

Additions and Corrections

This report includes additional information, and technical errors found between June 15, 2008, and January 18, 2012, in the SI editions of the 2008, 2009, 2010, and 2011 *ASHRAE Handbook* volumes. Occasional typographical errors and nonstandard symbol labels will be corrected in future volumes. The most current list of Handbook additions and corrections is on the ASHRAE Web site (www.ashrae.org).

The authors and editor encourage you to notify them if you find other technical errors. Please send corrections to: Handbook Editor, ASHRAE, 1791 Tullie Circle NE, Atlanta, GA 30329, or e-mail mowen@ashrae.org.

2008 HVAC Systems and Equipment

- p. 6.2, after Eq. (2). Units for T_p and T_r should be K, not °C.
- p. 6.4, 1st col. After Eq. (9b), the multiplier for large spaces should be $(4.91/D_e)^{0.25}$.
- p. 10.7, Fig. 9. The title should read “Trapping Temperature-Regulated Coils.” Also, the bottom of the figure was cut off; please see the entire figure, presented below.
- p. 12.20, 2nd col., after Eq. (18). The reference to Equation (21) should be to Equation (18).
- p. 12.24, Effect on Piping Pressure Loss. The reference to Equation (235) should be to Equation (18).
- p. 17.5, 1st col. In the equation for chiller sizing, delete “3.5”
- p. 21.1, Fig. 1. Please replace the figure with the one at right.
- p. 22.1, Fig. 1. Please replace the figure with the one at bottom right.
- p. 23.4, Fig. 7. Replace the figure with the one on p. A.2.
- p. 23.10, Dry Air-Conditioning Systems, 4th paragraph. After the second sentence, please add, “Dehumidified ventilation air that

positively pressurizes the building may help counter moist air infiltration.”

- p. 25.4, 1st col. The second equation should solve for t_4 .
- p. 25.8, Paragraphs 7 to 11 repeat text earlier on the page; delete them. In Eq. (24), in both denominators, change m_e to m_s .
- p. 30.10, 2nd col. Midway down the column, change “31.00 MJ/m³” to “31.21 MJ/m³.”
- p. 31.7, 2nd col., 4th line. Change “sue” to “use.”
- p. 35.9, after Eq. (17). Units for d_i should be mm.
- p. 34.36, References. The Rutz (1992) resource is no longer available from the ASHRAE Handbook editor; instead, it is available

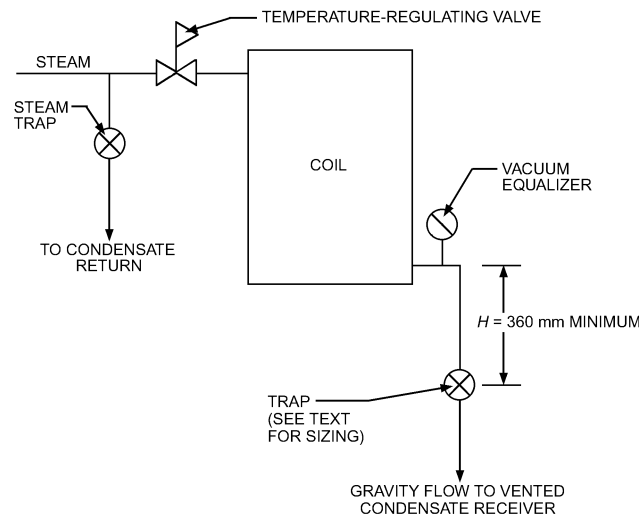


Fig. 9 Trapping Temperature-Regulated Coils
(2008 HVAC Systems and Equipment, Chapter 10, p. 7)

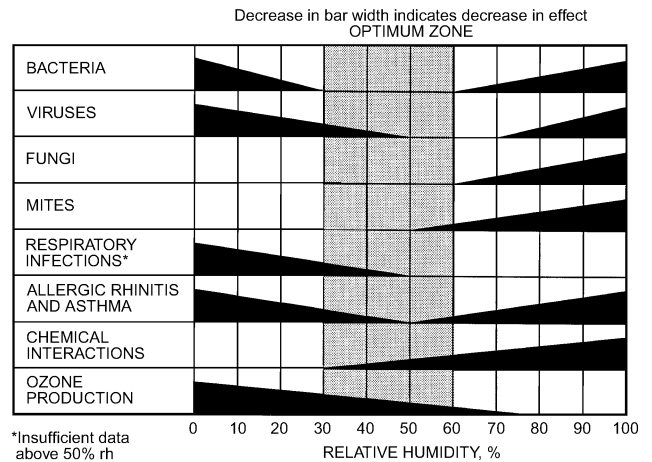


Fig. 1 Optimum Humidity Range for Human Comfort and Health
(Adapted from Sterling et al. 1985)
(2008 HVAC Systems and Equipment, Chapter 21, p. 1)

