



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

Public Review Draft

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

**First Public Review (February 2019)
(Draft Shows Proposed Changes to Current Standard)**

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FOREWORD

This proposed addendum cleans up outdated language regarding walk-in cooler and walk-in freezer requirements, and make the requirements consistent with current federal regulations that either already came into effect June 5, 2017 or will come into effect July 10, 2020. This proposal adds the updated performance requirements in Tables to be consistent with 10 CFR 431.306. Increased product costs associated with the increased performance requirements were evaluated as part of the federal rulemaking process and deemed cost effective. Information on cost effectiveness can be found in https://www.energy.gov/sites/prod/files/2016/12/f34/WICF_ECS_Final_Rule_0.pdf.

[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 cn to 90.1-2016

Modify the standard as follows (IP and SI Units)

6.4.1.1 Minimum Equipment Efficiencies—Listed Equipment—Standard Rating and Operating Conditions

Equipment shown in Tables [6.8.1-1](#) through 6.8.1-~~16~~22 shall have a minimum performance at the specified rating conditions when tested in accordance with the specified test procedure. Where multiple rating conditions or performance requirements are provided, the *equipment* shall satisfy all stated requirements unless otherwise exempted by footnotes in the table. *Equipment* covered under the Federal Energy Policy Act of 1992 (EPACT) shall have no minimum *efficiency* requirements for operation at minimum capacity or other than standard rating conditions. *Equipment* used to provide *service water-heating* functions as part of a combination *system* shall satisfy all stated requirements for the appropriate *space* heating or cooling category.

Tables are as follows:

...

p. [Table 6.8.1-20, Walk-In Cooler and Freezer Display Door Efficiency Requirements](#)

q. [Table 6.8.1-21 Walk-In Cooler and Freezer Non-display Door Efficiency Requirements](#)

r. [Table 6.8.1-22 Walk-In Cooler and Freezer Refrigeration System Efficiency Requirements](#)

(portions of section not shown are unchanged)

6.4.5 Walk-In Coolers and Walk-In Freezers

Site-assembled or site-constructed *walk-in coolers* and *walk-in freezers* shall conform to the following requirements:

- a. Shall be equipped with *automatic door* closers that firmly close *walk-in doors* that have been closed to within 1 in. (25 mm) of full closure.

Exception to 6.4.5(a)

Doors wider than 3 ft 9 in. (1.1 m) or taller than 7 ft (2.1 m).

- b. Doorways shall have strip *doors* (curtains), spring-hinged *doors*, or other method of minimizing *infiltration* when *doors* are open.
- c. *Walk-in coolers* shall contain *wall*, *ceiling*, and *door* insulation of at least R-25 (R-4.4) and at least R-32 (R-5.6) for *walk-in freezers*.

Exception to 6.4.5(c)

Glazed portions of *doors* or structural members.

- d. *Walk-in freezers* shall contain *floor* insulation of at least R-28 (R-4.9).
- e. Evaporator fan motors that are less than 1 hp (0.75 kW) and less than 460 V shall use electronically commutated motors (brushless direct-current motors) or three-phase motors.
- f. Lights shall use light sources with an *efficacy* of 40 lm/W or more, including *ballast* losses (if any). Light sources with lower may be used in conjunction with a timer or device that turns off the lights within 15 minutes of when the *walk-in cooler* or *walk-in freezer* is not occupied by people.
- g. Transparent reach-in *doors* for *walk-in freezers*, and windows in *walk-in freezer doors*, shall be of triple-pane glass, either filled with inert gas or with heat-reflective treated glass.
- h. Transparent reach-in *doors* for *walk-in coolers*, and windows in *walk-in cooler doors*, shall be double-pane glass with heat-reflective treated glass and gas filled, or they shall be triple-pane glass, either filled with inert gas or with heat-reflective treated glass.
- i. Antisweat heaters without antisweat heater *controls* shall have a total *door* rail, glass, and frame heater power draw of $\leq 7.1 \text{ W/ft}^2$ (76 W/m^2) of *door* opening for *walk-in freezers* and 3.0 W/ft^2 (32 W/m^2) of *door* opening for *walk-in coolers*.
- j. Antisweat heater *controls* shall reduce the *energy* use of the antisweat heater as a function of the relative humidity in the air outside the *door* or to the condensation on the inner glass pane.
- k. Condenser fan motors that are less than 1 hp (0.75 kW) shall use electronically commutated motors, permanent split-capacitor-type motors, or three-phase motors.
- l. All *walk-in freezers* shall incorporate temperature-based defrost termination *control* with a time limit default. The defrost cycle shall terminate first on an upper temperature limit breach and second upon a time limit breach.

