**Errata to**
Geothermal Heating and Cooling: Design of Ground-Source Heat Pump Systems
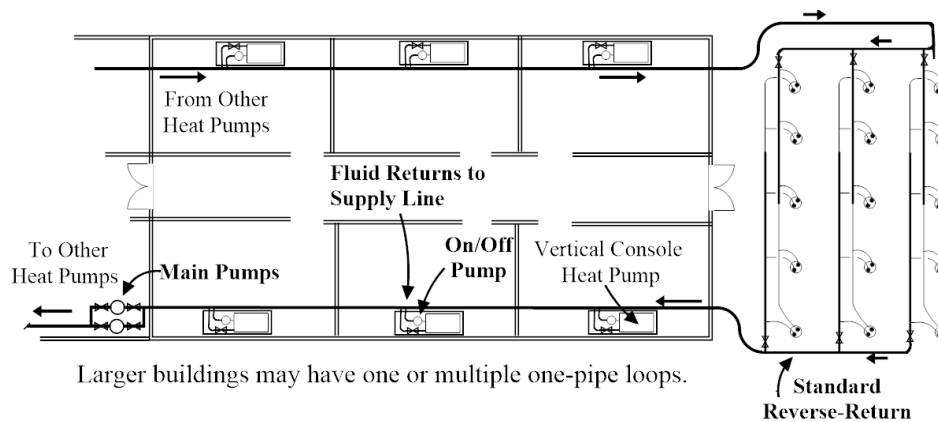**(2015)**

March 18, 2021

Shaded items have been added since the previously published errata sheet dated September 18, 2019.

Page xi: In the last paragraph, in the second sentence, add the spreadsheet tools *HeadLossTableIP.xlsm* and *HeadLossTableSI.xlsm* to those listed.

Page 9:   Figures 1.6 and 1.7 were inadvertently printed with elements of the drawings missing. Please see the corrected **Figures 1.6 and 1.7** below.
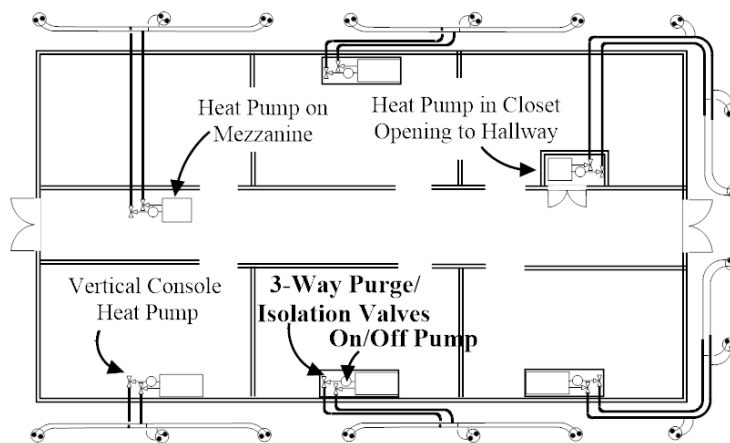
Figure 1.6   Unitary-Loop GCHP with Each Heat Pump Connected to Individual Loops

Figure 1.7   One-Pipe Loop GCHP with Reverse-Return Header Ground Loop

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Please notify ASHRAE of any other errors you might find by using the Comment on Publications form at www.ashrae.org/resources--publications.

Page 30:   Add the following to Table 2.4:

Correction Factors for Non-Rated Building Loop ELTs							
ELT = 90°F(32°C)		ELT = 100°F(38°C)		ELT = 110°F(43°C)		ELT = 120°F(49°C)	
HC	COP	HC	COP	HC	COP	HC	COP
1.04	1.20	1.01	1.04	0.98	0.94	0.95	0.83

Page 35:   In Example 2.1, change the sentence for Step 3 from "Step 3 is to correct TC and input power from 66.2°F EATWB to 65°F..." to "Step 3 is to correct TC and input power from 66.2°F EATWB to **63°F**...."

In Step 4, change the last sentence from "The correction factors are 0.985 for TC and 0.990 for power" to "The correction factors are 0.985 for TC and **0.97** for power."