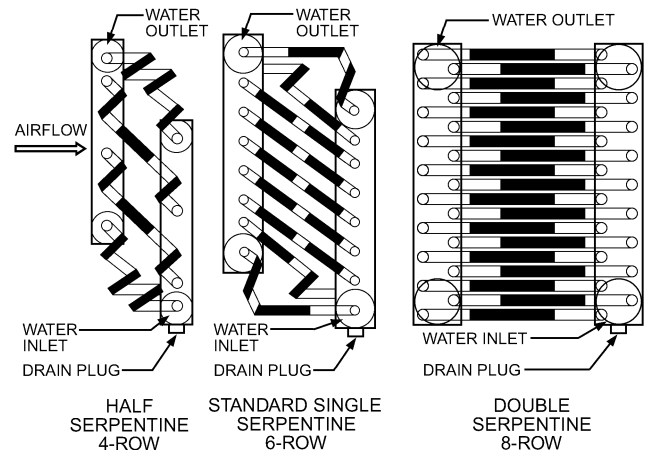


Fig. 1 Typical Water Circuit Arrangements
(2008 HVAC Systems and Equipment, Chapter 22, p. 1)

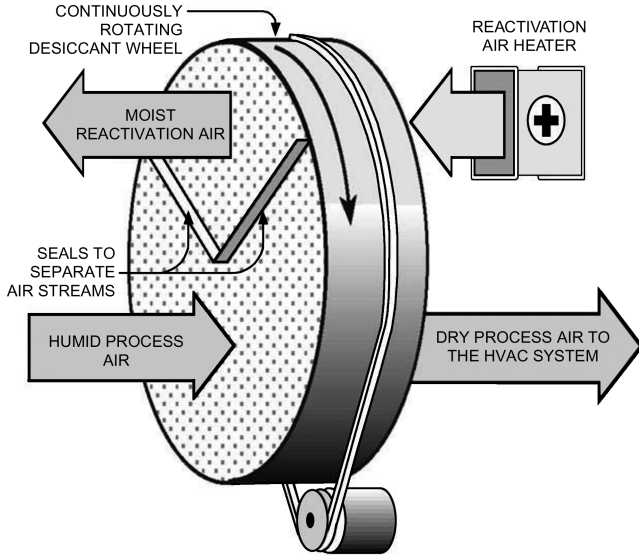


Fig. 7 Typical Rotary Dehumidification Wheel
(2008 HVAC Systems and Equipment, Chapter 23, p. 4)

from NTIS at <http://www.ntis.gov/search/product.aspx?ABBR=PB92217504>.

p. 43.6, Eq. (3). Change “ Dp ” to “ Δp .”

p. 45.12, Table 11, Notes. L is determined from Equation (5), not Equation (4).

p. 49.3, 1st col., 3rd line. The Energy Policy and Conservation Act of 2005 should be Public Law 109-58.

p. 50.28, Open Systems paragraph. Change “corrosion coon systems” to “corrosion coupon systems.”

2009 Fundamentals

Contributors List. For Ch. 15, add the following contributors: Hakim Elmahdy, National Research Council of Canada; Brian Crooks; John L. Wright, University of Waterloo; and William R. McCluney, SunPine Consulting.

p. 1.4, Table 2. Correct values for s_s for 40 to 64°C are provided below.