Exception to 6.4.5(l)

Walk-in coolers and *walk-in freezers* combined in a single enclosure greater than 3000 ft^2 (280 m^2).

Doors in *walk-in coolers* and *walk-in freezers* shall meet the requirements of Tables 6.8.1-20 and 6.8.1-21. *Walk-in cooler* and *walk-in freezer* refrigeration systems, except for *walk-in process cooling* refrigeration systems as defined in 10 CFR 431.302, shall meet the requirements of Table 6.8.1-22.

Table 6.8.1-20 Walk-In Cooler and Freezer Display Door Efficiency Requirements

<u>Class Descriptor</u>	<u>Class</u>	<u>Maximum Energy Consumption (kWh/day)^a</u>	<u>Test Procedure</u>
<u>Display door, medium temperature</u>	<u>DD, M</u>	$0.04 \times A_{dd} + 0.41$	<u>10 CFR 431</u>
<u>Display door, low temperature</u>	<u>DD, L</u>	$0.15 A_{dd} + 0.29$	

a. A_{dd} is the surface area (ft²) of the display door.

Table 6.8.1-21 Walk-In Cooler and Freezer Non-display Door Efficiency Requirements

<u>Class Descriptor</u>	<u>Class</u>	<u>Maximum Energy Consumption (kWh/day)^a</u>	<u>Test Procedure</u>
<u>Passage door, medium temperature</u>	<u>PD, M</u>	$0.05 \times A_{nd} + 1.7$	<u>10 CFR 431</u>
<u>Passage door, low temperature</u>	<u>PD, L</u>	$0.14 \times A_{nd} + 4.8$	
<u>Freight door, medium temperature</u>	<u>FD, M</u>	$0.04 \times A_{nd} + 1.9$	
<u>Freight door, low temperature</u>	<u>FD, L</u>	$0.12 A_{nd} + 5.6$	

a. A_{nd} is the surface area (ft²) of the non-display door.

Table 6.8.1-22 Walk-In Cooler and Freezer Refrigeration System Efficiency Requirements

<u>Class Descriptor</u>	<u>Class</u>	<u>Minimum Annual Walk-In Energy Factor AWEF (Btu/W-h)^a</u>	<u>Test Procedure</u>	<u>Compliance date: equipment manufactured starting on:</u>
<u>Dedicated condensing, medium temperature, indoor system</u>	<u>DC.M.I</u>	<u>5.61</u>	<u>AHRI 1250</u>	<u>June 5, 2017</u>
<u>Dedicated condensing, medium temperature, outdoor system</u>	<u>DC.M.O</u>	<u>7.60</u>		
<u>Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) < 6,500 Btu/h</u>	<u>DC.L.I, < 6,500 Btu/h</u>	<u>$9.091 \times 10^{-5} \times q_{net} + 1.81$</u>	<u>AHRI 1250</u>	<u>July 10, 2020</u>
<u>Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) ≥ 6,500 Btu/h</u>	<u>DC.L.I, ≥ 6,500 Btu/h</u>	<u>2.40</u>		
<u>Dedicated condensing, low temperature, outdoor system, net capacity (q_{net}) < 6,500 Btu/h</u>	<u>DC.L.O, < 6,500 Btu/h</u>	<u>$6.522 \times 10^{-5} \times q_{net} + 2.73$</u>		
<u>Dedicated condensing, low temperature, outdoor system, net capacity (q_{net}) ≥ 6,500 Btu/h</u>	<u>DC.L.O, ≥ 6,500 Btu/h</u>	<u>3.15</u>		
<u>Unit cooler, medium</u>	<u>UC.M</u>	<u>9.00</u>		
<u>Unit cooler, low temperature, net capacity (q_{net}) < 15,500 Btu/h</u>	<u>UC.L, < 15,500 Btu/h</u>	<u>$1.575 \times 10^{-5} \times q_{net} + 3.91$</u>		
<u>Unit cooler, low temperature, net capacity (q_{net}) ≥ 15,500 Btu/h</u>	<u>UC.L,, ≥ 15,500 Btu/h</u>	<u>4.15</u>		

