ASHRAE HANDBOOK

Additions and Corrections

This report includes additional information and technical errors found between June 15, 2000, and July 31, 2003, in the inch-pound (I-P) edition of the 2000, 2001, and 2002 *ASHRAE Handbooks*. 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.

2000 HVAC Systems and Equipment

p. 1.3, 2nd column. In the Space requirements paragraph the first sentence should read:

"A decentralized system may or may not have an equipment room."

p. 7.11, 2nd column, 2nd to last paragraph. The Btu in the last sentence should be Btu/h.

p. 7.11, 2nd column, last paragraph. The "Btu" in the first sentence should be "Btu/h."

p. 7.28, 1st column, 3rd paragraph, third line up. The number should read "600 V."

p. 7.28, 1st column, 3rd paragraph, last line. Change "5 Hz" to "5 cycles."

p. 7.33, 1st column, last paragraph. Change "7000 lb/h" to "7000 lb" and "7 lb/h" to "7 lb."

p. 7.33, 1st column, last line. The "total energy requirement" should be "total power requirement."

p. 7.33, 2nd column, 2nd paragraph, last sentence. "More energy than the gas turbine" should be "more power than the gas turbine."

p. 7.33, 2nd column, last sentence in Example 1. "Preceding energy costs" should be "preceding power costs."

p. 8.18, 1st column, 1st line. Change "amplify" to "raise."

p. 9.4, 2nd column, 1st full paragraph, 2nd to last sentence. Delete "by more than 25% of the sensible load."

p. 11.27, Fig. 22. Replace Fig. 22 with the figure at top right, in which the primary and secondary systems are not shown to be connected.

p. 11.29, 2nd column, last line. Change "visa" to "vice."

p. 11.30, 2nd column, first bulleted text. Change "capacity" to "power."

p. 18.7, Fig. 13. Should read:

"Curve shows performance of a fixed fan size running at a fixed speed."

p. 20.2, 1st column, last paragraph. Delete second sentence that reads "Water vapor migrates from areas of high vapor pressure and lower temperature."

p. 24.11, Table 3. The second column heading should read "Dust Spot Efficiency."



Fig. 22 Basic Heating System Schematic

(2000 HVAC Systems and Equipment, Chapter 11, p. 27)

p. 26.9, Fuel Oil Preparation System, 3rd paragraph, 1st sentence. Delete " $\times 10^{60}$ " so that the viscosity is just "156 cSt."

p. 30.31, 1st column, 1st reference. Change the year to 1992 and "Customer Service" to "Handbook Editor."

p. 32.3, 2nd column. In the definition for *n*, replace the last two definitions with "1.0 for ceiling heating and floor cooling panels, and 1.1 for floor heating and ceiling cooling panels."

p. 37.1, 1st column, last paragraph, 2nd to last sentence. Delete "the volume of the."

p. 41.11, 1st column. In the section on L Bends, change references from Equation (4) to Equation (5). Change references from Equation (5) to Equation (6). Change the reference from Equation (6) to Equation (7).

p. 42.14, 2nd column, last reference. The year should be 1998 and the edition should be 3rd.

p. 44.4, Eqs. (3) and (4). The equations should read as follows:

$$x_2 = x_1 + \varepsilon \left(\frac{w_{min}}{w_s}\right) (x_3 - x_1) \tag{3}$$

$$x_4 = x_3 - \varepsilon \left(\frac{w_{min}}{w_e}\right)(x_3 - x_1) \tag{4}$$

2001 Fundamentals

p. 1.8, Example 2, Solution (a), 5th line. Change "Chapter 20" to read "Chapter 19 of the 1997 *ASHRAE Handbook–Fundamentals.*"

p. 1.11, Example 4, Solution, 2nd line. Change "Chapter 20" to read "Chapter 19 of the 1997 *ASHRAE Handbook–Fundamentals.*"

p. 1.11, Example 4, last equation. The subscript for the second \dot{W} should be II, not 2.

p. 1.14, Fig. 16. Change "Heat Amplifier" to "Temperature Amplifier."

p. 2.10, Table 2. The units for ε should be μ in, not ft:

Table 2	Effective	Roughness	of (Conduit	Surfaces
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Material	ε, μin
Commercially smooth brass, lead, copper, or plastic pipe	0.06
Steel and wrought iron	1.8
Galvanized iron or steel	6.0
Cast iron	10.2

p. 6.5, Table 2, under "Specific Entropy." At t = 129°F, change the value for s_{da} to "0.05946 Btu/lb_{da} · °F."

