Errata to
HVAC Simplified
(2006)

May 21, 2019

Shaded items have been added since the previously published errata sheet dated March 7, 2016.

Page xi: A committee member's name was misspelled in the Acknowledgments. Change "Sterling Wilkes" to "**Stirling Walkes**."

Page xi: Replace the second paragraph of the Acknowledgments with the following:

> Additionally, the members of the ASHRAE Publications Committee and staff have provided encouragement and support for this effort. I also wish to thank my employer, The University of Alabama, for providing a sabbatical for the Spring 2004 semester, during which I completed the first five chapters of this work. I also wish to thank the many students; my mentors Drs. Jerald Parker, Harry Mei, and Gene Martinez; and my ASHRAE colleagues, who have encouraged me to do a better job of presenting the ideas and concepts that have helped me learn. Finally, I wish to express my special gratitude to Barbara Hattemer McCrary, my former student who became my teacher in the use of spreadsheets as an engineering tool, and Kevin Rafferty, who reviewed the entire book and has provided a wealth of technical and philosophical insight throughout our many years of collaboration.

Page 7: In the left column, change the last sentence from "…located on the saturated liquid line…" to "…located on the saturated **vapor** line…"

Page 13: In Table 2.4, in the Cond. Temp. row for 110°F and the column for Evaporation Temperature of 40°F, change value for kW from "28.4" to "**2.84**".

Page 13: In Table 2.4, in the Cond. Temp. row for 110°F and the column for Evaporation Temperature of 20°F, change the value for q_r from "2.73" to "**27.3**".

Page 18: In Problem 2.2, change "120°F discharge temperature" to "120°F discharge **saturation** temperature."

Page 20: Change the definition of R_L in the nomenclature for Equation 3.3 from "$[\ln(r_o/r_i)2k]$" to "$[\ln(r_o/r_i)2\pi k]$."

Page 20: Change the definition of R_c in the nomenclature list for Equation 3.4 from "$(1/h_c\text{A})$" to "$(1/h_c)$."

Page 22: In Equation 3.11. change "$R_w = (k/\Delta x)$" to "$R_w = (\Delta \boldsymbol{x}/\boldsymbol{k})$."

Page 22: Change Equation 3.12a,b from "$(R_{ov} = R_i + R_w + R_0 = 1/h_i + k/(\Delta x) + 1/h_o) \ : \Rightarrow U_{ov} = 1/R_{ov}$" to "$(R_{ov} = R_i + R_w + R_0 = 1/h_i + (\Delta \boldsymbol{x})/\boldsymbol{k} + 1/h_o) \ : \Rightarrow U_{ov} = 1/R_{ov}$."

Page 22: In Equation 3.14, the term "h_i" is missing from the denominator. Change the equation to the following:

$$U_{ov} = \frac{1}{r_o/r_i \boldsymbol{h_i} + \frac{r_0 \ln(r_o/r_i)}{k} + \frac{1}{h_o}}$$

Page 30: In Equation 4.16 a, b, c, in the last section of equation, change

$$\boldsymbol{t_3} = \frac{W_2 + W_1 m_1/m_2}{1 + m_1/m_2} \quad \text{to} \quad \boldsymbol{W_3} = \frac{W_2 + W_1 m_1/m_2}{1 + m_1/m_2}.$$

Page 32: In Equation 4.17 a, b, c, in the last section of equation, change

$$\boldsymbol{t_3} = \frac{W_2 + W_1 Q_1/Q_2}{1 + Q_1/Q_2} \quad \text{to} \quad \boldsymbol{W_3} = \frac{W_2 + W_1 Q_1/Q_2}{1 + Q_1/Q_2}.$$

Page 42: In Table 5.2, in the heading row for Model 180 (middle of the table), in the right-most column heading, change "75000 cfm" to "**7500** cfm."