a. q_{net} is net capacity (Btu/hr) as determined in accordance with AHRI Standard 1250

(SI Units)

Table 6.8.1-20 Walk-In Cooler and Freezer Display Door Efficiency Requirements

<u>Class Descriptor</u>	<u>Class</u>	<u>Maximum Energy Consumption (kWh/day)^a</u>	<u>Test Procedure</u>
<u>Display door, medium temperature</u>	<u>DD, M</u>	<u>$0.43 \times A_{dd} + 0.41$</u>	<u>10 CFR 431</u>
<u>Display door, low temperature</u>	<u>DD, L</u>	<u>$1.6 A_{dd} + 0.29$</u>	

a. A_{dd} is the surface area (m²) of the display door.

Table 6.8.1-21 Walk-In Cooler and Freezer Non-display Door Efficiency Requirements

<u>Class Descriptor</u>	<u>Class</u>	<u>Maximum Energy Consumption (kWh/day)^a</u>	<u>Test Procedure</u>
<u>Passage door, medium temperature</u>	<u>PD, M</u>	<u>$0.54 \times A_{nd} + 1.7$</u>	<u>10 CFR 431</u>
<u>Passage door, low temperature</u>	<u>PD, L</u>	<u>$1.5 \times A_{nd} + 4.8$</u>	
<u>Freight door, medium temperature</u>	<u>FD, M</u>	<u>$0.43 \times A_{nd} + 1.9$</u>	
<u>Freight door, low temperature</u>	<u>FD, L</u>	<u>$1.3 A_{nd} + 5.6$</u>	

b. A_{nd} is the surface area (m²) of the non-display door.

Table 6.8.1-22 Walk-In Cooler and Freezer Refrigeration System Efficiency Requirements

<u>Class Descriptor</u>	<u>Class</u>	<u>Minimum Annual Walk-In Energy Factor AWEF (W/W)^a</u>	<u>Test Procedure</u>	<u>Compliance date: equipment manufactured starting on:</u>
<u>Dedicated condensing, medium temperature, indoor system</u>	<u>DC.M.I</u>	<u>1.64</u>	<u>AHRI 1251</u>	<u>June 5, 2017</u>
<u>Dedicated condensing, medium temperature, outdoor system</u>	<u>DC.M.O</u>	<u>2.23</u>		
<u>Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) < 1.9 kW</u>	<u>DC.L.I, < 1.9 kW</u>	<u>$9.091 \times 10^{-2} \times q_{net} + 0.530$</u>	<u>AHRI 1251</u>	<u>July 10, 2020</u>
<u>Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) ≥ 1.9 kW</u>	<u>DC.L.I, ≥ 1.9 kW</u>	<u>0.703</u>		
<u>Dedicated condensing, low temperature, outdoor system, net capacity (q_{net}) < 1.9 kW</u>	<u>DC.L.O, < 1.9 kW</u>	<u>$6.522 \times 10^{-2} \times q_{net} + 0.800$</u>		
<u>Dedicated condensing, low temperature, outdoor system, net capacity (q_{net}) ≥ 1.9 kW</u>	<u>DC.L.O, ≥ 1.9 kW</u>	<u>0.923</u>		
<u>Unit cooler, medium</u>	<u>UC.M</u>	<u>2.64</u>		
<u>Unit cooler, low temperature, net capacity (q_{net}) < 4.5 kW</u>	<u>UC.L, < 4.5 kW</u>	<u>$1.575 \times 10^{-2} \times q_{net} + 1.146$</u>		
<u>Unit cooler, low temperature, net capacity (q_{net}) ≥ 4.5 kW</u>	<u>UC.L., ≥ 4.5 kW</u>	<u>1.22</u>		

a. q_{net} is net capacity (kW) as determined in accordance with AHRI 1251.

