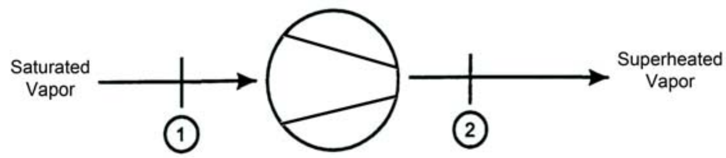
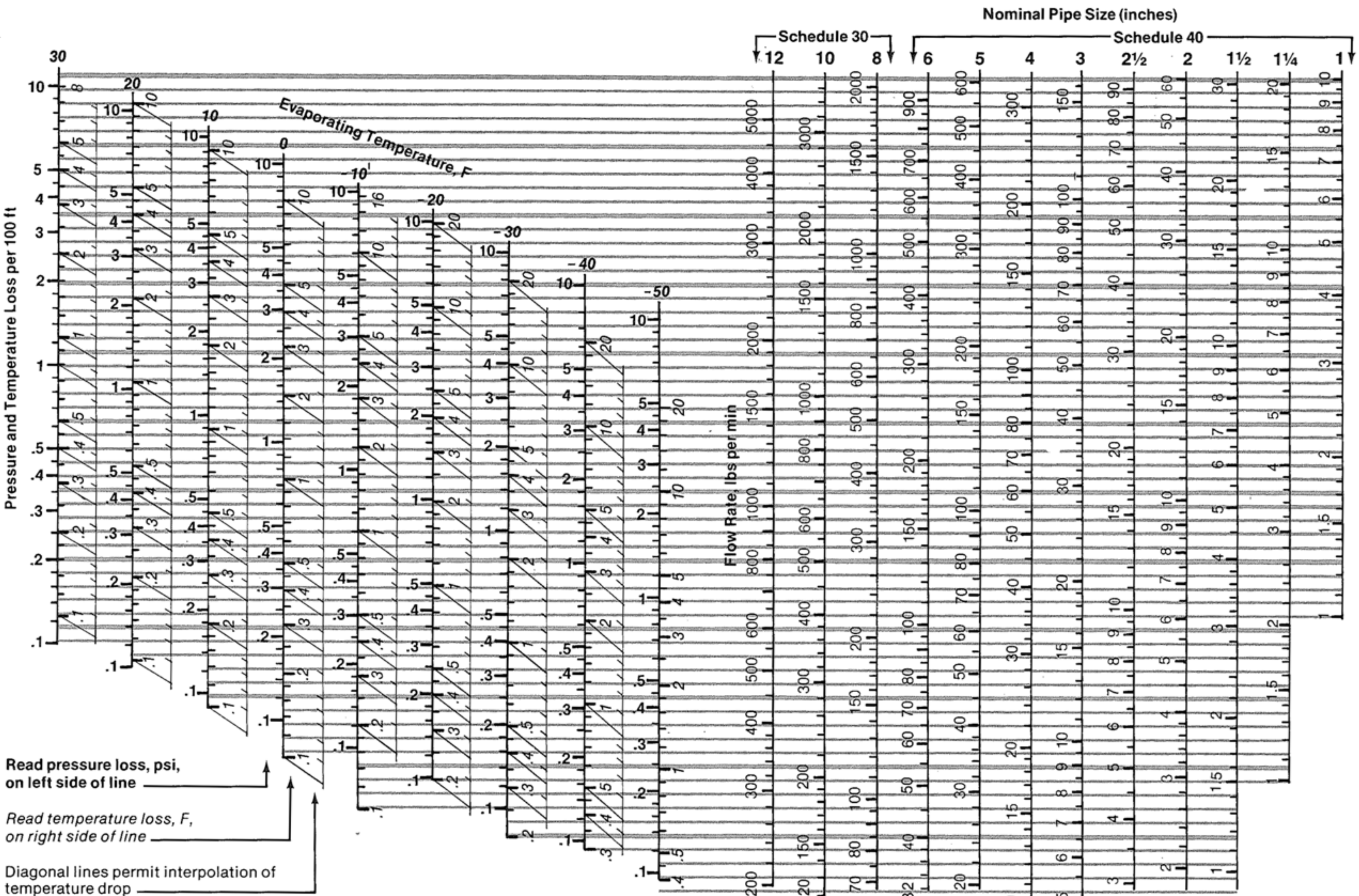
Errata to
Fundamentals of Refrigeration I-P
January 17, 2012

Items highlighted in gray have been added since the previous errata.