Page 47: In Table 5.5 in the fourth row under the heading (fifth row overall), in the second-to-last column, change "1230/1390" to "**1730**/1390."

Page 59: In Figure 5.16a (the left graph), change the vertical axis label from, "Head loss…" to "**Evaporator** Head Loss…," and in 5.16b (the right graph), change vertical axis label from, "Head loss…" to "**Condenser** Head Loss…"

Page 65: In problem 5.13, change "…can provide 85°F" to "…can provide 85°F **with an entering water temperature (EWT) of 95°F."**

Page 65: The table accompanying Problem 5.14 should show corrections as indicated in bold in the table below:

	10 a.m. Cooling Loads (MBtu/h)		**3 p.m. Cooling Loads (MBtu/h)**	
	Sensible	**Total**	**Sensible**	**Total**
Zone 1	30	40	**42**	**60**
Zone 2	**45**	**60**	35	45
Zone 3	25	35	**38**	**54**
Zone 4	30	38	40	55
Total				

Page 69: In the note at bottom of right column, change "…the current version of Addendum n…" to "…**ASHRAE Standard 62.1**…"

Page 89: In Table 7.1, in the heading row, change the values for R-values from "h·°F·ft^2 Btu" to "**h·°F·ft^2/Btu**" in three places.

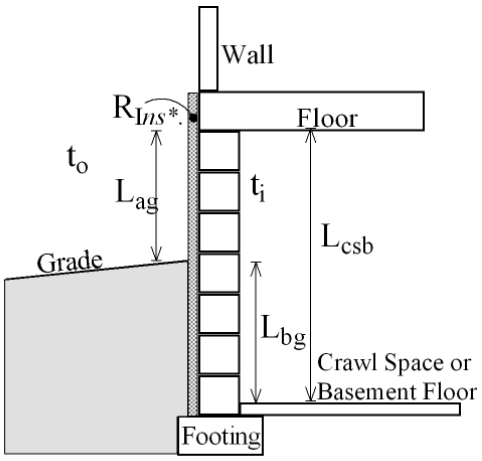
Page 89–91: The last sentence of page 89, which ends on page 91, reads "Reflective surfaces should be located so that a ventilation path is between the barrier and an asphalt single roof" but should read "Reflective surfaces should be located so that a ventilation path is between the barrier and an asphalt **shingle** roof."

Page 91: In the title of Table 7.3, "Solar Heat Gain Factor (SHGF)" should read "Solar Heat Gain **Coefficient** (SHG**C**)."

Page 91: In the first paragraph in the right-hand column, "solar heat gain factor" should read "solar heat gain **coefficient**" and "SHGF" should read "SHG**C**" (two instances).

Page 91: There is a typo of a missing word in the first sentence of the last paragraph on this page. Add "to" between "designed" and "reduce" so that the sentence reads "Table 7.3 applies to unshaded windows, although some glazing types have reflective treatments designed **to** reduce the effects of solar heat gain."

Page 94: The figure below was inadvertently left out of Table 7.6 and should be included as part of the table.



*Insulation can also be located on interior wall.

Page 94: The equation in the second line of the Table 7.6 heading should be corrected from "$\{q_{csb} - F_{csb}$ ....]}" to "$\{q_{csb} = F_{csb}$ ....]}."

Page 95: The numerator in Equation 7.12 lists "F_{csb}/P_{Bldg}" but should instead list "$F_{csb} \times P_{Bldg}$." The corrected equation follows.

$$t_{CS}(^{\circ}\mathrm{F}) = \frac{(A_F/R_F)t_i + (F_{csb} \times P_{Bldg} + 1.08Q_{CSV})t_o + (A_D/R_D + 1.08Q_{DL})t_s}{A_F/R_F + F_{csb} \times P_{Bldg} + A_D/R_D + 1.08(Q_{CSV} + Q_{DL})}$$

Page 95: The subscript in Equation 7.14 should be changed from "Celiling" to "**Ceiling**"; the corrected equation follows.

$$q_{Ceiling} = \frac{A_C}{R_C}(t_i - t_A)$$

Page 100: In Problem 7.14, the last line of the problem reads "a 1/2 in. air gap" but should read "a 1/2 in. **argon** gap."