Temp. t , °C	s_s	Temp. t , °C	s_s
40	0.5650	66	2.0117
41	0.5925	67	2.1220
42	0.6213	68	2.2398
43	0.6514	69	2.3659
44	0.6830	70	2.5011
45	0.7162	71	2.6464
46	0.7509	72	2.8028
47	0.7874	73	2.9715
48	0.8256	74	3.1539
49	0.8658	75	3.3517
50	0.9081	76	3.5668
51	0.9525	77	3.8014
52	0.9993	78	4.0581
53	1.0485	79	4.3401
54	1.1003	80	4.6511
55	1.1549	81	4.9956
56	1.2126	82	5.3794
57	1.2734	83	5.8091
58	1.3377	84	6.2933
59	1.4056	85	6.8430

Temp. t , °C	s_s	Temp. t , °C	s_s
60	1.4775	86	7.4721
61	1.5537	87	8.1987
62	1.6345	88	9.0472
63	1.7203	89	10.0508
64	1.8114	90	11.2558
65	1.9084		

pp. 1.6-1.7, Table 3. In the column headings, change “Sat. Solid” to “Sat. Liquid” in three places.

p. 1.9, 1st col. The reference to Equation (38) in Chapter 5 should be to Chapter 6.

p. 1.12, Example 3. Reference to Table 2 should be to Table 3. Fig. 2 should be Fig. 3, and Fig. 3 should be Fig. 2.

p. 1.13, Example 5. The reference to Table 2 should be to Table 3.

p. 1.14, Example 5. The solution to the equation should be 15 g_w/s, or 0.015 kg_w/s.

p. 3.2, 2nd col., last paragraph. Delete the second instance of the following sentence: “The terms E_M and $H_M (= E_M/g)$ are defined as positive, and represent energy added to the fluid by pumps or blowers.”

p. 4.19, Table 8, Eq. (T8.12). Change 0.37 to 0.037.

p. 4.22, Table 10. Correct Eqs. (T10.1) and (T10.7) as follows:

$$\frac{1 - \exp[-N(1 + c_r)]}{1 + c_r} \quad (\text{T10.1})$$

$$\frac{1 - \exp(-c_r \gamma)}{c_r} \quad (\text{T10.7})$$

p. 4.24, Table 11. In the Muley and Manglik (1999) equation for Nu, the last line should read “ $\times \text{Re}^{0.728-0.0543 \sin\{\pi(90-\beta)/45+3.7\}}$.”

p. 9.17, between Eqs. (64) and (65). The reference to Equation (58) should be to Equation (60).

p. 9.19, Eq. (79). The equation should be $t_{oc} = 17.8 + 0.31t_{out}$.

p. 13.14, 2nd col., 3rd full paragraph. The equation should read $\rho = P/(R_{air}T)$.

p. 14.1, 1st paragraph. The StationFinder utility is included only with the HandbookCD+ version of this chapter, not with the CD-ROM included with the print edition.

p. 14.7, Eq. (5). Add a closing parenthesis at the end of the equation.

p. 14.9, Eq. (20). The first operator should be +, not –.

Ch. 14, Appendix: Design Conditions for Selected Locations, and complete listing of stations on CD. The main entry for Taiwan should read “Taiwan.”

Ch. 14, Station List and Climatic Design Conditions Tables (available on the CD-ROM). In the Russian Federation, station UST-ISIM, WMO ID 283820, the longitude should be 71.18 E. Hong Kong International (WMO ID 450070) and Hong Kong Observatory (WMO ID 450050) should appear under Hong Kong rather than China. Correct the following latitudes and longitudes:

Station	WMO ID	Latitude	Longitude
Somersets, KY	724354	37.054N	84.601W
South St. Paul, MN	726603	44.857N	93.018W
Dyersburg, TN	723347	36.000 N	89.400W

p. 15.11, Example 2, Solution. The second reference to Table 4 should be to Table 1.

p. 15.11, Example 3, Solution. The mullions should be 80 mm.

p. 15.16, 1st col., top. Add “when” before “greater accuracy is desired.”

p. 15.29, Table 12. Change the title to read, “Solar Heat Gain Coefficients and U-Factors for Standard hollow Glass Block Wall Panels.”

p. 15.60, Symbols. Add the definition “ F_R = radiant fraction.”

p. 15.62, References. Add the following source before LBL 2003:

Laoudi, A., A.D. Galasiu, M.R. Atif, and A. Haqqani. 2003. SkyVision: A software tool to calculate the optical characteristics and daylighting performance of skylights. *Building Simulation, 8th IBPSA Conference*, Eindhoven, Netherlands, pp. 705-712.

p. 16.7, Eq. (26). On the third line, change “[$C_p(3) - C_p(4)$]” to “[$C_p(3) + C_p(4)$].”

p. 16.23, Eq. (48). The equation should use the absolute value of Δt .

p. 17.5, Eq. (8), definition for A_L . Discharge coefficient C_D should equal 1, and the unit for A_L is cm^2 .