In the second equation under the sentences for Step 4, change

$$W_{1080} = Cf_{1200 \rightarrow 1080} \times W_{1200} = 0.990 \times 1637 = 1621 \text{ W}$$

to

$$W_{1080} = Cf_{1200 \rightarrow 1080} \times W_{1200} = \mathbf{0.97} \times 1637 = \mathbf{1588 \text{ W}}$$

Page 36:   In the second set of equations at the top of the page, change the second equation (directly before the sentence for Step 6) from

$$W_7 = Cf_{9 \rightarrow 7} \times W_{90} = 1.015 \times 1621 = 1645 \text{ W}$$

to

$$W_7 = Cf_{9 \rightarrow 7} \times W_{90} = 1.015 \times \mathbf{1588} = \mathbf{1612 \text{ W}}$$

In the equations under the sentence for Step 6, change the third equation from

$$W_{hp+fan} = 1645 + 296 = 1941 \text{ W}$$

to

$$W_{hp+fan} = \mathbf{1612} + 296 = \mathbf{1908 \text{ W}}$$

In the equation under the sentence for Step 7, change

$$W_{total} = W_{hp+fan+pump} = 1645 + 296 + 190 = 2131 \text{ W}$$

to

$$W_{total} = W_{hp+fan+pump} = \mathbf{1612} + 296 + 190 = \mathbf{2098 \text{ W}}$$

Change the equation and sentence at the end of Example 2.1 from

$$EER_{system} = 31{,}740 \text{ Btu/h} \div 2131 \text{ W} = 14.9 \text{ Btu/Wh}$$

(This is 32% less than the EER of 22.0 Btu/Wh at GLHP conditions.)

to

$$EER_{system} = 31{,}740 \text{ Btu/h} \div \mathbf{2098 \text{ W}} = \mathbf{15.1 \text{ Btu/Wh}}$$

(This is **31%** less than the EER of 22.0 Btu/Wh at GLHP conditions.)

Page 56: In the third bullet at the top of the page, change "...the LLT will be approximately 15°F (6.7°C) higher..." to "...the LLT will be approximately 15°F (**8.3°C**) higher...."

Page 70: Under the Solution heading on this page, in the first and third equations, change both instances of "372,000 Btu/h" to "**–372,000 Btu/h**."

Page 72: Under the Solution heading, under the second full sentence, in the three equations that begin with "Fo$_{[x]}$ = 4 × 0.08 m^2/day...," change the values G_f = 0.96, G_1 = 0.58, and G_2 = 0.20 to G_f = **1.02**, G_1 = **0.56**, and G_2 = **0.19**.

Page 73: Change the equation for L_h in the middle of the page from

$$L_h = \frac{(1950 \times 0.23) + 64{,}300 \times (0.135 + 0.31 \times 0.185 + 1.01 \times 0.095)}{8°C - \dfrac{0°C + -3°C}{2} + -0.5°C} = 7025 \text{ ft}$$

$$= 2110 \text{ m} \div 25 \text{ bores} = 84 \text{ m/bore}$$

to

$$L_h = \frac{(1950 \times 0.23) + 64{,}300 \times (0.135 + 0.31 \times 0.185 + 1.01 \times 0.095)}{8°C - \dfrac{0°C + -3°C}{2} + -0.5°C} = \textbf{3164 m}$$

$$= 2110 \text{ m} \div \textbf{20} \text{ bores} = \textbf{106} \text{ m/bore}$$

Page 74: Correct Table 3.4 values as shown below. Deleted values are shown in ~~strikethrough~~ and corrected values are shown in underline.

Table 3.4 Thermal Conductivity (k) and Diffusivity (α) of Sand and Clay Soils—Values Indicate Ranges Predicted by Five Independent Methods (Farouki 1982)

Dry Density		Moisture	Sands: 0.075 to 5 mm (> #200 Standard Sieve)				Clays: < 0.075 mm (< #200 Standard Sieve)			
			Thermal Conductivity (±20%)		Thermal Diffusivity (±20%)		Thermal Conductivity (±20%)		Thermal Diffusivity (±20%)	
lb/ft^3	kg/m^3	%	Btu/h·ft·°F	W/m·°C	ft^2/day	m^2/day	Btu/h·ft·°F	W/m·°C	ft^2/day	m^2/day
80	1280	5	0.80	1.38	0.95	0.088	0.40	0.69	0.48	0.045
80	1280	10	0.85	1.47	0.85	0.079	0.42	0.73	0.42	0.039
80	1280	15	0.90	1.56	0.75	0.070	0.47	0.81	~~0.40~~0.41	~~0.037~~0.038
80	1280	20	0.95	1.64	0.71	0.066	0.50	0.87	~~0.37~~0.38	~~0.034~~0.035
100	1600	5	1.10	1.90	1.04	0.097	0.55	0.95	0.53	0.049
100	1600	10	~~1.45~~1.35	2.51	1.03	0.096	0.55	0.95	0.44	0.041
100	1600	15	~~1.40~~1.45	2.42	1.00	0.093	0.65	1.13	~~0.42~~0.43	~~0.039~~0.40
100	1600	20	1.55	2.68	0.92	0.086	0.70	1.21	0.48	0.045
120	1920	5	1.55	2.68	1.23	0.114	0.70	1.21	0.56	0.052
120	1920	10	1.70	2.94	1.12	0.104	0.70	1.21	0.46	0.043
120	1920	15	1.90	3.29	1.06	0.099	0.95	1.64	0.55	0.051