12 Normative References

Air Conditioning, Heating and Refrigeration Institute (AHRI)
 2111 Wilson Blvd., Suite 500, Arlington, VA 22201

AHRI Standard 1250-2014 (I-P)	Performance Rating of Walk-in Coolers and Freezers
AHRI Standard 1251-2014 (SI)	Performance Rating of Walk-in Coolers and Freezers

U.S. Department of Energy (DOE)
 1000 Independence Avenue, SW, Washington, DC 20585

10 CFR Part 431.304

Uniform test method for the measurement of energy consumption of walk-in coolers and walk-in freezers.

NOTE TO REVIEWER: Addendum CF also affect portions of sections changed by this proposal. Specifically, CF modifies items g and h of Section 6.4.5. The following shows how the sections will appear if addendum CF is also approved. Additional changes needed to combine this addendum with prior addenda are shown in strikeout and underline. Such changes do not change the substantive nature of prior approved addenda and are not available for comment. (No additional changes necessary in this case.)

6.4.1.1 Minimum Equipment Efficiencies—Listed Equipment—Standard Rating and Operating Conditions

Equipment shown in Tables [6.8.1-1](#) through 6.8.1-22 shall have a minimum performance at the specified rating conditions when tested in accordance with the specified test procedure. Where multiple rating conditions or performance requirements are provided, the *equipment* shall satisfy all stated requirements unless otherwise exempted by footnotes in the table. *Equipment* covered under the Federal Energy Policy Act of 1992 (EPACT) shall have no minimum *efficiency* requirements for operation at minimum capacity or other than standard rating conditions. *Equipment* used to provide *service water-heating* functions as part of a combination *system* shall satisfy all stated requirements for the appropriate *space* heating or cooling category.

Tables are as follows:

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p. Table 6.8.1-20, Walk-In Cooler and Freezer Display Door Efficiency Requirements

q. Table 6.8.1-21 Walk-In Cooler and Freezer Non-display Door Efficiency Requirements

r. Table 6.8.1-22 Walk-In Cooler and Freezer Refrigeration System Efficiency Requirements

(portions of section not shown are unchanged)

6.4.5 Walk-In Coolers and Walk-In Freezers

Site-assembled or site-constructed *walk-in coolers* and *walk-in freezers* shall conform to the following requirements:

- a. Shall be equipped with *automatic door* closers that firmly close *walk-in doors* that have been closed to within 1 in. (25 mm) of full closure.

Exception to 6.4.5(a)

Doors wider than 3 ft 9 in. (1.1 m) or taller than 7 ft (2.1 m).

- b. Doorways shall have *strip doors* (curtains), *spring-hinged doors*, or other method of minimizing *infiltration* when *doors* are open.
- c. *Walk-in coolers* shall contain *wall*, *ceiling*, and *door* insulation of at least R-25 (R-4.4) and at least R-32 (R-5.6) for *walk-in freezers*.

Exception to 6.4.5(c)

Glazed portions of *doors* or structural members.

- d. *Walk-in freezers* shall contain *floor* insulation of at least R-28 (R-4.9).
- e. Evaporator fan motors that are less than 1 hp (0.75 kW) and less than 460 V shall use electronically commutated motors (brushless direct-current motors) or three-phase motors.
- f. Lights shall use light sources with an *efficacy* of 40 lm/W or more, including *ballast* losses (if any). Light sources with lower may be used in conjunction with a timer or device that turns off the lights within 15 minutes of when the *walk-in cooler* or *walk-in freezer* is not occupied by people.
- g. Transparent reach-in *doors* for *walk-in freezers*, and windows in *walk-in freezer doors*, shall be of triple-pane glass, either filled with inert gas or with heat-reflective treated glass, or vacuum insulating glazing.
- h. Transparent reach-in *doors* for *walk-in coolers*, and windows in *walk-in cooler doors*, shall be double-pane glass with heat-reflective treated glass and gas filled, or triple-pane glass, either filled with inert gas or with heat-reflective treated glass, or vacuum insulating glazing.