p. 17.7. For Eq. (11), the correct equation is as follows:

$$Q_v = 0.05A_{cf} + 3.5(N_{br} + 1) \quad (11)$$

In the definitions after Eq. (18), change $q_{vnt,l}$ to q_{vnl} .

p. 17.8, Eq. (21). The closing parenthesis should be at the end of the equation.

p. 18.2, 2nd col., Cooling Load Calculations in Practice section. On the third line, change “filtration” to “infiltration.”

pp. 18.8-18.11, Tables 5A to 5E. Items with an asterisk appear only in Swierzyzna (2009); all others appear in both Swierzyzna (2008) and (2009). In the heading for Table 5E, change “Btu/h” to “W.”

p. 18.14, Eq. (9). In the definitions, change 0.24 to 1.006, and 0.45 to 1.84.

p. 18.31, Eq. (39). The denominator of the first fraction should be $\pi(z_2 - z_1)$.

p. 18.31, Eq. (40). The correct equation is as follows:

$$U_{avg,bf} = \frac{2k_{soil}}{\pi w_b} \times \left[\ln \left(\frac{w_b}{2} + \frac{z_f}{2} + \frac{k_{soil} R_{other}}{\pi} \right) - \ln \left(\frac{z_f}{2} + \frac{k_{soil} R_{other}}{\pi} \right) \right] \quad (40)$$

p. 18.32, Table 24. In column 1, change the second occurrence of “200 mm” to “100 mm.”

p. 18.33, 2nd col. In the list of variables under item 2, T_r = room or return air temperature, °C.

p. 18.43, Table 31. For the radiant and convective columns, use the data shown at right.

p. 18.42, Part 4. Change “the addition of a overhang” to “the addition of a 3 m overhang.”

p. 19.18, Eqs. (55), (57), and (59). Multiply the right-hand side of the equation by the conversion factor 86 400 s/day. For Eq. (57), also change η_h to η_c .

p. 20.12, Fig. 10. The correct figure is shown above right.

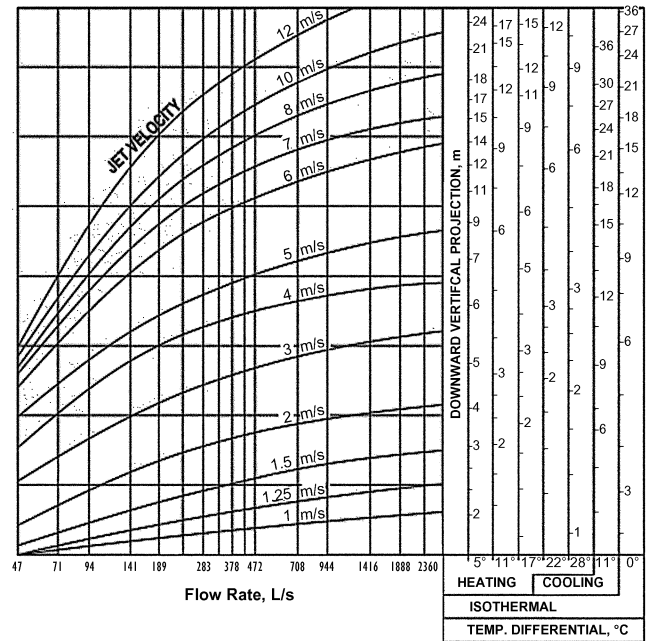


Fig. 10 Downward Vertical Projection of Heated and Cooled Jets Along Perimeter Spaces (2009 Fundamentals, Chapter 20, p. 12)

Data for Table 31

(2009 Fundamentals, Ch. 18, p. 43)

Convective 54%, W	Radiant 46%, W	Convective 54%, W	Radiant 46%, W
-9	-7	473	403
-14	-12	672	572
-19	-16	836	712
-23	-20	907	772
-26	-22	834	711
-10	-9	616	525
58	50	254	217
137	117	48	40
211	180	34	29
273	232	21	18
322	275	9	8
374	318	0	0

p. 20.13, 2nd col., Air Diffusion Performance Index (ADPI), 1st paragraph. The reference should be to Equation (15).

p. 20.14, 2nd col., Convective Flows Associated with Space Heat Sources, last paragraph. The reference should be to Equation (12).

p. 21.6, Table 1. Units for Absolute Roughness ϵ should be mm.

p. 21.33, Table for ED5-1, Wye, 30°, Converging. In the expression centered over the table columns, change Q_b to Q_s .

pp. 21.41-44. In the table titles, change “D5-3” to “ED5-3.”

pp. 21.42-44, Tables for ED5-3, $D_c > 250$ mm, Converging. In the expressions centered over the table columns, change Q_b to Q_s (three places).

p. 21.44, Figures for ED5-6 and ED5-9. The correct figures are shown on p. A.4, left column.

pp. 21.45 (bottom table) and 21.46 (top table). Change “ C_{b1} Values” to “ C_{b2} Values.”

