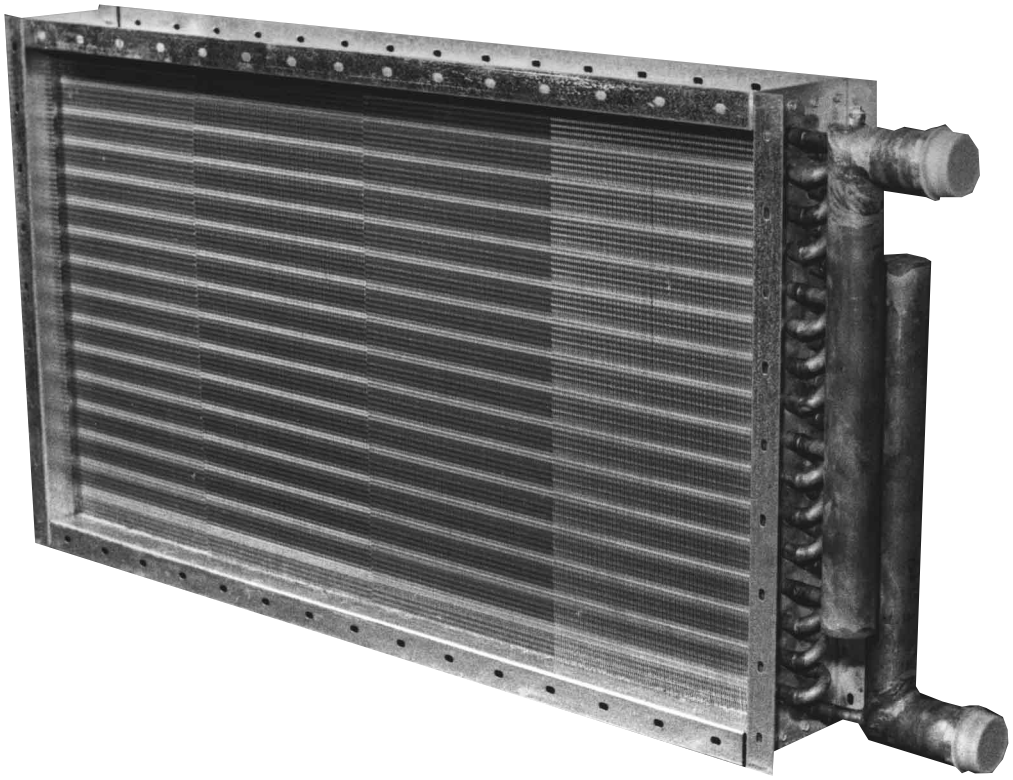
COLMAC COIL
Manufacturing Inc.

BULLETIN 5050

5/8" WATER COOLING COILS

APRIL 1, 2000
REVISED

WATER COOLING COILS
5/8" OD TUBE



Type BW
Chilled Water Coils

MANUFACTURER CERTIFIED TO ARI AS COMPLYING WITH ARI STANDARD 410
FORCED CIRCULATION AIR-COOLING and AIR HEATING COILS

Colmac coils are rated in accordance with standard industry practice.

SPECIFY COLMAC QUALITY

Table of Contents

COIL NOMENCLATURE

Ordering Data

BW	L	24	48	4R	8F	WR	L	100

Type of Coil
BW - Basic Water

Tube Size
L - 5/8 Inch O.D.

Finned Height
6 through 72 inches

Note: Finned height is equal to the number of: 5/8" tubes high x 1.5

Finned Length
12 through 240 inches

Rows Deep
2 through 12

Note: Fin Depth (in direction of Airflow) # of Rows x 1.2990

Fins per Inch
4 through 14

Fin Patterns
FF - Flat Fin, Flat Edge
FR - Flat Fin, Ripple Edge
WF - Waffle Fin, Flat Edge
WR - Waffle Fin, Ripple

Header Location
R - Right Hand
L - Left Hand

Coil Circuiting
Water
200 - Double
150 - One and one half
100 - Full
075 - Three Quarters
067 - Two Thirds
050 - Half
033 - One Third
025 - Quarter
SPE - Special: Can be shown as a percentage as above (038, 167, etc.) or as Feeds/Passes.

Note – A **Right** or **Left** hand Coil is determined by the location of the Outlet Connection, when facing in the same direction as the air flow.

Type BW Coils
General

Colmac Type BW Water Coils are certified under ARI Standard 410-81. Capacities are based on counterflow air and water through the coil. Application data is based on standard air conditions. Coil tested to 350 psig dry air under water.

Tubes

- 5/8" O.D. seamless copper in a 1.50 inch equilateral staggered pattern.
- Mechanically or hydraulically expanded into full length fin collars.
- Copper return bends and stub connections are brazed into expanded tube ends using high temp brazing alloy.
- 4 thru 8 rows deep ARI certified (2 thru 12 rows available).

Fins

- Aluminum alloy configured plate type fins (copper fin and flat plate fin available).
- 8 to 12 fins per inch ARI certified (4 thru 14 fins per inch available).
- WF and WR fin patterns ARI certified.

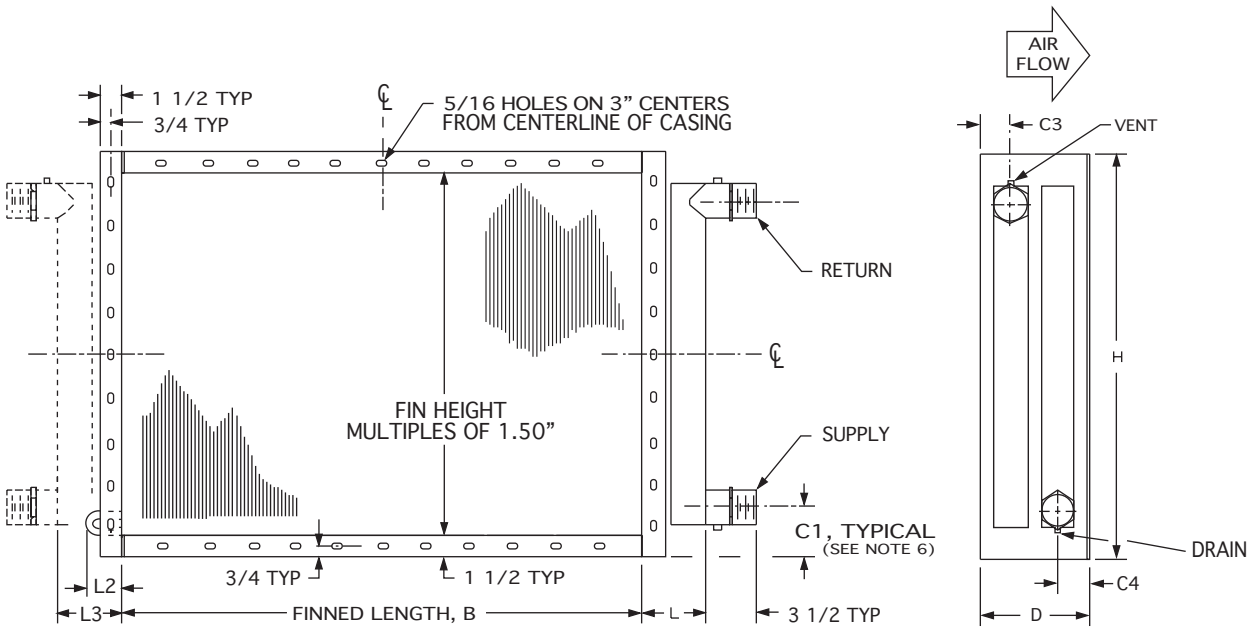
Headers

- Seamless copper tube in accordance with ASTM B88.
- Headers individually sized to coils to minimize water pressure drop.

Coil Casing

- Mill Galvanized sheet metal with full slotted flanges for convenient mounting.
- Finned heights from 6 to 72 inches.
- Finned lengths from 12 to 240 inches.

DIMENSIONS
5/8" Basic Water Coils



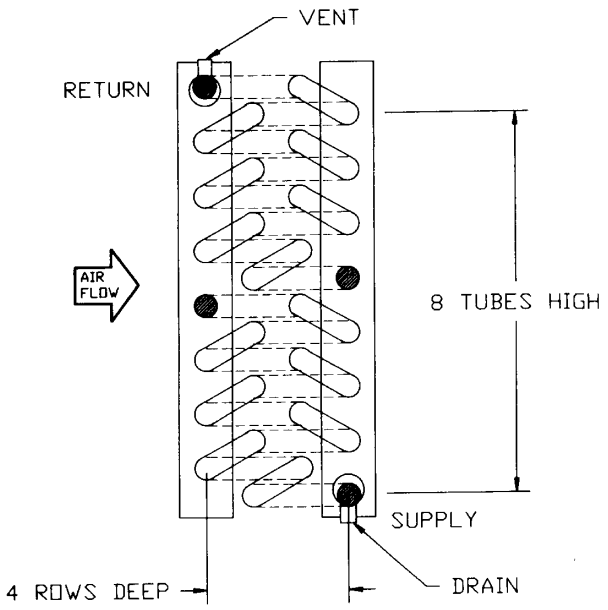
Rows	Circuiting	Fin Height 6 to 17 in. Supply & Return MPT	Fin Height 18 to 29 in. Supply & Return MPT	Fin Height 30 to 43 in. Supply & Return MPT	Fin Height 44 + in Supply & Return MPT	L	Note 5 D	C3/C4	Basic Water L2	Basic Water L3	Cleanable Removable Plugs Opposite Supply End L2	Cleanable Removable Plugs Opposite Supply End L3	Cleanable Removable Plugs Both Ends L2	Cleanable Removable Plugs Both Ends L3
1	Full **	1	1 1/4	1 1/2	2	Note 3	4 1/2	2 1/4	—	Note 1	—	—	—	—
	Partial	1	1 1/4	1 1/2	2	Note 4	4 1/2	1 1/8	2 1/2	—	—	—	—	—
2	Double **	2 1/2	2 1/2	2	2 1/2	Note 3	6	3	—	Note 1	—	—	—	—
	Full / Partial	1 1/2	2	2	2 1/2	Note 4	6	1 1/2	2 1/2	—	3 3/4	—	—	—
3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Full / Partial	1 1/2	2	2	2 1/2	Note 3	7	2 1/4	—	Note 1	—	Note 2	—	Note 2
4	Double	2 1/2	2 1/2	2 1/2	3	Note 3	8 1/2	3	2 1/2	—	3 3/4	—	3 3/4	—
	Full / Partial	1 1/2	2	2 1/2	3	Note 3	8 1/2	2 1/4	2 1/2	—	3 3/4	—	3 3/4	—
6	Double **	2 1/2	2 1/2	2 1/2	3	Note 3	11	3	—	Note 1	—	Note 2	—	Note 2
	Full / Partial	1 1/2	2	2 1/2	3	Note 3	11	2 1/4	2 1/2	—	3 3/4	—	3 3/4	—
8	Double	2 1/2	2 1/2	2 1/2	3	Note 3	13 1/2	2 7/8	2 1/2	—	3 3/4	—	3 3/4	—
	Full / Partial	1 1/2	2	2 1/2	3	Note 3	13 1/2	2 1/4	2 1/2	—	3 3/4	—	3 3/4	—
10	Double **	2 1/2	2 1/2	2 1/2	3	Note 3	16	2 7/8	—	Note 1	—	Note 2	—	Note 2
	Full / Partial	1 1/2	2	2 1/2	3	Note 3	16	2 1/4	2 1/2	—	3 3/4	—	3 3/4	—