Page 78: In item 12, in the first sentence, change "...with the exception of the line-source method that only ignores the first 0.08 h of data..." to "...with the exception of the line-source method that only ignores the first **8 h** of data...."

Page 82: In the paragraph above Equation 3.17, in the first sentence, change "...the temperature profile of the single heat source" to "...the temperature profile of the single **line** heat source."

In the paragraph above Equation 3.17, in the second sentence, change "The volume of incremental round cylinders [= $\rho L_{bore}(r_o{}^2 - r_i{}^2)$] of earth at increasing radii..." to "The volume of incremental round cylinders **of outer radius r_o and inner radius r_i** [= $\pi L_{bore}(r_o{}^2 - r_i{}^2)$] of earth at increasing radii...."

Page 84: In Example 3.5, in the first sentence, change "Compute the 10-year temperature penalty..." to "Compute the **20**-year temperature penalty...."

Page 85: In the first paragraph, the second sentence, change "This can be accomplished using three radii of earth..." to "This can be accomplished using **four** radii of earth...."

In the second paragraph, the next-to-last sentence, change "Equation 3.11 is applied to find the temperature rise for a single U-tube..." to "Equation **3.17** is applied to find the temperature rise for a single U-tube...."

In the second paragraph, the last sentence, change "Equation 3.17 is then applied to prorate the average penalty for the entire grid" to "Equation **3.21** is then applied to prorate the average penalty for the entire grid."

Page 86: Change the first full sentence on the page from "Equation 3.17 is applied to determine total heat stored in the three hollow cylinders" to "Equation 3.17 is applied to determine total heat stored in the **four** hollow cylinders."

Page 88: In the SI portion of Table 3.6, in the first footnote, change the second instance of "60 m bores" to "**90 m** bores."

Page 91: In the first paragraph, in the seventh line, change "...shown in Figure 2.17 that has a full-load system EER of..." to "...shown in **Figure 2.18** that has a full-load system EER of...."

In the first paragraph, change the two references to "Table 2.8" to "**Figure 2.17**" and the two references to "Table 2.9" to "**Figure 2.19**."

Page 93: Change the second bullet from "Replace the heat pumps if they do not meet the recommendations listed in Table 2.10" to "Replace the heat pumps if they do not meet the recommendations listed in **Table 2.8**."

Page 94: In the first full paragraph, change the four periods from "(10:00 a.m., 3:00 p.m., 6:00 p.m., and 2:00 a.m.)" to "(10:00 a.m., **2:00 p.m.**, 6:00 p.m., and 2:00 a.m.)."

Page 100: In the third bullet, change "15°F (6.7°C)" to "15°F (**8.3°C**)."

Page 105:   In the fifth paragraph, at the end of the first line, change "Figure 4.7" to "**Table 4.7.**"

Page 106:   In the first paragraph of Section 4.2.8, in the second sentence, change "Two common-loop GCHP circuits (see Figure 1.8)..." to "Two common-loop GCHP circuits (**similar to the single common-loop circuit shown in Figure 1.8**)...."

In the first paragraph of Section 4.2.8, in the third sentence, change "...purge values shown in Figure 1.8..." to "...purge **valves** shown in Figure 1.8...."

Page 107:   In the first full paragraph, change the first sentence from "...by a single nominal 1/6 hp (200 W input) circulator pump on each pump (800 W total)" to "...by a single nominal 1/6 hp (200 W input) circulator pump on each **heat** pump (800 W total)."

Page 109:   In the paragraph above the first equation, change the last sentence from "The ratio of the product of cooling load (Q_c) and EFLH$_c$ to the product of heating requirement (Q_h) and EFLH$_h$ is" to "The ratio of **the product (q_{lc}) of cooling load and** EFLH$_c$ to **the product (q_{lh}) of heating requirement and** EFLH$_h$ is".

