤0.680 FL	
			≤0.540 *IPLV*.IP	≤0.440 *IPLV*.IP	
	≥300 tons and <600 tons		≤0.610 FL	≤0.625 FL	
			≤0.520 *IPLV*.IP	≤0.410 *IPLV*.IP	
	≥600 tons		≤0.560 FL	≤0.585 FL	
			≤0.500 *IPLV*.IP	≤0.380 *IPLV*.IP	
~~Water~~Liquid-cooled, electrically operated centrifugal	<150 tons	kW/ton	≤0.610 FL	≤0.695 FL	AHRI 550/590
			≤0.550 *IPLV*.IP	≤0.440 *IPLV*.IP	
	≥150 tons and <300 tons		≤0.610 FL	≤0.635 FL	
			≤0.550 *IPLV*.IP	≤0.400 *IPLV*.IP	
	≥300 tons and <400 tons		≤0.560 FL	≤0.595 FL	
			≤0.520 *IPLV*.IP	≤0.390 *IPLV*.IP	
	≥400 tons and <600 tons		≤0.560 FL	≤0.585 FL	
			≤0.500 *IPLV*.IP	≤0.380 *IPLV*.IP	
	≥600 tons		≤0.560 FL	≤0.585 FL	
			≤0.500 *IPLV*.IP	≤0.380 *IPLV*.IP	
Air-cooled absorption, single effect	All capacities	*COP* (W/W)	≥0.600 FL	NA[d]	AHRI 560
~~Water~~Liquid-cooled absorption, single effect	All capacities	*COP* (W/W)	≥0.700 FL	NA[d]	AHRI 560
Absorption double effect, indirect fired	All capacities	*COP* (W/W)	≥1.000 FL	NA[d]	AHRI 560
			≥1.050 *IPLV*.IP		
Absorption double effect, direct fired	All capacities	*COP* (W/W)	≥1.000 FL	NA[d]	AHRI 560
			≥1.000 *IPLV*.IP		

a. The requirements for centrifugal ~~chillers~~ chilling packages shall be adjusted for nonstandard rating conditions per Section 6.4.1.2.1 and are only applicable for the range of conditions listed there. The requirements for air-cooled, ~~water~~liquid-cooled positive displacement and absorption ~~chillers~~ chilling packages are at standard rating conditions defined in the reference test procedure.

b. Both the full-load and *IPLV*.IP requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.

c. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

d. NA means the requirements are not applicable for Path B, and only Path A can be used for compliance.

e. FL is the full-load performance requirements, and *IPLV*.IP is for the part-load performance requirements.

f. Electrically operated chilling packages employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

Modify Seciton 3.2 as shown (SI).

integrated part-load value (IPLV.~~SI~~SI): a single-number figure of merit based on part-load *COPC* expressing part-load *efficiency* for air-conditioning and heat pump *equipment* on the basis of weighted operation at various load capacities for the *equipment*.

[. . .]

nonstandard part-load value (NPLV.SI): a single-number part-load *efficiency* figure of merit calculated and referenced to conditions other than *IPLV.SI* conditions, for units that are not designed to operate at AHRI standard rating conditions.

[. . .]

Modify Section 3.3 as shown (SI).

*IPLV.~~SI~~*SI *integrated part-load value*

[. . .]

NPLV.SI *nonstandard part-load value*

Modify Section 6.4.1.2 as shown (SI).

6.4.1.2.1 ~~Water~~Liquid-Cooled Centrifugal Chilling Package~~s~~ Cooling *Efficiency* Adjustment. Liquid-cooled centrifugal chiller packages ~~*Equipment*~~ not designed for cooling operation at AHRI Standard 551/591 test and rating conditions of 7.00°C leaving and 12.00°C entering chilled-~~fluid~~ liquid temperatures, and with 30.00°C entering and 35.00°C leaving condenser-~~fluid~~ liquid temperatures shall have maximum full-load (FL) *COP* and part-load cooling energy *efficiency (IPLV*.SI*)* rating requirements, listed in Table 6.8.1-3 and 6.8.1-16, adjusted using the following equations:

$$\sout{FL_{adj} = FL \times K_{adj}} \quad FL.SI_{adj} = FL.SI \times K_{adj}$$

$$\sout{PLV_{adj} = IPLV.SI \times K_{adj}} \quad PLV.SI_{adj} = IPLV.SI \times K_{adj}$$

