ADDENDA

2012 Supplement

ANSI/ASHRAE/IES Addenda a, b, c, g, h, j, k, o, p, s, y, z, bz, cg, ci, and ds to ANSI/ASHRAE/IES Standard 90.1-2010

Energy Standard for Buildings Except Low-Rise Residential Buildings

See Appendix for approval dates.

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CONTENTS

ANSI/ASHRAE Addenda to ANSI/ASHRAE/IES Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings

NOTE

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FOREWORD

This addendum updates the test procedure references in the tables in Section 10.8 and adds a normative reference in Chapter 12. This makes the table references more consistent with other equipment tables (and other test procedure references) in the standard.

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

Addendum a to Standard 90.1-2010

Modify the footnotes to Tables 10.8A, 10.8B, and 10.8C as follows (I-P and SI units):

TABLE 10.8A Minimum Nominal Efficiency for General Purpose Design A and Design B Motors Rated 600 Volts or Less[a]

Minimum Nominal Full-Load Motor Efficiency (%) prior to December 19, 2010

	Open Drip-Proof Motors			Totally Enclosed Fan-Cooled Motors		
Number of Poles =>	**2**	**4**	**6**	**2**	**4**	**6**
Synchronous Speed (RPM) =>	**3600**	**1800**	**1200**	**3600**	**1800**	**1200**
Motor Horsepower						
1	NR	82.5	80.0	75.5	82.5	80.0
1.5	82.5	84.0	84.0	82.5	84.0	85.5
2	84.0	84.0	85.5	84.0	84.0	86.5
3	84.0	86.5	86.5	85.5	87.5	87.5
5	85.5	87.5	87.5	87.5	87.5	87.5
7.5	87.5	88.5	88.5	88.5	89.5	89.5
10	88.5	89.5	90.2	89.5	89.5	89.5
15	89.5	91.0	90.2	90.2	91.0	90.2
20	90.2	91.0	91.0	90.2	91.0	90.2
25	91.0	91.7	91.7	91.0	92.4	91.7
30	91.0	92.4	92.4	91.0	92.4	91.7
40	91.7	93.0	93.0	91.7	93.0	93.0
50	92.4	93.0	93.0	92.4	93.0	93.0
60	93.0	93.6	93.6	93.0	93.6	93.6
75	93.0	94.1	93.6	93.0	94.1	93.6
100	93.0	94.1	94.1	93.6	94.5	94.1
125	93.6	94.5	94.1	94.5	94.5	94.1
150	93.6	95.0	94.5	94.5	95.0	95.0
200	94.5	95.0	94.5	95.0	95.0	95.0

a Nominal efficiencies shall be established in accordance with ~~NEMA Standard MG1~~ <u>DOE 10 CFR 431</u>. ~~Design A and Design B are National Electric Manufacturers Association (NEMA) design class designations for fixed-frequency small and medium AC squirrel-cage induction motors.~~
NR—No requirement

TABLE 10.8B Minimum Nominal Full-Load Efficiency for 60 HZ NEMA General Purpose Electric Motors (Subtype I) Rated 600 Volts or Less (Random Wound)[a]

Minimum Nominal Full Load Efficiency (%) for Motors Manufactured on or after December 19, 2010

	Open Drip-Proof Motors			Totally Enclosed Fan-Cooled Motors		
Number of Poles =>	**2**	**4**	**6**	**2**	**4**	**6**
Synchronous Speed (RPM) =>	**3600**	**1800**	**1200**	**3600**	**1800**	**1200**
Motor Horsepower						
1	77.0	85.5	82.5	77.0	85.5	82.5
1.5	84.0	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5
7.5	88.5	91.0	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0
15	90.2	93.0	91.7	91.0	92.4	91.7
20	91.0	93.0	92.4	91.0	93.0	91.7
25	91.7	93.6	93.0	91.7	93.6	93.0
30	91.7	94.1	93.6	91.7	93.6	93.0
40	92.4	94.1	94.1	92.4	94.1	94.1
50	93.0	94.5	94.1	93.0	94.5	94.1
60	93.6	95.0	94.5	93.6	95.0	94.5
75	93.6	95.0	94.5	93.6	95.4	94.5
100	93.6	95.4	95.0	94.1	95.4	95.0
125	94.1	95.4	95.0	95.0	95.4	95.0
150	94.1	95.8	95.4	95.0	95.8	95.8
200	95.0	95.8	95.4	95.4	96.2	95.8
250	95.0	95.8	95.4	95.8	96.2	95.8
300	95.4	95.8	95.4	95.8	96.2	95.8
350	95.4	95.8	95.4	95.8	96.2	95.8
400	95.8	95.8	95.8	95.8	96.2	95.8
450	95.8	96.2	96.2	95.8	96.2	95.8
500	95.8	96.2	96.2	95.8	96.2	95.8

a Nominal efficiencies shall be established in accordance with ~~NEMA Standard MG1~~ DOE 10 CFR 431.

TABLE 10.8C Minimum Nominal Full-Load Efficiency of General Purpose Electric Motors (Subtype II and Design B)[a]

Minimum Nominal Full Load Efficiency (%) for Motors Manufactured on or after December 19, 2010

	Open Drip-Proof Motors				Totally Enclosed Fan Cooled Motors			
Number of Poles =>	**2**	**4**	**6**	**8**	**2**	**4**	**6**	**8**
Synchronous Speed (RPM) =>	**3600**	**1800**	**1200**	**900**	**3600**	**1800**	**1200**	**900**
Motor Horsepower								
1	NR	82.5	80.0	74.0	75.5	82.5	80.0	74.0
1.5	82.5	84.0	84.0	75.5	82.5	84.0	85.5	77.0
2	84.0	84.0	85.5	85.5	84.0	84.0	86.5	82.5
3	84.0	86.5	86.5	86.5	85.5	87.5	87.5	84.0
5	85.5	87.5	87.5	87.5	87.5	87.5	87.5	85.5
7.5	87.5	88.5	88.5	88.5	88.5	89.5	89.5	85.5
10	88.5	89.5	90.2	89.5	89.5	89.5	89.5	88.5
15	89.5	91.0	90.2	89.5	90.2	91.0	90.2	88.5
20	90.2	91.0	91.0	90.2	90.2	91.0	90.2	89.5
25	91.0	91.7	91.7	90.2	91.0	92.4	91.7	89.5
30	91.0	92.4	92.4	91.0	91.0	92.4	91.7	91.0
40	91.7	93.0	93.0	91.0	91.7	93.0	93.0	91.0
50	92.4	93.0	93.0	91.7	92.4	93.0	93.0	91.7
60	93.0	93.6	93.6	92.4	93.0	93.6	93.6	91.7
75	93.0	94.1	93.6	93.6	93.0	94.1	93.6	93.0
100	93.0	94.1	94.1	93.6	93.6	94.5	94.1	93.0
125	93.6	94.5	94.1	93.6	94.5	94.5	94.1	93.6
150	93.6	95.0	94.5	93.6	94.5	95.0	95.0	93.6
200	94.5	95.0	94.5	93.6	95.0	95.0	95.0	94.1
250	94.5	95.4	95.4	94.5	95.4	95.0	95.0	94.5
300	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
350	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
400	95.4	95.4	NR	NR	95.4	95.4	NR	NR
450	95.8	95.8	NR	NR	95.4	95.4	NR	NR
500	95.8	95.8	NR	NR	95.4	95.8	NR	NR

a Nominal efficiencies shall be established in accordance with ~~NEMA Standard MG1~~ DOE 10 CFR 431.

NR—No requirement

In Section 12, Normative References, add the following under U.S. Department of Energy:

10 CFR 431 Subpart B, App B, Uniform Test Method for Measuring Nominal Full Load Efficiency of Electric Motors.

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FOREWORD

The 2010 edition of the ASME Safety Code for Elevators and Escalators *added allowances to permit varying the speed of escalators and moving walks to conserve energy. It does not yet permit automatically stopping and starting of escalators or moving walks. Variable-speed technology is common for this application in other countries.*

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 b to Standard 90.1-2010

Revise the standard as follows (I-P and SI units):

10.4.4 Escalators and Moving Walks. Escalators and moving walks shall automatically slow to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code, when not conveying passengers.

12. NORMATIVE REFERENCES

American Society of Mechanical Engineers, ASME, Three Park Avenue, New York, NY 10016-5990	
ASME A17.1-2010/CSA B44-10	Safety Code for Elevators and Escalators

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FOREWORD

The treatment of laboratory exhaust fans is currently not specified. Laboratory exhaust design requires sufficient momentum of exhaust volume to exit the building wake in order to prevent re-entrainment of exhaust air. The standard design approach to accomplish this for VAV supply systems utilizes an outdoor air bypass damper that ensures a constant volume stack discharge (brings in outdoor air to supplement any decrease in exhaust volume from the building). Clarifying this as the baseline approach will make it clear to design teams that other approaches considered to be energy reduction strategies will be acknowledged as such and appropriately credited.

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

Addendum c to Standard 90.1-2010

Revise the standard as follows (I-P and SI units):

G3.1.1 Baseline HVAC System Type and Description. *HVAC systems* in the *baseline building design* shall be based on usage, number of floors, *conditioned floor area*, and heating source as specified in Table G3.1.1A and shall conform with the *system* descriptions in Table G3.1.1B. For *systems* 1, 2, 3, and 4, each *thermal block* shall be modeled with its own *HVAC system*. For *systems* 5, 6, 7, 8, 9, and 10 each floor shall be modeled with a separate *HVAC system*. Floors with identical *thermal blocks* can be grouped for modeling purposes.

Exceptions:

a. Use additional *system* type(s) for nonpredominant conditions (i.e., *residential*/*nonresidential* or heating source) if those conditions apply to more than 20,000 ft^2 (1900 m^2) of *conditioned floor area*.

b. If the baseline *HVAC system* type is 5, 6, 7, 8, 9, or 10 use separate *single-zone systems* conforming with the requirements of System 3 or System 4 (depending on building heating source) for any *spaces* that have occupancy or *process loads* or schedules that differ significantly from the rest of the building. Peak thermal loads that differ by 10 $Btu/h \cdot ft^2$ (31.2 W/m^2) or more from the average of other *spaces* served by the *system* or schedules that differ by more than 40 equivalent full-load hours per week from other *spaces* served by the *system* are considered to differ significantly. Examples where this exception may be applicable include, but are not limited to, computer server rooms, natatoriums, and continually occupied security areas.

c. For laboratory *spaces* in a building having a total laboratory exhaust rate greater than 5000 cfm (2400 L/s), use a single *system* of type 5 or 7 serving only those *spaces*. For all-electric buildings, the heating shall be *electric resistance.* <u>The lab exhaust fan shall be modeled as constant horsepower reflecting constant volume stack discharge with outdoor air bypass.</u>

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FOREWORD

With the approval of Addendum aq to Standard 90.1-2010, this standard can now add requirements for some of the process and plug loads within a building. The Department of Energy has defined minimum efficiency requirements for some Commercial Refrigerator and Freezers that went into effect as of 1/1/2010. Additional requirements for commercial refrigeration equipment have also been defined and approved per 10CFR Part 431 and will go into effect on 1/1/2012. This addendum adds these requirements to Standard 90.1-2010.

As part of the DOE evaluation, they have calculated that the standard changes will result in 1.035 quads of energy savings over a 30 year period from 2012-2042. The economic analysis shows a scalar (payback) of 1.3 to 3.9.