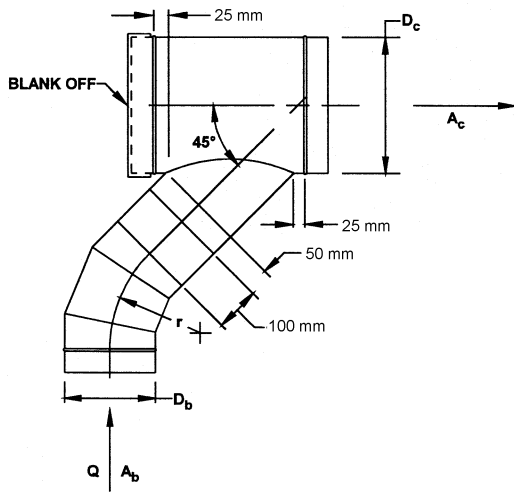


Figure for ED5-6
(2009 Fundamentals, Chapter 21, p. 44)

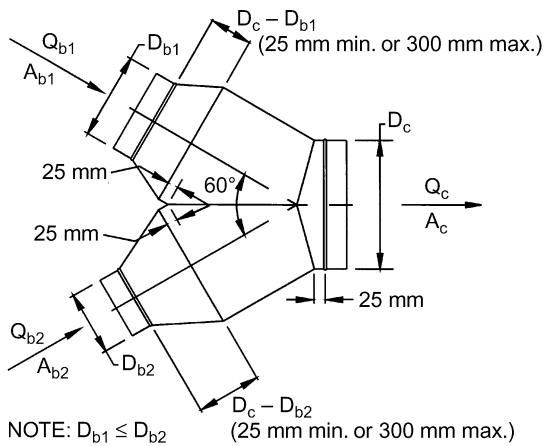


Figure for ED5-9
(2009 Fundamentals, Chapter 21, p. 44)

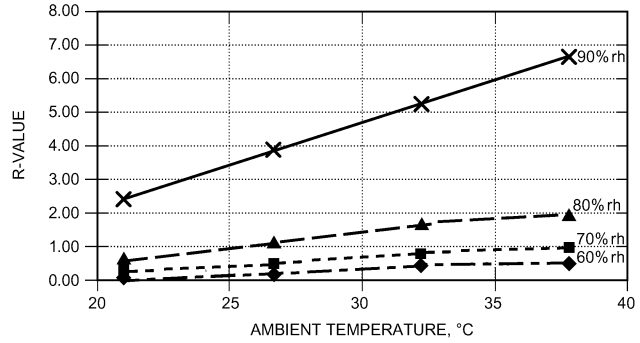


Fig. 6 R-Value Required to Prevent Condensation on Surface with Emittance $\epsilon = 0.1$
(2009 Fundamentals, Chapter 23, p. 14)

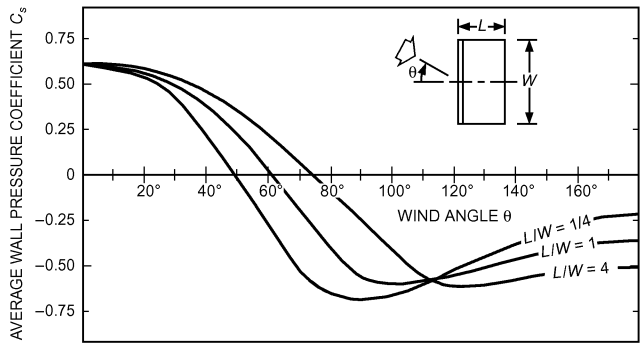


Fig. 7 Surface-Averaged Wall Pressure Coefficients for Tall Buildings
(Akins et al. 1979)
(2009 Fundamentals, Chapter 24, p. 5)

p. 23.2, Table 2. The heading for the rightmost column should read, “Nominal Pipe or Tube Size, mm.”