**Will result in Opposite End Connections.

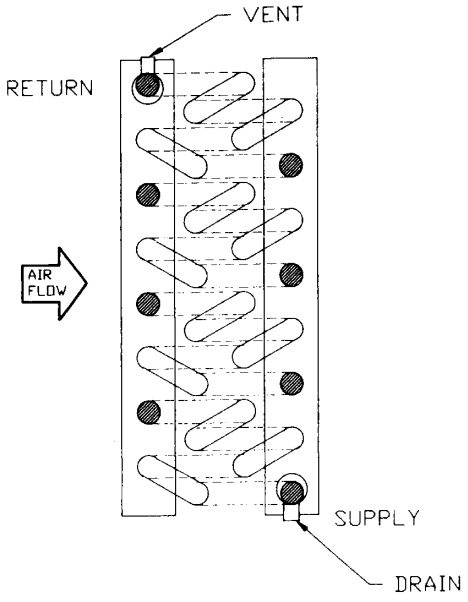
Notes:

1. Same as appropriate "L".
2. Add 1 3/4" to appropriate "L".
3. 2 1/2" plus Header Nominal OD.
4. 3" plus Header Nominal OD.l
5. Consult Factory for "D" when using cleanable return bends
6. C1 & C2 = Flange + 1/2 Conn. Nom. OD.
7. Circuiting over "Full" requires 2 1/2 or larger headers.
8. Intermediate tube sheets provided when finned length exceeds 54".

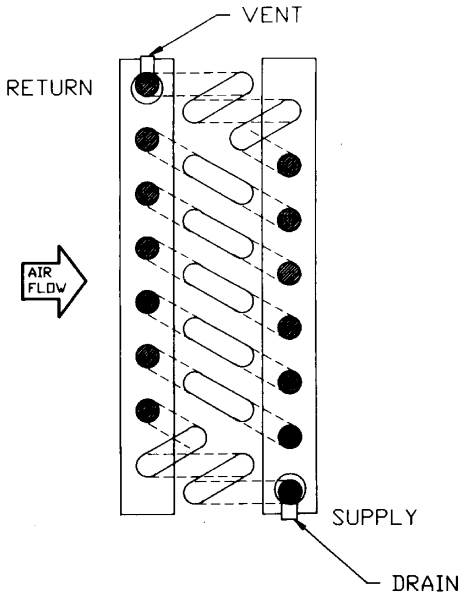
TYPICAL CIRCUITING ARRANGEMENTS



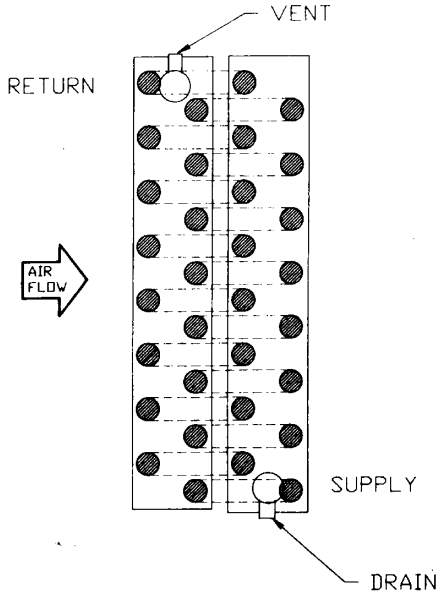
QUARTER CIRCUIT (25)



HALF CIRCUIT (50)



FULL CIRCUIT (10)



DOUBLE CIRCUIT (00)

-- FULL OR HALF IS STANDARD COIL ARRANGEMENT.
-- DOUBLE CIRCUIT REDUCES WATER VELOCITY AND PRESSURE DROP IN TUBES.
-- HALF AND QUARTER CIRCUIT INCREASES WATER VELOCITY AND PRESSURE DROP IN TUBES.
-- DRAINABLE CIRCUIT AVAILABLE. (ALL WATER COILS SELF DRAINING BY DESIGN)
-- OTHER CIRCUITING ARRANGEMENTS ARE AVAILABLE.
-- RIGHT AND LEFT HAND CONNECTIONS AVAILABLE.

When selecting cooling coils it is advisable for economy to consider . . .

- The leaving air dry bulb temperature should be 6 or more degrees F above the entering water temperature.
- Higher air and water velocities yield higher cooling capacities. Water velocities between 4 and 8 ft/sec and air velocities between 400 and 700 ft/min. are recommended.

EXAMPLE

Example of Chilled Water Cooling Coil Selection for either Cooling and Dehumidifying or Sensible Cooling Only Applications.

Given or Calculated Information:

Q_a	Air Flow Rate, ft^3/min. (std.)	2000
t_1	Entering dry bulb air temperature, °F	80
t_2	Leaving dry bulb air temperature, °F	58
t'_1	Entering wet bulb air temperature, °F	67
t'_2	Leaving wet bulb air temperature, °F	56.7
t_{wl}	Entering Water temperature, °F	45
t_{w2}	Leaving Water temperature, °F	52
A_f	Face Area, ft^2	4
V_a	Air Face Velocity, ft/min. (std.)	500

SOLUTION

1. The Chilled Water Coil may be selected by using the worksheet on Page 5. The application of certain formulas may be necessary to develop input information for the worksheet selection procedure. General formulas are given on Page 14. Refer to Pages 15 and 16 for definition of symbols and subscripts.
2. When the CFM is given and the desired ft/min. in known, the required face area is known. Thus, the face dimensions may be assumed for the application desired.
3. Several circuits should be tried to produce a resulting water velocity between 4 and 8 ft/sec. It may be helpful to select a water velocity of 6 ft/sec. and work backwards to find the approximate number of circuits required.

CHILLED WATER COIL WORKSHEET **JOB: EXAMPLE** **DATE:**

I. COIL DIMENSIONS: HEIGHT: **24**IN.; LENGTH: **24** IN.; TUBE SIZE: **5/8** O.D.; FINS/INCH **8**

II. AIR DATA: Air Quantity, Qa = **2000** SCFM

Air Velocity, $V_a = \frac{Q_a}{A_f} = \frac{\textbf{2000}\ \text{SCFM}}{4\text{ft}^2} = \textbf{500}$ ft/min. (std)

$\Delta t_a = t_1 - t_2 = \textbf{80 - 58} = \textbf{22}°\text{F.}$

$t'_1 = \textbf{67.0}$; $t'_2 = \textbf{56.7}$

$\Delta\mathbf{h} = h_1 - h_2 = \textbf{31.62 - 24.29} = \textbf{7.33}$ Btu/lb., **(Table 1)**

Sensible and Total Heat Loads,

$q_s = 1.08\ \text{SCFM}\Delta T_A = 1.08\ \ \textbf{(2000)}\ \ \textbf{(22)} = \textbf{47,520}$ Btuh

$q_t = 4.5\ \ \text{SCFM}\Delta h = 4.5\ \ \textbf{(2000)}\ \ \textbf{(7.33)} = \textbf{65,970}$ Btuh

Air Sensible Heat Ratio, $r = \frac{q_s}{q_t} = \textbf{.724}$

III. WATER DATA: $t_W = t_{w2} - t_{wl} = \textbf{52 - 45} = 7°\text{F.}$

GPM required $= \frac{q_t}{500\Delta t_w} = \frac{\textbf{65,970}}{500\ (7)} = \textbf{18.8}5$ GPM

$V_w = \frac{1.194\ \text{GPM}}{N_c} = \frac{1.194\ (\textbf{18.85})}{\textbf{4}} = \textbf{5.6}$ ft/sec

(Quarter Circuit)

IV. THERMAL CHARACTERISTICS.

Log Mean Temp. Difference **(Table 4)**

$\Delta T_L = t_1 - t_{w2} = \textbf{80–52} = \textbf{28}°\text{F.}$

$\Delta T_S = t_2 - t_{wl} = \textbf{58–45} = \textbf{13}°\text{F.}$

$\Delta T_m = \textbf{19.63}°\text{F}$

V. Unit Capacity **(Figs. 1-6 and 4a)**

$K_T = \frac{K \not{/} R^*}{(R_a + R_m) + R_w} = \frac{\textbf{(198)}\ \ \textbf{(1.18)}\ \ \textbf{(.0919)}}{\textbf{(.085) + (.015)}} = \textbf{215}$ Btu/hr ft^2°F row

Number of Rows, N_r

$N_r = \frac{q_t}{A_t\ t_m\ K_T} = \frac{\textbf{65,970}}{\textbf{(4)\ (19.63)\ (215)}} = \textbf{3.9}$ or **4 rows**

v. DRY OR WET SURFACE AIR FRICTION: **Fig.7**

ΔP_{st},Dry $= N_r\ (\Delta P_{st/N_r}) = \textbf{4}\ \ (\ \textbf{.079}\ ) = \textbf{.32}$ in. H_2O

ΔP_{sw}, Wet $= N_r\ (\Delta P_{sw/N_r}) = \textbf{4}\ \ (\ \textbf{.13}\ ) = \textbf{.52}$ in. H_2O

VI. WATER FRICTION: **Table 8, 9, Fig. 8**

$\Delta P_w = \left[\Delta P_h + L_e \left(\frac{\Delta Pt}{L_e F_t}\right)\right] F_t = \left[\ .77\ +\ (\ 54.5\ )\ (\ .245)\ \right]\ 1.03 = \textbf{.14.5}$ ft. H_2O

CHILLED WATER COIL WORKSHEET **JOB:** **DATE:**

I. COIL DIMENSIONS: HEIGHT: _____IN.; LENGTH: _____IN.; TUBE SIZE: _____O.D.; FINS/INCH _____.

II. AIR DATA: Air Quantity, Q_a = _____SCFM

Air Velocity, $V_a = \frac{Q_a}{A_f}$ = _____SCFM/ft^2 = _____ft/min. (std)

$\Delta t_a = t_1 - t_2$ = _____ - _____ = _____°F.

t'_1 = _____ ; t'_2 = _____.

$\Delta h = h_1 - h_2$ = _____ - _____ = _____Btu/lb., **(Table 1)**

Sensible and Total Heat Loads,

$q_s = 1.08\ SCFM\Delta T_A$ = 1.08 **(** _____ **) (** _____ **) =** _____Btuh

$q_t = 4.5\ SCFM\Delta h$ = 4.5 **(** _____ **) (** _____ **) =** _____Btuh

Air Sensible Heat Ratio, $r = \frac{q_s}{q_t}$ = _____.