This addendum adds two additional tables, Table 6.8.1L and 6.8.1M, which define the minimum efficiency requirements for commercial refrigerators and freezers. Also a reference to AHRI Standard 1200 and AHAM Standard HRF-1 is added in Section 12.

***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 g to Standard 90.1-2010

Add new Tables 6.8.1L and 6.8.1M.

6.4.1.1 Minimum Equipment Efficiencies—Listed Equipment—Standard Rating and Operating Conditions. Equipment shown in Tables 6.8.1A through 6.8.1~~K~~M 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 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:

a. Table 6.8.1A—Air Conditioners and Condensing Units
b. Table 6.8.1B—Heat Pumps
c. Table 6.8.1C—Water-Chilling Packages (see Section 6.4.1.2 for water-cooled centrifugal water-chilling packages that are designed to operate at nonstandard conditions)
d. Table 6.8.1D—Packaged Terminal and Room Air Conditioners and Heat Pumps
e. Table 6.8.1E—Furnaces, Duct Furnaces, and Unit Heaters
f. Table 6.8.1F—Boilers
g. Table 6.8.1G—Heat Rejection Equipment
h. Table 6.8.1H—Heat Transfer Equipment
i. Table 6.8.1 I—Variable Refrigerant Flow Air Conditioners
j. Table 6.8.1 J—Variable Refrigerant Flow Air-to-Air and Applied Heat Pumps
k. Table 6.8.1K—Air Conditioners Serving Computer Rooms
l. Table 6.8.1L—Commercial Refrigerator and Freezers
m. Table 6.8.1M—Commercial Refrigeration Equipment

All furnaces with input ratings of ≥225,000 Btu/h (65 kW), including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75% of the input rating. Air conditioners primarily serving computer rooms and covered by ASHRAE Standard 127 shall meet the requirements in Table 6.8.1K. All other air conditioners shall meet the requirements in Table 6.8.1A.

Add the following tables in I-P units:

TABLE 6.8.1L Commercial Refrigerator and Freezers (I-P Units)

Equipment Type	Application	Energy Use Limits (kWh per day)	Test Procedure
Refrigerator with solid doors	Holding Temperature	0.10 × V + 2.04	AHRI 1200
Refrigerator with transparent doors		0.12 × V + 3.34	
Freezers with solid doors		0.40 × V + 1.38	
Freezers with transparent doors		0.75 × V + 4.10	
Refrigerators/freezers with solid doors		the greater of 0.12 × V + 3.34 or 0.70	
Commercial refrigerators	Pulldown	0.126 × V + 3.51	

V = the chiller or frozen compartment volume (ft^3) as defined in the Association of Home Appliance Manufacturers Standard HRF-1.

TABLE 6.8.1M Commercial Refrigeration Minimum Efficiency Requirements (I-P Units)

Equipment Type				Energy Use Limits (kWh/day) as of 1/1/2012[b,c]	Test Procedure
Equipment Class[a]	Family Code	Operating Mode	Rating Temperature		
VOP.RC.M	Vertical Open	Remote Condensing	Medium Temperature	0.82 × TDA + 4.07	AHRI 1200
SVO.RC.M	Semivertical Open	Remote Condensing	Medium Temperature	0.83 × TDA + 3.18	
HZO.RC.M	Horizontal Open	Remote Condensing	Medium Temperature	0.35 × TDA + 2.88	
VOP.RC.L	Vertical Open	Remote Condensing	Low Temperature	2.27 × TDA + 6.85	
HZO.RC.L	Horizontal Open	Remote Condensing	Low Temperature	0.57 × TDA + 6.88	
VCT.RC.M	Vertical Transparent Door	Remote Condensing	Medium Temperature	0.22 TDA + 1.95	
VCT.RC.L	Vertical Transparent Door	Remote Condensing	Low Temperature	0.56 × TDA + 2.61	
SOC.RC.M	Service Over Counter	Remote Condensing	Medium Temperature	0.51 × TDA + 0.11	
VOP.SC.M	Vertical Open	Self Contained	Medium Temperature	1.74 × TDA + 4.71	
SVO.SC.M	Semivertical Open	Self Contained	Medium Temperature	1.73 × TDA + 4.59	
HZO.SC.M	Horizontal Open	Self Contained	Medium Temperature	0.77 × TDA + 5.55	
HZO.SC.L	Horizontal Open	Self Contained	Low Temperature	1.92 × TDA + 7.08	
VCT.SC.I	Vertical Transparent Door	Self Contained	Ice Cream	0.67 × TDA + 3.29	
VCS.SC.I	Vertical Solid Door	Self Contained	Ice Cream	0.38 × V + 0.88	
HCT.SC.I	Horizontal Transparent Door	Self Contained	Ice Cream	0.56 × TDA + 0.43	
SVO.RC.L	Semivertical Open	Remote Condensing	Low Temperature	2.27 × TDA + 6.85	
VOP.RC.I	Vertical Open	Remote Condensing	Ice Cream	2.89 × TDA + 8.7	
SVO.RC.I	Semivertical Open	Remote Condensing	Ice Cream	2.89 × TDA + 8.7	
HZO.RC.I	Horizontal Open	Remote Condensing	Ice Cream	0.72 × TDA + 8.74	
VCT.RC.I	Vertical Transparent Door	Remote Condensing	Ice Cream	0.66 × TDA + 3.05	
HCT.RC.M	Horizontal Transparent Door	Remote Condensing	Medium Temperature	0.16 × TDA + 0.13	
HCT.RC.L	Horizontal Transparent Door	Remote Condensing	Low Temperature	0.34 × TDA + 0.26	
HCT.RC.I	Horizontal Transparent Door	Remote Condensing	Ice Cream	0.4 × TDA + 0.31	
VCS.RC.M	Vertical Solid Door	Remote Condensing	Medium Temperature	0.11 × V + 0.26	
VCS.RC.L	Vertical Solid Door	Remote Condensing	Low Temperature	0.23 × V + 0.54	
VCS.RC.I	Vertical Solid Door	Remote Condensing	Ice Cream	0.27 × V + 0.63	
HCS.RC.M	Horizontal Solid Door	Remote Condensing	Medium Temperature	0.11 × V + 0.26	
HCS.RC.L	Horizontal Solid Door	Remote Condensing	Low Temperature	0.23 × V + 0.54	
HCS.RC.I	Horizontal Solid Door	Remote Condensing	Ice Cream	0.27 × V + 0.63	

TABLE 6.8.1M Commercial Refrigeration Minimum Efficiency Requirements (I-P Units)

Equipment Type				Energy Use Limits (kWh/day) as of 1/1/2012[b,c]	Test Procedure
Equipment Class[a]	Family Code	Operating Mode	Rating Temperature		
HCS.RC.I	Horizontal Solid Door	Remote Condensing	Ice Cream	0.27 × V + 0.63	AHRI 1200
SOC.RC.L	Service Over Counter	Remote Condensing	Low Temperature	1.08 × TDA + 0.22	
SOC.RC.I	Service Over Counter	Remote Condensing	Ice Cream	1.26 × TDA + 0.26	
VOP.SC.L	Vertical Open	Self Contained	Low Temperature	4.37 × TDA + 11.82	
VOP.SC.I	Vertical Open	Self Contained	Ice Cream	5.55 × TDA + 15.02	
SVO.SC.L	Semivertical Open	Self Contained	Low Temperature	4.34 × TDA + 11.51	
SVO.SC.I	Semivertical Open	Self Contained	Ice Cream	5.52 × TDA + 14.63	
HZO.SC.I	Horizontal Open	Self Contained	Ice Cream	2.44 × TDA + 9.0	
SOC.SC.I	Service Over Counter	Self Contained	Ice Cream	1.76 × TDA + 0.36	
HCS.SC.I	Horizontal Solid Door	Self Contained	Ice Cream	0.38 × V + 0.88	

[a] Equipment class designations consist of a combination (in sequential order separated by periods (AAA).(BB).(C)) of:
(AAA)—An equipment family code (VOP = vertical open, SVO = semivertical open, HZO = horizontal open, VCT = vertical transparent doors, VCS = vertical solid doors, HCT = horizontal transparent doors, HCS = horizontal solid doors, or SOC = service over counter);
(BB)—An operating mode code (RC = remote condensing or 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.
[b] V is the volume of the case, as measured in AHRI Standard 1200, Appendix C.
[c] TDA is the total display area of the case, as measured in the AHRI Standard 1200, Appendix D.

Add the following tables in SI Units:

Table 6.8.1L Commercial Refrigerator and Freezers (SI)

Equipment Type	Application	Energy Use Limits (kWh per day)	Test Procedure
Refrigerator with solid doors	Holding Temperature	3.53 x V + 2.04	AHRI 1200
Refrigerator with transparent doors		4.24 x V + 3.34	
Freezers with solid doors		14.13 x V + 1.38	
Freezers with transparent doors		26.49 x V + 4.10	
Refrigerators/freezers with solid doors		the greater of 4.24 x V + 3.34 or 0.70	
Commercial refrigerators	Pulldown	4.45 x V + 3.51	

V means the chiller or frozen compartment volume (m^3) as defined in the Association of Home Appliance Manufacturers Standard HRF-1-2008

Table 6.8.1M Commercial Refrigeration Minimum Efficiency Requirements (SI)