Page 113: The note under the title for Table 8.6 should not reference "Figure 8.1" but "**Figure 7.4**."

Page 114: In the left column, in the second sentence in "Internal Loads and Lighting" section, change "…Table 8.**9**…" to "…Table 8.**10**…"

Page 114: In the right column, in the second full sentence, change "…(which can also be converted to MBtu/h using 3412 MBtu/W-h)" to "…**(which can also be used to convert kW to MBtu/h using 3.412 MBtu/kW-h)**."

Page 119: In Problem 8.2, change "…heat gain of the walls…" to "…heat gain of the **10 ft high** walls…."

Page 133: In the right column, in the item 7 discussion, change "…Figure 9.**9**" to "…Figure 9.**11**."

Page 144: In Problem 9.1, change "…and an 18 × 20 ft floor…" to "…and an 18 × **40** ft floor…."

Page 159: In the left column, in the first sentence after Equation 10.8, change "…Figure 10.8" to "…Figure 10.**11**."

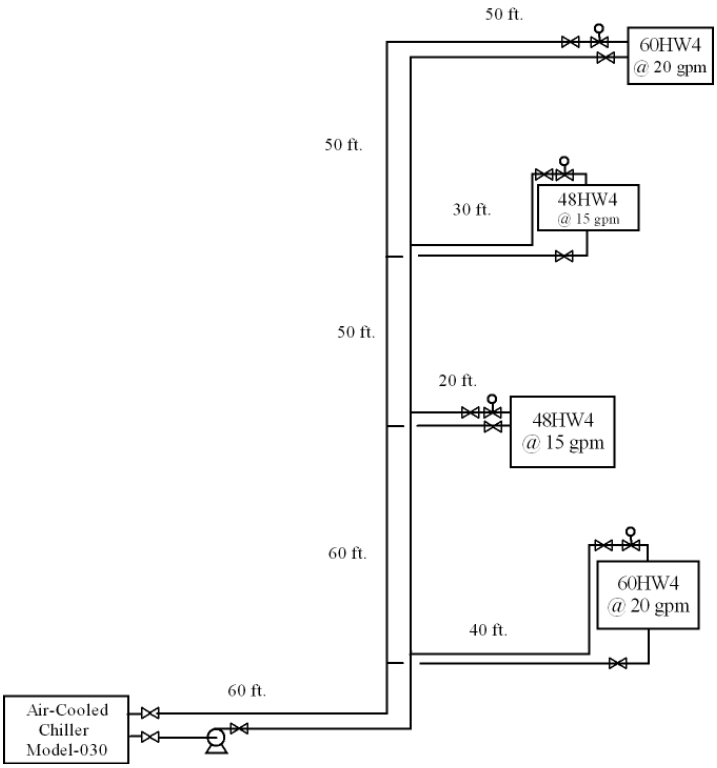
Pages 161–63: Figures 10.17 and 10.18 come before Figures 10.13, 10.14, 10.15, and 10.16. Change the order of these pages so that the figures appear in the text in order.

Page 166: In Problem 10.1, change "The fan coil units are Model 60-HW-4 (Table 5.12)" to "The fan coil units are Model 60-HW-4 (Table 5.12) **with a flow rate of 20 gpm each**."