p. 6.11, Table 3. For 256°F, replace the following variables with these values:

v _{fg}	v_g	h _f	h_{fg}	hg	s_f	s _{fg}
12.517	12.535	224.72	941.33	1166.05	0.3763	1.3152

p. 17.3, 1st column, 9th line. Change "25 kWh/ft²·yr" to read "15 kWh/ft²·yr."

p. 23.2, Thermal Insulation section, 1st sentence. Delete "transfer" from "radiative transfer modes" and add "transfer" after "heat."

p. 25.24, 1st column, after 10th entry. Add the following:

Lotz, W.A. 1964. Vapor barrier design, neglected key to freezer insulation effectiveness. *Quick Frozen Foods* (November):122.

p. 26.8, Fig. 6A. The label *P*_{outside} should indicate the more diagonal line.

p. 26.28, Symbols. Change the definition for *g* to read "gravitational constant," and add the following definition:

G = wind speed multiplier (Table 10)

p. 26.30, References. Add the following source below Klauss et al.:

Klote, J.H. and J.A. Milke. 1992. Design of smoke management systems. ASHRAE.

p. 27.1. The second paragraph under Climatic Design Conditions should read, "Information on station location, period analyzed, heating design conditions, mean annual extreme, and standard deviation of minimum and maximum dry-bulb temperature are listed in Tables 1A, 2A, and 3A. Information on the design conditions for cooling and humidity control, along with the mean daily temperature range for the warmest month, is provided in Tables 1B, 2B, and 3B."

p. 29.14, Eq. (13). The equation should read as follows:

$$q_b = AE_D \,\text{SHGC}(\theta)\text{IAC} \tag{13}$$

p. 29.30, Table 21. The U-factor for Roof 7 should be 0.069.

p. 30.33, Table 13. In the footnote, change the reference for ID numbers from "Table 5" to "Table 4."

p. 30.38, 2nd column, 2nd paragraph. The reference to Tables 16 through 22 should be to Tables 15 through 22.

p. 31.20, Eq. (52). Replace the superscripted θ with ϕ in two places.

p. 33.1, Eq. (1). In the third term on the right side, replace v with v.

p. 33.1, Eq. (2). In the first term on the right side, replace X with Y.

p. 33.1, Example. At the end of the 1st paragraph, add, "*Note*: For this example, buoyancy and pressure are not considered."

p. 33.2, Eq. (13). In the denominators, $v_{i,j}$ should be $v_{t_{i,j}}$. The correct equation is presented here for clarity:

$$\begin{split} & \left(1 - \frac{\Delta x u_{i+1,j}}{2 v_{l_{i,j}}} + \frac{\Delta x^2 u_{i+1,j}^2}{8 v_{l_{i,j}}^2}\right) \omega_{i+1,j} \\ & + \left(1 + \frac{\Delta x u_{i-1,j}}{2 v_{l_{i,j}}} + \frac{\Delta x^2 u_{i-1,j}^2}{8 v_{l_{i,j}}^2}\right) \omega_{i-1,j} + \cdots \\ & \cdots + \left(1 - \frac{\Delta x v_{i,j+1}}{2 v_{l_{i,j}}} + \frac{\Delta x^2 v_{i,j+1}^2}{8 v_{l_{i,j}}^2}\right) \omega_{i,j+1} \\ & + \left(1 + \frac{\Delta x v_{i,j-1}}{2 v_{l_{i,j}}} + \frac{\Delta x^2 v_{i,j-1}^2}{8 v_{l_{i,j}}^2}\right) \omega_{i,j-1} \\ & \left(4 + \frac{\Delta x^2 (u_{i,j}^2 + v_{i,j}^2)}{4 v_{l_{i,j}}^2}\right) \end{split}$$

p. 33.4, Symbols. Replace *P* with *p*. Correct the units for the following values:

$c = Btu/lb \cdot {}^{\circ}F$ or $Btu/slug \cdot {}^{\circ}F$	$k = Btu/s \cdot ft \cdot {}^{\circ}F$	$K = \mathrm{ft}^2/\mathrm{s}^2$
L = ft	$p = lb^{f}/ft^{2}$	s = ft
$T = {}^{\circ}\mathbf{R}$	$u, u_{\tau}, v, V, V' = \text{fps}$	$x, \Delta x, y = \text{ft}$

