BSR/ASHRAE/IES Addendum BR
to ANSI/ASHRAE/IES Standard 90.1-2016

Public Review Draft

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

Second Public Review Draft (May 2019)
(Draft Shows Proposed Independent Substantive Changes to Previous Public Review Draft)

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FOREWORD

New DOE refrigeration minimum efficiency requirements went into effect on March 27, 2017 and this addendum updates the requirements in table 6.8.1-12 and 6.8.1-13 to align with the DOE requirements. There were also some nomenclature and other changes which have also been updated in this addendum.

The DOE approach is to combine the requirements of table 6.8.1-12 commercial refrigerators and 6.8.1-13 into one combined table and we have followed this approach and integrated all the refrigeration requirements into table 6.8.1-13 and will eliminate table 6.8.1-12.

The economic justification for the more stringent efficiency levels was addressed in the DOE rulemaking documents for the applicable energy conservation standards rulemaking

The following is a summary of the ISC changes;

1. As requested by DOE they asked that we merge the cells in the Rating Temperature and Operating Temperature columns for all commercial ice cream freezer equipment classes to clearly show that the same rating temperature and operating temperature apply to all classes. This was done by showing the same requirements in both rating and operating for commercial ice cream freezer equipment classes.
2. In the IP and SI tables there are several missing '+' signs (between the variable and intercept in the linear equations) and superfluous periods (at the end of equations) in the Maximum Daily Energy Consumption equations for Self-Contained Commercial Refrigerators and Commercial Freezers with and Without Doors and Self-Contained Commercial Ice Cream Freezers and these have been corrected
3. Remote Condensing Horizontal Open Commercial Freezers are mistakenly classified as 'HZO.RC.M' instead of 'HZO.RC.L' in the Equipment Classifications in the SI table. Per footnote c, rating temperature codes are "M" for medium temperature, "L" for low temperature, and "I" for ice cream temperature.
4. The operating mode classification for Vertical Open Self-Contained Commercial Refrigerators and Freezers is mistakenly included as 'SV' instead of 'SC' in the same table - the full equipment classification for this class should be 'VOP.SC.M' instead of 'VOP.SV.M'.

[Note to Reviewers: This public review draft makes proposed independent substantive changes to the previous public review draft. 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 previous draft 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 substantive changes.]

Addendum BR to 90.1-2016

Delete 6.4.1.1.l because table 6.8.1-12 will be merged into renumbered table 6.8.1-13 which will become table 6.8.1-17 and revised m as shown. This was in the first public review and was not changed in the ISC

Delete the current IP table 6.8.1-12. Note it will not be replaced and will be integrated into table 6.8.1-13

Delete the current IP table 6.8.1-13 and replace it with a new revised table combining table 6.8.1-12 and 6.8.1-13.;and replace with the following new table 6.8.1-13

Table 6.8.1-13 Commercial Refrigerators, Freezers and Refrigeration—Minimum *Efficiency* Requirements