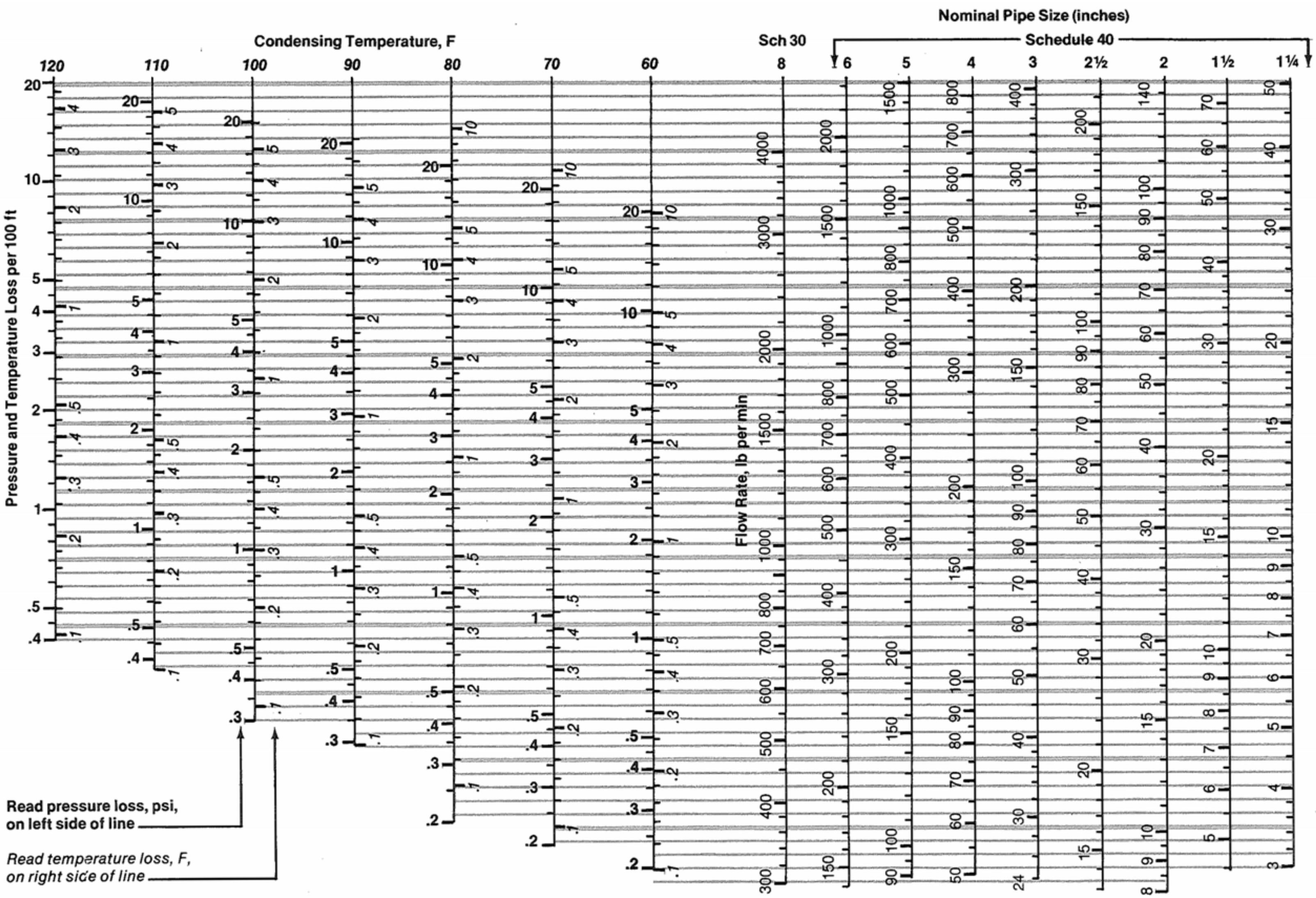
Page #	Location	
21	5 lines from top	Added "(Specific heat of air at constant pressure is 0.2359 Btu/lb)."
25	3 lines from bottom	$h_g = 111.530$ Btu/lb
25	2 lines from bottom	$h_f = 34.859$ Btu/lb
25	bottom line	$x = (88.414 - 34.859)/(111.530 - 34.859) = 0.700$
26	4 lines from top	$\rho_f = 73.23\ \text{lb/ft}^3$
26	5 lines from top	$v_f = 1/73.23 = 0.01366\ \text{ft}^3/\text{lb}$
26	6 lines from top	$v_g = 0.3207\ \text{ft}^3/\text{lb}$
26	7 lines from top	$v = 0.01366 + (0.700)(0.3207 - 0.01366)$
26	8 lines from top	$= 0.229\ \text{ft}^3/\text{lb}$
35	Update Figure 2-10	 **Figure 2-10 Ideal compressor.**
36	4 lines from top	$h_1 = 107.471$ Btu/lb $\quad s_1 = s_2 = 0.22278$ Btu/lb·°R
36	6 lines from top	0.22278 Btu/lb·°R
36	12 lines from top	$T = T_{sat} = 105.17°\text{F}$
36	13 lines from top	s should be 0.22278