Equipment Type				Energy Use Limits (kWh/day) as of 1/1/2012[b,c]	Test Procedure
Equipment Class[a]	Family Code	Operating Mode	Rating Temperature		
VOP.RC.M	Vertical Open	Remote Condensing	Medium Temperature	8.83 × TDA + 4.07	
SVO.RC.M	Semivertical Open	Remote Condensing	Medium Temperature	8.93 × TDA + 3.18	
HZO.RC.M	Horizontal Open	Remote Condensing	Medium Temperature	3.77 × TDA + 2.88	
VOP.RC.L	Vertical Open	Remote Condensing	Low Temperature	24.43 × TDA + 6.85	
HZO.RC.L	Horizontal Open	Remote Condensing	Low Temperature	6.14 × TDA + 6.88	
VCT.RC.M	Vertical Transparent Door	Remote Condensing	Medium Temperature	2.37 × TDA + 1.95	
VCT.RC.L	Vertical Transparent Door	Remote Condensing	Low Temperature	6.03 × TDA + 2.61	
SOC.RC.M	Service Over Counter	Remote Condensing	Medium Temperature	5.49 × TDA + 0.11	
VOP.SC.M	Vertical Open	Self Contained	Medium Temperature	18.73 × TDA + 4.71	
SVO.SC.M	Semivertical Open	Self Contained	Medium Temperature	18.62 × TDA + 4.59	
HZO.SC.M	Horizontal Open	Self Contained	Medium Temperature	8.29 × TDA + 5.55	
HZO.SC.L	Horizontal Open	Self Contained	Low Temperature	20.67 × TDA + 7.08	
VCT.SC.I	Vertical Transparent Door	Self Contained	Ice Cream	7.21 × TDA + 3.29	
VCS.SC.I	Vertical Solid Door	Self Contained	Ice Cream	13.42 × V + 0.88	
HCT.SC.I	Horizontal Transparent Door	Self Contained	Ice Cream	6.03 × TDA + 0.43	AHRI 1200
SVO.RC.L	Semivertical Open	Remote Condensing	Low Temperature	24.43 × TDA + 6.85	
VOP.RC.I	Vertical Open	Remote Condensing	Ice Cream	31.11 × TDA + 8.7	
SVO.RC.I	Semivertical Open	Remote Condensing	Ice Cream	31.11 × TDA + 8.7	
HZO.RC.I	Horizontal Open	Remote Condensing	Ice Cream	7.75 × TDA + 8.74	
VCT.RC.I	Vertical Transparent Door	Remote Condensing	Ice Cream	7.10 × TDA + 3.05	
HCT.RC.M	Horizontal Transparent Door	Remote Condensing	Medium Temperature	1.72 × TDA + 0.13	
HCT.RC.L	Horizontal Transparent Door	Remote Condensing	Low Temperature	3.66 × TDA + 0.26	
HCT.RC.I	Horizontal Transparent Door	Remote Condensing	Ice Cream	4.31 × TDA + 0.31	
VCS.RC.M	Vertical Solid Door	Remote Condensing	Medium Temperature	3.88 × V + 0.26	
VCS.RC.L	Vertical Solid Door	Remote Condensing	Low Temperature	8.12 × V + 0.54	
VCS.RC.I	Vertical Solid Door	Remote Condensing	Ice Cream	9.53 × V + 0.63	
HCS.RC.M	Horizontal Solid Door	Remote Condensing	Medium Temperature	3.88 × V + 0.26	
HCS.RC.L	Horizontal Solid Door	Remote Condensing	Low Temperature	8.12 × V + 0.54	
HCS.RC.I	Horizontal Solid Door	Remote Condensing	Ice Cream	9.53 × V + 0.63	
HCS.RC.I	Horizontal Solid Door	Remote Condensing	Ice Cream	9.53 × V + 0.63	
SOC.RC.L	Service Over Counter	Remote Condensing	Low Temperature	11.63 × TDA + 0.22	
SOC.RC.I	Service Over Counter	Remote Condensing	Ice Cream	13.56 × TDA + 0.26	
VOP.SC.L	Vertical Open	Self Contained	Low Temperature	47.04 × TDA + 11.82	
VOP.SC.I	Vertical Open	Self Contained	Ice Cream	59.74 × TDA + 15.02	AHRI 1200
SVO.SC.L	Semivertical Open	Self Contained	Low Temperature	46.72 × TDA + 11.51	
SVO.SC.I	Semivertical Open	Self Contained	Ice Cream	5.52 × TDA + 14.63	
HZO.SC.I	Horizontal Open	Self Contained	Ice Cream	59.42 × TDA + 9.0	
SOC.SC.I	Service Over Counter	Self Contained	Ice Cream	18.94 × TDA + 0.36	
HCS.SC.I	Horizontal Solid Door	Self Contained	Ice Cream	13.42 × V + 0.88	

[a c] Equipment class designations consist of a combination (in sequential order separated by periods(AAA).(BB).(C)) of:
(AAA)—An equipment family code (VOP=vertical open, SVO=semivertical open, HZO=horizontal open, VCT=vertical transparent doors, VCS=vertical solid doors, HCT=horizontal transparent doors, HCS=horizontal solid doors, or SOC=service over counter);
(BB)—An operating mode code (RC=remote condensing or SC=self contained); and
(C)—A rating temperature code (M=medium temperature (3.3 °C), L=low temperature (-17.8 °C), or I=ice-cream temperature (-9.4 °C)). For example, "VOP.RC.M" refers to the "vertical open, remote condensing, medium temperature" equipment class.

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

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

Add a reference in Section 12 under Air-Conditioning, Heating, and Refrigeration Institute:

Air Conditioning, Heating and Refrigeration Institute, 2111 Wilson Blvd., Suite 500, Arlington, VA 22201	
AHRI 1200-2010	Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets

Add a reference in Section 12 under Association of Home Appliance Manufacturers

Association of Home Appliance Manufacturers, 1111 19th Street NW, Suite 402, Washington, DC 20036	
ANSI/AHAM HRF-1-2008	Energy and Internal Volume of Refrigerating Appliances (including errata issued November 17, 2009)

(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

This addendum amends the minimum energy efficiency standards for water-to-air heat pumps (water loop, ground water, and ground loop) listed in Table 6.8.1B of Standard 90.1-2010.These new minimum efficiencies meet or exceed the Energy Star Tier 1 levels for Ground Water and Ground Source heat pumps that were in effect until January 1, 2011. Proposed cooling EERs and heating COPs are on average 3% to 11% more stringent than values currently listed in the standard. These new minimums are proposed to become effective immediately upon publication of the addendum. Finally, the proposal corrects the minimum efficiencies for through-the-wall products and removes the small-duct, high-velocity product class from Table 6.8.1B.

***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 h to Standard 90.1-2010

Amend Table 6.8.1B to modify minimum energy efficiency requirements for water to air heat pumps as follows (I-P units):

TABLE 6.8.1 B Electrically Operated Unitary and Applied Heat Pumps—Minimum Efficiency Requirements (I-P Units)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[~~a~~]	Test Procedure[~~b~~a]
Air cooled (cooling mode)	<65,000 Btu/h[~~c~~b]	All	Split system	13.0 SEER	AHRI 210/240
			Single packaged	13.0 SEER	
Through-the-wall, air cooled	≤30,000 Btu/h[~~c~~b]	All	Split system	12.0 SEER	
			Single packaged	12.0 SEER	
~~Single-duct high-velocity air cooled~~	~~<65,000 Btu/h[c]~~[b]	~~All~~	~~Split system~~	~~10.0 SEER~~	
Air cooled (cooling mode)	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split system and single package	11.0 EER 11.2 IEER	AHRI 340/360
		All other	Split System and Single Package	10.8 EER 11.0 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split system and single package	10.6 EER 10.7 IEER	
		All other	Split system and single package	10.4 EER 10.5 IEER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split system and single package	9.5 EER 9.6 IEER	
		All other	Split system and single package	9.3 EER 9.4 IEER	
Water to air: water loop ~~source~~ (cooling mode)	<17,000 Btu/h	All	86°F entering water	~~11.2 EER~~ 12.2 EER	ISO 13256-1
	≥17,000 Btu/h and <65,000 Btu/h	All	86°F entering water	~~12.0 EER~~ 13 EER	
	≥65,000 Btu/h and <135,000 Btu/h	All	86°F entering water	~~12.0 EER~~ 13 EER	
Water to air: ground water ~~water source~~ (cooling mode)	<135,000 Btu/h	All	59°F entering water	~~16.2 EER~~ 18.0 EER	
Brine to air: ground loop ~~source~~ (cooling mode)	<135,000 Btu/h	All	77°F entering water	~~13.4 EER~~ 14.1 EER	

TABLE 6.8.1 B Electrically Operated Unitary and Applied Heat Pumps—Minimum Efficiency Requirements (I-P Units) (Continued)

Water to water: water loop ~~source~~ ~~water to water~~ (cooling mode)	<135,000 Btu/h	All	86°F entering water	10.6 EER	
Water to water: ground~~water~~ water ~~source~~ ~~water to water~~ (cooling mode)	<135,000 Btu/h	All	59°F entering water	16.3 EER	ISO-13256-2
Brine to water: ground loop ~~source~~ ~~brine to water~~ (cooling mode)	<135,000 Btu/h	All	77°F entering water	12.1 EER	
Air cooled (heating mode)	<65,000 Btu/h[~~c~~b]	—	Split system	7.7 HSPF	
		—	Single package	7.7 HSPF	
Through-the-wall, (air cooled, heating mode)	≤30,000 Btu/h[~~c~~b] (cooling capacity)	—	Split system	7.4 HSPF	AHRI 210/240
		—	Single package	7.4 HSPF	
~~Small-duct high velocity (air cooled, heating mode)~~	~~<65,000 Btu/h~~[~~c~~b]	—	~~Split system~~	~~6.8 HSPF~~	
Air cooled (heating mode)	≥65,000 Btu/h and <135,000 Btu/h (Cooling Capacity)	—	47ºF db/43ºF wb outdoor air	3.3 COP	
			17ºF db/15ºF wb outdoor air	2.25 COP	AHRI 340/360
	≥135,000 Btu/h (Cooling Capacity)	—	47ºF db/43ºF wb Outdoor Air	3.2 COP	
			17ºF db/15ºF wb outdoor air	2.05 COP	
Water to air: water loop ~~source~~ (heating mode)	<135,000 Btu/h (cooling capacity)	—	68°F entering water	~~4.2 COP~~ 4.3 COP	
Water to air: ground water ~~water source~~ (heating mode)	<135,000 Btu/h (cooling capacity)	—	50°F entering water	~~3.6 COP~~ 3.7 COP	ISO 13256-1
Brine to air: ground loop ~~source~~ (heating mode)	<135,000 Btu/h (cooling capacity)	—	32°F entering fluid	~~3.1 COP~~ 3.2 COP	
Water to water: water loop ~~source~~ ~~water to water~~ (heating mode)	<135,000 Btu/h (cooling capacity)	—	68°F entering water	3.7 COP	
Water to water: ground~~water~~ water ~~source water to water~~ (heating mode)	<135,000 Btu/h (cooling capacity)	—	50°F entering water	3.1 COP	ISO 13256-2
Brine to water: ground loop ~~source~~ ~~brine to water~~ (heating mode)	<135,000 Btu/h (cooling capacity)	—	32°F entering fluid	2.5 COP	

[a] ~~IPLV and part load rating conditions are only applicable to equipment with capacity modulation.~~
[~~a~~b] Section 12 contains a complete specification of the referenced test procedure, including the reference year version of the test procedure
[~~c~~b] Single-phase, air-cooled air conditioners <65,000 Btu/h are regulated by NAECA, SEER values are those set by NAECA

Amend Table 6.8.1B to modify minimum energy efficiency requirements for water to air heat pumps as follows (SI units):

TABLE 6.8.1 B Electrically Operated Unitary and Applied Heat Pumps— Minimum Efficiency Requirements

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency[a]	Test Procedure[~~b~~a]
Air cooled (cooling mode)	<19 kW[~~e~~b]	All	Split system	3.81 $SCOP_c$	AHRI 210/240
			Single packaged	3.81 $SCOP_c$	
Through-the-wall, air cooled	≥9 kW[~~e~~b]	All	Split system	3.51 $SCOP_c$	
			Single packaged	3.51 $SCOP_c$	
~~Single-duct high-velocity air cooled~~	~~<19 kW~~[~~e~~b]	~~All~~	~~Split system~~	~~2.93 $SCOP_c$~~	
Air cooled (cooling mode)	≥19 kW and <40 kW	Electric Resistance (or None)	Split system and single package	3.22 COP_c 3.28 $ICOP_c$	AHRI 340/360
		All other	Split system and single package	3.16 COP_c 3.22 $ICOP_c$	
	≥40 kW and <70 kW	Electric Resistance (or None)	Split system and single package	3.13 $ICOP_c$	
		All other	Split system and single package	3.05 COP_c 3.07 $ICOP_c$	
	≥70 kW	Electric Resistance (or None)	Split system and single package	2.78 COP_c 2.81 $ICOP_c$	
		All other	Split system and single package	2.72 COP_c 2.75 $ICOP_c$	
Water to air: water loop ~~source~~ (cooling mode)	<5 kW	All	30°C entering water	~~3.28 COP_c~~ 3.57 COP_c	ISO 13256-1
	≥5 kW and <19 kW	All	30°C entering water	~~3.51 COP_c~~ 3.81 COP_c	
	≥19 kW and <40 kW	All	30°C entering water	~~3.51 COP_c~~ 3.81 COP_c	
Water to air: ground water ~~water source~~ (cooling mode)	<40 kW	All	15°C entering water	~~4.74 COP_c~~ 5.27 COP_c	
Brine to air: ground loop ~~source~~ (cooling mode)	<40 kW	All	25°C entering water	~~3.92 COP_c~~ 4.13 COP_c	
Water to water: water loop ~~source~~ ~~water to water~~ (cooling mode)	<40 kW	All	30°C entering water	3.10 COP_c	ISO-13256-2
Water to water: Ground~~water~~ water ~~source~~ ~~water to water~~ (cooling mode)	<40 kW	All	15°C entering water	4.77 COP_c	
Brine to water: ground loop ~~source~~ ~~Brine to water~~ (cooling mode)	<40 kW	All	25°C entering water	3.55 COP_c	