Equipment Category	Condensing Unit Configuration	Equipment Family	Rating Temp (F)	Operating Temp (F)	Equipment Classification[c]	Maximum daily energy consumption kWh/day [d,e]	Test Standard
Remote Condensing Commercial Refrigerators and Commercial Freezers	Remote (RC)	Vertical Open (VOP)	38 (M)	≥32	VOP.RC.M	0.64 x TDA +4.07	AHRI 1200
			0 (L)	<32	VOP.RC.L	2.20 x TDA + 6.85	
		Semivertical Open (SVO)	38 (M)	≥32	SVO.RC.M	0.66 x TDA + 3.18	
			0 (L)	<32	SVO.RC.L	2.20 x TDA + 6.85	
		Horizontal Open (HZO)	38 (M)	≥32	HZO.RC.M	0.35 x TDA + 2.88	
			0 (L)	<32	HZO.RC.L	0.55 x TDA + 6.88	
		Vertical Closed Transparent (VCT)	38 (M)	≥32	VCT.RC.M	0.15 x TDA + 1.95	
			0 (L)	<32	VCT.RC.L	0.49 x TDA + 2.61	
		Horizontal Closed Transparent (HCT)	38 (M)	≥32	HCT.RC.M	0.16 x TDA + 0.13	
			0 (L)	<32	HCT.RC.L	0.34 x TDA + 0.26	
		Vertical Closed Solid (VCS)	38 (M)	≥32	VCS.RC.M	0.10 x V + 0.26	
			0 (L)	<32	VCS.RC.L	0.21 x V + 0.54	
		Horizontal Closed Solid (HCS)	38 (M)	≥32	HCS.RC.M	0.10 x V+ 0.26	
			0 (L)	<32	HCS.RC.L	0.21 x V + 0.54	
		Service Over Counter (SOC)	38 (M)	≥32	SOC.RC.M	0.44 x TDA + 0.11	
			0 (L)	<32	SOC.RC.L	0.93 x TDA + 0.22	
Self-Contained Commercial Refrigerators and Commercial Freezers with and Without Doors	Self-Contained (SC)	Vertical Open (VOP)	38 (M)	≥32	VOP.~~SC~~SV.M	1.69 x TDA + 4.71	AHRI 1200
			0 (L)	<32	VOP.SC.L	4.25 x TDA + 11.82	
		Semivertical Open (SVO)	38 (M)	≥32	SVO.SC.M	1.70 x TDA + 4.59	
			0 (L)	<32	SVO.SC.L	4.26 x TDA +11.51	
		Horizontal Open (HZO)	38 (M)	≥32	HZO.SC.M	0.72 x TDA + 5.55	
			0 (L)	<32	HZO.SC.L	1.90 x TDA + 7.08	
		Vertical Closed Transparent (VCT)	38 (M)	≥32	VCT.SC.M	0.10 x V + 0.86	
			0 (L)	<32	VCT.SC.L	0.29 x V+ 2.95	
		Vertical Closed Solid (VCS)	38 (M)	≥32	VCS.SC.M	0.05 x V + 1.36	
			0 (L)	<32	VCS.SC.L	0.22 x V + 1.38	
		Horizontal Closed Transparent (HCT)	38 (M)	≥32	HCT.SC.M	0.06 x V + 0.37	
			0 (L)	<32	HCT.SC.L	0.08 x V + 1.23	
		Horizontal Closed Solid (HCS)	38 (M)	≥32	HCS.SC.M	0.05 x V + 0.91	
			0 (L)	<32	HCS.SC.L	0.06 x V + 1.12	
		Service Over Counter (SOC)	38 (M)	≥32	SOC.SC.M	0.52 x TDA + 1.00	
			0 (L)	<32	SOC.SC.L	1.10 x TDA + 2.10	

Self-Contained Commercial Refrigerators with Transparent Doors for Pull-Down Temperature Applications	Self-Contained (SC)	Pull-Down (PD)	38 (M)	≥32	PD.SC.M	0.11 x V + 0.81	AHRI 1200
Commercial Ice-Cream Freezers	Remote (RC)	Vertical Open (VOP)	-15 (I)	≤-5[b]	VOP.RC.I	2.79 x TDA + 8.70	AHRI 1200
		Semivertical Open (SVO)			SVO.RC.I	2.79 x TDA + 8.70	
		Horizontal Open (HZO)			HZO.RC.I	0.7 x TDA + 8.74	
		Vertical Closed Transparent (VCT)			VCT.RC.I	0.58 x TDA + 3.05	
		Horizontal Closed Transparent (HCT)			HCT.RC.I	0.4 x TDA + 0.31	
		Vertical Closed Solid (VCS)			VCS.RC.I	0.25 x V + 0.63	
		Horizontal Closed Solid (HCS)			HCS.RC.I	0.25 x V + 0.63	
		Service Over Counter (SOC)			SOC.RC.I	1.09 x TDA + 0.26	
	Self-Contained (SC)	Vertical Open (VOP)			VOP.SC.I	5.4 x TDA + 15.02	AHRI 1200
		Semivertical Open (SVO)			SVO.SC.I	5.41 x TDA + 14.63	
		Horizontal Open (HZO)			HZO.SC.I	2.42 x TDA + 9.00	
		Vertical Closed Transparent (VCT)			VCT.SC.I	0.62 x TDA + 3.29	
		Horizontal Closed Transparent (HCT)			HCT.SC.I	0.56 x TDA + 0.43	
		Vertical Closed Solid (VCS)			VCS.SC.I	0.34 × V + 0.88.	
		Horizontal Closed Solid (HCS)			HCS.SC.I	0.34 × V + 0.88.	
		Service Over Counter (SOC)			SOC.SC.I	1.53 x TDA + 0.36	

a. The meaning of the letters in this column is indicated in the columns to the left.