36	15 lines from top	$h_2 = 116.71 + \frac{(0.22278 - 0.21844)}{(0.22530 - 0.21844)}(120.64 - 116.71)$
36	16 lines from top	$= 119.20$ Btu/lb
36	8 lines from bottom	$\dot{W}_{in} = (2\ \text{lb/min})(1\ \text{min/60 s})[(119.20 - 107.471)]\ \text{Btu/lb}$
36	7 lines from bottom	$= 0.391\ \text{Btu/s} = 1407\ \text{Btu/h}$
36	6 lines from bottom	$= (1407\ \text{Btu/h})\left(\frac{1}{2545\ \text{Btu/h}}\right) = 0.55\ \text{hp}$
38	15 lines from top	$p_2(sat.) = 5.778$ psia
38	18 lines from top	$h_1 = 30.671\ \text{Btu/lb} = h_2$
39	2 lines from top	$h_{f2} = 18.570$ Btu/lb $\quad h_{g2} = 95.877$ Btu/lb
39	4 lines from top	$= \frac{30.671 - 18.570}{95.877 - 18.570}$
39	5 lines from top	$= 0.157$ or 15.7%
40	2 lines from top	$h_1 = 30.671$ Btu/lb $\quad h_2 = 95.877$ Btu/lb
40	4 lines from top	$= (5\ \text{lb/min})(95.877 - 30.671)\ \text{Btu/lb}$
181–182	N/A	Figures 7-3 and 7-4 have been replaced with more legible graphics (see below).