p. 23.13. In Eq. (3), delete “0.2.” In definitions following Eq. (5), units for P should be m; for C_p , the value should be 1001 J/(kg·K). In Example 1, the last equation should be $50 + 2.7 = 52.7^\circ\text{C}$.

p. 23.14, Fig. 6. The correct figure is shown at upper right.

p. 24.5, Fig. 7. The curves for $L/W = 1/4$ and $L/W = 4$ should be swapped. The correct figure is shown at right.

p. 26.7, Table 4. The density value for Roofing, Asbestos/cement shingles should be 1920 kg/m^3 .

p. 26.19, References. Please add the following entry:

Cardenes, T.J. and G.T. Bible. 1987. *The thermal properties of wood—Data base*. American Society of Testing and Materials, West Conshohocken, PA.

pp. 27.3-4, Example 3. In the example introduction, change R-13 to R-2.3, and R-4 to R-0.7. After the table for the parallel-path method, U_2 should equal 0.541. Substituting this value into the equation for U_{av} gives a result of 0.067, and for R_{Tav} a result of 2.79. In the table for the isothermal-planes method, row 4, $R_{avs} = 1.54$. In the equation

for U_{avs} , change the result to 0.651, and substitute this into the equation for R_{avs} on p. 27.4, giving a result of 1.54.

p. 27.9, Step 4, last line. The reference should be to Table 3 in Chapter 1.

p. 29.9, Table 9. In the Specific Volume of Suction Gas column, the value for R-134a (tetrafluoroethane) should be 0.1214.

p. 36.2, 1st col., Hydraulic diameter D_h . The second sentence should read “For a rectangular duct with dimensions $W \times H$, the hydraulic diameter $D_h = 2WH/(W + H)$.”

p. 39.2, Table 2, Viscosity (absolute). In the fourth data row, change 0.0671955 to 0.671955.

2010 Refrigeration

Ch. 1. All existing references to Table 19 should be to Table 20. All existing references to Table 20 should be to Table 19.

p. 19.2, Eq. (4). Change t_{wo} to x_{wo} .

2011 HVAC Applications

(CD only) Table of Contents, p. 2. Replace the second instance of “Building Operations and Management” with “General Applications.”

Contributors List. For Chapter 4, add Dennis Wessel, Karpinski Engineering.

p. 5.7, 2nd col., 2nd bulleted point. Change 15 m/s to 0.15 m/s.

Table 4 Energy Cost Percentiles from 2003 Commercial Survey
(2011 HVAC Applications, Ch. 36, p. 9)