b. Ice-cream freezer is defined in 10 CFR 431.62 as a commercial freezer that is designed to operate at or below −5 °F and that the manufacturer designs, markets, or intends for the storing, displaying, or dispensing of ice cream.

c. Equipment class designations consist of a combination (in sequential order separated by periods (AAA).(BB).(C)) of the following: (AAA)—An equipment family code (VOP = vertical open, SVO = semivertical open, HZO = horizontal open, VCT = vertical closed transparent doors, VCS = vertical closed solid doors, HCT = horizontal closed transparent doors, HCS = horizontal closed solid doors, and SOC = service over counter); (BB)—An operating mode code (RC = remote condensing and SC = self-contained); and (C)—A rating temperature code (M = medium temperature [38°F], L = low temperature [0°F], or I = ice cream temperature [-15°F]). For example, "VOP.RC.M" refers to the "vertical open, remote condensing, medium temperature" equipment class.

d. V is the volume of the case (ft^3) as measured in AHRI Standard 1200, Appendix C.

e. TDA is the total display area of the case (ft^2) as measured in AHRI Standard 1200, Appendix D.

Delete the current SI table 6.8.1-12 and integrate the new table into table 6.8.1-13

Modify the SI table 6.8.1-13 which is a combination of the old table 6.8.1-12 and 6.8.1-1 with the ISC changes

Table 6.8.1-13 Commercial Refrigerators, Freezer, and Refrigeration—Minimum *Efficiency* Requirements

Equipment Category	Condensing Unit Configuration	Equipment Family	Rating Temp (C)	Operating Temp (C)	Equipment Classification[c]	Maximum daily energy consumption kWh/day [d,e]	Test Standard
Remote Condensing Commercial Refrigerators and Commercial Freezers	Remote (RC)	Vertical Open (VOP)	3 (M)	≥0	VOP.RC.M	6.89 x TDA + 4.07	AHRI 1201
			-18 (L)	<0	VOP.RC.L	23.68 x TDA + 6.85	
		Semivertical Open (SVO)	3 (M)	≥0	SVO.RC.M	7.10 x TDA + 3.18	
			-18 (L)	<0	SVO.RC.L	23.68 x TDA + 6.85	
		Horizontal Open (HZO)	3 (M)	≥0	HZO.RC.M	3.77 x TDA + 2.88	
			-18 (L)	<0	HZO.RC.M	5.92 x TDA + 6.88	
		Vertical Closed Transparent (VCT)	3 (M)	≥0	VCT.RC.~~M~~L	1.61 x TDA + 1.95	
			-18 (L)	<0	VCT.RC.L	5.27 x TDA + 2.61	
		Horizontal Closed Transparent (HCT)	3 (M)	≥0	HCT.RC.M	1.72 x TDA + 0.13	
			-18 (L)	<0	HCT.RC.L	3.66 x TDA + 0.26	
		Vertical Closed Solid (VCS)	3 (M)	≥0	VCS.RC.M	3.53 x V + 0.26	
			-18 (L)	<0	VCS.RC.L	7.42 x V + 0.54	
		Horizontal Closed Solid (HCS)	3 (M)	≥0	HCS.RC.M	3.53 x V+ 0.26	
			-18 (L)	<0	HCS.RC.L	7.42 x V + 0.54	
		Service Over Counter (SOC)	3 (M)	≥0	SOC.RC.M	4.74 x TDA + 0.11	
			-18 (L)	<0	SOC.RC.L	10.01 x TDA + 0.22	
Self-Contained Commercial Refrigerators and Commercial Freezers With and Without Doors	Self-Contained (SC)	Vertical Open (VOP)	3 (M)	≥0	VOP.~~SV~~SC.M	18.19 x TDA + 4.71	AHRI 1201
			-18 (L)	<0	VOP.SC.L	45.75 x TDA + 11.82	
		Semivertical Open (SVO)	3 (M)	≥0	SVO.SC.M	18.30 x TDA + 4.59	
			-18 (L)	<0	SVO.SC.L	45.85 x TDA + 11.51	
		Horizontal Open (HZO)	3 (M)	≥0	HZO.SC.M	7.75 x TDA + 5.55	
			-18 (L)	<0	HZO.SC.L	20.45 x TDA + 7.08	
		Vertical Closed Transparent (VCT)	3 (M)	≥0	VCT.SC.M	3.53 x V + 0.86	
			-18 (L)	<0	VCT.SC.L	10.24 x V+ 2.95	
		Vertical Closed Solid (VCS)	3 (M)	≥0	VCS.SC.M	1.77 x V + 1.36	
			-18 (L)	<0	VCS.SC.L	7.77 x V + 1.38	
		Horizontal Closed Transparent (HCT)	3 (M)	≥0	HCT.SC.M	2.12 x V + 0.37	
			-18 (L)	<0	HCT.SC.L	2.83 x V + 1.23	
		Horizontal Closed Solid (HCS)	3 (M)	≥0	HCS.SC.M	1.77 x V + 0.91	
			-18 (L)	<0	HCS.SC.L	2.12 x V + 1.12	
		Service Over Counter (SOC)	3 (M)	≥0	SOC.SC.M	5.60 x TDA + 1.00	
			-18 (L)	<0	SOC.SC.L	11.84 x TDA + 2.10	
Self-Contained Commercial Refrigerators with Transparent Doors for Pull-Down Temperature Applications	Self-Contained (SC)	Pull-Down (PD)	3 (M)	≥0	PD.SC.M	3.88 x V + 0.81	AHRI 1201
Commercial Ice-Cream Freezers	Remote (RC)	Vertical Open (VOP)	-26 (I)	≤-20=-26[b]	VOP.RC.I	30.03 x TDA + 8.70	AHRI 1201
		Semivertical Open (SVO)			SVO.RC.I	30.03 x TDA + 8.70	

