

LINOVECTOR II

Bare Element "3"
Copper/Aluminum and
Steel Element Ratings

Submittal

Specification

Bare Element "3"

ELEMENT:

TYPE: Cu/AL (Mechanically Expanded)
LENGTHS: 2'0" thru 12'6" in 1" Increments
for 1" & 1-1/4" Cu.
2'0" to 8'0" in 1" Increments
for 3/4" Cu.

One End Flared (Std)

See Catalog for Working
Pressures

BRACKETS:

Wall Mtd B.B. Hngr

ELEMENT:

TYPE: IPS Steel (Mechanically Expanded)
LENGTHS: 2'0" to 12'6" in 1" Increments
 NPT Thread both Ends (Std)
 Beveled Ends for Field Weld (Opt'l)

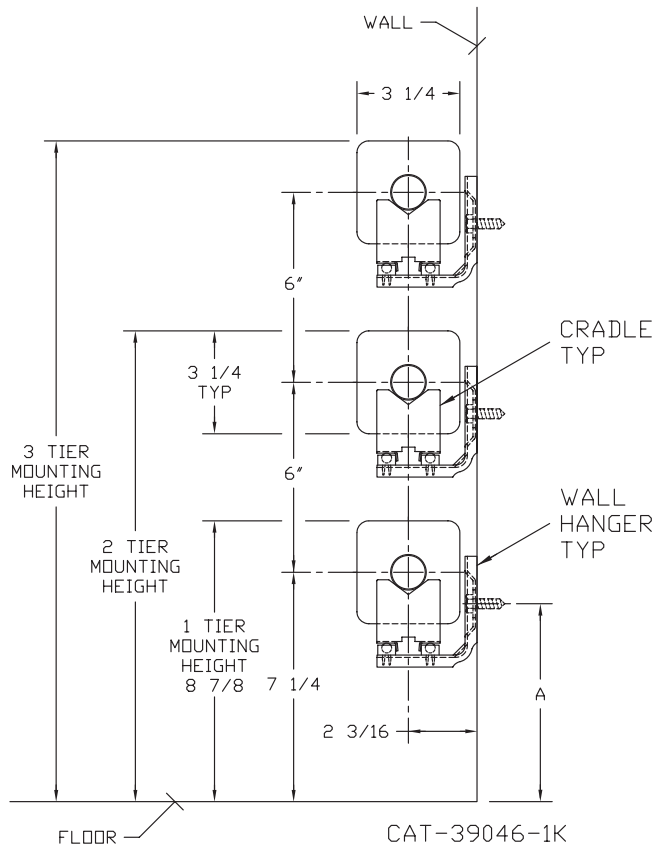
See Catalog for Working
Pressures

BRACKETS:

Wall Mtd B.B. Hngr

Bare Element "3" 3-1/4" Wide Fin B.B. Hanger Wall "3"

ELEMENT TUBE SIZE	FIN SIZE HEIGHT x WIDTH	CRADLE NUMBER	A
3/4 COPPER	3 1/4 x 3 1/4	2	6 3/8
1" COPPER	3 1/4 x 3 1/4	2	6 1/4
1 1/4 COPPER	3 1/4 x 3 1/4	1	6 3/4
1" STEEL	3 1/4 x 3 1/4	2	6 1/8
1 1/4 STEEL	3 1/4 x 3 1/4	1	6 5/8