III. WATER DATA: $t_W = t_{w2} - t_{wl}$ = _____ – _____ = _____°F.

GPM required = $\frac{q_t}{500\Delta t_w}$ = _____ / 500 ( ) = _____GPM

$V_w = \frac{1.194\ GPM}{N_c} = \frac{1.194\ (\quad)}{(\quad)}$ = _____ft/sec

IV. THERMAL CHARACTERISTICS.

Log Mean Temp. Difference **(Table 4)**

$\Delta T_L = t_1 - t_{w2}$ = _____ – _____ = _____°F.

$\Delta T_S = t_2 - t_{wl}$ = _____ – _____ = _____°F.

ΔT_m = _____°F

V. Unit Capacity **(Figs. 1-6 and 4a)**

$K_T = \frac{K \not{\prime} R^*}{(R_a + R_m) + R_w}$ = $\frac{(\quad)\ (\quad)\ (\quad)}{(\quad) + (\quad)}$ = Btu/hr ft^2°F row

Number of Rows, N_r

$N_r = \frac{q_t}{A_t\ t_m\ K_T}$ = _____ / ( ) ( ) ( ) = _____**rows**

v. DRY OR WET SURFACE AIR FRICTION: **Fig.7**

ΔP_{st},Dry $= N_r\ (\Delta P_{st/N_r})$ = _____(_____) = _____in. H_2O

ΔP_{sw}, Wet $= N_r\ (\Delta P_{sw/N_r})$ = _____(_____) = _____in. H_2O

VI. WATER FRICTION: **Table 5, 6, 7, 8, 9, Fig. 8**

$\Delta P_w = \left[\Delta P_h + L_e \left(\frac{\Delta Pt}{L_e F_t}\right)\right] F_t = \left[\quad + (\quad)(\quad)\right]$ _____ = _____ft. H_2O

Table 1

ENTHALPY OF MOIST AIR

Enthalpy of moist air in BTU per pound of dry air.

°F	TENTHS OF DEGREES									
WB	**.0**	**.1**	**.2**	**.3**	**.4**	**.5**	**.6**	**.7**	**.8**	**.9**
40	15.23	15.28	15.32	15.37	15.42	15.46	15.51	15.56	15.60	15.65
41	15.70	15.74	15.79	15.84	15.89	15.93	15.98	16.03	16.08	16.12
42	16.17	16.22	16.27	16.32	16.37	16.41	16.46	16.51	16.56	16.61
43	16.66	16.71	16.76	16.80	16.85	16.90	16.95	17.00	17.05	17.10
44	17.15	17.20	17.25	17.30	17.35	17.40	17.45	17.50	17.55	17.60
45	17.65	17.70	17.75	17.80	17.85	17.91	17.96	18.01	18.06	18.11
46	18.16	18.21	18.26	18.32	18.37	18.42	18.47	18.52	18.58	18.63
47	18.68	18.73	18.79	18.84	18.89	18.95	19.00	19.05	19.10	19.16
48	19.21	19.27	19.32	19.37	19.43	19.48	19.54	19.59	19.64	19.70
49	19.75	19.81	19.86	19.92	19.97	20.03	20.08	20.14	20.19	20.25
50	20.30	20.36	20.41	20.47	20.53	20.58	20.64	20.69	20.75	20.81
51	20.86	20.92	20.98	21.03	21.09	21.15	21.21	21.26	21.32	21.38
52	21.44	21.49	21.55	21.61	21.67	21.73	21.79	21.84	21.90	21.96
53	22.02	22.08	22.14	22.20	22.26	22.32	22.38	22.44	22.50	22.56
54	22.62	22.68	22.74	22.80	22.86	22.92	22.98	23.04	23.10	23.16
55	23.22	23.28	23.34	23.41	23.47	23.53	23.59	23.65	23.72	23.78
56	23.84	23.90	23.97	24.03	24.10	24.16	24.22	24.29	24.35	24.42
57	24.48	24.54	24.61	24.67	24.74	24.80	24.86	24.93	24.99	25.06
58	25.12	25.19	25.25	25.32	25.38	25.45	25.52	25.58	25.65	25.71
59	25.78	25.85	25.92	25.98	26.05	26.12	26.19	26.26	26.32	26.39
60	26.46	26.53	26.60	26.67	26.74	26.81	26.87	26.94	27.01	27.08
61	27.15	27.22	27.29	27.36	27.43	27.50	27.57	27.64	27.71	27.78
62	27.85	27.92	27.99	28.07	28.14	28.21	28.28	28.35	28.43	28.50
63	28.57	28.64	28.72	28.79	28.87	28.94	29.01	29.09	29.16	29.24
64	29.31	29.39	29.46	29.54	29.61	29.69	29.76	29.84	29.91	29.99
65	30.06	30.14	30.21	30.29	30.37	30.45	30.52	30.60	30.68	30.75
66	30.83	30.91	30.99	31.07	31.15	31.23	31.30	31.38	31.46	31.54
67	31.62	31.70	31.78	31.86	31.94	32.02	32.10	32.18	32.26	32.34
68	32.42	32.50	32.59	32.67	32.75	32.84	32.92	33.00	33.08	33.17
69	33.25	33.33	33.42	33.50	33.59	33.67	33.75	33.84	33.92	34.01
70	34.09	34.18	34.26	34.35	34.43	34.52	34.61	34.69	34.78	34.86
71	34.95	35.04	35.13	35.21	35.30	35.39	35.48	35.57	35.65	35.74
72	35.83	35.92	36.01	36.10	36.19	36.29	36.38	36.47	36.56	36.65
73	36.74	36.83	36.92	37.02	37.11	37.20	37.29	37.38	37.48	37.57
74	37.66	37.76	37.85	37.95	38.04	38.14	38.23	38.33	38.42	38.52
75	38.61	38.71	38.80	38.90	38.99	39.09	39.19	39.28	39.38	39.47
76	39.57	39.67	39.77	39.87	39.97	40.07	40.17	40.27	40.37	40.47
77	40.57	40.67	40.77	40.87	40.97	41.08	41.18	41.28	41.38	41.48
78	41.58	41.68	41.79	41.89	42.00	42.10	42.20	42.31	42.41	42.52
79	42.62	42.73	42.83	42.94	43.05	43.16	43.26	43.37	43.48	43.58
80	43.69	43.80	43.91	44.02	44.13	44.24	44.34	44.45	44.56	44.67

Air density ratios with standard air as unity are tabulated for various altitudes in Table 2 and for various temperatures in Table 3. If a correction is made for both altitude and temperature, multiply ratios together.

Table 2

ALTITUDE FEET			
ALT.	DENS.	ALT.	DENS.
0	1.000	5000	0.826
500	0.981	5500	0.811
1000	0.962	6000	0.796
1500	0.944	6500	0.781
2000	0.926	7000	0.766
2500	0.908	7500	0.751
3000	0.891	8000	0.736
3500	0.875	8500	0.722
4000	0.858	9000	0.708
4500	0.842	9500	0.694
5000	0.826	10,000	0.680

Table 3

TEMPERATURE FAHRENHEIT							
TEMP.	DENS.	TEMP.	DENS.	TEMP.	DENS.	TEMP.	DENS.
0	1.152	100	0.946	200	0.803	300	0.698
10	1.128	110	0.930	210	0.791	310	0.689
20	1.104	120	0.914	220	0.779	320	0.680
30	1.082	130	0.898	230	0.768	330	0.671
40	1.060	140	0.883	240	0.757	340	0.662
50	1.039	150	0.869	250	0.746	350	0.654
60	1.019	160	0.855	260	0.736	360	0.646
70	1.000	170	0.841	270	0.726	370	0.638
80	0.982	180	0.828	280	0.716	380	0.631
90	0.964	190	0.815	290	0.707	390	0.624
100	0.946	200	0.803	300	0.698	400	0.617

Standard Air is defined as weighing 0.075 pounds per cubic foot at sea level (29.92" H_g Barometric Pressure) and at 70° Fahrenheit.