Change the first equation from

$$Q_c/Q_h = \frac{228 \text{ kBtu/h} \times 890 \text{ h}}{121 \text{ kBtu/h} \times 755 \text{ h}} = 2.2$$

to

$$Q_c/Q_h = \frac{\boldsymbol{q_{lc}} \times \mathbf{EFLH}_{\boldsymbol{c}}}{\boldsymbol{q_{lh}} \times \mathbf{EFLH}_{\boldsymbol{h}}} = \frac{228 \text{ kBtu/h} \times 890 \text{ h}}{121 \text{ kBtu/h} \times 755 \text{ h}} = 2.2$$

Page 109:   In the paragraph above the second equation, change the last sentence from "In this case," to "**Thus for this situation the total heat ratio is**".

Change the second equation from

$$Q_c/Q_h = \frac{1.33 \times q_{lh} \times 1000 \text{ h}}{q_{lh} \times 500 \text{ h}} = 2.67$$

to

$$Q_c/Q_h = \frac{1.33 \times \boldsymbol{q_{lc}} \times 1000 \text{ h}}{q_{lh} \times 500 \text{ h}} = 2.67$$

In the next-to-last paragraph, change "...the temperature penalty of 3.9°F can be *estimated* by interpolating between the value of..." to "...the temperature penalty of 3.9°F can be *estimated* by interpolating **for the building $\boldsymbol{Q_c/Q_h}$ = 2.2** between the value of...."

Page 110:   In the first full paragraph, change the end of the next-to-last sentence from "...the length is 251 ft (77 m)" to "...the length is **314 ft (95.7 m) per bore.**"
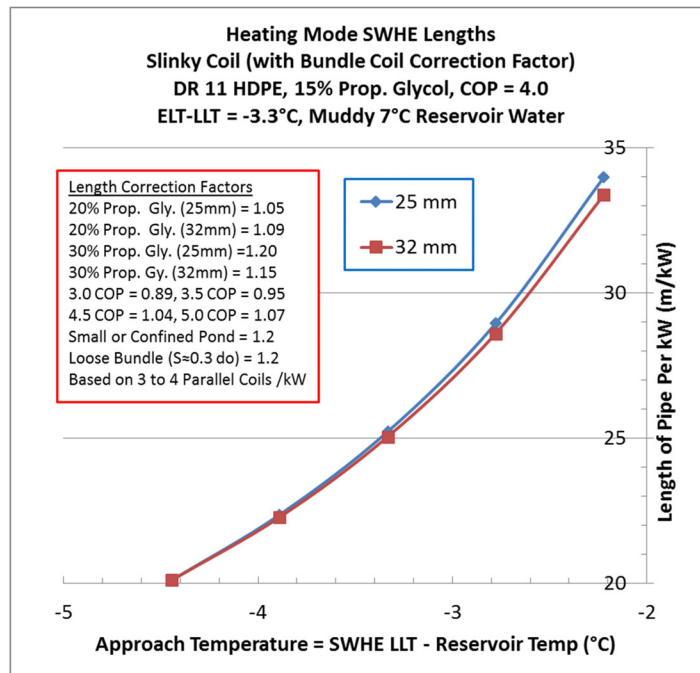
Page 111:   In the first paragraph of Section 4.3.1, change the ending of the next-to-last sentence from "...because there is no load diversity (see Table 4.2)" to "...because there is no load diversity, **since cooling loads in all zones peak during the noon–4:00 p.m. time period** (see Table 4.2)."

Page 114:   In the last bullet on the page, change "...with a thermal conductivity of 0.44 Btu/h·ft·°F (0.76 W/m·K) for the 0.22 Btu/h·ft·°F (1.6 W/m·K) product..." to "...with a thermal conductivity of 0.44 Btu/h·ft·°F (0.76 W/m·K) for the 0.22 Btu/h·ft·°F (**0.38 W/m·K**) product...."

Page 115:   In the full bullet at the top of the page, change "...with a thermal conductivity of 0.44 Btu/h·ft·°F (0.76 W/m·K) for the 0.22 Btu/h·ft·°F (1.6 W/m·K) product..." to "...with a thermal conductivity of 0.44 Btu/h·ft·°F (0.76 W/m·K) for the 0.22 Btu/h·ft·°F (**0.38 W/m·K**) product...."

In the third paragraph of Section 4.3.5, in the first sentence, change "Substituting a grout with a thermal conductivity of 0.42 Btu/h·ft·°F (73 W/m·K)..." to "Substituting a grout with a thermal conductivity of 0.42 Btu/h·ft·°F (**0.73 W/m·K**)...."