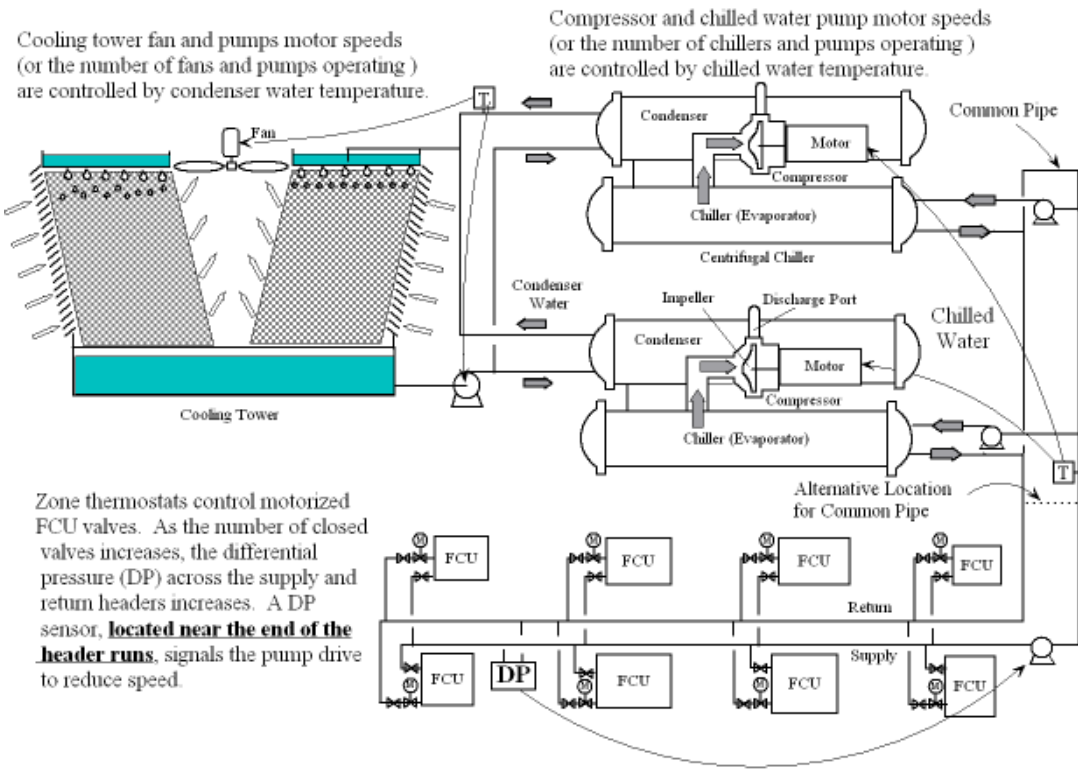
Page 166: In Problem 10.3, change "…water loop shown in Figure 10.3" to "…water loop shown in Figure 10.**7**."

Page 166: In Problem 10.3, change "…tower is 12 ft." to "…tower is 12 ft **and the distance from the chiller to the cooling tower is 200 ft**."

Page 166: Problems 10.4 and 10.5 refer to a figure that was inadvertently omitted. The figure is shown below.