TABLE 6.8.1 B Electrically Operated Unitary and Applied Heat Pumps—Minimum Efficiency Requirements (Continued)

Air cooled (heating mode)	<19 kW[~~e~~b]	—	Split system	2.26 $SCOP_H$	AHRI 210/240
		—	Single package	2.26 $SCOP_H$	
Through-the-wall, (air cooled, heating mode)	≤9 kW[~~e~~b] (cooling capacity)	—	Split system	2.17 $SCOP_H$	
		—	Single package	2.17 $SCOP_H$	
~~Small-duct high velocity (air cooled, heating mode)~~	~~<19 kW~~[~~e~~b]	—	~~Split system~~	~~2.0 HSPF~~	
Air cooled (heating mode)	≥19 kW and <40 kW (Cooling Capacity)	—	8.3°C db/6.1°C wb outdoor air	3.3 COP_H	AHRI 340/360
			–8.3°C db/–9.4°C wb outdoor air	2.25 COP_H	
	≥40 kW (Cooling Capacity)	—	8.3°C db/6.1°C wb outdoor air	3.2 COP_H	
			–8.3°C db/–9.4°C wb outdoor air	2.05 COP_H	
Water to air: water loop ~~source~~ (heating mode)	<40 kW (cooling capacity)	—	20°C entering water	~~4.2 COP~~ 4.3 COP_H	ISO 13256-1
Water to air: ground water ~~water source~~ (heating mode)	<40 kW (cooling capacity)	—	10°C entering water	~~3.6 COP~~ 3.7 COP_H	
Brine to air: ground loop ~~source~~ (heating mode)	<40 kW (cooling capacity)	—	0°C entering fluid	~~3.1 COP~~ 3.2 COP_H	
Water to water: water loop ~~source water to water~~ (heating mode)	<40 kW (cooling capacity)	—	20°C entering water	3.7 COP_H	ISO 13256-2
Water to water: ground~~water~~ water ~~source water to water~~ (heating mode)	<40 kW (cooling capacity)	—	10°C entering water	3.1 COP_H	
Brine to water: ground loop ~~source brine to water~~ (heating mode)	<40 kW (cooling capacity)	—	0°C entering fluid	2.5 COP_H	

[a] ~~IPLV and part load rating conditions are only applicable to equipment with capacity modulation.~~
[a~~b~~] Section 12 contains a complete specification of the referenced test procedure, including the reference year version of the test procedure
[~~e~~b] Single-phase, air-cooled air conditioners <19 kW are regulated by NAECA, SEER values are those set by NAECA

(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 Table 6.8.1A, three issues need to be corrected.

1. *In the preparation of Table 6.8.1, as a result of addendum CO, a mistake was found for the efficiency requirements for the new category of evaporatively cooled units with a capacity from 240,000 Btu/h to 760,000 Btu/h in the category of other heat. The EER as of 6/1/2011 is shown as 12.2 EER, whereas the EER for the same unit with electric heat is 11.9 EER. The EER for other size units is 0.2 EER lower for other heat to account for the increased pressure drop. The current value for this product results in a 0.3 increase, which is an error. The values of 12.2 EER should be 11.7 EER, which is 0.2 below the 11.9 listed for the electric heat unit.*
2. *In addition, the small duct high velocity requirements have been dropped by DOE and they are only allowing such systems under a waiver clause so the addendum has also made a change to remove the small duct high velocity systems from Tables 6.8.1A and 6.8.1B.*
3. *Note a states that the "IPLV and part load rating conditions are only applicable to equipment with capacity modulation". The IPLV term is no longer used and has been replaced by the IEER which applies to all units including those that do not have capacity modulation.*

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 j to Standard 90.1-2010

Modify the standard as follows (I-P and SI units):

TABLE 6.8.1A Electrically Operated Unitary Air Conditioners and Condensing Units—Minimum Efficiency Requirements (I-P Units)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Air conditioners, air cooled	<65,000 Btu/h[~~e~~b]	All	Split system	13.0 SEER	AHRI 210/240
			Single package	13.0 SEER	
Through-the-wall (air cooled)	≤30,000 Btu/h[~~e~~b]	All	Split system	12.0 SEER	
			Single package	12.0 SEER	
~~Small-duct high-velocity (air cooled)~~	~~<65,000 Btu/h~~[~~e~~b]	~~All~~	~~Split system~~	~~10.0 SEER~~	
Air conditioners, air cooled	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split system and single package	11.2 EER 11.4 IEER	AHRI 340/360
		All other	Split System and Single Package	11.0 EER 11.2 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split system and single package	11.0 EER 11.2 IEER	
		All other	Split system and single package	10.8 EER 11.0 IEER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric resistance (or none)	Split system and single package	10.0 EER 10.1 IEER	
		All other	Split system and single package	9.8 EER 9.9 IEER	
	≥760,000 Btu/h	Electric resistance (or none)	Split system and single package	9.7 EER 9.8 IEER	
		All other	Split system and single package	9.5 EER 9.6 IEER	

TABLE 6.8.1A Electrically Operated Unitary Air Conditioners and Condensing Units—Minimum Efficiency Requirements (I-P Units)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Air conditioners, water cooled	<65,000 Btu/h	All	Split system and single package	12.1 EER 12.3 IEER	AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split system and single package	11.5 EER (before 6/1/2011) 12.1 EER (as of 6/1/2011) 11.7 IEER (before 6/1/2011) 12.3 IEER (as of 6/1/2011)	AHRI 340/360
		All other	Split system and single package	11.3 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011) 11.5 IEER (before 6/1/2011) 12.1 IEER (as of 6/1/2011)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split system and single package	11.0 EER (before 6/1/2011) 12.5 EER (as of 6/1/2011) 11.2 IEER (before 6/1/2011) 12.5 IEER (as of 6/1/2011)	
		All other	Split system and single package	10.8 EER (before 6/1/2011) 12.3 EER (as of 6/1/2011) 11.0 IEER (before 6/1/2011) 12.5 IEER (as of 6/1/2011)	
	≥240,000 Btu/h and <760,000 Btu/h	Electric resistance (or none)	Split system and single package	11.0 EER (before 6/1/2011) 12.4 EER (as of 6/1/2011)11.1 EER (before 6/1/2011) 12.6 EER (as of 6/1/2011)	
		All other	Split system and single package	10.8 EER (before 6/1/2011) 12.2 EER (as of 6/1/2011) 10.9 EER (before 6/1/2011) 12.4 EER (as of 6/1/2011)	
Air conditioners, water cooled	≥760,000 Btu/h	Electric resistance (or none)	Split system and single package	11.0 EER (before 6/1/2011) 12.2 EER (as of 6/1/2011) 11.1 EER (before 6/1/2011) 12.4 EER (as of 6/1/2011	AHRI 340/360
		All other	Split system and single package	10.8 EER (before 6/1/2011) 12.0 EER (as of 6/1/2011) 10.9 EER (before 6/1/2011) 12.2 EER (as of 6/1/2011)	

TABLE 6.8.1A Electrically Operated Unitary Air Conditioners and Condensing Units— Minimum Efficiency Requirements (I-P Units)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[~~a~~]	Test Procedure[b]
Air conditioners, evaporatively cooled	<65,000 Btu/h[~~c~~b]	All	Split system and single package	12.1 EER 12.3 IEER	AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split system and single package	11.5 EER (before 6/1/2011) 12.1 EER (as of 6/1/2011) 11.7 IEER (before 6/1/2011) 12.3 IEER (as of 6/1/2011)	AHRI 340/360
		All other	Split system and single package	11.3 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011) 11.5 IEER (before 6/1/2011) 12.1 IEER (as of 6/1/2011)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split system and single package	11.0 EER (before 6/1/2011) 12.0 EER (as of 6/1/2011) 11.2 IEER (before 6/1/2011) 12.2 IEER (as of 6/1/2011)	
		All other	Split system and single package	10.8 EER (before 6/1/2011) 11.8 EER (as of 6/1/2011) 11.0 IEER (before 6/1/2011) 12.0 IEER (as of 6/1/2011)	
	≥240,000 Btu/h and <760,000 Btu/h	Electric resistance (or none)	Split system and single package	11.0 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011) 11.1 IEER (before 6/1/2011) 12.1 IEER (as of 6/1/2011)	
		All other	Split system and single package	10.8 EER (before 6/1/2011) ~~12.2~~ 11.7 EER (as of 6/1/2011) 10.9 IEER (before 6/1/2011) 11.9 IEER (as of 6/1/2011)	
	≥760,000 Btu/h	Electric resistance (or none)	Split system and single package	11.0 EER (before 6/1/2011) 11.7 EER (as of 6/1/2011) 11.1 IEER (before 6/1/2011) 11.9 IEER (as of 6/1/2011)	
		All other	Split system and single package	10.8 EER (before 6/1/2011) 11.5 EER (as of 6/1/2011) 10.9 IEER (before 6/1/2011) 11.7 IEER (as of 6/1/2011)	
Condensing units air cooled	≥135,000Btu/h	—	—	10.1 EER (before 6/1/2011) 10.5 EER (as of 6/1/2011) 11.4 IEER (before 6/1/2011) 11.8 IEER (as of 6/1/2011)	AHRI 365
Condensing units water cooled	≥135,000Btu/h	—	—	13.1 EER (before 6/1/2011) 13.5 EER (as of 6/1/2011) 13.6 IEER (before 6/1/2011) 14.0 IEER (as of 6/1/2011)	
Condensing units evaporatively cooled	≥135,000Btu/h	—	—	13.1 EER (before 6/1/2011) 13.5 EER (as of 6/1/2011) 13.6 IEER (before 6/1/2011) 14.0 IEER (as of 6/1/2011)	

~~a IPLV and part load rating conditions are only applicable to equipment with capacity modulation~~

[~~b~~a] Section 12 contains a complete specification of the referenced test procedure, including the reference year version of the test procedure

[~~c~~b] Single-phase, air-cooled air conditioners <65,000 Btu/h are regulated by NAECA, SEER valu~~v~~es are those set by NAECA