Page 116:   In the full bullet at the top of the page, in the second sentence, change "If the bore separation distance is decreased to 15 ft (7.6 m)..." to "If the bore separation distance is decreased to 15 ft (**4.6 m**)..."

Page 119:   In the bottom third of the page, in the SI version of the equation following the sentence "The required water flow rate for the fluid cooler is," change "Q_w (L/min) =" to "Q_w (**L/s**) =".

Page 122:   In the first line at the top of the page, change "System COP_h > 3.5 Btu/Wh (COP_c > 3.5)" to "System COP_h > **3.5** (COP_c > 3.5)".

Page 143:   Change superscripts in the third row of Table 5.1 from "–15" to "–5" as shown below. Deleted values are shown in strikethrough. Added values are shown in underline.

Table 5.1   Thermal Properties of HDPE Pipe (PPI 2014)

Thermal Property	PE3xxx	PE4xxx
Thermal Conductivity	0.25 Btu/h·ft·°F (0.43 W/m·K)	0.26 Btu/h·ft·°F (0.45 W/m·K)
Specific Heat	0.46 Btu/lb·°F (1.93 kJ/kg·K)	0.46 Btu/lb·°F (1.93 kJ/kg·K)
Coefficient of Expansion	$9 \times 10^{-\cancel{15}\underline{5}}$ in./in.·°F ($16 \times 10^{-\cancel{15}\underline{5}}$ m/m·K)	$8 \times 10^{-\cancel{15}\underline{5}}$ in./in.·°F ($14 \times 10^{-\cancel{15}\underline{5}}$ m/m·K)

Page 150:   In Figure 5.19, in the red-bordered box, change "30% Prop. Gly. (25 mm) = 1.15" to "30% Prop. Gly. (**32 mm**) = 1.15." See the corrected figure below.

Heating Mode SWHE Lengths
Slinky Coil (with Bundle Coil Correction Factor)
DR 11 HDPE, 15% Prop. Glycol, COP = 4.0
ELT-LLT = -3.3°C, Muddy 7°C Reservoir Water

Length Correction Factors
20% Prop. Gly. (25mm) = 1.05
20% Prop. Gly. (32mm) = 1.09
30% Prop. Gly. (25mm) =1.20
30% Prop. Gy. (32mm) = 1.15
3.0 COP = 0.89, 3.5 COP = 0.95
4.5 COP = 1.04, 5.0 COP = 1.07
Small or Confined Pond = 1.2
Loose Bundle (S≈0.3 do) = 1.2
Based on 3 to 4 Parallel Coils /kW

Figure 5.8   Heating-Mode Design Lengths for HDPE SWHEs (SI Units)

Page 151:   In Example 5.2, in the first paragraph, in the fifth line, change "1/4 in." to "**3/4 in.**"

Page 152:   In Example 5.2, in the last large paragraph, in the second line, change "(1.0 to 1.25 coils/ton) at 20 to 25" to "(1.0 to 1.25 coils/ton) at **16 to 20**."

Page 168:   In the example box, in the first paragraph, in the first sentence, change "...and 11.5 kBtu/h·ft^2 (36 kW/m^2) sensible cooling..." to "...and **8.5** kBtu/h·ft^2 (**27** kW/m^2) sensible cooling...."

Page 170:   Equation 5.25 has a closing curly bracket in the wrong place. The equation, currently written as

$$t_{grn}(d, \tau_d) \; = \; t_{mean} - A_s \times e^{\{[-d(\pi/365\alpha)^{0.5}]\cos[(2\pi/365)(\tau_d - \tau_{min} - 0.5d(365/\pi\alpha)^{0.5})]\}}$$

should be written as

$$t_{grn}(d, \tau_d) \; = \; t_{mean} - A_s \times e^{\{[-d(\pi/365\alpha)]^{0.5}\}} \cos[(2\pi/365)(\tau_d - \tau_{min} - 0.5d(365/\pi\alpha)^{0.5})]$$