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

where

FL.SI = full-load COP_R value from Table 6.8.1-3 or 6.8.1-16

FL.SI_{adj} = minimum full-load COP_R rating, adjusted for nonstandard conditions

IPLV.SI = *IPLV*.SI value from Table 6.8.1-3 or 6.8.1-16

PLV.SI_{adj} = minimum *NPLV*.SI rating, adjusted for nonstandard conditions

A = $0.00000153181 \times (LIFT)^4 - 0.000202076 \times (LIFT)^3 + 0.0101800 \times (LIFT)^2 - 0.264958 \times LIFT + 3.93073$

B = $0.0027 \times LvgEvap + 0.982$

LIFT = LvgCond – LvgEvap

LvgCond = full-load condenser leaving ~~fluid~~ liquid temperature (°C)

LvgEvap = full-load evaporator leaving liquid temperature (°C)

The FL.SI_{adj} and PLV.SI_{adj} values are only applicable for centrifugal ~~chillers~~ chilling packages meeting all of the following full-load design ranges:

- 2.20°C ≤ LvgEvap ≤ ~~15.60~~21.10°C and
- 15.56 °C≤ LvgCond ≤ ~~46.00~~ 57.00°C and
- 11.00°C ≤ LIFT ≤ 44.00°C

Manufacturers shall calculate the FL.SI_{adj} and PLV.SI_{adj} before determining whether to label the chiller per Section 6.4.1.5. Compliance with 90.1-2007, 2010, 2013, 2016, 2019, 2022, or combinations thereof, shall be labeled on ~~chillers~~ chilling packages within the scope of the standard.

Centrifugal ~~chillers~~ chilling packages designed to operate outside of these ranges are not covered by this standard.

~~**Example (Section 6.4.1.2.1)**~~

~~Path A 2110 *kW* centrifugal chiller Table 6.8.1-3:~~

~~FL = $6.286\ COP_R$~~

~~IPLV.SI = $7.041\ COP_R$~~

~~LvgCond = 37.00°C~~

~~LvgEvap = 6.00°C~~

~~LIFT = 37.00 − 6.00 = 31.00°C~~

~~A = $0.00000153181 \times (31.00)4 - 0.000202076 \times (31.00)3 + 0.0101800 \times (31.00)2 - 0.264958 \times 31.00 + 3.93073 = 0.894625$~~

~~B = $0.0027 \times 6.00 + 0.982 = 0.998200$~~

~~K_{adj} = $0.894625 \times 0.998200 = 0.893014$~~

~~FL_{adj} = $6.286 \times 0.893014 = 5.613\ COP_R$~~

~~PLV_{adj} = $7.041 \times 0.893014 = 6.288\ COP_R$~~

6.4.1.2.2 ~~Positive Displacement (Air- and Water-Cooled) Chilling Packages~~ Chilling Packages Employing Freeze-Protection Liquids. ~~Equipment with an evaporator leaving fluid temperature higher than 32.00°F and water-cooled positive displacement chilling packages with a condenser leaving fluid temperature below 115.00 shall show compliance with Table 6.8.1-3 when tested or certified with water at standard rating conditions, per the referenced test procedure.~~ Electrically operated chilling packages that employ freeze-protection liquids in any heat exchanger with an application cooling duty evaporator liquid leaving temperature or heating operation source liquid temperature above 0.00°C shall show *efficiency* compliance as per the applicable requirements in Sections 6.4.1.2.2.1 through 6.4.1.2.2.4.

Absorption chilling packages with freeze-protection liquids are exempt from the *efficiency* requirements listed in Table 6.8.1-3 and shall only show compliance when applied with water.