TABLE 6.8.1A Electrically Operated Unitary Air Conditioners and Condensing Units— Minimum Efficiency Requirements (SI)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Air Conditioners, Air Cooled	<19 kW[eb]	All	Split System	3.81 $SCOP_C$	AHRI 210/240
			Single Package	3.81 $SCOP_C$	
Through-the-Wall (air cooled)	≤9 kW[eb]	All	Split system	3.52 $SCOP_C$	
			Single Package	3.52 $SCOP_C$	
Small-Duct High-Velocity (Air Cooled)	<19 kW[cb]	All	Split System	2.93 SCOP	
Air Conditioners, Air Cooled	≥19 kW and <40 kW	Electric Resistance (or None)	Split System and Single Package	3.28 COP_C 3.34 ICOP	AHRI 340/360
		All other	Split System and Single Package	3.22 COP_C 3.28 ICOP	
	≥40 kW and <70 kW	Electric Resistance (or None)	Split System and Single Package	3.22 COP_C 3.28 ICOP	
		All other	Split System and Single Package	3.17 COP_C 3.22 ICOP	
	≥70 kW and <223 kW	Electric Resistance (or None)	Split System and Single Package	2.93 COP_C 2.96 ICOP	
		All other	Split System and Single Package	2.87 COP_C 2.90 ICOP	
	≥223 kW	Electric Resistance (or None)	Split System and Single Package	2.84 COP_C 2.87 ICOP	
		All other	Split System and Single Package	2.78 COP_C 2.81 ICOP	
Air Conditioners, Water Cooled	< 19 kW	All	Split System and Single Package	3.55 COP_C 3.6 ICOP	AHRI 210/240
	≥19 kW and <40 kW	Electric Resistance (or None)	Split System and Single Package	3.37 COP_C (before 6/1/2011) 3.55 COP_C (as of 6/1/2011) 3.43 ICOP (before 6/1/2011) 3.60 ICOP (as of 6/1/2011)	AHRI 340/360
		All other	Split System and Single Package	3.31 COP_C (before 6/1/2011) 3.49 COP_C (as of 6/1/2011) 3.37 ICOP (before 6/1/2011) 3.55 ICOP (as of 6/1/2011)	
	≥40 kW and <70 kW	Electric Resistance (or None)	Split System and Single Package	3.22 COP_C (before 6/1/2011) 3.66 COP_C (as of 6/1/2011) 3.28 ICOP (before 6/1/2011) 3.66 ICOP (as of 6/1/2011)	
		All other	Split System and Single Package	3.17 COP_C (before 6/1/2011) 3.58 COP_C (as of 6/1/2011) 3.19 ICOP (before 6/1/2011) 3.63 ICOP (as of 6/1/2011)	
	≥70 kW and <223 kW	Electric Resistance (or None)	Split System and Single Package	3.22 COP_C (before 6/1/2011) 3.63 COP_C (as of 6/1/2011) 3.25 ICOP (before 6/1/2011) 3.69 ICOP (as of 6/1/2011)	
		All other	Split System and Single Package	3.17 COP_C (before 6/1/2011) 3.58 COP_C (as of 6/1/2011) 3.19 ICOP (before 6/1/2011) 3.63 ICOP (as of 6/1/2011)	

TABLE 6.8.1A Electrically Operated Unitary Air Conditioners and Condensing Units—Minimum Efficiency Requirements (SI)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Air Conditioners, Water Cooled	≥223 kW	Electric Resistance (or None)	Split System and Single Package	3.22 COP_C (before 6/1/2011) 3.58 COP_C (as of 6/1/2011) 3.25 ICOP (before 6/1/2011) 3.63 ICOP (as of 6/1/2011	AHRI 340/360
		All other	Split System and Single Package	3.17 COP_C (before 6/1/2011) 3.52 COP_C (as of 6/1/2011) 3.19 ICOP (before 6/1/2011) 3.58 ICOP (as of 6/1/2011)	
Air Conditioners, Evaporatively Cooled	<19 kW[~~e~~b]	All	Split System and Single Package	3.55 COP_C 3.60 ICOP	AHRI 210/240
	≥19 kW and <40 kW	Electric Resistance (or None)	Split System and Single Package	3.37 COP_C (before 6/1/2011) 3.55 COP_C (as of 6/1/2011) 3.43 ICOP (before 6/1/2011) 3.60 ICOP (as of 6/1/2011)	AHRI 340/360
		All other	Split System and Single Package	3.31 COP_C (before 6/1/2011) 3.49 COP_C (as of 6/1/2011) 3.37 ICOP (before 6/1/2011) 3.55 ICOP (as of 6/1/2011)	
	≥40 kW and <70 kW	Electric Resistance (or None)	Split System and Single Package	3.22 COP_C (before 6/1/2011) 3.52 COP_C (as of 6/1/2011) 3.28 ICOP (before 6/1/2011) 3.58 ICOP (as of 6/1/2011)	
		All other	Split System and Single Package	3.17 COP_C (before 6/1/2011) 3.46 COP_C (as of 6/1/2011) 3.22 ICOP (before 6/1/2011) 3.52 ICOP (as of 6/1/2011)	
	≥70 kW and <223 kW	Electric Resistance (or None)	Split System and Single Package	3.22 COP_C (before 6/1/2011) 3.49 COP_C (as of 6/1/2011) 3.25 ICOP (before 6/1/2011) 3.55 ICOP (as of 6/1/2011)	
		All other	Split System and Single Package	3.17 COP_C (before 6/1/2011) ~~3.58~~3.43 COP_C (as of 6/1/2011) 3.19 ICOP (before 6/1/2011) 3.49 ICOP (as of 6/1/2011)	
	≥223 kW	Electric Resistance (or None)	Split System and Single Package	3.22 COP_C (before 6/1/2011) 3.43 COP_C (as of 6/1/2011) 3.25 ICOP (before 6/1/2011) 3.49 ICOP (as of 6/1/2011)	
		All other	Split System and Single Package	3.17 COP_C (before 6/1/2011) 3.37 COP_C (as of 6/1/2011) 3.19 ICOP (before 6/1/2011) 3.43 ICOP (as of 6/1/2011)	

TABLE 6.8.1A Electrically Operated Unitary Air Conditioners and Condensing Units—Minimum Efficiency Requirements (SI)

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[~~a~~]	Test Procedure[b]
Condensing Units Air Cooled	≥40 kW			2.96 COP_C (before 6/1/2011) 3.08 COP_C (as of 6/1/2011) 3.34 ICOP (before 6/1/2011) 3.46 ICOP (as of 6/1/2011)	AHRI 365
Condensing Units Water Cooled	≥40 kW			3.84 COP_C (before 6/1/2011) 3.96 COP_C (as of 6/1/2011) 3.99 ICOP (before 6/1/2011) 4.10 ICOP (as of 6/1/2011)	
Condensing Units Evaporatively Cooled	≥40 kW			3.84 COP_C (before 6/1/2011) 3.96 COP_C (as of 6/1/2011) 3.99 ICOP (before 6/1/2011) 4.10 ICOP (as of 6/1/2011)	

~~[a] IPLV and part load rating conditions are only applicable to equipment with capacity modulation~~
[~~b~~a] Section 12 contains a complete specification of the referenced test procedure, including the reference year version of the test procedure
[~~c~~b] Single phase, air cooled air conditioners <19 kW are regulated by NAECA, SEER values are those set by NAECA

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FOREWORD

This will make the transformer test procedure references consistent with other references in Chapter 6.

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 k to Standard 90.1-2010

Modify the standard as follows (I-P and SI units):

8.1 General.

8.1.1 Scope. This section applies to all building power distribution *systems* and only to equipment described below.

8.1.1.1 New Buildings. Equipment installed in new buildings shall comply with the requirements of this section.

8.1.1.2 Addition to Existing Buildings. Equipment installed in *additions* to *existing buildings* shall comply with the requirements of this section.

8.1.1.3 Alterations to Existing Buildings.

8.1.1.3.1 Alterations to building service equipment or systems shall comply with the requirements of this section applicable to those specific portions of the building and its systems that are being altered.

8.1.1.3.2 Any new equipment subject to the requirements of this section that is installed in conjunction with the *alterations*, as a direct replacement of existing equipment shall comply with the specific requirements applicable to that equipment.

Exception to 8.1.1.3: Compliance shall not be required for the relocation or reuse of existing equipment at the same site.

8.1.2 Low Voltage Dry-Type Distribution *Transformers*. Low voltage *dry-type transformers* shall comply with the provisions of the Energy Policy Act of 2005 where applicable, as shown in Table 8.1. *Transformers* that are not included in the scope of the Energy Policy Act of 2005 have no performance requirements in this section, and are listed for ease of reference below as exceptions.

TABLE 8.1 Minimum Nominal Efficiency Levels for ~~NEMA Class I~~ 10 CFR 431 Low Voltage Dry-Type Distribution Transformers[a]

Single Phase Transformers		Three Phase Transformers	
kVA[a,b]	**Efficiency (%)[b,c]**	**kVA[a,b]**	**Efficiency (%)[b,c]**
15	97.7	15	97.0
25	98.0	30	97.5
37.5	98.2	45	97.7
50	98.3	75	98.0
75	98.5	112.5	98.2
100	98.6	150	98.3
167	98.7	225	98.5
250	98.8	300	98.6
333	98.9	500	98.7
		750	98.8
		1000	98.9

a. A low voltage distribution transformer is a transformer that is aircooled, does not use oil as a coolant, has an input voltage ≤600 Volts, and is rated for operation at a frequency of 60 Hz.
b. Kilovolt-ampere rating.
c. Nominal efficiencies shall be established in accordance with the ~~NEMA TP-1 2002~~ 10 CFR 431 test procedure for low-voltage, dry-type transformers. ~~Class I Low Voltage Dry-Type is a National Electrical Manufacturers Association (NEMA) design class designation.~~

Exceptions: *Transformers* that meet the Energy Policy Act of 2005 exclusions based on ~~NEMA TP-1~~ 10 CFR 431 definition:

a. special purpose applications
b. not likely to be used in general purpose applications
c. *transformers* with multiple voltage taps where the highest tap is at least 20% more than the lowest tap.

Products meeting these criteria and exempted from 8.1.2 include the following: drive transformer, rectifier transformer, auto-transformer, uninterruptible power system transformer, impedance transformer, regulating transformer, sealed and nonventilating transformer, machine tool transformer, welding transformer, grounding transformer, or testing transformer.

Add to Normative References:

U.S. Department of Energy 1000 Independence Avenue, SW, Washington, DC 20585	
10 CFR 431 Subpart K, App A	Uniform Test Method for Measuring the Energy Consumption of Distribution Transformers

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FOREWORD

This addendum updates the fenestration air leakage provisions of Standard 90.1-2010 to clarify the requirements for glazed sectional garage doors. A definition for sectional garage doors is also added.

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 o to Standard 90.1-2010

Revise the standard as follows (I-P and SI units).

Add the following definition:

sectional garage door: an upward-acting, *nonswinging* door assembly made of two or more horizontal panels hinged together vertically.

Modify Section 5.4.3.2, Fenestration and Doors, as follows (sections not shown remain unchanged):

d. 0.4 cfm/ft^2 for *nonswinging opaque doors* and glazed *sectional garage doors*, tested at a pressure of at least 1.57 pounds per square foot (psf) or higher in accordance with ANSI/DASMA 105, NFRC 400, or ASTM E283.

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FOREWORD

This addendum adds a reference to CRRC-1 for cool roof testing requirements.

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 p to Standard 90.1-2010

Modify Section 5.5.3.1 as follows (I-P and SI units):

5.5.3.1.1 Roof Solar Reflectance and Thermal Emittance. *Roofs*, in climate zones 1 through 3 shall have one of the following:

a. a minimum three-year-aged solar reflectance of 0.55 ~~when tested in accordance with ASTM C1549 or ASTM E1918,~~ and ~~in addition,~~ a minimum three-year-aged thermal emittance of 0.75, when tested in accordance with ~~ASTM C1371 or ASTM E408~~ CRRC-1 Standard.
b. a minimum ~~three-year-aged~~ Solar Reflectance Index of 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 2.1 Btu/h·ft^2·°F, based on three-year-aged solar reflectance and three-year-aged thermal emittance tested in accordance with CRRC-1 Standard.
c. increased roof insulation levels found in Table 5.5.3.1.2.