Page 171: In Example 5.6, in the first set of equations of the Solution, change the equations from

$$\Delta t_{resv\ header} = C_{resv} \times [t_{grn} - t_{coil}] \times L_{header} \div Q$$
$$= 0.0103\ (gpm/ft) \times [80°F - 50°F] \times 200\ ft \div 50\ gpm = 1.24°F \qquad \text{(I-P)}$$

$$\Delta t_{resv\ header} = C_{resv} \times [t_{grn} - t_{coil}] \times L_{header} \div Q$$
$$= 0.0021\ (L/s·m) \times [26.7°C - 10°C] \times 61\ m \div 3.15\ L/s = 0.68°C \qquad \text{(SI)}$$

to

$$\Delta t_{resv\ header} = C_{resv} \times [\boldsymbol{t_{resv}} - t_{coil}] \times L_{header} \div Q$$
$$= 0.0103\ (gpm/ft) \times [80°F - 50°F] \times 200\ ft \div 50\ gpm = 1.24°F \qquad \text{(I-P)}$$

$$\Delta t_{resv\ header} = C_{resv} \times [\boldsymbol{t_{resv}} - t_{coil}] \times L_{header} \div Q$$
$$= 0.0021\ (L/s·m) \times [26.7°C - 10°C] \times 61\ m \div 3.15\ L/s = 0.68°C \qquad \text{(SI)}$$

Change the last equation on the page from

$$\Delta t_{grn\ header} = C_{resv} \times [t_{grn} - t_{lrh}] \times L_{header} \div Q$$
$$= 0.0020\ (gpm/ft) \times [74°F - 51.24°F] \times 600\ ft \div 50\ gpm = 0.55°F \qquad \text{(I-P)}$$

to

$$\Delta t_{grn\ header} = \boldsymbol{C_{grn}} \times [t_{grn} - t_{lrh}] \times L_{header} \div Q$$
$$= 0.0020\ (gpm/ft) \times [74°F - 51.24°F] \times 600\ ft \div 50\ gpm = 0.55°F \qquad \text{(I-P)}$$

Page 172: In the top example box, change the first equation from

$$\Delta t_{grn\ header} = C_{resv} \times [t_{grn} - t_{lrh}] \times L_{header} \div Q$$
$$= 0.00041\ (L/s·m) \times [23.3°C - 10.68°C] \times 183\ m \div 3.15\ L/s = 0.30°C \qquad \text{(SI)}$$

to

$$\Delta t_{grn\ header} = \boldsymbol{C_{grn}} \times [t_{grn} - t_{lrh}] \times L_{header} \div Q$$
$$= 0.00041\ (L/s·m) \times [23.3°C - 10.68°C] \times 183\ m \div 3.15\ L/s = 0.30°C \qquad \text{(SI)}$$

In the top example box, change the last set of equations from

$$ELT = t_{resv} + \Delta t_{resv\ header} + \Delta t_{resv\ header} = 50 + 1.24 + 0.55 = 51.8°F \qquad \text{(I-P)}$$

$$ELT = t_{resv} + \Delta t_{resv\ header} + \Delta t_{resv\ header} = 10 + 0.68 + 0.3 = 11.0°C \qquad \text{(SI)}$$

to

$$ELT = t_{resv} + \Delta t_{resv\ header} + \Delta \boldsymbol{t_{grn}} = 50 + 1.24 + 0.55 = 51.8°F \qquad \text{(I-P)}$$

$$ELT = t_{resv} + \Delta t_{resv\ header} + \Delta \boldsymbol{t_{grn}} = 10 + 0.68 + 0.3 = 11.0°C \qquad \text{(SI)}$$

In Example 5.7, in the sentence above the last set of equations, change "(see Equation 4.2)" to "(see Equation **4.3**)."

Page 173: Change Equation 5.27 from

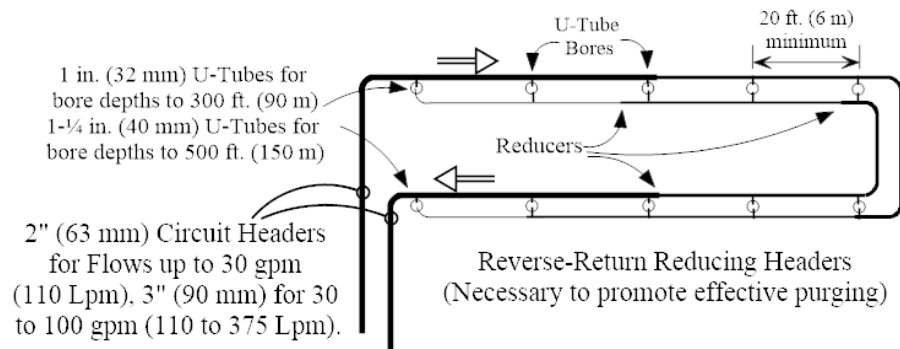$$S_f = \frac{2\pi L}{\cos h^{-1}\left(\dfrac{D^2 - r_1^2 - r_2^2}{2r_1 r_2}\right)}$$

to

$$S_f = \frac{2\pi L}{\cos \mathbf{h}^{-1}\left(\dfrac{D^2 - r_1^2 - r_2^2}{2r_1 r_2}\right)}$$

Add the following to the nomenclature listed after Equation 5.27:

$\cosh^{-1}$ = inverse hyperbolic cosine

Page 181: In Figure 6.3, the conversion of 3 in. to 63 mm should be to **90 mm**. The corrected figure is included below.