Add the following definitions to the list of symbols:

g = acceleration of gravity

 $X = \rho g_x = 0$, body force (buoyancy) horizontal component

 $Y = \rho g_{\nu}$ body force (buoyancy) vertical component

p. 34.9, Fig. 9. Replace SI value chart with I-P value chart (p. A.4)

p. 34.23, Example 9, 2nd paragraph, 2nd line. Change "Figure 13 in Chapter 16" to read "Figure 2 in Chapter 43 of the 1999 *ASHRAE Handbook—HVAC Applications.*" Figure 2 is presented on page 3 for convenience.

p. 34.17, 2nd column, 1st paragraph. AMCA *Standard* 500-L should be AMCA *Standard* 500.

p. 34.57, table for CR-6 Screen (Only). In the cell for n = 0.65 and $A_1/A_0 = 1.2$, replace "0.36" with "0.52."

p. 35.6, Fig. 1. Replace Figure 1 with the corrected figure shown at the top of page 3.

p. 37.1. The conversion values for Btu/lb[.] F should be as follows (asterisks indicate that the conversion factor is exact):

Multiply	By	To Obtain			
Btu/lb·°F (specific heat, c_p)					
(International Table)	*4.1868	kJ/(kg·K)			
(thermochemical)	*4.184	kJ/(kg·K)			

p. 38.4. Under the Specific Heat column, the cross reference should be to Table 4 in Chapter 25.

p. I.28, Index. The page numbers for the **Louvers, sizing** entry should be 34.17-18.



Fig. 1 Friction Loss for Water in Commercial Steel Pipe (Schedule 40) (2001 Fundamentals, Chapter 35, p. 6)



Fig. 2 Stack Designs Providing Vertical Discharge and Rain Protection (2001 Fundamentals, Chapter 34, p. 23)

2002 Refrigeration

p. 2.4, Example 1. Please replace the specified Solution calculations with the following text:

Estimated friction loss = 0.59×3.05 = 1.8 psi

Total pressure losses	10.0 + 1.7	=	11.8 psi
Total liquid line losses			– 11.8 psi

1

The saturation temperature at 199 psig is 101.1°F

p. 2.16, Example 2. In the Solution, the reference to Table 10 should be to Table 16.

p. 12.1, 2nd column. In the first full paragraph, change "These values decrease" to "These values increase."

p. 12.7, Infiltration Load values. Delete " $^{\text{o}F}$ " from the definitions for h_f , h_r , and ρ_r ; for ρ_i , the entire definition should read only "density incoming air, lb/ft³."

p. I.30, Index. Add the following index entry after Load coefficients:

Louvers, F30.45 sizing, F34.17-18

2003 HVAC Applications

p. 1.4, Evaporative Cooling. The reference to Chapter 50 should be to Chapter 51.

p. 16.13, Temperature and Humidity, 3rd paragraph. If fullcoverage smocks are not used, temperature set points can be higher, not lower.

p. 31.5, Type II Hoods, Condensate hood list item. The second and third sentences for this item should read, "The hood is designed to direct the condensate toward a perimeter gutter for collection and drainage, allowing none to drip onto the appliance below. Flow rates are typically based on 50 to 75 cfm per square foot of hood opening."

p. 36.3, Table 3. Add the following footnote:

3. For updated information on heat pump life, see Lovvorn and Hiller (2002).

p. 36.13, References. Add the following source after Lovvorn and Hiller (1985):

Lovvorn, N.C. and C.C. Hiller. 2002. Heat pump life revisited. *ASHRAE Transactions* 108(2):107-112.s