Exceptions:

a. Ballasted *roofs* with a minimum stone ballast of 17 lb/ft^2 or 23 lb/ft^2 pavers.
b. *Vegetated Roof Systems* that contain a minimum thickness of 2.5 in. of growing medium and covering a minimum of 75% of the roof area with durable plantings.
c. *Roofs*, where a minimum of 75% of the roof area:
   i. Is shaded during the peak sun angle on June 21st by permanent components or features of the building, or
   ii. Is covered by offset photovoltaic arrays, building integrated photovoltaic arrays, or solar air or water collectors, or
   iii. Is permitted to be interpolated using a combination of parts i and ii above.
d. Steep sloped *roofs*
e. Low sloped metal building roofs in climate zones 2 and 3.
f. *Roofs* over ventilated attics or *roofs* over *semi-heated spaces* or *roofs* over *conditioned spaces* that are not *cooled spaces.*
g. Asphaltic membranes in climate zones 2 and 3.

The values for three-year-aged solar reflectance and three-year-aged thermal emittance shall be determined by a laboratory accredited by a nationally recognized accreditation organization~~, such as the Cool Roof Rating Council CRRC-1 Product Rating Program,~~ and shall be labeled and certified by the manufacturer.

Modify Section 12 as follows:

12. NORMATIVE REFERENCES

American Society for Testing and Materials,
100 Barr Harbor Dr., West Conshohocken, PA 19428-2959

~~ASTM C1371-04~~	~~Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers~~
~~ASTM C1549-04~~	~~Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer~~
~~ASTM E408-71 (2002)~~	~~Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques~~
~~ASTM E903-96~~	~~Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres~~

Cool Roof Rating Council
1610 Harrison Street, Oakland, CA 94612

ANSI/CRRC-1 Standard-2010	Cool Roof Rating Council—ANSI/CRRC-1 Standard

Modify Informative Appendix E as follows:

INFORMATIVE APPENDIX E—INFORMATIVE REFERENCES

~~CRRC~~
~~Cool Roof Rating Council~~
~~1738 Excelsior Avenue~~
~~Oakland, CA 94602~~
~~(T) 866-465-2523~~
~~(F) 510-482-4421~~
~~www.coolroofs.org~~

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FOREWORD

Large amounts of fan energy can be wasted when zones report incorrect information to the control system, which causes the supply fan speed to increase, often to maximum speed. This addendum requires additional safeguards to prevent this, and for non-DDC systems requires location of sensors in locations that do not require high setpoints.

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Addendum s to Standard 90.1-2010

Revise the standard as follows (I-P and SI units):

6.5.3.2.2 Static Pressure Sensor Location. Static pressure sensors used to control VAV fans shall be ~~placed in a position~~ located such that the controller setpoint is no greater than ~~one third the total design fan static pressure~~ 1.2” w.c. (300 Pa)~~, except for systems with zone reset control complying with Section 6.5.3.2.3~~. If this results in the sensor being located downstream of major duct splits, ~~multiple~~ sensors shall be installed in each major branch to ensure that static pressure can be maintained in each.

Exception: Systems complying with Section 6.5.3.2.3.

6.5.3.2.3 Setpoint Reset. For systems with DDC of individual zones ~~boxes~~ reporting to the central control panel, static pressure setpoint shall be reset based on the *zone* requiring the most pressure; i.e., the setpoint is reset lower until one *zone* damper is nearly wide open. Controls shall provide the following:

1. Monitor zone damper positions or other indicator of need for static pressure;
2. Automatically detect those zones that may be excessively driving the reset logic and generate an alarm to the system operator; and
3. Readily allow operator removal of zone(s) from the reset algorithm.

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FOREWORD

These tables update the standard to include the new federal energy efficiency standards for motors used in HVAC equipment that will be in effect starting in 2015. It is consistent with how Standard 90.1 has provided motor efficiency to the users of this standard.

The edits also clarify the minimum efficiency values for Design B motors, which can be subtype I or subtype II design (based on information from NEMA).

Definitions are added to help end users with different motors that have different efficiency standards but the same horsepower ratings.

***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 y to Standard 90.1-2010

Add the following to Section 3 of Standard 90.1-2010 as follows (I-P and SI Units):

0.1 Abbreviations and Acronyms

IEC International Electrotechnical Commission

Modify Section 3 and Section 10 of Standard 90.1-2010 as follows (I-P Units):

3.2 Definitions

~~***General Purpose Electric Motor (subtype I)***: any electric motor that meets the definition of "general purpose" motor as codified by the Department of Energy rule in 10 CFR 431 in effect on December 19, 2007.~~

general purpose electric motor (subtype I): a motor that is designed in standard ratings with either

1. standard operating characteristics and standard mechanical construction for use under usual service conditions, such as those specified in NEMA Standards Publication MG1–1993, paragraph 14.02, "Usual Service Conditions," and without restriction to a particular application or type of application; or

2. standard operating characteristics or standard mechanical construction for use under unusual service conditions, such as those specified in NEMA Standards Publication MG1–1993, paragraph 14.03, "Unusual Service Conditions," or for a particular type of application, and which can be used in most general-purpose applications.

General purpose electric motors (subtype I) are constructed in NEMA T-frame sizes, or IEC metric equivalent, starting at 143T.

~~***General Purpose Electric Motor (subtype II)***: any electric motor incorporating the design elements of a general purpose electric motor (subtype I) that are configured as a U-frame motor, design C motor, close-coupled pump motor, footless motor, vertical solid shaft, normal thrust motor (tested in a horizontal configuration), 8-pole motor (900 rpm), or polyphase motor with voltage no more than 600 volts (other than 230 or 460 volts).~~

general purpose electric motor (subtype II): a motor incorporating the design elements of a general purpose electric motor (subtype I) that is configured as one of the following:

(i) A U-frame motor
(ii) A Design C motor
(iii) A close-coupled pump motor
(iv) A footless motor
(v) A vertical, solid-shaft, normal-thrust motor (as tested in a horizontal configuration)
(vi) An 8-pole motor (900 rpm)
(vii) A polyphase motor with voltage of not more than 600 volts (other than 230 or 460 volts)

Except for U-frame sizes, general purpose electric motor (subtype II) refers to motors constructed in NEMA T-frame sizes, or IEC metric equivalent, starting at 143T.

small electric motor: a NEMA general purpose, alternating current, single-speed induction motor, built in a two-digit frame number series in accordance with NEMA Standards Publication MG1-1987, including IEC metric equivalent motors; constructed in the NEMA 42, 48, and 56 frame sizes, or IEC metric equivalent.

10. OTHER EQUIPMENT

10.8 Product Information:

10.8B Minimum Nominal Full-Load Efficiency for 60 HZ NEMA ~~General Purpose Electric Motors (Subtype I)~~ *general purpose electric motors (subtype I)* Rated 600 Volts or Less (Random Wound)[a]

10.8C Minimum Nominal Full-Load Efficiency of ~~General Purpose Electric Motors (Subtype II and Design B)~~ *general purpose electric motors (subtype II* and all Design B motors greater than 200 horsepower)[a]

Table 10.8D Minimum Average Full-Load Efficiency for Polyphase *Small Electric Motors*[a]

Minimum Average Full-Load Efficiency (%) for Motors Manufactured on or after March 9, 2015			
Open Motors			
Number of Poles =>	2	4	6
Synchronous Speed (RPM) =>	3600	1800	1200
Motor Horsepower			
0.25	65.6	69.5	67.5
0.33	69.5	73.4	71.4
0.50	73.4	78.2	75.3
0.75	76.8	81.1	81.7
1	77.0	83.5	82.5
1.5	84.0	86.5	83.8
2	85.5	86.5	N/A
3	85.5	86.9	N/A

[a] Average full-load efficiencies shall be established in accordance with 10 CFR 431.

Table 10.8E Minimum Average Full-Load Efficiency for Capacitor-Start Capacitor-Run and Capacitor-Start Induction-Run *Small Electric Motors*[a]

Minimum Average Full-Load Efficiency (%) for Motors Manufactured on or after March 9, 2015			
Open Motors			
Number of Poles =>	2	4	6
Synchronous Speed (RPM) =>	3600	1800	1200
Motor Horsepower			
0.25	66.6	68.5	62.2
0.33	70.5	72.4	66.6
0.50	72.4	76.2	76.2
0.75	76.2	81.8	80.2
1	80.4	82.6	81.1
1.5	81.5	83.8	N/A
2	82.9	84.5	N/A
3	84.1	N/A	N/A

[a] Average full-load efficiencies shall be established in accordance with 10 CFR 431.

Add Tables 10.8D and 10.8E as follows (SI units):

Table 10.8D Minimum Average Full-Load Efficiency for Polyphase *Small Electric Motors*[a]

Minimum Average Full-Load Efficiency (%) for Motors Manufactured on or after March 9, 2015			
Open Motors			
Number of Poles =>	**2**	**4**	**6**
Synchronous Speed (RPM) =>	**3600**	**1800**	**1200**
Motor Size (kW)			
0.19	65.6	69.5	67.5
0.25	69.5	73.4	71.4
0.37	73.4	78.2	75.3
0.56	76.8	81.1	81.7
0.75	77.0	83.5	82.5
1.1	84.0	86.5	83.8
1.5	85.5	86.5	N/A
2.2	85.5	86.9	N/A

[a] Average full-load efficiencies shall be established in accordance with 10 CFR 431.

Table 10.8E Minimum Average Full-Load Efficiency for Capacitor-Start Capacitor-Run and Capacitor-Start Induction-Run *Small Electric Motors*[a]

Minimum Average Full-Load Efficiency (%) for Motors Manufactured on or after March 9, 2015			
Open Motors			
Number of Poles =>	**2**	**4**	**6**
Synchronous Speed (RPM) =>	**3600**	**1800**	**1200**
Motor Size (kW)			
0.19	66.6	68.5	62.2
0.25	70.5	72.4	66.6
0.37	72.4	76.2	76.2
0.56	76.2	81.8	80.2
0.75	80.4	82.6	81.1
1.1	81.5	83.8	N/A
1.5	82.9	84.5	N/A
2.2	84.1	N/A	N/A

[a] Average full-load efficiencies shall be established in accordance with 10 CFR 431.

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FOREWORD

The existing wording regarding water economizers is often overlooked by designers. This addendum relocates it to the economizer requirements.

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Addendum z to Standard 90.1-2010

Revise the standard as follows (I-P and SI units):

6.5.~~2.4~~1.5 Economizer Humidification System Impact. Systems with hydronic cooling and humidification systems designed to maintain inside humidity at a dew-point temperature greater than 35°F shall use a water economizer if an economizer is required by Section 6.5.1.

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FOREWORD

This electrical monitoring addendum provides the requirement to install basic electrical metering of important major end uses and to provide appropriate basic reporting of the resulting consumption data. The resulting information will be available to the occupant and operator to support decisions on efficient energy use and reduction through operational change, maintenance, control adjustment, and facility upgrade.

Monitoring of energy use can be accomplished from very simple to complicated arrangements.

Actual energy savings from monitoring feedback availability can be difficult to measure. General assessments by case study and review of applications indicates typical conservative savings from 5% to 10% of whole-building energy. The paper "The Effectiveness of Feedback on Energy Consumption" (by Sarah Darby, April 2006, Environmental Change Institute, University of Oxford) is one collective study on energy monitoring feedback that provides references to many of the available case studies and other research on the subject, most of which are based on U.S. data.