1 in. (32 mm) U-Tubes for bore depths to 300 ft. (90 m)
1-¼ in. (40 mm) U-Tubes for bore depths to 500 ft. (150 m)

2" (63 mm) Circuit Headers for Flows up to 30 gpm (110 Lpm), 3" (90 mm) for 30 to 100 gpm (110 to 375 Lpm).

U-Tube Bores

20 ft. (6 m) minimum

Reducers

Reverse-Return Reducing Headers (Necessary to promote effective purging)

Figure 6.3   Reverse-Return Ground-Loop Circuit with Reduced Header Sections

Page 184: In the second paragraph, in the next-to-last sentence, change "...the EER is 14.4 Btu/Wh (COP$_c$ = 4.2) and COP$_h$ = 3.85" to "...the EER is 14.4 Btu/Wh (COP$_c$ = 4.2) and COP$_h$ = **3.63**."

Page 191: In the third paragraph under Equation 6.4, change "Table 9.14" to "**Table 9.12**".

Page 192: In Table 6.6, in the first column and sixth body row, change "2 1/5" to "**2 1/2**."

In Table 6.6, in the fourth column and second body row, change "1.0957" to "**0.957**."

Page 202: In the first paragraph of Section 6.7.1, in the first sentence, change "Figure 4.6" to "**Figure 4.8**".

Page 226: Change the caption of Figure 7.1 from "Aquifer Types—Confined (Water Table) and Unconfined (Artesian)" to "Aquifer Types—**Unconfined** (Water Table) and **Confined** (Artesian)".

Page 227:   In Table 7.1, in the row for "Medium sand," in the column for "Permeability, m/day," change "40" to "**4.1**".

Page 228:   In the first paragraph, change the next-to-last sentence from "The units of transmissivity are gal/ft^2·day (m^2/day)" to "The units of transmissivity are gal/**ft**·day (m^2/day)."

Page 233:   In the second paragraph of Section 7.3, roughly in the middle of the paragraph, change "...a conductor casing (shown in Figure 7.7) is required..." to "...**a conductor casing is required**...."

Page 238:   In the last line on the page, change "0.25 ft/s (0.82 m/s)" to "0.25 ft/s (**0.075 m/s**)".

Page 241:   In Example 7.2, in the first sentence, change "A building with a block load of 250 tons (88 kW)..." to "A building with a block load of 250 tons (**880 kW**)...."

In Example 7.2, in the Solution, in the first sentence under the first set of equations, change "For a 250 ton (88 kW) load (cooling)..." to "For a 250 ton (**880 kW**) load (cooling)..."

Page 283:   In the second line on the page, change "in Table 8.7" to "in **Table 8.6**".

In the third line on the page, change "(configuration 2, Table 8.6)" to "(configuration 2, **Table 8.5**)."

In the first full paragraph, in the last sentence, change "Table 8.7" to "**Table 8.6**" and change "(configuration 2, Table 8.6)" to "(configuration 2, **Table 8.5**)."

Page 288:   In the third-to-last line on the page, change "Table 8.10" to "**Table 8.9**".

Page 304:   In the fourth paragraph, in the first sentence, change "75 ft (2.9 m)" to "75 ft (**22.9 m**)".

Page 305:   In the first paragraph, in the last line, change "100 ft (30 m)" to "100 ft (**33 m**)".

In the last paragraph, in the first sentence, change "130.6 ft (37.7 m)" to "130.6 ft (**39.8 m**)".

Page 307:   In the footnote to Table 8.17, change "36°F (1.3°C)" to "36°F (**2.2°C**)".