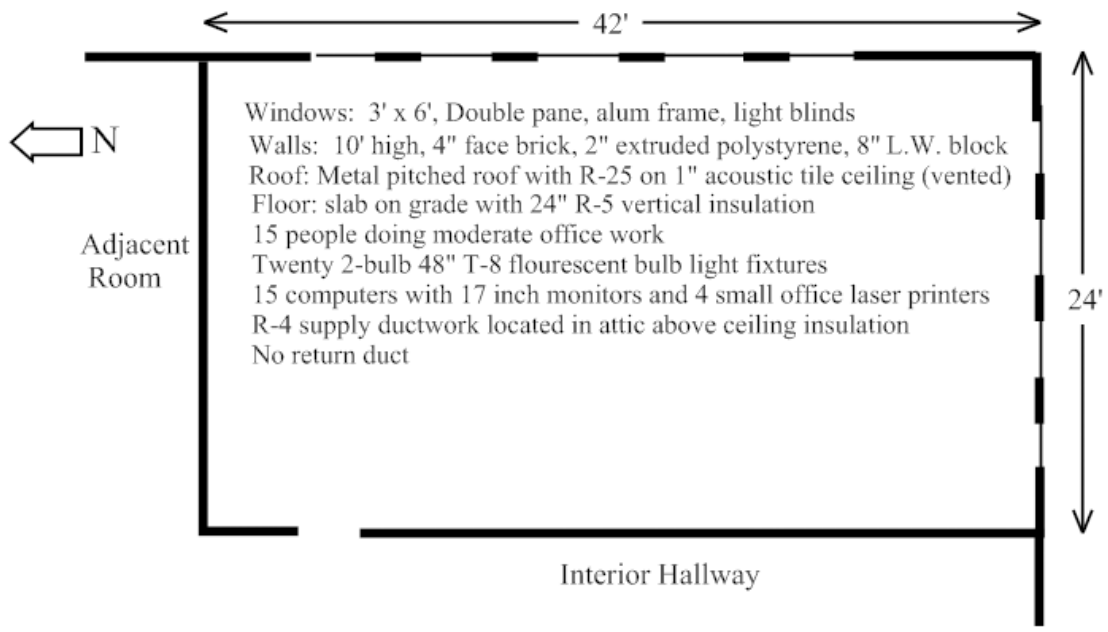


Page 185: The bottom "supply" line in Figure 11.12 is slightly off. Replace the figure with the following:

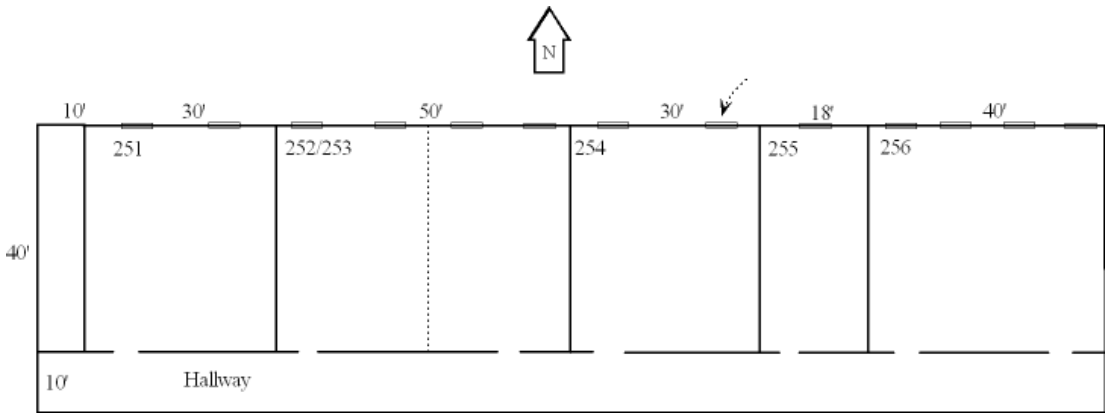


Page 187:	In Problem 11.2, change "Compute the demand, KVA, and KVAR of a 6-pole, 20 hp motor at 100%, 75%, and 50% load." to "Compute the demand **and current** of a 6-pole, **230-VAC, 3-phase,** 20 hp motor at 100%, 75%, and 50% load."
Page 187:	In Problem 11.3, change "Compute the demand, KVA, and KVAR of a 2-pole, 15 hp motor at 100%, 75%, and 50% load" to "Compute the demand **and current** of a **6-pole, 460-VAC, 3-phase,** 15 hp motor at 100%, 75%, and 50% load."
Page 187:	In Problem 11.4, change "Select an 1800 rpm motor… specify resulting demand (kW), KVA, and KVAR at the design point and at 6000 cfm" to "Select an 1800 rpm, **230-VAC, 3-phase** motor… specify resulting demand (kW) **and current**."
Page 187:	In Problem 11.6, change "…shown in Figure 10.12" to "…shown Figure 10.**15**."
Page 187:	In Problem 11.9, change "…cost of bulbs (at $3.00 each)" to "…cost of bulbs (at **30¢ each for incandescent and $3.00 each for compact fluorescent)**."
Page 189	An unnecessary blank page at the end of Chapter 11 was accidentally inserted. As a result, in the reprint dated 8/18 with the note "Errata noted in the list dated 03/08/16 have been corrected" on the back cover, there are two Page 189s. The correct Page 189 is the first page of Chapter 12. Page numbering for the Table of Contents is not affected.
Page 197:	In the fifth line of the first paragraph in the right-hand column, change "100 ccf of natural gas" to "**one** ccf of natural gas."
Page 206:	In Problem 12.10, change "The energy inflation rate is expected to be 8%" to "**Inflation rates are 8% for energy, 5% for maintenance, and 5% general**."
Page 211:	Replace Figure A.2 with the attached Table A.1.