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Addendum bz to Standard 90.1-2010

Modify the standard as follows (I-P and SI units):

8.4.2 Electrical Energy Monitoring

8.4.2.1 Monitoring. Measurement devices shall be installed to monitor the electrical energy use for each of the following separately:

a. Total electrical energy
b. HVAC Systems
c. Interior lighting
d. Exterior lighting
e. Receptacle circuits

For buildings with tenants, these systems shall be separately monitored for the total building and (excluding shared systems) for each individual tenant.

8.4.2.2 Recording and Reporting. The electrical energy usage for all loads specified in Section 8.4.2.1 shall be recorded a minimum of every 15 minutes and reported at least hourly, daily, monthly, and annually. The data for each tenant space shall be made available to that tenant. The system shall be capable of maintaining all data collected for a minimum of 36 months.

Exceptions to 8.4.2.1 and 8.4.2.2:

a. Building or additions less than 10,000 ft^2 (929 m^2)
b. Individual tenant spaces less than 5,000 ft^2 (929 m^2)
c. *Dwelling units*
d. Residential buildings with less than 10,000 ft^2 (929 m^2) of common area
e. Critical and Equipment branches of NEC Article 517

Add the following reference to Section 12 (I-P and SI units):

12. NORMATIVE REFERENCES

Reference	Title
National Fire Protection Association **1 Battery March Park, P.O Box 9101,** **Quincy, MA 02269-9101**	
ANSI/NFPA 70-2008	National Electric Code

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FOREWORD

Changes were made in Addenda d, x, ab, and ac that affected Section 11 and Appendix G of Standard 90.1. This addendum makes Section 11 and Appendix G consistent with those changes.

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 cg to Standard 90.1-2010

Modify Table 11.3.1 as follows (I-P and SI units):

No.	Proposed Building Design (Column A) Design Energy Cost (DEC)	Budget Building Design (Column B) Energy Cost Budget (ECB)
6. Lighting		
	Lighting power in the *proposed building design* shall be determined as follows: a. Where a complete lighting system exists, the actual lighting power for each thermal block shall be used in the model. b. Where a lighting system has been designed, lighting power shall be determined in accordance with Sections 9.1.3 and 9.1.4. c. Where no lighting exists or is specified, lighting power shall be determined in accordance with the Building Area Method for the appropriate building type. d. Lighting system power shall include all lighting system components shown or provided for on plans (including lamps, ballasts, task fixtures, and furniture-mounted fixtures). e. The lighting schedules in the *proposed building design* shall reflect the mandatory automatic lighting control requirements in Section 9.4.1 (e.g., programmable controls or occupancy sensors). **Exception**: Automatic daylighting controls required by Section 9.4.1 shall be modeled directly in the *proposed building design* or through schedule adjustments determined by a separate daylighting analysis approved by the rating authority. f. Automatic lighting controls included in the *proposed building design* but not required by Section 9.4.1 may be modeled directly in the building simulation or be modeled in the building simulation through schedule adjustments determined by a separate analysis approved by the *authority having jurisdiction*. As an alternative to modeling such lighting controls, the *proposed building design* lighting power density may be reduced by the sum of all additional allowances per Section 9.6.2c and Table 9.6.2, which are calculated individually as the lighting power under control multiplied by *cf*, where *cf* is the appropriate control factor given in Table 9.6.2 corresponding to the space type and the lighting controls designed to be used.	a. Lighting power in the *budget building design* shall be determined using the same categorization procedure (building area method or space-by-space method ~~function~~) and categories as the *proposed design* with lighting power set equal to the maximum allowed for the corresponding method and category in ~~either~~ Section 9.2 ~~5 or 9.6~~. Additional *interior lighting power* for nonmandatory controls allowed under Section 9.6.2.c shall not be included in the *budget building design*. b. Power for fixtures not included in the *LPD* calculation shall be modeled identically in the *proposed building design* and *budget building design*. ~~Lighting controls shall be the minimum required~~. c. Mandatory automatic lighting controls required by Section 9.4.1 shall be modeled the same as the *proposed building design*.

Modify Table G3.1 as follows (I-P and SI units):

No. Proposed Building Performance	Baseline Building Performance
6. Lighting	
Lighting power in the *proposed design* shall be determined as follows: a. Where a complete lighting system exists, the actual lighting power for each thermal block shall be used in the model. b. Where a lighting system has been designed, lighting power shall be determined in accordance with Sections 9.1.3 and 9.1.4. c. Where lighting neither exists nor is specified, lighting power shall be determined in accordance with the Building Area Method for the appropriate building type. d. Lighting system power shall include all lighting system components shown or provided for on the plans (including lamps and ballasts and task and furniture-mounted fixtures). **Exception:** For multifamily *dwelling units*, hotel/motel guest rooms, and other spaces in which lighting systems are connected via receptacles and are not shown or provided for on building plans, assume identical lighting power for the *proposed* and *baseline building designs* in the simulations. e. Lighting power for parking garages and building facades shall be modeled. ~~f. Credit may be taken for the use of automatic controls for daylight utilization but only if their operation is either modeled directly in the building simulation or modeled in the building simulation through schedule adjustments determined by a separate daylighting analysis approved by the *rating authority*.~~ ~~g. For automatic lighting controls in addition to those required for minimum code compliance under Section 9.4.1, credit may be taken for automatically controlled systems by reducing the connected lighting power by the applicable percentages listed in Table G3.2. Alternatively, credit may be taken for these devices by modifying the lighting schedules used for the *proposed design*, provided that credible technical documentation for the modifications are provided to the *rating authority*.~~ f. The lighting schedules in the *proposed building design* shall reflect the mandatory automatic lighting control requirements in Section 9.4.1 (e.g., programmable controls or occupancy sensors). **Exception**: Automatic daylighting controls required by Section 9.4.1 shall be modeled directly in the p*roposed building design* or through schedule adjustments determined by a separate daylighting analysis approved by the rating authority. g. Automatic lighting controls included in the *proposed building design* but not required by Section 9.4.1 may be modeled directly in the building simulation or be modeled in the building simulation through schedule adjustments determined by a separate analysis approved by the *authority having jurisdiction*. As an alternative to modeling such lighting controls, the *proposed building design* lighting power may be reduced by the sum of all additional allowances per Section 9.6.2c and Table 9.6.2, which are calculated individually as the lighting power under control multiplied by *cf*, where *cf* is the appropriate control factor given in Table 9.6.2 corresponding to the space type and the lighting controls designed to be used.	a. Lighting power in the baseline building design shall be determined using the same categorization procedure (building area method or space-by-space method ~~function~~) and categories as the *proposed design* with lighting power set equal to the maximum allowed for the corresponding method and category in Section 9.2. Additional *interior lighting power* for nonmandatory controls allowed under Section 9.6.2.c shall not be included in the *baseline building design*. ~~No automatic lighting controls (e.g., programmable controls or occupancy sensors) shall be modeled in the baseline building design, as the lighting schedules used are understood to reflect the mandatory control requirements in this standard.~~ b. Mandatory automatic lighting controls required by Section 9.4.1 shall be modeled the same as the *proposed building design*.

Delete Table G3.2 as follows (I-P and SI units):

TABLE G3.2 Power Adjustment Percentages for Automatic Lighting Controls

~~Automatic Control Device(s)~~	~~Non-24-h and ≤5000 ft^2~~	~~All Other Spaces not required to have automatic lighting control~~
~~1. Programmable timing control~~	~~10%~~	~~0%~~
~~2. Occupancy sensor~~	~~15%~~	~~10%~~
~~3. Occupancy sensor and programmable timing control~~	~~15%~~	~~10%~~

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FOREWORD

Since the ECB method and Addendum G were initially adopted into Standard 90.1, the cooling tower market has moved to variable-speed fan controls rather than two-speed fan motors on cooling towers. The change to variable-speed drives on the cooling tower fan(s) reflects current practice and will serve as a truer baseline for comparisons between the baseline system (Systems 7 and 8) and the proposed building system by users of Appendix G as well as the Energy Cost Budget Method.

In addition, an exception has been added for climates with extremely high design wet-bulb temperatures such that the baseline system will not require an unreasonably large cooling tower. In such climate zones, the current requirement is not a realistic baseline and unfairly penalizes the proposed design. The changes in this Addendum correct this condition by providing a more realistic baseline.

Finally, the use of "open circuit" as opposed to "closed circuit" cooling towers has been clarified in the text (reference Addendum ad to Standard 90.1-2007).

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 ci to Standard 90.1-2010

Modify Section 3.2—Definitions as follows (I-P and SI units):

cooling design wet-bulb temperature: the mean coincident outdoor wet-bulb temperature utilized in conjunction with the *cooling design dry-bulb temperature*, often used for the sizing of cooling *systems* ~~and evaporative heat rejection *systems* such as cooling towers~~.

evaporation design wet-bulb temperature: the outdoor wet-bulb temperature utilized in conjunction with the mean coincident dry-bulb temperature, often used for the sizing of evaporative *systems* such as cooling towers.

Modify footnote e to Table 11.3.2A as follows (I-P and SI units):

e. **Chilled water:** For *systems* using purchased chilled water, the chillers are not explicitly modeled and chilled-water costs shall be based as determined in Section 11.2.3. Otherwise, the *budget building design's* chiller plant shall be modeled with chillers having the number as indicated in Table 11.3.2B as a function of *budget building design* chiller plant load and type as indicated in Table 11.3.2C as a function of individual chiller load. Where chiller fuel source is mixed, the system in the *budget building design* shall have chillers with the same fuel types and with capacities having the same proportional capacity as the *proposed building design's* chillers for each fuel type. Chilled-water supply temperature shall be modeled at 44°F (6.7°C) design supply temperature and 56°F (13°C) return temperature. Piping losses shall not be modeled in either building model. Chilled-water supply water temperature shall be reset in accordance with Section 6.5.4.3. Pump system power for each pumping system shall be the same as the *proposed building design*; if the *proposed building design* has no chilled-water pumps, the *budget building design* pump power shall be 22 W/gpm (349 kW/1000 L/s) (equal to a pump operating against a 75 ft (23 m) head, 65% combined impeller and motor *efficiency*). The chilled water system shall be modeled as primary-only variable flow with flow maintained at the design rate through each chiller using a bypass. Chilled-water pumps shall be modeled as riding the pump curve or with variable-speed drives when required in Section 6.5.4.1. The heat rejection device shall be an axial fan open circuit cooling tower with ~~two-speed~~ variable-speed fan~~s~~ control if required in Section 6.5.5. Condenser water design supply temperature shall ~~be 85°F or 10° F (29°C or 5.6°C)~~ be calculated using the cooling tower approach to ~~1%~~ the 0.4% *evaporation design wet-bulb temperature* ~~design wet-bulb temperature~~ as generated by the formula below, ~~whichever is lower,~~ with a design temperature rise of 10°F (5.6°C).

$$\text{Approach}_{10°F\ Range} = 25.72 - (0.24 \times WB)$$

where WB is the *0.4% evaporation design wet-bulb temperature* in °F; valid for wet bulbs from 55°F to 90°F.

$$\text{Approach}_{5.6°C\ Range} = 10.02 - (0.24 \times WB)$$

where WB is the *0.4% evaporation design wet-bulb temperature* in °C; valid for wet bulbs from 12.8°C to 32.2°C.