		CONCE	RETE B	LOCK	WALL		PRECAST AND CAST-IN-PLACE CONCRETE WALLS								
Wall Number =	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
U-factor, Btu/h·ft ² ·°F	0.067	0.059	0.073	0.186	0.147	0.121	0.118	0.074	0.076	0.115	0.068	0.082	0.076	0.047	0.550
Total R	14.8	16.9	13.7	5.4	6.8	8.2	8.4	13.6	13.1	8.7	14.7	12.2	13.1	21.4	1.8
Mass, lb/ft ²	22.3	22.3	46.0	19.3	21.9	34.6	29.5	29.6	53.8	59.8	56.3	100.0	96.3	143.2	140.0
Thermal Capacity,	4.8	4.8	10.0	4.1	4.7	7.4	6.1	6.1	10.8	12.1	11.4	21.6	20.8	30.9	30.1
Btu/ft ² .°F															
Hour						Co	nduction	Time F	actors,	%					
0	0	1	0	1	0	1	1	0	1	2	1	3	1	2	1
1	4	1	2	11	3	1	10	8	1	2	2	3	2	2	2
2	13	5	8	21	12	2	20	18	3	3	3	4	5	3	4
3	16	9	12	20	16	5	18	18	6	5	6	5	8	3	<u>/</u>
4	14	10	12	15	15	/ 0	14	14	8	6	/	6	9)	8
5		10		10	12	9	10		9	6	8	6	9)	8
6 7	9	9	9	/	10	9		8	9	0	8	0	8	0	8
/	/ 6	8	8	2	8	8 0	0	0	9	0	7	5	6	0	8
8	4	6	6	3	4	0 7	4	4	0 7	6	6	5	6	6	6
9 10	3	5	5	2		6	2	2	7	5	6	5	5	6	6
10	3	4	4	1	3	6 6	2	2	6	5	5	5	5	5	5
12	2	4	3	1	2	5	1	2	5	5	5	4	4	5	4
12	2	3	2	1	2	4	1		4	5	4	4	4	5	4
14	2	3	2	0	1	4	•	1	4	4	4	4	3	4	4
15	1	3	2	0	1	3	1	1	3	4	3	4	3	4	3
16	1	2	1	0	1	3	0	1	2	<mark>4</mark>	<mark>3</mark>	<mark>4</mark>	3	<mark>4</mark>	3
17	1	2	1	0	1	2	0	0	2	3	3	<mark>4</mark>	2	<mark>4</mark>	3
18	1	2	1	0	0	2	0	0	1	3	2	<mark>4</mark>	2	<mark>4</mark>	2
19	0	1	1	0	0	2	0	0	1	3	2	3	2	3	2
20	0	1	1	0	0	2	0	0	1	3	2	3	2	3	2
21	0	1	1	0	0	2	0	0	1	3	2	3	2	3	1
22	0	1	1	0	0	1	0	0	1	<mark>3</mark>	2	<mark>3</mark>	1	<mark>3</mark>	1
23	0	1	0	0	0	1	0	0	1	2	2	2	1	3	1
Total Percentage	100	100	100	<mark>100</mark>	<mark>100</mark>	100	<mark>100</mark>	<mark>100</mark>	100	100	<mark>100</mark>	<mark>100</mark>	100	<mark>100</mark>	100
Layer ID from	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01	F01
outside to inside	M03	M08	F07	M08	M08	M09	M11	M11	M11	F06	M13	F06	M15	M16	M16
(see Table 22)	I04	104	M05	F02	F04	F04	I01	I04	102	I01	104	102	I04	105	F02
	G01	G01	104	_	G01	G01	F04	G01	M11	M13	G01	M15	G01	G01	_
	F02	F02	G01		F02	F02	G01	F02	F02	G01	F02	G01	F02	F02	_
	_	_	F02		_	_	F02	_	_	F02	_	F02		_	_
					Wall I	Number	Descriptio	ons							

Table 20	Wall Conduction Time Series (CTS) (Concluded)
	(2001 Fundamentals, Chapter 29, page 29)

8 in. LW CMU, R-11 batt insulation, gyp board
8 in. LW CMU with fill insulation, R-11 batt insulation, gyp board

3. 1 in. stucco, 8 in. HW CMU, R-11 batt insulation, gyp board

4. 8 in. LW CMU with fill insulation

a. b. W. CMU with fill insulation, gyp board
b. 12 in. LW CMU with fill insulation, gyp board
c. 12 in. LW CMU with fill insulation, gyp board
c. 4 in. LW concrete, R-5 board insulation, gyp board
a. 4 in. LW concrete, R-11 batt insulation, gyp board

9. 4 in. LW concrete, R-10 board insulation, 4 in. LW concrete

10. EIFS finish, R-5 insulation board, 8 in. LW concrete, gyp board

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8 in. HW concrete, R-11 batt insulation, gyp board
14. 12 in. HW concrete, R-19 batt insulation, gyp board
15. 12 in. HW concrete