Page 223: Replace the current Figure C.4 with the Figure C.4 below (a room dimension and a wall height were added to the figure).



Page 226: Replace Figure C.7 with the following corrected figure:



CD: On the CD accompanying *HVAC Simplified*, replace older versions of the Excel spreadsheets with the following:

A-AHPCorrect08.xls
EcoAnal-10-09.xls
EcoAnal-20-09.xls
EcoAnal-Tax&Dpr-5.xls
EcoLoan15-09.xls
EcoLoan30-13.xls
E-Ductulator09.xls
E-pipelator12.xls
FanPumpCalc09.xls
Heat&CoolCost&CO2-13.xls
HVAC-SystemEff11-12.xls
Mortgage09.xls
PsychProcess09.xls
ResLoad11.xls
TideLoad10V1.xls
WAHPcorrector13.xls

Also add the following files:

ExcelMacroSettings.pdf
ResLoadInstructions.pdf
UnitsConverter.xls

Note that any original spreadsheet not replaced by an updated spreadsheet mentioned on this Errata Sheet is to remain the current version of that program for use with *HVAC Simplified.*

To obtain any of these files, please list the files you need on the Comment on Publications form at www.ashrae.org/resources--publications and they will be emailed to you.

Table A.1 Unit Conversion Factors

LENGTH	1 m = 3.2808 ft = 39.37 in = 100 cm = 10^6 μm = 10^{10} Angstrom
	1 ft = 0.3048 m = 12 in = 30.48 cm = 0.33333 yd
	1 km = 1000 m = 0.621 mi, 1 in = 2.540 cm = 0.0254 m
	1 mi = 5280 ft = 1760 yd = 1609.4 m
AREA	1 m^2 = 10.76 ft^2 = 10^4 cm^2 1 acre = 43,560 ft^2 = 4047 m^2
	1 ft^2 = 144 in^2 = 0.09291 m^2 = 929.1 cm^2 1 ha = 10^4 m^2 = 2.47 acre
VOLUME	1 gal = 0.13368 ft^3 = 3.785 L = 4 qt = 8 pints = 16 cups = 256 Tbsp
	1 L = 10^{-3} m^3 = 10^3 ml = 10^3 cm^3 = 1.057 qt = 0.03531 ft^3
	1 m^3 = 35.31 ft^3 = 1000 L = 264.1 gal = 1.308 yd^3
TIME	1 hr = 60 min = 3600 s, 1 yr = 52.14 wks = 365 days = 8760 hr
MASS	1 kg = 1000 g = 2.2046 lbm = 35.27 oz. Av. = 0.068521 slugs
	1 lbm = 0.4536 kg = 453.6 g = 16 oz. Av. = 0.031081 slugs
FORCE	1 N = 1 kg·m/s^2 = 0.2248 lbf = 10^5 dyn = 10^5 g·cm/s^2
	1 lbf = 4.448 N = 4.448 × 10^5 dyn