6.4.1.2.2.1 All electrically operated cooling-only air-cooled and electrically operated positive displacement liquid-cooled chilling packages shall show compliance with the cooling *efficiency* requirements listed in Table 6.8.1-3 when applied within the operating limits of AHRI 551/591, at AHRI 551/591 standard rating conditions when tested or rated with water used as a heat transfer liquid.

6.4.1.2.2.2 All liquid-cooled electrically operated cooling-only centrifugal chilling packages shall show compliance with the cooling *efficiency* requirements listed in Table 6.8.1-3 when applied within the operating limits defined in AHRI 551/591, at the application rating conditions for a cooling *efficiency* adjusted using K_{adj} as defined in Section 6.4.1.2.1, when tested or rated with water used as a heat transfer liquid.

6.4.1.2.2.3 All electrically operated air-source and electrically operated positive displacement liquid-source heat pump and heat recovery chilling packages shall show compliance with the cooling *efficiency* requirements listed in Table 6.8.1-16 when applied within the operating limits of AHRI 551/591 at AHRI 551/591 standard rating conditions when tested or rated with water used as a heat transfer liquid. They also shall show compliance with the heating *efficiency* requirements listed in Table 6.8.1-16 at one of the AHRI 551/591 standard heating rating conditions when tested or rated with water used as a heat transfer liquid. Heating-only chilling packages shall meet the heating *efficiency* requirements at one of the AHRI 551/591 heating liquid temperature rating conditions and are not required to meet the cooling *efficiency* requirements of Table 6.8.1-16.

6.4.1.2.2.4 All liquid-source centrifugal heat pump and heat recovery chilling packages shall show compliance with the cooling *efficiency* requirements listed in Table 6.8.1-16 when applied within the operating limits defined in AHRI 551/591 at the application rating conditions for cooling *efficiency,* adjusted using K_{adj} as defined in Section 6.4.1.2.1, when tested or rated with water used as a heat transfer liquid. They also shall show compliance with the heating *efficiency* requirements in Table 6.8.1-16 at one of the AHRI 551/591 standard rating conditions when tested or rated with water used as a heat transfer liquid. Heating-only chillers shall meet the heating *efficiency* requirements at one of the AHRI 551/591 heating liquid temperature rating conditions and are not required to meet the cooling *efficiency* requirements of Table 6.8.1-16.

Modify Table 6.8.1-3 to change "water" to "fluid" and correct some of the significant figures in the table to align with the requirements defined in AHRI 550/590 which requires 4 significant figures for efficiency metrics (SI).

Table 6.8.1-3 ~~Water~~Liquid-Chilling Packages—Minimum Efficiency Requirements [a,b,e,f]