Based on temperatures superheated above saturation as normally occurs in practice. See text for details.

Wall thicknesses used for this chart are not a design recommendation. Consult applicable codes and standards for safety limitations. See text for loss with other wall thicknesses.

Figure 7-3 Pressure and temperature losses for ammonia in steel pipe suction lines.



Based on temperatures superheated above saturation as normally occurs in practice. See text for details.

Wall thicknesses used for this chart are not a design recommendation. Consult applicable codes and standards for safety limitations. See text for loss with other wall thicknesses.

Figure 7-4 Pressure and temperature losses for ammonia in steel pipe discharge lines.

Page #	Location	
26	6 lines from bottom	h = 59.103 Btu/lb v = 1/40.66 = 0.02459 ft^3/lb
35	Equation 2-17	$-\dot{W}_{out} = \dot{m}_2 h_2 - \dot{m}_1 h_1$
37	Example 2-6	h_2 = 24.72 Btu/lb
55	12 lines from top; insert after first sentence.	"Thus the results shown in figure 3-9 include the removal of flash gas."
55	13 lines from top	"temperature is observed to be approximately"
55	13 lines from top	30°F should be 22°F.
55	14 lines from top	70 psia should be 60.1 psia.
55	15 lines from top	55 psia should be 70.0 psia, and 18°F should be 30°F.
55	17 lines from top	2% should be 4%
62	Example 3-3 solution	h_1 = 617.590 Btu/lb and s_1 = 1.29629 Btu/lb·°R
89	Example 4-2 solution	Change the last sentence of Example 4-2 solution to: "Because the can's surface temperature is less than the surrounding air's dew point temperature, moisture must condense on the can surface."
110	Skill Dev Exercise 4-5	Change last sentence to read "Assume that the refrigerant enters the coil as a saturated liquid and leaves as a saturated vapor at 35°F with no pressure drop."
144–145	In text	All occurrences of "impellor" should be spelled "impeller."
176	Table 7-1	Row two, column two, the roughness factor should be 0.000005.
177	Example 7-1	Viscosity = μ =0.0199 lb/ft·h (1 h/3600 s) = 0.00000553 = 5.53 $\times 10^{-6}$ lb/ft·s
231	Figure 9-1	Revise Figure 9-1 as shown on following pages.
234	Equation 9-2	$V_f = A_f L\left[\pi R^2\left(\frac{\theta}{180°}\right) - R(R - H_f)\sin\theta\right]$
248	Eight lines from bottom	Change 1.9 × 1.9 = 3.61 ft to (2)(1.9 ft) = 3.8 ft.
248	Seven lines from bottom	Change 3.6 ft 3.8 ft.
248	Three lines from bottom	Change 3.6 ft to 3.8 ft.
259	Figure 10-1	Revise Figure 10-1 as shown on the following pages.
265	Table 10-2	Seventh column, second row: 8.81 should be 10.36.
272	Last sentence	"The dominant code in the U.S. HVAC&R industry is ASHRAE Standard 15, which is continuously maintained by ASHRAE and consists of 13 sections and ten appendices."
274	Example 10-1	$m = \frac{pV}{R_{\text{R-404A}}T} = \frac{(14.7)(144)(69)}{(15.83)(70+460)} = 17.4\frac{\text{lb R-404A}}{1000\ \text{ft}^3}$
275	Third line from top	"See that the maximum allowed quantity of refrigerant R-404A, according to Table 10-1, is 2227 lb, which in this situation is far greater than the 45 lb charge."
276	7 lines from top	44 should be 144

Page #	Location	
291–292	Correct the solution as follows.	Furthermore, we can write $$\frac{M}{\Delta t} = \dot{m} \quad \text{and} \quad \frac{Q_{total}}{\Delta t} = \dot{Q}$$ where the dot above the quantity denotes a time rate of change or flow. Substituting $\dot{m}$ and $\dot{Q}$ into the above equation gives $$\dot{Q} = \dot{m}c_{p,\,unfrozen}(T_{initial} - T_{freeze}) + \dot{m}h_L + \dot{m}c_{p,\,frozen}(T_{freeze} - T_{final})$$ For this example, $\dot{m}$ = 200 lb/min, and from Appendix C, Table C-2, for blueberries, we have $c_{p,unfrozen}$ = 0.91 Btu/lb°F $c_{p,frozen}$ = 0.49 Btu/lb°F h_L = 122 Btu/lb T_{freeze} = 29.1°F So, $$\dot{Q} = (200)(0.91)(80 - 29.1) + (200)(122) + (200)(0.49)[29.1 - (-5)]$$ $$= 9264 + 24{,}400 + 3342$$ $$= 37{,}010 \text{ Btu/min}$$ or that $$\dot{Q} = \frac{37{,}010}{200} = 185 \text{ tons, refrigerating capacity}$$
298	17 lines from bottom	Replace last part of paragraph with "Figure 11-7d shows the airflow pattern as horizontal with no baffling. Other spiral freezer designs use baffles to split and direct the airflow in a manner to decrease freezing times. Additionally, the airflow pattern may be arranged such that the coldest air first contacts the coldest product. This is generally referred to as a parallel arrangement."
311	First three lines from top	$$h_{am,\,in}(\text{sat. liq., }-20°\text{F}) = 21.253 \text{ Btu/lb}$$ $$h_{am,\,out}(\text{sat. vap., }-20°\text{F}) = 604.789 \text{ Btu/lb}$$ $$\dot{m}_{am} = \frac{(140 \text{ lb/min})(0.695 \text{ Btu/lb}\cdot°\text{F})[10°\text{F} - (-5°\text{F})]}{(604.789 - 21.253) \text{ Btu/lb}} = 2.50 \text{ lb/min}$$
314	Skill Dev Exercise 11-5	Change 20,000 lb to 60,000 lb.
351	Skill Dev Exercise 12-5	Modify last paragraph to read: "Assuming that each month contains 30 days, what is the average daily leak rate of R-123 for each month? Is there reason for concern? Use the Internet to access the U.S. EPA regulations concerning refrigerant leak rates and determine if there is cause for concern. Is there another reason for concern?"