- i. Antisweat heaters without antisweat heater *controls* shall have a total *door* rail, glass, and frame heater power draw of $\leq 7.1 \text{ W/ft}^2$ (76 W/m^2) of *door* opening for *walk-in freezers* and 3.0 W/ft^2 (32 W/m^2) of *door* opening for *walk-in coolers*.
- j. Antisweat heater *controls* shall reduce the *energy* use of the antisweat heater as a function of the relative humidity in the air outside the *door* or to the condensation on the inner glass pane.
- k. Condenser fan motors that are less than 1 hp (0.75 kW) shall use electronically commutated motors, permanent split-capacitor-type motors, or three-phase motors.
- l. All *walk-in freezers* shall incorporate temperature-based defrost termination *control* with a time limit default. The defrost cycle shall terminate first on an upper temperature limit breach and second upon a time limit breach.

Exception to 6.4.5(l)

Walk-in coolers and *walk-in freezers* combined in a single enclosure greater than 3000 ft² (280 m²).

Doors in *walk-in coolers* and *walk-in freezers* shall meet the requirements of Tables 6.8.1-20 and 6.8.1-21. *Walk-in cooler* and *walk-in freezer* refrigeration systems, except for walk-in process cooling refrigeration systems as defined in 10 CFR 431.302, shall meet the requirements of Table 6.8.1-22.

(IP Units)

Table 6.8.1-20 Walk-In Cooler and Freezer Display Door Efficiency Requirements

Class Descriptor	Class	Maximum Energy Consumption (kWh/day) ^a	Test Procedure
Display door, medium temperature	DD, M	$0.04 \times A_{dd} + 0.41$	10 CFR 431
Display door, low temperature	DD, L	$0.15 A_{dd} + 0.29$	

a. A_{dd} is the surface area (ft²) of the display door.

Table 6.8.1-21 Walk-In Cooler and Freezer Non-display Door Efficiency Requirements

Class Descriptor	Class	Maximum Energy Consumption (kWh/day) ^a	Test Procedure
Passage door, medium temperature	PD, M	$0.05 \times A_{nd} + 1.7$	10 CFR 431
Passage door, low temperature	PD, L	$0.14 \times A_{nd} + 4.8$	
Freight door, medium temperature	FD, M	$0.04 \times A_{nd} + 1.9$	
Freight door, low temperature	FD, L	$0.12 A_{nd} + 5.6$	

c. A_{nd} is the surface area (ft²) of the non-display door.

Table 6.8.1-22 Walk-In Cooler and Freezer Refrigeration System Efficiency Requirements

Class Descriptor	Class	Minimum Annual Walk-In Energy Factor AWEF (Btu/W-h)^a	Test Procedure	Compliance date: equipment manufactured starting on:
Dedicated condensing, medium temperature, indoor system	DC.M.I	5.61	AHRI 1250	June 5, 2017
Dedicated condensing, medium temperature, outdoor system	DC.M.O	7.60		
Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) < 6,500 Btu/h	DC.L.I, < 6,500 Btu/h	$9.091 \times 10^{-5} \times q_{net} + 1.81$	AHRI 1250	July 10, 2020
Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) \geq 6,500 Btu/h	DC.L.I, \geq 6,500 Btu/h	2.40		
Dedicated condensing, low temperature, outdoor system, net capacity (q_{net}) < 6,500 Btu/h	DC.L.O, < 6,500 Btu/h	$6.522 \times 10^{-5} \times q_{net} + 2.73$		
Dedicated condensing, low temperature, outdoor system, net capacity (q_{net}) \geq 6,500 Btu/h	DC.L.O, \geq 6,500 Btu/h	3.15		
Unit cooler, medium	UC.M	9.00		
Unit cooler, low temperature, net capacity (q_{net}) < 15,500 Btu/h	UC.L, < 15,500 Btu/h	$1.575 \times 10^{-5} \times q_{net} + 3.91$		
Unit cooler, low temperature, net capacity (q_{net}) \geq 15,500 Btu/h	UC.L., \geq 15,500 Btu/h	4.15		

a. q_{net} is net capacity (Btu/h) as determined in accordance with AHRI 1250.