Equipment Type	Size Category	Units	Path A	Path B	Test Procedure[c]
Air-cooled ~~chillers~~	<528 kW	*COP* (W/W)	≥2.985 FL	≥2.966 FL	AHRI 551/591
			≥4.048 *IPLV*.SI	≥4.669 *IPLV*.SI	
	≥528 kW		≥2.985 FL	≥2.866 FL	
			≥4.137 *IPLV*.SI	≥4.758 *IPLV*.SI	
Air-cooled without condenser, electrically operated	All capacities	*COP* (W/W)	Air-cooled ~~chillers~~ without condensers must be rated with matching condensers and comply with air-cooled chiller *efficiency* requirements		AHRI 551/591
~~Water~~Liquid-cooled, electrically operated positive displacement	<264 kW	*COP* (W/W)	≥4.694 FL	≥4.513 FL	AHRI 551/591
			≥5.867 *IPLV*.SI	≥7.041 *IPLV*.SI	
	≥264 kW and <528 kW		≥4.889 FL	≥4.694 FL	
			≥6.286 *IPLV*.SI	≥7.184 *IPLV*.SI	
	≥528 kW and <1055 kW		≥5.334 FL	≥5.177 FL	
			≥6.519 *IPLV*.SI	≥8.001 *IPLV*.SI	
	≥1055 kW and <2110 kW		≥5.771 FL	≥5.633 FL	
			≥6.770 *IPLV*.SI	≥8.586 *IPLV*.SI	
	≥2100 kW		≥6.286 FL	≥6.018 FL	
			≥7.041 *IPLV*.SI	≥9.264 *IPLV*.SI	
~~Water~~Liquid-cooled, electrically operated centrifugal	<528 kW	*COP* (W/W)	≥5.771 FL	≥5.065 FL	AHRI 551/591
			≥6.401 *IPLV*.SI	≥8.001 *IPLV*.SI	
	≥528 kW and <1055 kW		≥5.771 FL	≥5.544 FL	
			≥6.401 *IPLV*.SI	≥8.801 *IPLV*.SI	
	≥1055 kW and <1407 kW		≥6.286 FL	≥5.917 FL	
			≥6.770 *IPLV*.SI	≥9.027 *IPLV*.SI	
	≥1407 kW and <2110 kW		≥6.286 FL	≥6.018 FL	
			≥7.041 *IPLV*.SI	≥9.264 *IPLV*.SI	
	≥2110 kW		≥6.286 FL	≥6.018 FL	
			≥7.041 *IPLV*.SI	≥9.264 *IPLV*.SI	
Air-cooled absorption, single effect	All capacities	*COP* (W/W)	≥0.6000 FL	NA[d]	AHRI 560

a. The requirements for centrifugal ~~chillers~~ chilling packages shall be adjusted for nonstandard rating conditions per Section 6.4.1.2.1 and are only applicable for the range of conditions listed there. The requirements for air-cooled, ~~water~~liquid-cooled positive displacement and absorption ~~chillers~~ chilling packages are at standard rating conditions defined in the reference test procedure.

b. Both the full-load and *IPLV*.SI requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.

c. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

d. NA means the requirements are not applicable for Path B, and only Path A can be used for compliance.

e. FL is the full-load performance requirements, and *IPLV*.SI is for the part-load performance requirements.

f. Electrically operated chilling packages employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

Table 6.8.1-3 ~~Water~~Liquid-Chilling Packages—Minimum Efficiency Requirements [a,b,e,f]

Equipment Type	Size Category	Units	Path A	Path B	Test Procedure[c]
~~Water~~Liquid-cooled absorption, single effect	All capacities	*COP* (W/W)	≥0.700 FL	NA[d]	AHRI 560
Absorption double effect, indirect fired	All capacities	*COP* (W/W)	≥1.000 FL	NA[d]	AHRI 560
			≥1.050 *IPLV*.SI		
Absorption double effect, direct fired	All capacities	*COP* (W/W)	≥1.000 FL	NA[d]	AHRI 560
			≥1.000 *IPLV*.SI		

a. The requirements for centrifugal ~~chillers~~ chilling packages shall be adjusted for nonstandard rating conditions per Section 6.4.1.2.1 and are only applicable for the range of conditions listed there. The requirements for air-cooled, ~~water~~liquid-cooled positive displacement and absorption ~~chillers~~ chilling packages are at standard rating conditions defined in the reference test procedure.

b. Both the full-load and *IPLV*.SI requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.

c. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

d. NA means the requirements are not applicable for Path B, and only Path A can be used for compliance.

e. FL is the full-load performance requirements, and *IPLV*.SI is for the part-load performance requirements.

f. Electrically operated chilling packages employing a freeze-protection liquid in accordance with Section 6.4.1.2.2 shall be tested or rated with water for the purpose of compliance with the requirements of this table.

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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About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

To stay current with this and other ASHRAE Standards and Guidelines, visit www.ashrae.org/standards, and connect on LinkedIn, Facebook, Twitter, and YouTube.

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IMPORTANT NOTICES ABOUT THIS STANDARD

To ensure that you have all of the approved addenda, errata, and interpretations for this Standard, visit www.ashrae.org/standards to download them free of charge.

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