		Horizontal Open (HZO)			HZO.RC.I	7.53 x TDA + 8.74	
		Vertical Closed Transparent (VCT)			VCT.RC.I	6.24 x TDA + 3.05	
		Horizontal Closed Transparent (HCT)			HCT.RC.I	4.31 x TDA + 0.31	
		Vertical Closed Solid (VCS)			VCS.RC.I	8.83 x V + 0.63	
		Horizontal Closed Solid (HCS)			HCS.RC.I	8.83 x V + 0.63	
		Service Over Counter (SOC)			SOC.RC.I	11.73 x TDA + 0.26	
	Self-Contained (SC)	Vertical Open (VOP)			VOP.SC.I	58.13 x TDA + 15.02	
		Semivertical Open (SVO)			SVO.SC.I	58.23 x TDA + 14.63	
		Horizontal Open (HZO)			HZO.SC.I	26.05 x TDA + 9.00	
		Vertical Closed Transparent (VCT)			VCT.SC.I	6.67 x TDA + 3.29	
		Horizontal Closed Transparent (HCT)			HCT.SC.I	6.03 x TDA + 0.43	
		Vertical Closed Solid (VCS)			VCS.SC.I	12.01 × V + 0.88.	
		Horizontal Closed Solid (HCS)			HCS.SC.I	12.01 × V + 0.88.	
		Service Over Counter (SOC)			SOC.SC.I	16.47 x TDA + 0.36	

a. The meaning of the letters in this column is indicated in the columns to the left.

b. Ice-cream freezer is defined in 10 CFR 431.62 as a commercial freezer that is designed to operate at or below −21 °C and that the manufacturer designs, markets, or intends for the storing, displaying, or dispensing of ice cream.

c. Equipment class designations consist of a combination (in sequential order separated by periods (AAA).(BB).(C)) of the following: (AAA)—An equipment family code (VOP = vertical open, SVO = semivertical open, HZO = horizontal open, VCT = vertical closed transparent doors, VCS = vertical closed solid doors, HCT = horizontal transparent doors, HCS = horizontal closed solid doors, and SOC = service over counter); (BB)—An operating mode code (RC = remote condensing and SC = self contained); and (C)—A rating temperature code (M = medium temperature [3.3°C], L = low temperature [-18°C], or I = ice cream temperature [-26.1 °C]). For example, "VOP.RC.M" refers to the "vertical open, remote condensing, medium temperature" equipment class.

d. V is the volume of the case (m^3) as measured in AHRI Standard 1200, Appendix C.

e. TDA is the total display area of the case (m^2) as measured in AHRI Standard 1200, Appendix D.