(SI Units)

Table 6.8.1-20 Walk-In Cooler and Freezer Display Door Efficiency Requirements

Class Descriptor	Class	Maximum Energy Consumption (kWh/day) ^a	Test Procedure
Display door, medium temperature	DD, M	$0.43 \times A_{dd} + 0.41$	10 CFR 431
Display door, low temperature	DD, L	$1.6 A_{dd} + 0.29$	

a. A_{dd} is the surface area (m²) of the display door.

Table 6.8.1-21 Walk-In Cooler and Freezer Non-display Door Efficiency Requirements

Class Descriptor	Class	Maximum Energy Consumption (kWh/day) ^a	Test Procedure
Passage door, medium temperature	PD, M	$0.54 \times A_{nd} + 1.7$	10 CFR 431
Passage door, low temperature	PD, L	$1.5 \times A_{nd} + 4.8$	
Freight door, medium temperature	FD, M	$0.43 \times A_{nd} + 1.9$	
Freight door, low temperature	FD, L	$1.3 A_{nd} + 5.6$	

d. A_{nd} is the surface area (m²) of the non-display door.

Table 6.8.1-22 Walk-In Cooler and Freezer Refrigeration System Efficiency Requirements

Class Descriptor	Class	Minimum Annual Walk-In Energy Factor AWEF (W/W) ^a	Test Procedure	Compliance date: equipment manufactured starting on:
Dedicated condensing, medium temperature, indoor system	DC.M.I	1.64	AHRI 1250	June 5, 2017
Dedicated condensing, medium temperature, outdoor system	DC.M.O	2.23		
Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) < 1.9 kW	DC.L.I, < 1.9 kW	$9.091 \times 10^{-2} \times q_{net} + 0.530$	AHRI 1250	July 10, 2020
Dedicated condensing, low temperature, indoor system, net capacity (q_{net}) ≥ 1.9 kW	DC.L.I, ≥ 1.9 kW	0.703		
Dedicated condensing, low temperature, outdoor	DC.L.O, < 1.9 kW	$6.522 \times 10^{-2} \times q_{net} + 0.800$		

Class Descriptor	Class	Minimum Annual Walk-In Energy Factor AWEF (W/W) ^a	Test Procedure	Compliance date: equipment manufactured starting on:
system, net capacity (q_{net}) < 1.9 kW				
Dedicated condensing, low temperature, outdoor system, net capacity (q_{net}) \geq 1.9 kW	DC.L.O, \geq 1.9 kW	0.923		
Unit cooler, medium	UC.M	2.64		
Unit cooler, low temperature, net capacity (q_{net}) < 4.5 kW	UC.L, < 4.5 kW	$1.575 \times 10^{-2} \times q_{net} + 1.146$		
Unit cooler, low temperature, net capacity (q_{net}) \geq 4.5 kW	UC.L., \geq 4.5 kW	1.22		

a. q_{net} is net capacity (kW) as determined in accordance with AHRI 1251.

12 Normative References

Air Conditioning, Heating and Refrigeration Institute (AHRI)
2111 Wilson Blvd., Suite 500, Arlington, VA 22201

AHRI Standard 1250-2014 (I-P)

Performance Rating of Walk-in Coolers and Freezers

AHRI Standard 1251-2014 (SI)

Performance Rating of Walk-in Coolers and Freezers

U.S. Department of Energy (DOE)
1000 Independence Avenue, SW, Washington, DC 20585

10 CFR Part 431.304

Uniform test method for the measurement of energy consumption of walk-in coolers and walk-in freezers.