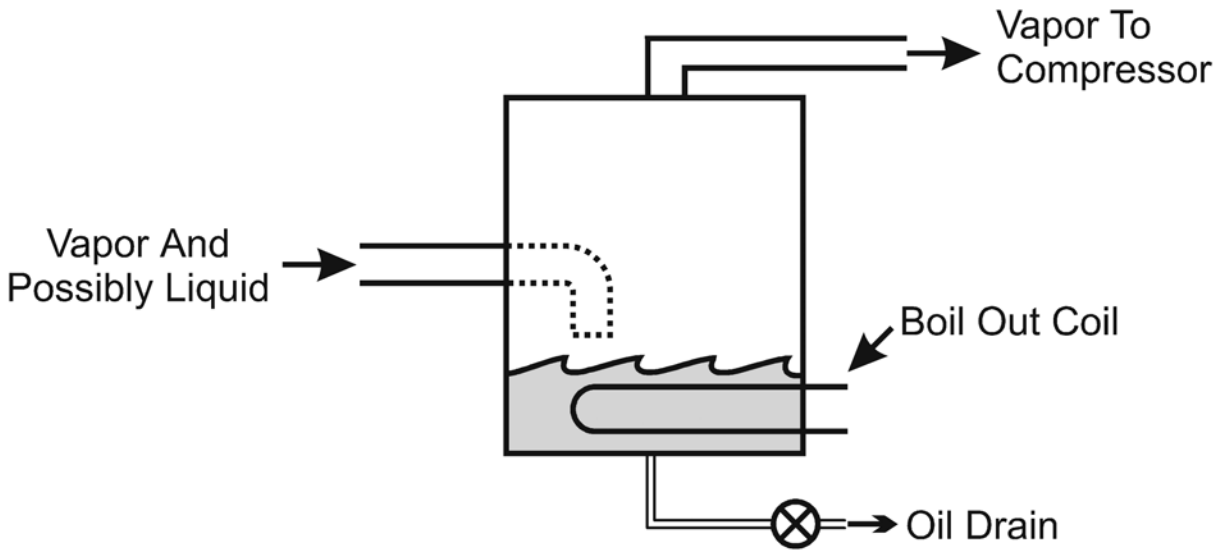


Figure 9-1 Suction line accumulator.

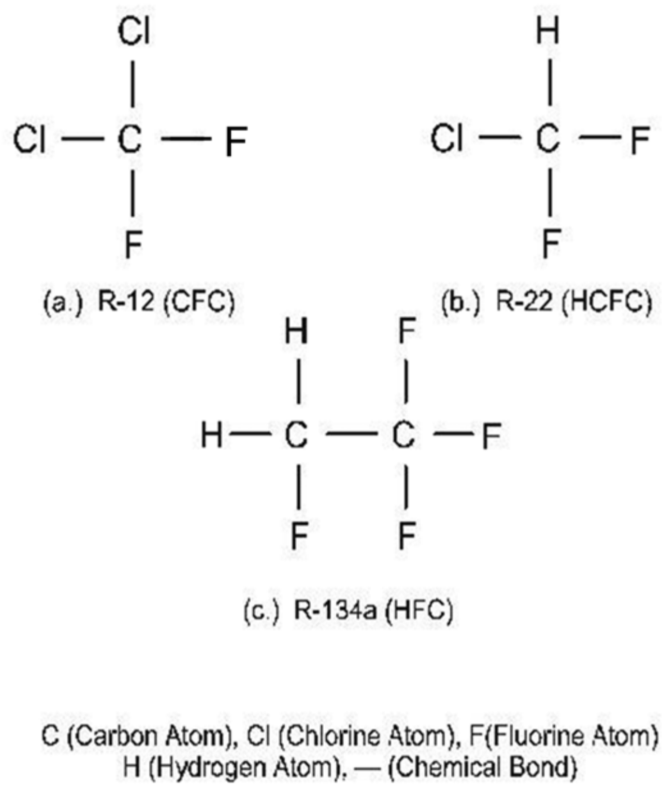


Figure 10-1 Molecular structures of select halocarbon refrigerants.