Page 317:   In the last line on the page, change "$0.81/m^2, or 8.1 cents/m^2" to "$0.81/m^2, or **81** cents/m^2"

Page 325: In the next-to-last paragraph, change the following values

250 ft/ton (22 m/kW·ton)
185 ft/ton (16 m/kW·ton)
170 ft/ton (15 m/kW·ton)
201 ft/ton (17 m/kW·ton)

to

250 ft/ton (22 m/**kW**)
185 ft/ton (16 m/**kW**)
170 ft/ton (15 m/**kW**)
201 ft/ton (**18 m/kW**)

In the last paragraph, change the following values

150 ft/ton (13 m/kW·ton)
200 ft/ton (17 m/kW·ton)
200 and 225 ft/ton (17 and 20 m/kW·ton)

to

150 ft/ton (13 m/**kW**)
200 ft/ton (17 m/**kW**)
200 and 225 ft/ton (17 and 20 m/**kW**)

Page 330: In the fourth line on the page, change "119 ft/ton (97 W/m)" to "119 ft/ton (97 W/m **or 10.3 m/kW**)".

Page 332: In the fourth–fifth lines on the page, change "120 ft/ton (96 W/m)" to "120 ft/ton (96 W/m **or 10.4 m/kW**)".

Page 346: For Table 9.7, change the title from "Itemized Cost per Unit Floor Area for EPRI/TVA Study (Zimmerman 2000)" to "**Itemized Costs for Low-, Mid-, and High-Cost GSHP Systems for EPRI/TVA Study (Zimmerman 2000)**", add lines to delineate the interior and exterior cost sections above the total interior and total exterior rows, and move the row for "Total GSHP system cost" and the Low, Mid, and High system descriptors to the bottom of the table. For clarity, the revised table is included below.

Table 9.7   Itemized Costs for Low-, Mid-, and High-Cost GSHP Systems for EPRI/TVA Study (Zimmerman 2000)

Item	Cost, $/ft^2			Cost, $/m^2		
Major equipment	2.51	2.59	3.11	27.01	27.87	33.46
Piping/valves	1.91	1.46	2.99	20.55	15.71	32.17
Pumps/controls	0.24	0.24	0.12	2.58	2.58	1.29
Ductwork	2.01	2.39	3.16	21.63	25.72	34.00
HVAC controls	0.08	1.89	1.33	0.86	20.34	14.31
Other	0.41	1.72	0.56	4.41	18.51	6.03
Total interior cost	7.16	10.29	11.27	77	111	121
Drilling (and casing)	1.90	2.30	3.39	20.44	24.75	36.48
Pipe and U-tubes	0.32	1.00	0.28	3.44	10.76	3.01

Table 9.7 Itemized Costs for Low-, Mid-, and High-Cost GSHP Systems for EPRI/TVA Study (Zimmerman 2000)

Grouting	0.31	0.42	0.23	3.34	4.52	2.47
Trenching/headers	0.88	0.74	1.18	9.47	7.96	12.70
Compaction	0.66		0.43	7.10		4.63
Other	0.24	0.17	0.28	2.58	1.83	3.01
Total exterior cost	4.31	4.63	5.79	46	50	62
Exterior cost percent of total	37.6%	31.0%	33.9%	37.6%	31.0%	33.9%
Total GSHP system cost	**Low**	**Mid**	**High**	**Low**	**Mid**	**High**
	11.47	**14.92**	**17.06**	**123**	**161**	**184**

Page 347: In the second bullet on the page, change the following values

$9.07/ft^2 ($141/m^2)
$5.58 ($100/m^2)
$3.49/ft^2 ($40/m^2)

to

$9.07/ft^2 (**$97.6/m^2**)
$5.58 (**$60.6/m^2**)
$3.49/ft^2 (**$37.9/m^2**)

Page 349: In Example 9.1, in the first sentence, change "Figure 2.17 (chilled-water VAV)" to "**Figure 2.18** (chilled-water VAV)"

Page 351: In the fourth-to-last line on the page, change "Table 9.9" to "**Table 9.11**".

Page 411: In the fourth paragraph, in the fourth sentence, change "...values of between 700 and 1200 Btu/h·ft^2·°F (47000 to 6800 W/m^2·°C)" to "...values of between 700 and 1200 Btu/h·ft^2·°F (**3980** to 6800 W/m^2·°C)."

Page 412: Change the last line of this page from "U-factor of 825 Btu/h·ft^2·°F (4685 W/m^2·°C)" to "U-factor of 825 Btu/h·ft^2·°F (**4690** W/m^2·°C)."

Page 413: In Table O.1, in the 17th body row, change "=IF(D4=1,E5/1.736,E5)" to "=IF(D4=1,E5/**5.68**,E5)."