Table 4

Log Mean Temperature Differences

LEAST or GREATEST TERMINAL TEMPERATURE DIFFERENCE

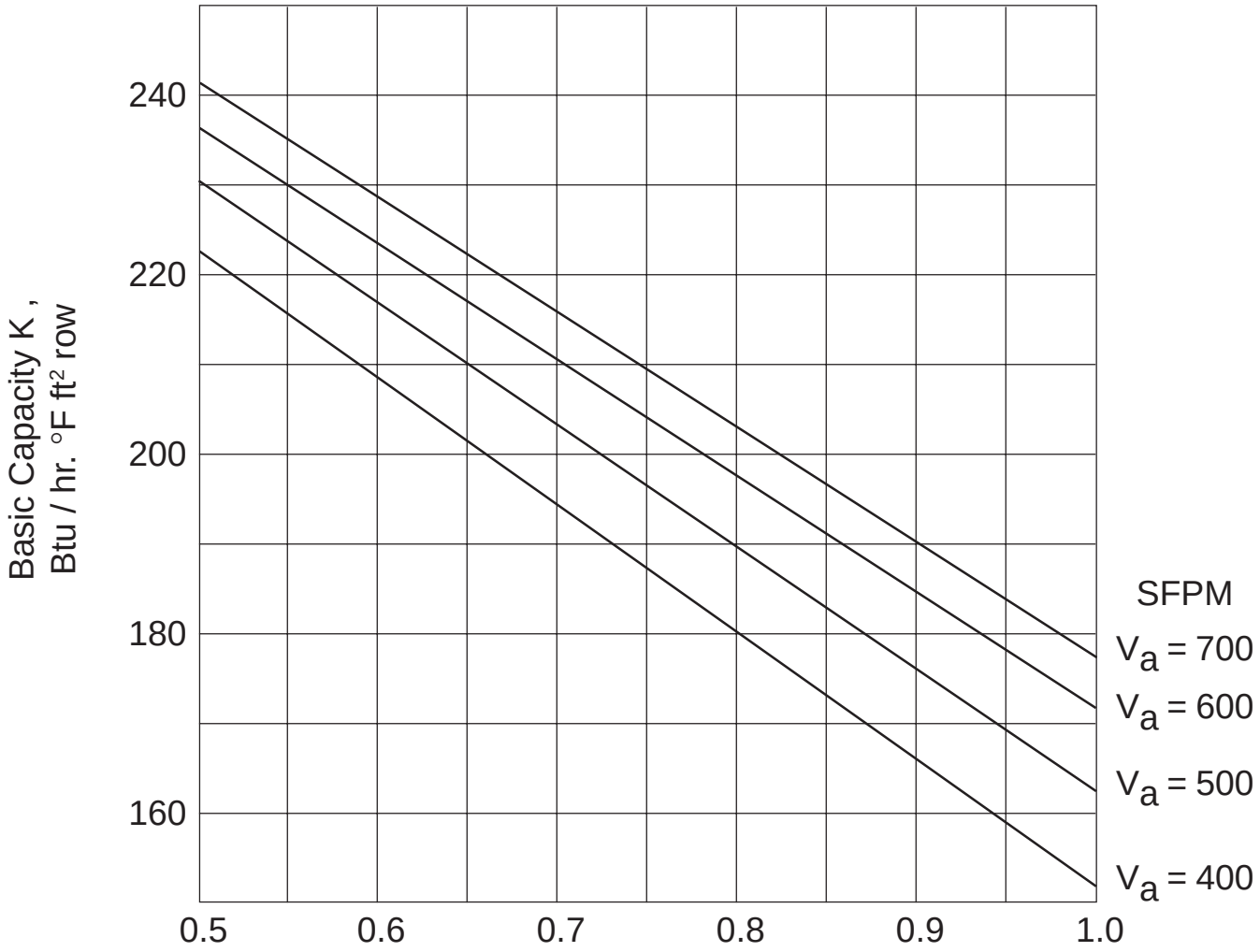
	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44
1	1.00	1.40	1.51	2.05	2.45	2.75	3.00	3.25	3.51	3.80	4.40	4.90	5.40	5.80	6.20	6.70	7.10	7.50	8.00	8.40	8.75	9.20	9.60	10.00	10.40	10.80	11.25
2	1.40	2.00	2.45	2.80	3.25	3.60	4.00	4.35	4.70	5.00	5.60	6.20	6.75	7.25	7.80	8.30	8.80	9.25	9.80	10.30	10.80	11.30	11.80	12.30	12.75	13.20	13.70
3	1.51	2.45	3.00	3.45	3.80	4.25	4.70	5.10	5.50	5.80	6.50	7.20	7.80	8.45	9.00	9.50	10.00	10.55	11.10	11.60	12.20	12.70	13.25	13.75	14.30	14.80	15.40
4	2.05	2.80	3.45	4.00	4.45	4.90	5.35	5.80	6.20	6.60	7.30	8.00	8.65	9.25	9.80	10.50	11.00	11.60	12.20	12.75	13.30	13.85	14.50	15.00	15.60	16.20	16.70
5	2.45	3.25	3.80	4.45	5.00	5.45	5.95	6.40	6.75	7.20	8.00	8.75	9.50	10.20	10.80	11.45	12.00	12.65	13.25	13.90	14.50	15.00	15.60	16.20	16.75	17.40	17.90
6	2.75	3.60	4.25	4.90	5.45	6.00	6.50	7.00	7.50	7.90	8.75	9.50	10.20	11.00	11.60	12.25	12.95	13.60	14.20	14.90	15.50	16.10	16.65	17.25	17.80	18.50	19.05
7	3.00	4.00	4.70	5.35	5.95	6.50	7.00	7.50	8.00	8.45	9.30	10.20	10.90	11.70	12.45	13.20	13.75	14.50	15.20	15.80	16.45	17.00	17.70	18.40	19.00	19.50	20.20
8	3.25	4.35	5.10	5.80	6.40	7.00	7.50	8.00	8.50	9.00	10.00	10.80	11.65	12.50	13.20	13.90	14.55	15.25	16.00	16.65	17.25	17.95	18.55	19.22	19.80	20.50	21.20
9	3.51	4.70	5.50	6.20	6.75	7.50	8.00	8.50	9.00	9.50	10.50	11.45	12.25	13.00	13.80	14.20	15.25	16.00	16.75	17.50	18.20	18.80	19.50	20.20	20.85	21.50	22.10
10	3.80	5.00	5.80	6.60	7.20	7.90	8.45	9.00	9.50	10.00	11.00	12.00	12.90	13.70	14.50	15.25	16.00	16.75	17.50	18.20	18.80	19.50	20.25	21.00	21.60	22.25	22.85
12	4.40	5.60	6.50	7.30	8.00	8.75	9.30	10.00	10.50	11.00	12.00	13.00	14.00	14.85	15.70	16.60	17.45	18.20	18.95	19.70	20.45	21.20	21.85	22.60	23.45	24.00	24.75
14	4.90	6.20	7.20	8.00	8.75	9.50	10.20	10.80	11.45	12.00	13.00	14.00	15.00	16.00	16.90	17.80	18.70	19.50	20.30	21.20	21.85	22.70	23.45	24.15	24.90	25.60	26.30
16	5.40	6.75	7.80	8.65	9.50	10.20	10.90	11.65	12.25	12.90	14.00	15.00	16.00	17.00	18.00	19.00	19.80	20.70	21.50	22.40	23.10	23.90	24.70	25.50	26.40	27.00	27.75
18	5.80	7.25	8.45	9.25	10.20	11.00	11.70	12.50	13.00	13.70	14.85	16.00	17.00	18.00	19.00	20.10	21.00	22.00	22.80	23.70	24.50	25.20	26.00	26.70	27.65	28.40	29.10
20	6.20	7.80	9.00	9.80	10.80	11.60	12.45	13.20	13.80	14.50	15.70	16.80	18.00	19.00	20.00	21.10	22.10	23.00	24.00	24.80	25.70	26.50	27.30	28.10	29.00	29.75	30.60
22	6.70	8.30	9.50	10.50	11.45	12.25	13.20	13.90	14.20	15.25	16.60	17.80	19.00	20.10	21.10	22.00	23.10	24.00	24.90	25.85	26.75	27.60	28.50	29.40	30.20	31.10	31.85
24	7.10	8.80	10.00	11.00	12.00	12.95	13.75	14.55	15.25	16.00	17.45	18.70	19.80	21.00	22.10	23.10	24.00	25.00	26.00	27.00	27.90	28.80	29.70	30.50	31.40	32.30	33.20
26	7.50	9.25	10.55	11.60	12.65	13.60	14.50	15.25	16.00	16.75	18.20	19.50	20.70	22.00	23.00	24.00	25.00	26.00	27.00	28.00	29.00	29.90	30.75	31.60	32.50	33.45	34.30
28	8.00	9.80	11.10	12.20	13.25	14.20	15.20	16.00	16.75	17.50	18.95	20.30	21.50	22.80	24.00	24.90	26.00	27.00	28.00	29.00	30.00	30.95	31.90	32.80	33.70	34.55	35.45
30	8.40	10.30	11.60	12.75	13.90	14.90	15.80	16.65	17.50	18.20	19.70	21.20	22.40	23.70	24.80	25.85	27.00	28.00	29.00	30.00	31.00	32.00	33.00	34.00	34.85	35.75	36.65
32	8.75	10.80	12.20	13.30	14.50	15.50	16.45	17.25	18.20	18.80	20.45	21.85	23.10	24.50	25.70	26.75	27.90	29.00	30.00	31.00	32.00	33.00	34.00	35.05	36.00	36.90	37.80
34	9.20	11.30	12.70	13.85	15.00	16.10	17.00	17.95	18.80	19.50	21.20	22.70	23.90	25.20	26.50	27.60	28.80	29.90	30.95	32.00	33.00	34.00	35.00	36.10	37.10	38.00	38.90
36	9.60	11.80	13.25	14.50	15.60	16.65	17.70	18.55	19.50	20.25	21.85	23.45	24.70	26.00	27.30	28.50	29.70	30.75	31.90	33.00	34.00	35.00	36.00	37.00	38.05	39.10	40.00
38	10.00	12.30	13.75	15.00	16.20	17.25	18.40	19.22	20.20	21.00	22.60	24.15	25.50	26.70	28.10	29.40	30.50	31.60	32.80	34.00	35.05	36.10	37.00	38.00	39.00	40.10	41.10
40	10.40	12.75	14.30	15.60	16.75	17.80	19.00	19.80	20.85	21.60	23.45	24.90	26.40	27.65	29.00	30.20	31.40	32.50	33.70	34.85	36.00	37.10	38.05	39.00	40.00	41.00	42.00
42	10.80	13.20	14.80	16.20	17.40	18.50	19.50	20.50	21.50	22.25	24.00	25.60	27.00	28.40	29.75	31.10	32.30	33.45	34.55	35.75	36.90	38.00	39.10	40.10	41.00	42.00	43.00
44	11.25	13.70	15.40	16.70	17.90	19.05	20.20	21.20	22.10	22.85	24.75	26.30	27.75	29.10	30.60	31.85	33.20	34.30	35.45	36.65	37.80	38.90	40.00	41.10	42.00	43.00	44.00
46	11.70	14.10	15.90	17.20	18.50	19.07	20.70	21.72	22.75	23.55	25.50	27.00	28.50	29.90	31.40	32.75	34.05	35.20	36.30	37.50	38.70	39.80	40.90	42.00	43.00	44.00	44.90
48	12.00	14.60	16.45	17.80	19.00	20.20	21.30	22.40	23.40	24.20	26.20	27.75	29.25	30.70	32.20	33.60	34.95	36.00	37.15	38.40	39.60	40.75	41.85	43.00	43.95	44.85	46.08
50	12.50	15.00	16.80	18.25	19.50	20.80	21.80	23.00	24.00	24.80	26.85	28.50	30.00	31.60	33.00	34.40	35.75	36.90	38.00	39.30	40.50	41.60	42.75	43.90	44.80	46.00	47.00
52	12.90	15.40	17.30	18.80	20.00	21.35	22.45	23.50	24.55	25.50	27.50	29.15	30.70	32.20	33.70	35.15	36.55	37.70	38.80	40.15	41.40	42.50	43.70	44.70	45.50	47.06	48.10
54	13.30	15.75	17.80	19.30	20.60	21.80	23.00	24.10	25.10	26.10	28.10	29.75	31.40	32.80	34.45	35.90	37.35	38.50	39.60	41.00	42.30	43.40	44.60	45.63	46.71	47.79	49.14
56	13.70	16.20	18.30	19.80	21.20	22.45	23.50	24.70	25.70	26.70	28.70	30.45	32.00	33.60	35.20	36.70	38.15	39.35	40.40	41.80	43.20	44.30	45.36	46.36	47.60	48.72	49.84
58	14.00	16.50	18.70	20.40	21.70	22.85	24.10	25.20	26.20	27.25	29.30	31.10	32.70	34.40	36.80	37.35	38.90	40.20	41.25	42.70	44.10	45.24	46.51	47.27	48.43	49.70	50.75
60	14.40	16.90	19.20	20.90	22.20	23.45	24.65	25.75	26.75	27.80	29.90	31.72	33.40	35.00	36.50	38.10	39.70	41.00	42.00	43.50	45.00	46.02	47.10	48.36	49.50	50.40	51.72
62	14.70	17.30	19.70	21.40	22.70	23.85	25.20	26.35	27.35	28.50	30.50	32.40	34.00	35.70	37.25	38.85	40.45	41.70	42.85	44.45	45.57	46.81	47.86	49.29	50.40	51.33	52.39
64	15.10	17.70	20.20	21.90	23.10	24.45	25.70	26.90	27.85	29.00	31.10	33.00	34.70	36.50	38.00	39.55	41.20	42.40	43.70	45.12	46.30	47.55	48.96	50.11	51.20	51.84	53.44
66	15.40	18.10	20.60	22.40	23.55	24.85	26.25	27.50	28.45	29.70	31.70	33.70	35.25	37.20	38.70	40.25	42.00	43.15	44.50	45.87	47.19	48.31	49.69	50.82	52.14	53.13	54.45
68	15.75	18.50	21.10	22.80	24.00	25.45	26.75	28.00	29.00	30.25	32.25	34.30	36.00	37.90	39.40	41.00	42.70	43.80	45.22	46.71	48.14	49.09	50.52	51.68	53.04	54.06	55.21
70	16.10	18.90	21.50	23.40	24.50	25.85	27.30	28.50	29.50	30.85	32.80	35.00	36.60	38.50	40.20	41.75	43.50	44.50	46.06	47.46	48.65	50.05	51.38	52.50	53.90	54.81	56.14
72	16.45	19.25	22.00	23.80	25.00	26.45	27.80	29.00	30.10	31.45	33.50	35.60	37.25	39.20	40.75	42.50	44.15	44.90	46.80	48.24	49.60	51.12	52.20	53.28	54.72	55.80	56.88
74	16.75	19.60	22.40	24.25	25.45	26.85	28.40	29.60	30.70	32.00	34.00	36.20	37.90	39.80	41.50	43.15	44.85	45.88	47.46	48.84	50.32	51.80	52.91	54.39	55.35	56.36	57.72
76	17.10	20.00	22.80	24.75	25.80	27.40	29.00	30.15	31.20	32.50	34.60	36.80	38.50	40.50	42.20	43.85	45.60	46.36	48.03	49.55	51.30	52.44	53.96	55.10	56.24	57.38	58.90
78	17.40	20.45	23.20	25.20	26.40	27.80	29.50	30.70	31.75	33.10	35.20	37.40	39.10	41.20	42.80	44.55	46.02	47.19	48.90	50.31	51.63	53.04	54.60	55.77	57.33	58.34	59.67
80	17.70	20.80	23.70	25.70	26.75	28.40	30.00	31.15	32.40	33.70	35.70	38.00	39.70	41.75	43.50	44.80	46.40	48.00	49.60	51.20	52.56	54.00	55.44	56.80	58.00	59.20	60.40