The tower shall be controlled to maintain a 70°F (21°C) leaving-water temperature where weather permits, floating up to leaving-water temperature at design conditions. Pump system power for each pumping system shall be the same as the *proposed building design*; if the *proposed building design* has no condenser water pumps, the *budget building design* pump power shall be 19 W/gpm (310 kW/1000 L/s) (equal to a pump operating against a 60 ft head (18 m), 60% combined impeller and motor *efficiency*). Each chiller shall be modeled with separate condenser water and chilled-water pumps interlocked to operate with the associated chiller.

Modify G3.1.3.11 as follows (I-P and SI units):

G3.1.3.11 Heat Rejection (Systems 7 and 8). The heat rejection device shall be an axial fan open circuit cooling tower with ~~two-speed~~ variable-speed fan~~s~~ control. Condenser water design supply temperature shall ~~be 85°F or 10°F (29°C or 5.6°C)~~ be calculated using the cooling tower approach to ~~1%~~ the 0.4% *evaporation design wet-bulb temperature* as generated by the formula below ~~design wet-bulb temperature, whichever is lower,~~ with a design temperature rise of 10°F (5.6°C).

$$\text{Approach}_{10°F\ Range} = 25.72 - (0.24 \times WB)$$

where WB is the *0.4% evaporation design wet-bulb temperature* in °F; valid for wet bulbs from 55°F to 90°F.

$$\text{Approach}_{5.6°C\ Range} = 10.02 - (0.24 \times WB)$$

where WB is the *0.4% evaporation design wet-bulb temperature* in °C; valid for wet bulbs from 12.8°C to 32.2°C.

The tower shall be controlled to maintain a 70°F (21°C) leaving-water temperature where weather permits, floating up to leaving-water temperature at design conditions. The *baseline building design* condenser-water pump power shall be 19 W/gpm (310 kW/1000 L/s). Each chiller shall be modeled with separate condenser water and chilled-water pumps interlocked to operate with the associated chiller.

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FOREWORD

This addendum corrects the definitions of primary sidelighted area, secondary sidelighted area, and sidelighting effective area to use the term "vertical fenestration" instead of "window" to clarify that glazed doors and other fenestration products are included as well as windows.

Additionally, the definition of daylight area under rooftop monitors is corrected to include the spread of light beyond the width of the rooftop monitor glazing.

***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 ds to Standard 90.1-2010

Revise the Standard as follows (I-P and SI units).

Modify definitions in Section 3.2 as follows:

daylight area:

b. ***under ~~rooftop monitors~~ clerestories:*** the *daylight area under ~~rooftop monitors~~ clerestories* is the combined *daylight area* under each *clerestory* or *rooftop monitor* without double counting overlapping areas. The *daylight area* under each *clerestory* or *rooftop monitor* is ~~the product of~~ the width of the *vertical ~~glazing~~ fenestration* above the ceiling level plus 2 ft (0.6 m) on each side, multiplied by ~~and~~ the smallest of the following horizontal distances inward from the bottom edge of the glazing, (See Figure 3.2):

1. the monitor sill height, MSH, (the vertical distance from the floor to the bottom edge of the monitor glazing), or
2. the distance to the edge of any *primary sidelighted area,* or
3. the distance to the front face of any vertical obstruction where any part of the obstruction is farther away than the difference between the height of the obstruction and the monitor sill height (MSH-OH).

primary sidelighted area: the total *primary sidelighted area* is the combined *primary sidelighted area* without double counting overlapping areas. The floor area for each *primary sidelighted area* is directly adjacent to *vertical ~~glazing~~fenestration* below the ceiling with an area equal to the product of the *primary sidelighted area* width and the *primary sidelighted area* depth. See Figure 3.3.

The *primary sidelighted area* width is the width of the ~~window~~*vertical fenestration* plus, on each side, the smallest of:

1. 2 ft (0.6 m), or
2. the distance to any 5 ft (1.5 m) or higher vertical obstruction.

The *primary sidelighted area* depth is the horizontal distance perpendicular to the ~~glazing~~ *vertical fenestration* which is the smaller of:

1. one ~~window~~*vertical fenestration* head height (head height is the distance from the floor to the top of the glazing), or
2. the distance to any 5 ft (1.5 m) or higher vertical obstruction.

secondary sidelighted area: the total *secondary sidelighted area* is the combined *secondary sidelighted area* without double counting overlapping areas. The floor area for each *secondary sidelighted area* is directly adjacent to a *primary sidelighted area* with an area equal to the product of the *secondary sidelighted area* width and the *secondary sidelighted area* depth. See Figure 3.4.

The *secondary sidelighted area* width is the width of the ~~window~~*vertical fenestration* plus, on each side, the smallest of:

1. 2 ft (0.6 m), or
2. the distance to any 5 ft (1.5 m) or higher vertical obstruction.

The *secondary sidelighted area* depth is the horizontal distance perpendicular to the *vertical fenestration* ~~glazing~~ which begins at the edge of the *primary sidelighted area* depth and ends at the smaller of:

1. one *vertical fenestration* ~~window~~ head height (head height is the distance from the floor to the top of the glazing), or
2. the distance to any 5 ft (1.5 m) or higher vertical obstruction.

If the adjacent *primary sidelighted area* ends at a 5 ft (1.5 m) or higher vertical obstruction or beyond the nearest edge of a neighboring *daylight area under skylight* or *primary sidelighted area*, there is no *secondary sidelighted area* beyond such obstruction or the edge of such areas.

***sidelighting effective aperture**:* relationship of daylight transmitted through *vertical fenestration* ~~windows~~ to the *primary sidelighted area~~s~~*. The *sidelighting effective aperture* is calculated according to the following formula:

Sidelighting Effective Aperture =

$$\frac{\sum \text{~~window~~ } \textit{vertical fenestration area} \times \text{~~window~~ } \textit{vertical fenestration VT}}{\text{~~Area of~~ primary sidelighted area}}$$

where ~~window~~ *vertical fenestration VT* is the *visible transmittance* of ~~windows~~ *vertical fenestration* as determined in accordance with Section 5.8.2.6.

9.4.1.4 Automatic Daylighting Controls for *Toplighting*. When the total *daylight area under skylights* plus the total *daylight area under ~~roof top monitors~~ clerestories* in an *enclosed space* exceeds 4,000 ft^2, the lamps for *general lighting* in the daylight area shall be separately controlled by at least one multilevel photocontrol (including continuous dimming devices) having the following characteristics:

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INFORMATIVE APPENDIX— 18-MONTH SUPPLEMENT: ADDENDA TO ANSI/ASHRAE/IES STANDARD 90.1-2010

This supplement includes Addenda a, b, c, g, h, j, k, o, p, s, y, z, bz, cg, ci, and ds to ANSI/ASHRAE/IES Standard 90.1-2010. The following table lists each addendum and describes the way in which the standard is affected by the change. It also lists the ASHRAE, IES, and ANSI approval dates for each addendum.

Addendum	Section(s) Affected	Description of Change(s)*	ASHRAE Standards Committee Approval	ASHRAE BOD Approval	IES Approval	ANSI Approval
90.1a	6. Heating, Ventilating, and Air Conditioning	This addendum updates the test procedure references for Design A and Design B motors in the tables in Section 10.8 and adds a normative reference in Section 12. This makes the table references more consistent with other equipment tables (and other test procedure references) in the standard.	1/21/12	1/26/12	1/18/12	1/26/12
90.1b	10. Other Equipment, 12. Normative References	This addendum requires escalators and moving walks to slow to the minimum permitted speed found in ASME A17.1/CSA B44.	6/25/11	6/29/11	6/30/11	6/30/11
90.1c	Informative Appendix G	This addendum clarifies the lab exhaust requirements for modeling in Appendix G.	6/25/11	6/29/11	6/30/11	6/30/11
90.1g	6. Heating, Ventilating, and Air Conditioning	This addendum adds two tables, Tables 6.8.1L and 6.8.1M, which define the minimum efficiency requirements for commercial refrigerators and freezers. Also references to AHRI Standard 1200 and AHAM Standard HRF-1 are added in Section 12.	6/25/11	6/29/11	6/30/11	6/30/11
90.1h	6. Heating, Ventilating, and Air Conditioning	This addendum amends the minimum energy efficiency standards for water-to-air heat pumps (water loop, ground water, and ground loop) listed in Table 6.8.1B (“Electrically Operated Unitary and Applied Heat Pumps”).	6/25/11	6/29/11	6/30/11	6/30/11
90.1j	6. Heating, Ventilating, and Air Conditioning	This addendum corrects three issues in Table 6.8.1A (“Electrically Operated Unitary Air Conditioners and Condensing Units”).	6/25/11	6/29/11	6/30/11	6/30/11
90.1k	8. Power	This addendum makes the transformer test procedure references consistent with other references in Section 6.	6/25/11	6/29/11	6/30/11	6/30/11
90.1o	5. Building Envelope	This addendum updates the fenestration air leakage provisions of Standard 90.1-2010 to clarify the requirements for glazed sectional garage doors. A definition for sectional garage doors is also added.	1/21/12	1/26/12	1/18/12	1/26/12
90.1p	5. Building Envelope	This addendum adds a reference to CRRC-1 for cool roof testing requirements.	1/21/12	1/26/12	1/18/12	1/26/12
90.1s	6. Heating, Ventilating, and Air Conditioning	This addendum requires additional safeguards to prevent incorrect information from being sent to the fan control system, and for non-DDC systems requires location of sensors in locations that do not require high setpoints.	1/21/12	1/26/12	1/18/12	1/26/12

Addendum	Section(s) Affected	Description of Change(s)*	ASHRAE Standards Committee Approval	ASHRAE BOD Approval	IES Approval	ANSI Approval
90.1y	10. Other Equipment	This addendum updates the standard to include the new federal energy efficiency standards for motors used in HVAC equipment that will be in effect starting in 2015. It is consistent with how Standard 90.1 has provided motor efficiency to the users of this standard.	1/21/12	1/26/12	1/18/12	1/26/12
90.1z	6. Heating, Ventilating, and Air Conditioning	This addendum relocates the water economizer requirements to the economizer section of the standard.	1/21/12	1/26/12	1/18/12	1/26/12
90.1bz	8. Power	This addendum provides electrical monitoring requirement to install basic electrical metering of important major end uses and to provide appropriate basic reporting of the resulting consumption data. The resulting information will be available to the occupant and operator to support decisions on efficient energy use and reduction through operational change, maintenance, control adjustment, and facility upgrade.	1/21/12	1/26/12	1/18/12	2/24/12
90.1cg	11. Energy Cost Budget Method, Informative Appendix G	This addendum makes Section 11 and Appendix G of Standard 90.1 consistent with Addenda d, x, ab, and ac to Standard 90.1-2007 (see Appendix F to Standard 90.1-2007 for more information on these addenda)	1/21/12	1/26/12	1/18/12	1/26/12
90.1ci	11. Energy Cost Budget Method, Informative Appendix G	This addendum makes requirements in Section 11 and Appendix G related to cooling towers consistent with current industry practice, which will serve as a truer baseline for comparisons between Systems 7 and 8.	1/21/12	1/26/12	1/18/12	2/24/12
90.1ds	5. Building Envelope	This addendum corrects the definitions of primary sidelighted area, secondary sidelighted area, and sidelighting effective area to use the term “vertical fenestration” instead of “window” to clarify that glazed doors and other fenestration products are included as well as windows.	1/21/12	1/26/12	1/18/12	2/24/12

* These descriptions may not be complete and are provided for information only.

NOTE

When addenda, interpretations, or errata to this standard have been approved, they can be downloaded free of charge from the ASHRAE Web site at http://www.ashrae.org.

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.