Building Use	Weighted Energy Cost Values, \$/yr per gross square metre					Mean
	Percentiles					
	10th	25th	50th	75th	90th	
Administrative/professional office	5.38	8.83	14.64	20.67	27.77	16.68
Bank/other financial	11.73	14.75	21.53	31.54	48.12	25.94
Clinic/other outpatient health	6.57	9.36	16.47	21.85	44.46	18.73
College/university	4.74	12.92	14.75	24.43	32.40	19.59
Convenience store	26.70	40.37	56.62	86.33	108.93	66.42
Convenience store with gas station	21.42	29.60	49.62	73.52	94.08	55.11
Distribution/shipping center	2.58	3.55	5.81	9.47	14.75	7.97
Dormitory/fraternity/sorority	6.24	7.43	9.36	13.89	22.93	11.52
Elementary/middle school	5.81	8.40	11.73	16.90	27.99	15.93
Entertainment/culture	1.51	4.52	6.03	24.22	191.82	30.46
Fast food	31.54	53.61	95.48	132.29	152.21	96.02
Fire station/police station	1.08	5.71	12.38	18.62	30.46	14.10
Government office	5.60	9.69	15.07	20.24	28.63	16.36
Grocery store/food market	27.99	33.05	46.39	56.73	73.74	52.10
High school	6.46	9.36	10.98	17.22	23.57	13.99
Hospital/inpatient health	14.75	23.25	26.48	34.12	38.21	29.06
Hotel	7.97	11.30	14.32	18.95	27.13	17.01
Laboratory	14.42	33.26	48.65	82.24	116.36	55.76
Library	8.40	11.41	14.75	25.94	31.43	18.08
Medical office (diagnostic)	3.55	7.32	10.98	22.93	27.23	14.32
Medical office (nondiagnostic)	6.24	8.50	11.41	15.50	20.67	12.38
Mixed-use office	4.95	9.15	13.99	21.10	31.22	19.16
Motel or inn	5.27	8.93	13.02	19.59	28.74	15.93
Nonrefrigerated warehouse	0.65	1.83	4.09	8.61	15.39	6.57
Nursing home/assisted living	7.86	12.06	16.36	26.59	32.19	19.16
Other	1.61	5.49	10.01	19.48	25.94	14.53
Other classroom education	2.26	5.38	9.90	13.56	23.04	10.33
Other food sales	6.46	7.75	10.23	25.30	64.80	23.68
Other food service	8.50	17.22	26.26	69.97	124.43	50.81
Other lodging	5.92	6.03	12.16	18.41	29.71	13.99
Other office	3.98	7.64	12.81	23.25	27.56	15.82
Other public assembly	3.77	5.38	8.72	16.79	22.17	12.38
Other public order and safety	10.76	12.16	16.79	36.38	51.02	22.17
Other retail	10.44	12.81	17.12	32.08	60.28	26.16
Other service	8.18	12.16	17.01	31.43	78.47	29.17
Post office/postal center	3.44	8.40	11.73	15.50	20.34	11.52
Preschool/daycare	4.95	8.29	11.73	16.90	28.31	13.99
Recreation	3.23	5.71	9.36	14.85	25.08	12.27
Refrigerated warehouse	4.09	4.09	23.79	43.06	56.51	26.37
Religious worship	2.69	3.98	6.46	9.04	14.21	7.75
Repair shop	2.15	3.77	6.57	12.38	15.82	8.07
Restaurant/cafeteria	12.06	20.02	35.84	80.09	112.81	51.67
Retail store	3.88	5.71	10.55	19.05	31.22	14.85
Self-storage	0.54	1.08	2.15	2.91	5.60	2.48
Social/meeting	2.05	3.55	7.10	10.98	24.43	9.58
Vacant	0.43	0.86	2.91	7.53	12.81	5.17
Vehicle dealership/showroom	7.21	9.58	14.75	31.97	42.84	22.28
Vehicle service/repair shop	3.12	5.38	8.29	14.85	22.28	11.84
Vehicle storage/maintenance	0.43	1.72	5.17	12.06	21.10	8.93
SUM or Mean for sector	2.80	5.81	11.41	21.53	42.30	19.38

Source: Calculated based on DOE/EIA preliminary 2003 CBECS microdata.

p. 28.8, 1st col. Under U.S. Evolutionary Power Reactor (USEPR), delete “0.125 in. of water” and the parentheses around “30 Pa.”

p. 36.9, Table 4. Replace the table with the one above.

p. 48.20, 2nd col. For frequency range #1, consult Table 13 for A_f . In definitions for Eq. (10), refer to Table 12 for α_a .

p. 50.18, Example 4, Solution. Change “2.2 mL/” to “2.2 mL/s.”

p. 60.6, Fig. 9. Replace the figure with the one provided on p. A.6.

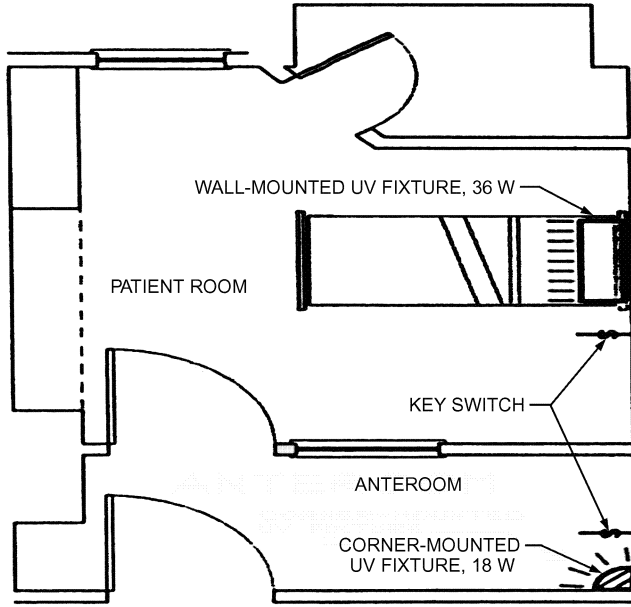


Fig. 9 Typical Layout of UVGI Fixtures for Patient Isolation Room

(First et al. 1999)
(2011 HVAC Applications, Ch. 60, p. 9)