LEAST or GREATEST TERMINAL TEMPERATURE DIFFERENCE

Figure 1

Basic Capacity - 8 FPI

(WF or WR Fins)



$r = q_s/q_t$

Air Sensible Heat Ratio

Figure 2

Basic Capacity - 10 FPI

(WF or WR Fins)

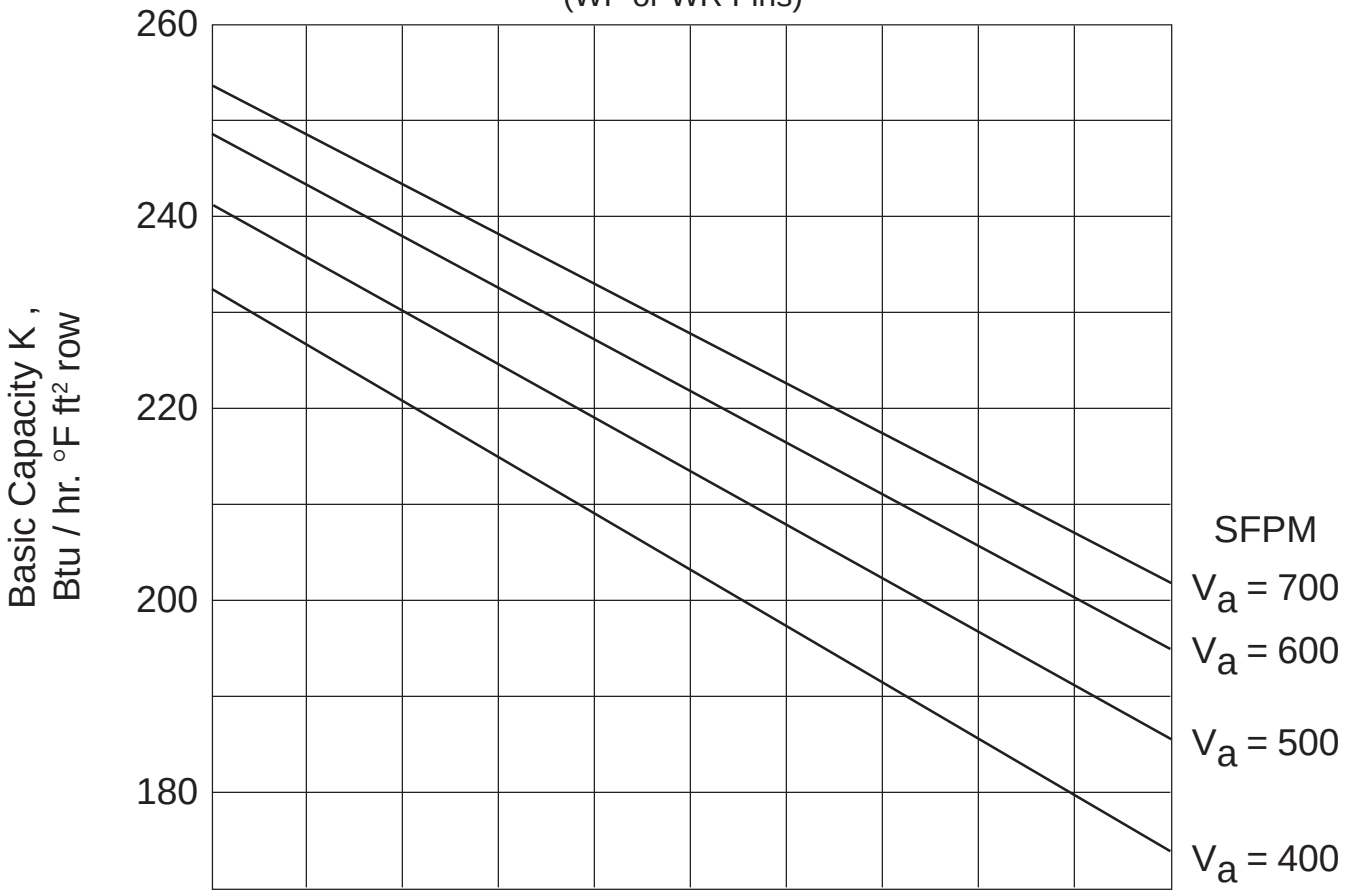


Figure 3

Basic Capacity - 12 FPI

(WF or WR Fins)

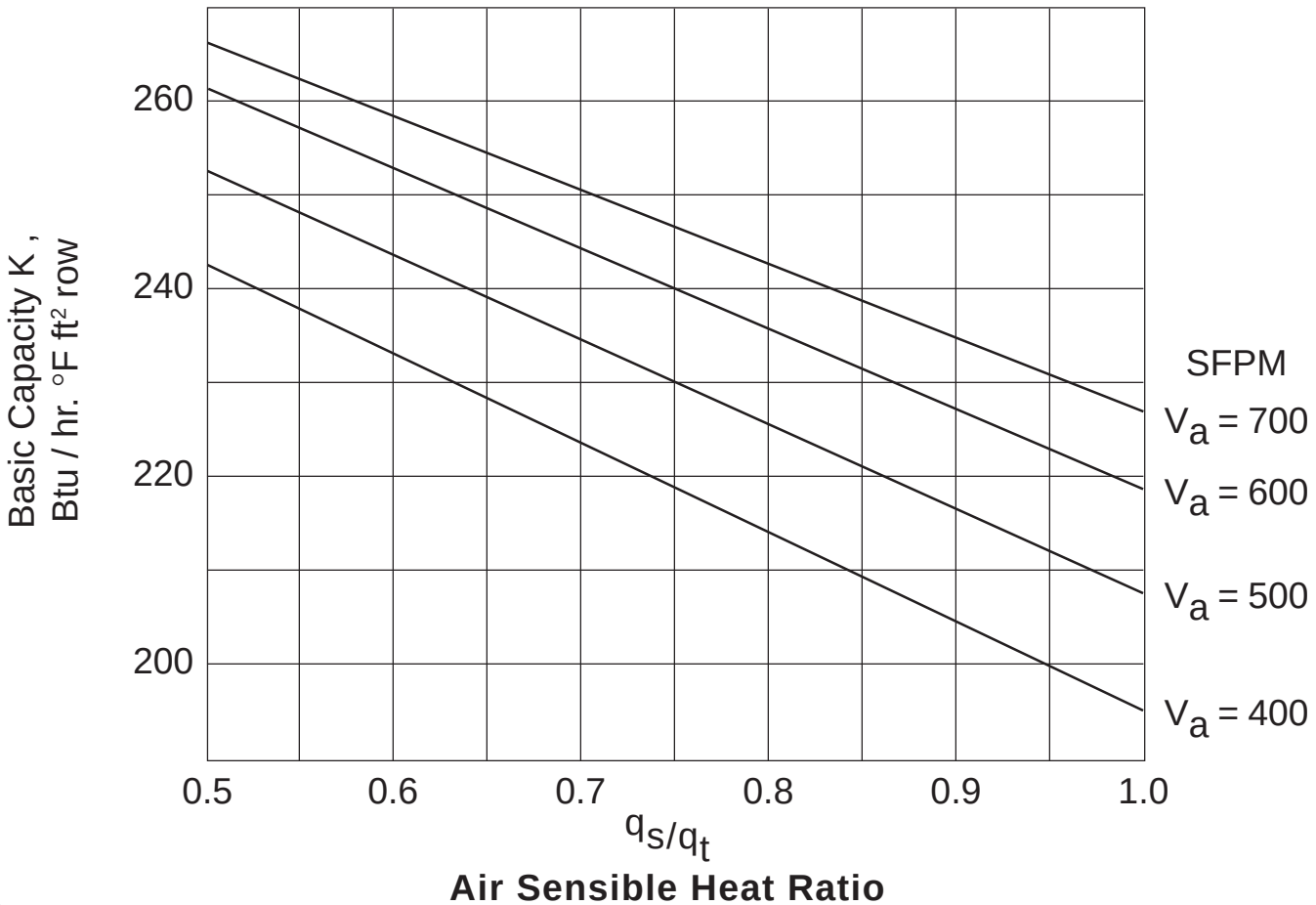


Figure 4

Basic Capacity Corrections Factor

(WF or WR Fins)