Table A.1 Unit Conversion Factors

ENERGY	1 J = 1 kg·m^2/s^2 = 107 g·cm^2/s^2 = 1 N·m = 0.7376 ft-lbf
	1 Btu = 778.16 ft·lbf = 1.055 × 10^6 ergs = 252 cal =1.0550 kJ
	1 cal = 4.186 J = 3.088 ft·lbf
	1 kcal = 4186 J = 1000 cal = 3.968 Btu
	1 erg = 1 g·cm^2/s^2 = 10^{-7} J
	1 Q = 10^{18} Btu = 1.055 × 10^{21} J = 10^3 Quad
	1 kJ = 0.94781 Btu = 0.23884 kcal = 1 kPa·m^3 = 6.242 × 10^{21} eV
POWER	1 W = 1 kg·m^2/s^3 = 1 J/s = 1 N·m/s = 3.412 Btu/hr
(Heat Transfer Rate)	1 hp = 550 ft·lbf/s = 33000 ft·lbf/min = 2545 Btu/h = 746 W
	1 kW = 1000 W = 3412 Btu/hr 1 MW = 3.412 × 10^6 Btu/hr
	1 ton (refrig.) = 12000 Btu/h = 3.517 kW
PRESSURE	1 atm = 14.696 lbf/in^2 = 760 torr = 101,325 Pa = 29.92 in Hg
	1 bar = 10^5 Pa = 14.504 lbf/in^2 = 10^6 dyn/cm^2 = 0.98692 atm
	1 Pa = 1 N/m^2 = 1 kg/m·s^2 = 1 J/m^3 = 1.4504 × 10^{-4} lbf/ft^2
	1 lbf/in^2 = 1 psi = 6894.6 Pa = 2.0418 in Hg = 144 lbf/ft^2
	1 in Hg = 3376.8 Pa = 0.4898 lbf/in^2 = 13.57 in H_2O
	1 in H_2O = 248.8 Pa = 0.0361 lbf/in^2=5.2 lbf/ft^2
Volume/Mass Flow Rate (Water)	1 gpm = 3.785 Lpm = 8.33 lb/min = 0.06297 kg/s
Volume Flow Rate	1 cfm = 28.32 Lpm= 0.472 Lps = 0.0283 m^3/min = 1.699 m^3/hr
POWER/AREA	1 W/m^2 = 0.3170 Btu/(h·ft^2) = 0.85984 kcal/(hr·m^2)
ENERGY/MASS	1 kJ/kg = 0.4299 Btu/lbm = 0.23884 kcal/kg
SPECIFIC HEAT	1 kJ/(kg·K) = 0.23884 Btu/(lbm·R) = 0.23884 kcal/(kg·K)
	1 Btu/(lbm·R) = 4.186 kJ/(kg·K)
THERMAL CONDUCTIVITY	1 W/(m·K) = 0.5778 Btu/(h·ft·R) [1 Btu/(h·ft·R) = 1.731 W/(m·K)]
CONVECTION COEFFICIENT	1 W/(m^2·K) = 0.176 Btu/(hr·ft^2·R) [1 Btu/(hr·ft^2·R)=5.678 W/(m^2·K)]
DYNAMIC VISCOSITY	1 kg/(m·s) = 1 N·s/m^2 = 0.6720 lbm/(ft·s) = 10 Poise
TEMPERATURE	1 K = 1.8 R , °C = (°F - 32)/1.8, °F = 1.8° C + 32, R = °F + 459.67
g_c	g_c = 1 = 1 kg·m/N·s^2 = 32.178 ft·lbm/lbf·s^2 = 1 ft·slug/lbf·s^2
Universal Gas Constant, $\bar{R}$	$\bar{R}$ = 8.3144 kJ/kmol-K = 1545 Btu/lbmol-R = 1.9872 kcal/kgmol-K

Source: K. Clark Midkiff, PhD, *Course Notes: ME 215, Thermodynamics I, University of Alabama*