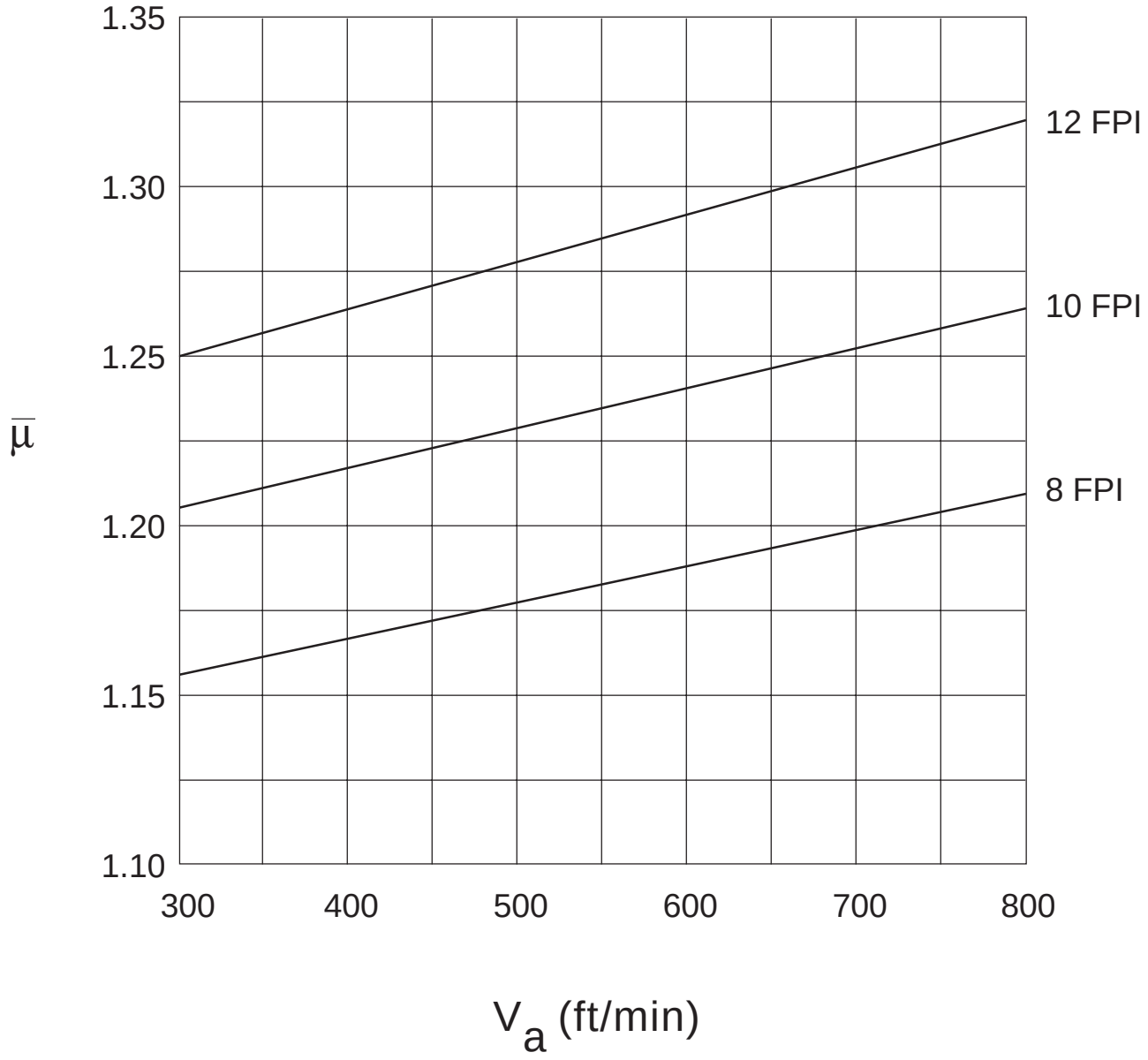


Figure 4a

R*, Characteristic thermal resistance values

(WF or WR Fins)

FPI	R*
8	0.0919
10	0.0976
12	0.1032

Figure 5

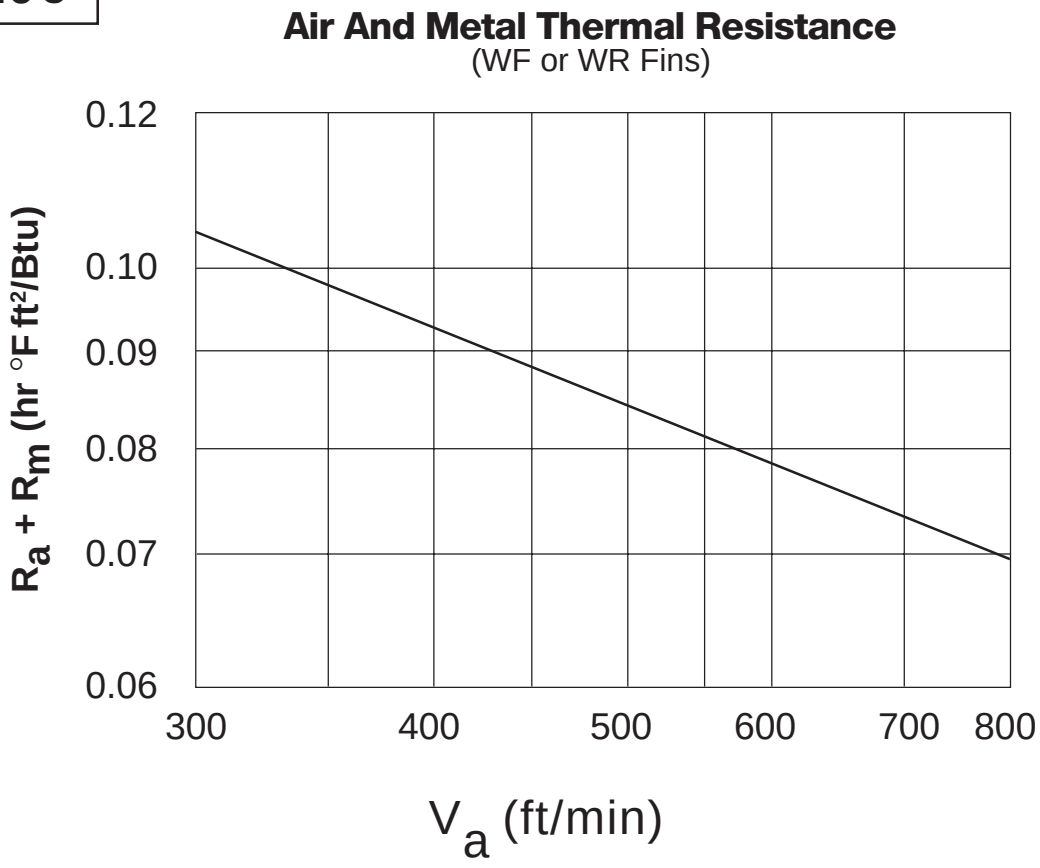


Figure 6

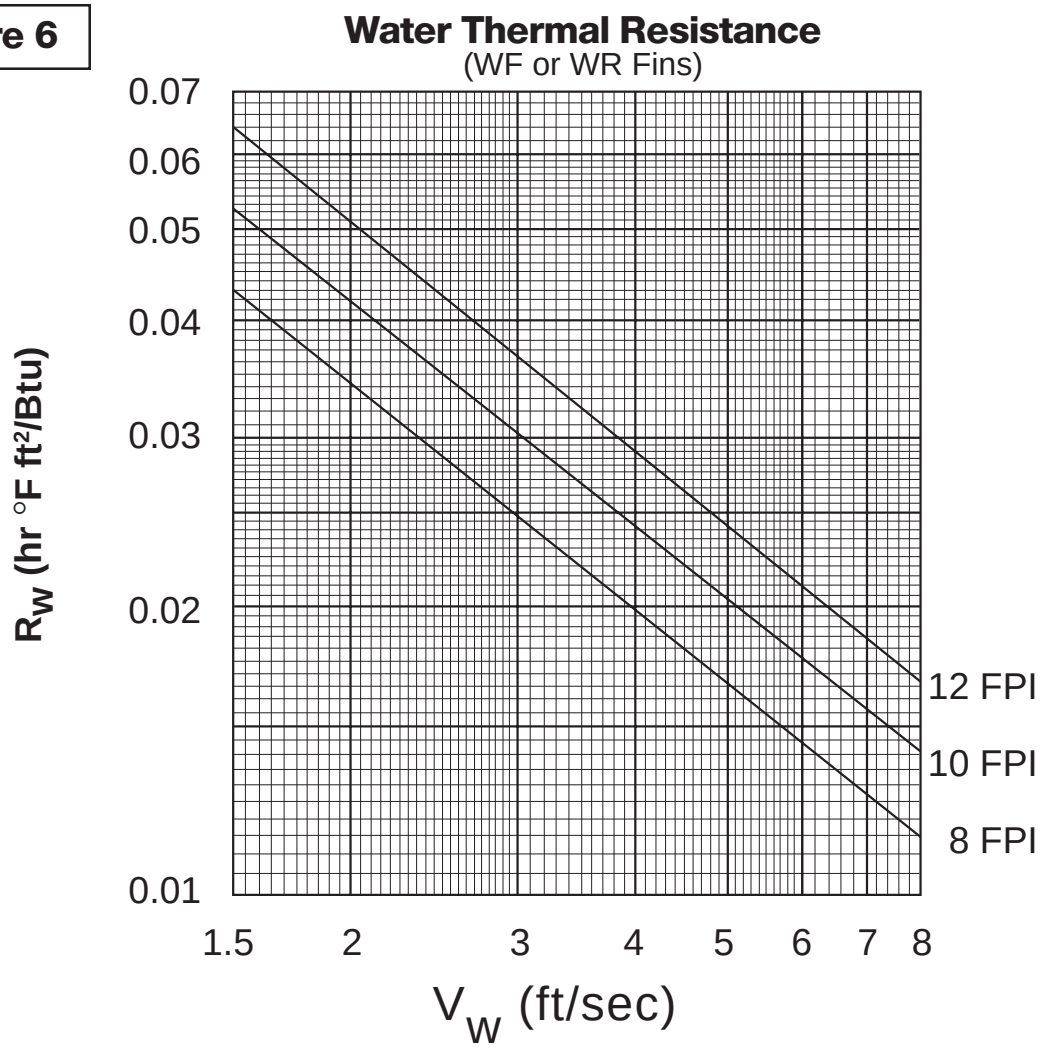


Figure 7

Dry and Wet Surface Air Friction
Type WF or WR Fins

Wet Fins

SFPM	8 FPI	10 FPI	12 FPI
300	0.053	0.068	0.086
400	0.088	0.107	0.130
500	0.130	0.152	0.179
600	0.180	0.203	0.232
700	0.237	0.259	0.289
800	0.300	0.320	0.350

Dry Fins

SFPM	8 FPI	10 FPI	12 FPI
300	0.034	0.041	0.048
400	0.054	0.065	0.075
500	0.079	0.092	0.105
600	0.107	0.122	0.139
700	0.138	0.155	0.175
800	0.173	0.191	0.215

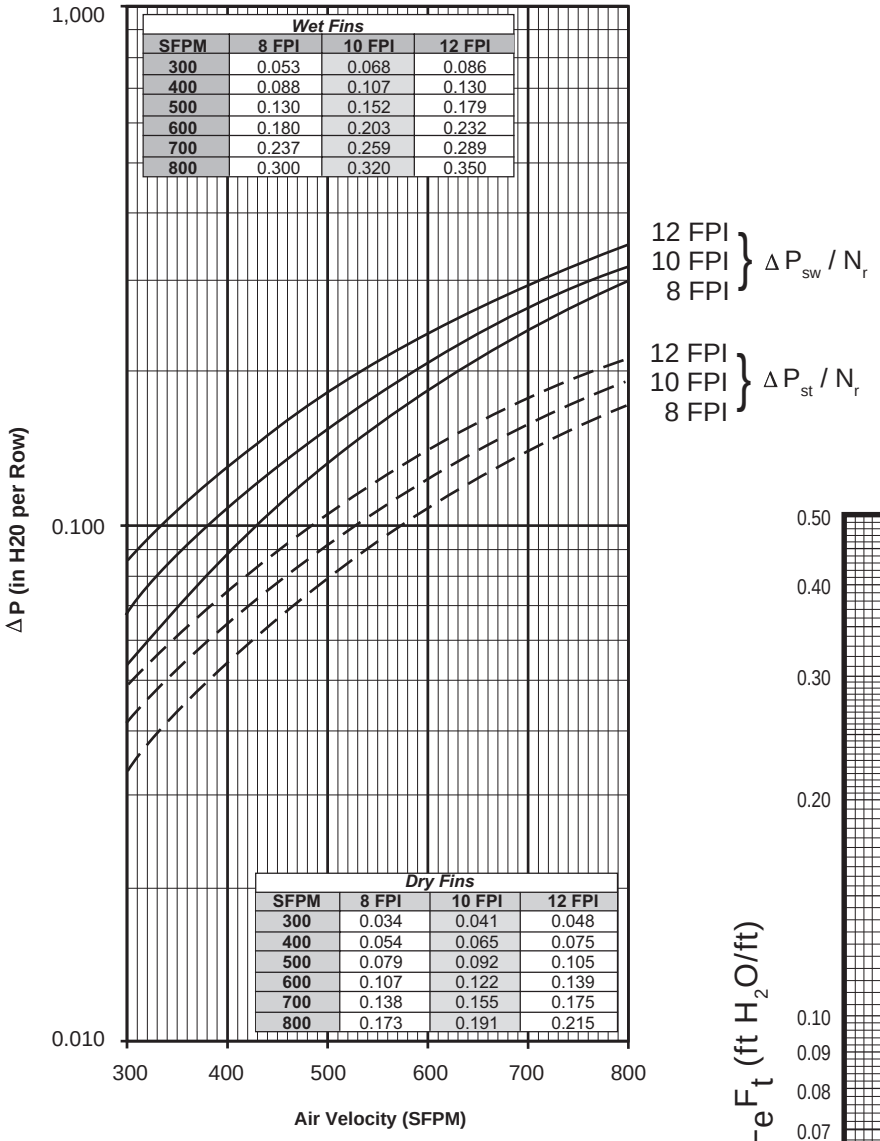
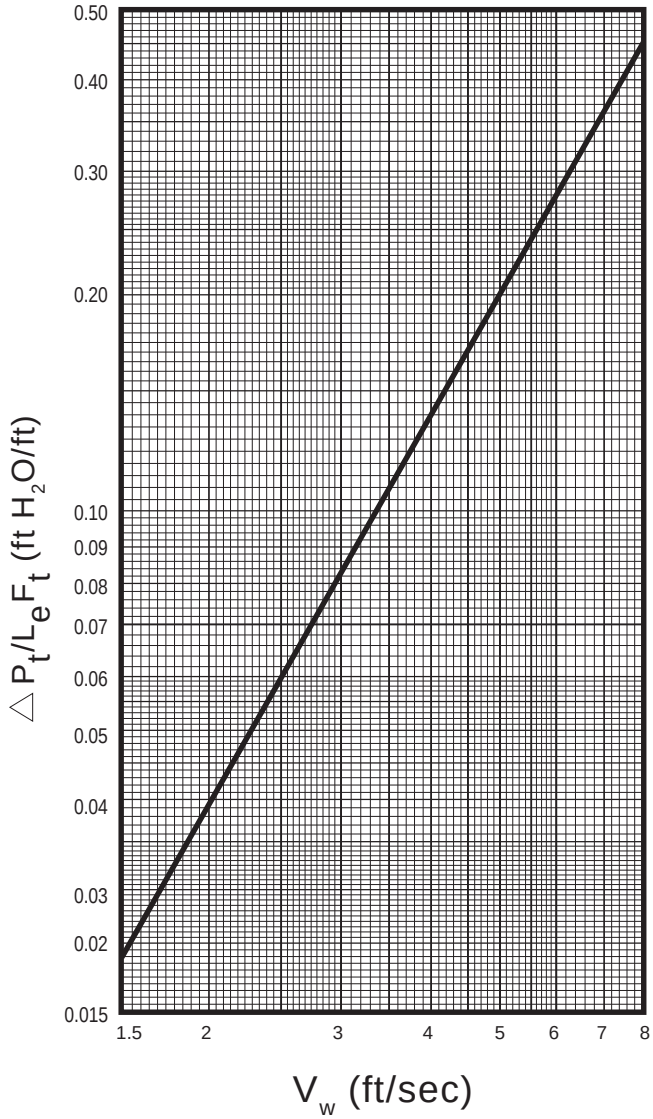


Figure 8

Water Friction Pressure Drop



Header Pressure Drop $\triangle Ph$, ft H_2O

Table 5
Double Circuit

No. Tubes In Face	Water Velocity, FPS 1	2	3	4	6	8
8	.22	.83	1.85	3.22	7.20	12.75
10	.33	1.30	2.85	5.00	10.20	19.98
12	.16	.57	1.21	2.11	4.5	7.75
14	.22	.77	1.65	2.80	6.05	10.50
16	.27	.98	2.11	3.60	7.75	13.45
18	.33	1.21	2.64	4.50	9.80	17.00
20	.15	.55	1.18	2.00	4.15	7.00
22	.18	.64	1.39	2.35	4.90	8.40
24	.23	.76	1.61	2.74	5.80	9.99
26	.25	.88	1.88	3.20	6.75	11.40
28	.29	1.01	2.15	3.60	7.70	13.10
30	.14	.50	1.05	1.80	3.79	6.40
32	.16	.56	1.19	2.00	4.20	7.10
34	.18	.62	1.30	2.25	4.70	7.99
36	.20	.70	1.46	2.50	5.20	8.98

Table 6
Full Circuit

No. Tubes In Face	Water Velocity, FPS 1	2	3	4	6	8
8	.07	.27	.61	1.07	2.40	4.22
10	.11	.42	.94	1.66	3.70	6.50
12	.05	.19	.41	.72	1.59	2.74
14	.07	.25	.56	.99	2.12	3.70
16	.09	.33	.72	1.24	2.74	4.78
18	.11	.41	.91	1.59	3.42	6.00
20	.05	.20	.44	.75	1.64	2.82
22	.07	.25	.53	.91	1.97	3.35
24	.08	.29	.62	1.08	2.30	4.00
26	.09	.34	.73	1.24	2.70	4.64
28	.10	.39	.84	1.44	3.09	5.28
30	.05	.19	.41	.70	1.50	2.60
32	.06	.21	.46	.78	1.70	2.92
34	.06	.24	.51	.87	1.89	3.30
36	.07	.27	.57	.99	2.25	3.65

Table 7
Half Circuit

No. Tubes In Face	Water Velocity, FPS 1	2	3	4	6	8
8	.03	.12	.27	.48	1.08	1.75
10	.05	.15	.42	.75	1.65	2.89
12	.02	.09	.19	.33	.72	1.26
14	.03	.12	.25	.44	.98	1.75
16	.04	.15	.33	.57	1.26	2.17
18	.05	.19	.41	.72	1.59	2.75
20	.03	.11	.24	.42	.92	1.62
22	.03	.13	.29	.51	1.11	1.95
24	.04	.15	.34	.60	1.31	2.30
26	.05	.18	.41	.69	1.54	2.71
28	.05	.21	.46	.82	1.79	3.12
30	.03	.11	.23	.40	.88	1.52
32	.03	.12	.26	.45	1.00	1.75
34	.04	.14	.30	.52	1.10	1.95
36	.04	.15	.33	.57	1.25	2.20

Table 8
Quarter Circuit

No. Tubes In Face	Water Velocity, FPS 1	2	3	4	6	8
8	.02	.08	.19	.34	.75	1.31
12	.01	.05	.12	.22	.48	.86
16	.02	.10	.22	.39	.86	1.52
20	.02	.08	.18	.32	.72	1.27
24	.03	.12	.26	.46	1.01	1.80
28	.04	.16	.35	.63	1.40	2.50
32	.02	.09	.20	.35	.78	1.36
36	.03	.11	.25	.44	.99	1.73

Table 9
Water Friction Temperature Correction Factor, F_t

Ave. Water Temp., °F	40	50	60	70	80	90	100
Correction Factor	1.06	1.03	1.00	.97	.94	.91	.88

FORMULAS

1. Air Face Velocity, std. ft/min.

$$V_a = SCFM/A_f$$

2. Sensible Cooling Load, Btuh

$$q_s = 1.10\ CFM\Delta t_a$$

$$= 1.10\ CFM\ (t_1 - t_2)$$

3. Leaving Dry Bulb Air Temperature, °F

$$t_2 = t_1 - \frac{q_s}{1.10\ CFM}$$

4. Total Cooling Load, Btuh

a. $q_t = 4.5\ CFM\Delta h$

$$= 4.5\ CFM\ (h_1 - h_2)$$

b. $q_t = 500\ GPM\Delta T_W$

$$= 500\ GPM\ (t_{wl} - t_{w2})$$

5. Air Sensible Heat Ratio

a. $r = q_s/q_t$

b. $$r = \frac{(t_1 - t_2)\ .244}{\Delta h}$$

6. Water Flow Rate, GPM

$$GPM = \frac{q_t}{500\Delta t_w}$$

7. Water Velocity, ft/sec.

$$V_w = \frac{1.194\ GPM}{No.\ of\ circuits}$$

8. Log Mean Temperature Difference, °F

$$\Delta t_m = \frac{(t_1 - t_{w2}) - (t_2 - t_{wl})}{\ln\left[\frac{t_1 - t_{w2}}{t_2 - t_{wl}}\right]}$$

9. Total Equivalent Length of Coil Circuit, ft.

$$L_e = 0.0833\left[\left(L_s\frac{N_t}{N_c}\right) + K_b\left(\frac{N_t}{N_c} - 1\right)\right]$$

10. Unit Capacity, Btu/hr ft^2, °F row

$$K_T = \frac{K \swarrow R_\star}{(R_a + R_m) + R_w}$$

11. Number of Rows, N_r

$$Nr = \frac{q_t}{A_f\Delta t_m K_t}$$

12. Dry or Wet Surface Air Friction, in H_2O

ΔP_{st}, Dry = N_r $(\Delta P_{st}/N_r)$

ΔP_{sw}, Wet = N_r $(\Delta P_{sw}/N_r)$

13. Water Friction, ft. H_2O

$$\Delta P_w = \left[\Delta P_h + L_e\left(\frac{\Delta P_t}{L_e F_t}\right)\right] F_t$$

SYMBOLS AND SUBSCRIPTS

A_f	Face Area, ft^2
q_t	Total heat capacity, Btuh
q_s	Sensible heat capacity, Btuh
r	Air sensible heat ratio
Δt_m	Log mean temperature difference, °F
t_w	Water temperature difference, °F
Δt_a	Air temperature difference, °F
t_{wl}	Inlet water temperature, °F
t_{w2}	Outlet water temperature, °F
t_1	Entering dry bulb air temperature, °F
t_2	Leaving dry bulb air temperature, °F
t'_1	Entering wet bulb air temperature, °F
t'_2	Leaving wet bulb air temperature, °F
h_1	Entering air enthalpy, Btu/lb. dry air
h_2	Leaving air enthalpy, Btu/lb. dry air
Δh	Enthalpy difference, Btu/lb. dry air
ΔP_{st}	Air pressure drop, dry surface, in H_2O/row
ΔP_{sw}	Air pressure drop, wet surface, in H_2O/row
ΔP_h	Water pressure drop from headers, ft. H_2O
ΔP_t	Water Pressure drop from tubes, ft. H_2O
ΔP_w	Total water pressure drop, ft. H_2O
V_a	Air face velocity, ft/min.
V_w	Water velocity, ft/sec.
L_e	Equivalent tube length, ft.
L_s	Length of straight coil tube in one pass, inches
N_t	Number of tubes in coil
N_c	Number of tube circuits in coil
N_r	Number of tube rows
K_b	Length of coil circuit per bend, 18 inches
F_t	Temperature correction factor
Q_a	Air flow rate, ft^3/min.
K	Basic capacity, Btu/hr ft^2 °F
K_T	Unit capacity, Btu/hr ft^2 °F
μ	Capacity correction factor
R*	Characteristic thermal resistance, hr °F ft^2/Btu
R_a	Air film thermal resistance, hr °F ft^2/Btu
R_m	Metal thermal resistance, hr °F ft^2/Btu
R_w	Water film thermal resistance, hr °F ft^2/Btu

COIL WEIGHTS – DRY – POUNDS

FINNED LENGTH INCHES

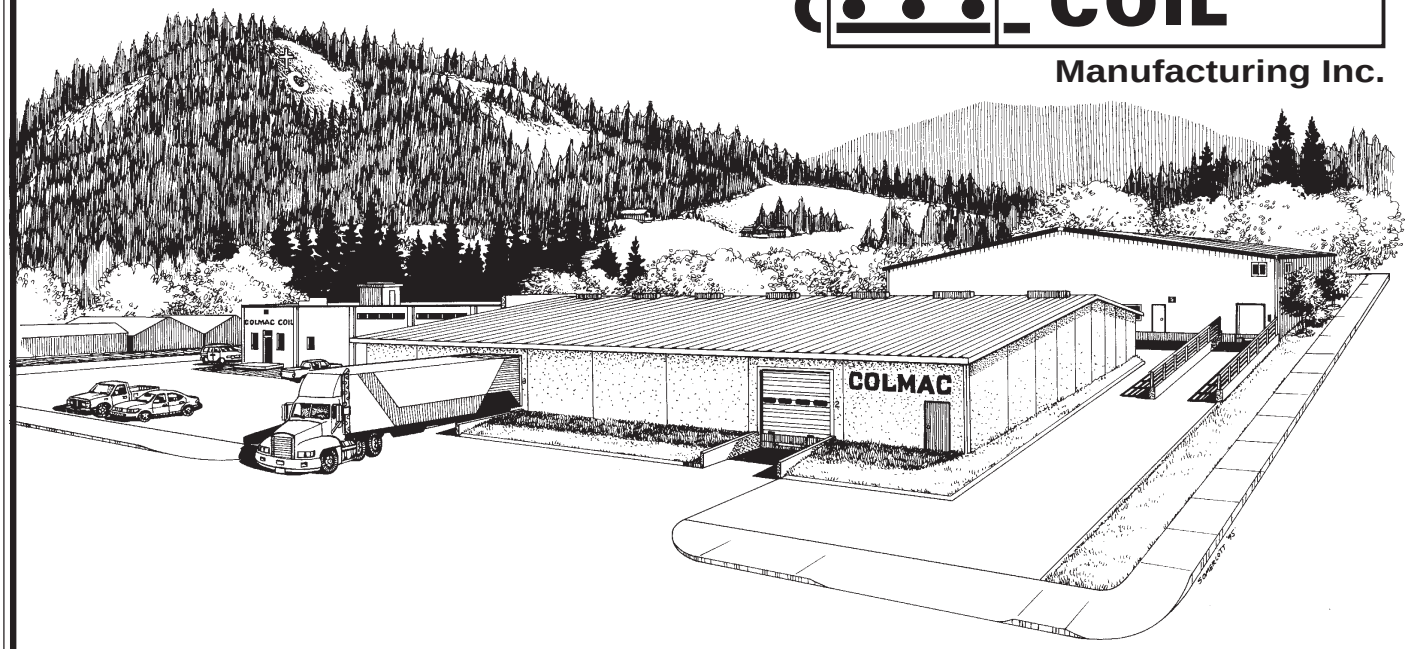
Rows	Fin Height	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
1	12	17	20	23	27	30	34	37	41	44	47	51	54	58	61	64	68	71	75	78
	15	19	23	27	31	34	38	42	46	50	53	57	61	65	69	72	76	80	84	88
	18	22	26	30	34	38	43	47	51	55	59	64	68	72	76	80	84	89	93	97
	21	27	32	36	41	45	50	54	59	64	68	73	77	82	86	91	96	100	105	109
	24	30	35	40	45	50	55	59	64	69	74	79	84	89	94	99	104	109	114	119
	27	33	38	43	49	54	59	65	70	76	81	86	92	97	102	108	113	118	124	129
	30	42	48	54	60	65	71	77	83	88	94	100	106	111	117	123	129	134	140	146
	33	46	52	58	64	70	76	83	89	95	101	107	113	119	126	132	138	144	150	156
	36	49	56	62	69	75	82	88	95	102	108	115	121	128	134	141	147	154	160	167
2	12	20	25	30	35	40	45	50	55	60	64	69	74	79	84	89	94	99	104	109
	15	23	29	35	40	46	52	58	63	69	75	81	86	92	98	104	109	115	121	127
	18	26	33	39	46	52	59	66	72	79	85	92	98	105	111	118	124	131	137	144
	21	32	40	47	54	62	69	76	84	91	98	106	113	120	127	135	142	149	157	164
	24	36	44	52	60	68	76	84	93	101	109	117	125	133	141	149	157	165	173	181
	27	40	49	57	66	75	84	93	102	111	120	128	137	146	155	164	173	182	190	199
	30	50	60	69	79	89	98	108	118	127	137	147	156	166	176	185	195	205	214	224
	33	54	65	75	86	96	107	117	127	138	148	159	169	180	190	200	211	221	232	242
	36	59	70	81	92	103	115	126	137	148	160	171	182	193	204	216	227	238	249	260
4	12	28	37	45	54	62	71	79	88	96	105	113	122	130	139	147	155	164	172	181
	15	33	43	53	63	73	83	93	103	114	124	134	144	154	164	174	184	194	204	214
	18	38	50	61	73	85	96	108	119	131	143	154	166	178	189	201	212	224	236	247
	21	46	59	72	86	99	112	125	138	151	165	178	191	204	217	230	244	257	270	283
	24	51	66	81	95	110	125	140	154	169	184	199	213	228	243	258	272	287	302	316
	27	57	73	89	106	122	138	155	171	187	203	220	236	252	269	285	301	318	334	350
	30	69	87	105	123	140	158	176	194	212	230	248	265	283	301	319	337	355	373	390
	33	75	94	114	133	153	172	191	211	230	250	269	289	308	327	347	366	386	405	424
	36	81	102	123	144	165	186	207	228	249	270	291	312	333	354	375	396	417	438	459
6	12	36	48	60	72	84	96	108	121	133	145	157	169	181	193	205	217	229	241	253
	15	43	58	72	86	101	115	129	144	158	172	187	201	216	230	244	259	273	287	302
	18	50	67	83	100	117	133	150	167	184	200	217	234	250	267	284	301	317	334	351
	21	60	79	98	117	136	155	174	193	212	231	250	269	288	307	326	345	364	383	402
	24	67	88	109	131	152	174	195	216	238	259	280	302	323	345	366	387	409	430	451
	27	74	98	121	145	169	193	216	240	264	287	311	335	359	382	406	430	453	477	501
	30	88	114	140	166	192	218	244	270	296	322	349	375	401	427	453	479	505	531	557
	33	96	124	152	181	209	238	266	294	323	351	380	408	436	465	493	522	550	578	607
	36	103	134	165	196	226	257	288	319	349	380	411	442	472	503	534	565	595	626	657
8	12	45	60	76	91	107	122	138	153	169	185	200	216	231	247	262	278	293	309	325
	15	53	72	91	109	128	147	165	184	203	221	240	259	277	296	315	333	352	371	389
	18	62	84	105	127	149	171	193	214	236	258	280	301	323	345	367	389	410	432	454
	21	73	98	123	148	173	198	223	248	272	297	322	347	372	397	422	447	472	497	522
	24	82	110	138	166	194	222	250	278	306	334	362	390	418	446	474	502	530	558	586
	27	91	122	153	184	216	247	278	309	340	371	403	434	465	496	527	558	589	621	652
	30	107	141	175	210	244	278	312	347	381	415	449	484	518	552	587	621	655	689	724
	33	116	154	191	228	266	303	341	378	415	453	490	528	565	602	640	677	715	752	789
	36	126	166	207	247	288	328	369	409	450	490	531	571	612	652	693	734	774	815	855

NOTES:

1. **FOR WATER COIL OPERATING WEIGHTS, ADD DRY COIL WEIGHTS TO 1.32 X FACE AREA X ROWS [($W_{OP} = W_{DRY} + (1.32 \times FDA \times 12)$]**
2. **WEIGHTS BASED ON 10 FPI COILS; VARIANCE FOR 6, 8, AND 12 FPI IS LESS THAN 5% OF LISTED WEIGHT.**

COLMAC COIL

Manufacturing Inc.



A Tradition of Quality

Colmac Coil was founded in 1971 and has been distinguished for its commitment to quality in the new and replacement coil markets with listings, certifications, and code markings such as ARI, ASME, UL, CSA, and CRN. Located in the Northwest USA, Colmac has grown to prominence as a trusted coil manufacturer with commercial/industrial heating & cooling, HVAC and refrigeration customers worldwide. Colmac has a network of over 250 factory representatives in over 80 sales offices around the world.

QUALITY COLMAC PRODUCTS

HEAT TRANSFER PRODUCTS

HVAC/Industrial/OEM

- Heating and Cooling Coils
- Fluid Coolers
- Heat Pipe Coils

HEAT PUMP WATER HEATERS

Commercial/Industrial

- Air-Source Heat Pump Water Heaters with Air Conditioning Benefit

REFRIGERATION PRODUCTS

Industrial/Commercial

- Evaporators - Air Coolers
- Air-Cooled Condensers
- Blast Freezers
- Tube Bundles
- Hydro Coolers
- Bunker Coils

Local Representative

COLMAC COIL MFG., INC.
370 North Lincoln
P.O. Box 571
Colville, WA 99114-0571
Phone: 509-684-2595
Fax: 509-684-8331
e-mail: mail@colmaccoil.com
Website: www.colmaccoil.com