Vulcan

RADIATOR

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www.vulcanrad.com

PROJECT: _____ DATE: _____

LOCATION: _____

ARCHITECT: _____

ENGINEER: _____

CONTRACTOR: _____

PO NUMBER: _____

STYLE "3" BARE ELEMENT

COPPER/ALUMINUM ELEMENTS

ALL RATINGS ARE IN BTU/HR/LIN FT AND BASED ON 3 FPS VELOCITY, 65° EAT

TUBE SIZE	CATALOG DESIGNATION	FIN SIZE HEIGHT X WIDTH	FINS PER FT.	FIN THICKNESS IN INCHES	TIERS AND CENTERS IN INCHES	MOUNTING HEIGHT IN INCHES	STEAM 215° FACTOR	HOT WATER (AVG.)									
								200°	190°	180°	170°	160°	150°	140°	130°	120°	
								CORRECTION FACTORS FOR AVERAGE WATER TEMPERATURES									
3/4"	VC3/4-33	3-1/4" SQ.	32	.020	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	970	830	760	670	590	510	440	390	320	250	
							1720	1480	1340	1190	1050	910	770	690	570	450	
							2410	2070	1880	1660	1470	1280	1080	960	800	630	
3/4"	VC3/4-34	3-1/4" SQ.	40	.020	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	1140	980	890	790	700	600	510	460	380	300	
							1880	1620	1470	1300	1150	1000	850	750	620	490	
							2570	2210	2000	1770	1570	1360	1160	1030	850	670	
3/4"	VC3/4-35	3-1/4" SQ.	50	.020	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	1260	1080	980	870	770	670	570	500	420	330	
							2010	1730	1570	1390	1230	1070	900	800	660	520	
							2690	2310	2100	1860	1640	1430	1210	1080	890	700	
1"	VC33	3-1/4" SQ.	32	.020	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	970	830	760	670	590	510	440	390	320	250	
							1720	1480	1340	1190	1050	910	770	690	570	450	
							2370	2040	1850	1640	1450	1260	1070	950	780	620	
1"	VC34	3-1/4" SQ.	40	.020	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	1080	930	840	750	660	570	490	430	360	280	
							1850	1590	1440	1280	1130	980	830	740	610	480	
							2490	2140	1940	1720	1520	1320	1120	1000	820	650	
1"	VC35	3-1/4" SQ.	50	.020	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	1210	1040	940	830	740	640	540	480	400	310	
							1940	1670	1510	1340	1180	1030	870	780	640	500	
							2600	2240	2030	1790	1590	1380	1170	1040	860	680	
1-1/4"	VC133	3-1/4" SQ.	32	.020	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	970	830	760	670	590	510	440	390	320	250	
							1680	1440	1310	1160	1020	890	760	670	550	440	
							2360	2030	1840	1630	1440	1250	1060	940	780	610	
1-1/4"	VC134	3-1/4" SQ.	40	.020	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	1060	910	830	730	650	560	480	420	350	280	
							1840	1580	1440	1270	1120	980	830	740	610	480	
							2450	2110	1910	1690	1490	1300	1100	980	810	640	
1-1/4"	VC135	3-1/4" SQ.	50	.020	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	1170	1010	910	810	710	620	530	470	390	300	
							1900	1630	1480	1310	1160	1010	860	760	630	490	
							2550	2190	1990	1760	1560	1350	1150	1020	840	660	

Note: Copper tube furnished flared one end standard.

STEEL ELEMENTS

ALL RATINGS ARE IN BTU/HR/LIN FT AND BASED ON 3 FPS VELOCITY, 65° EAT

TUBE SIZE	CATALOG DESIGNATION	FIN SIZE HEIGHT X WIDTH	FINS PER FT.	FIN THICKNESS IN INCHES	TIERS AND CENTERS IN INCHES	MOUNTING HEIGHT IN INCHES	STEAM 215° FACTOR	HOT WATER (AVG.)									
								200°	190°	180°	170°	160°	150°	140°	130°	120°	
								CORRECTION FACTORS FOR AVERAGE WATER TEMPERATURES									
1"	VS33	3-1/4" SQ.	32	.032	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	910	780	710	630	560	480	410	360	300	240	
							1580	1360	1230	1090	960	840	710	630	520	410	
							2200	1890	1720	1520	1340	1170	990	880	730	570	
1"	VS34	3-1/4" SQ.	40	.032	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	990	850	770	680	600	520	450	400	330	260	
							1700	1460	1330	1170	1040	900	770	680	560	440	
							2350	2020	1830	1620	1430	1250	1060	940	780	610	
1"	VS35	3-1/4" SQ.	50	.032	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	1060	910	830	730	650	560	480	420	350	280	
							1790	1540	1400	1240	1090	950	810	720	590	470	
							2450	2110	1910	1690	1490	1300	1100	980	810	640	
1-1/4"	VS133	3-1/4" SQ.	32	.032	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	900	770	700	620	550	480	410	360	300	230	
							1620	1390	1260	1120	990	860	730	650	530	420	
							2240	1930	1750	1550	1370	1190	1010	900	740	580	
1-1/4"	VS134	3-1/4" SQ.	40	.032	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	1000	860	780	690	610	530	450	400	330	260	
							1700	1460	1330	1170	1040	900	770	680	560	440	
							2250	1940	1760	1550	1370	1190	1010	900	740	590	
1-1/4"	VS135	3-1/4" SQ.	50	.032	1 2-6 CL 3-6 CL	8-7/8 14-7/8 20-7/8	1030	890	800	710	630	550	460	410	340	270	
							1750	1510	1370	1210	1070	930	790	700	580	460	
							2280	1960	1780	1570	1390	1210	1030	910	750	590	

- Notes: 1) Steel fins furnished as .032 thick, painted black.
 2) NPT threads furnished on steel elements. Please use domestic fittings for proper installation.
 3) The ends can be provided chamfered for field welded fittings when specified.

Design Data

Correction Factor Chart for Non-Standard Mounting Heights

MOUNTING HEIGHT (Inches)	ENCLOSURE STYLE						
	BARE FIN ALL SIZES	FRONT OUTLET	FT (FRONT & TOP)		SLOPE		
			3 1/4" FINS	4 1/4" FINS	2 3/4" FINS	3 1/4" FINS	4 1/4" FINS
40 or more	1.000	1.000	1.000	1.000	1.000	1.000	1.000
38	1.000	1.000	1.000	1.000	1.000	1.000	1.003
36	1.000	1.004	1.005	1.005	1.006	1.007	1.009
34	1.010	1.014	1.011	1.010	1.012	1.013	1.016
32	1.020	1.024	1.017	1.015	1.019	1.020	1.025
30	1.030	1.039	1.029	1.024	1.031	1.033	1.039
29	1.040	1.049	1.035	1.029	1.038	1.040	1.045
28	1.050	1.059	1.041	1.034	1.045	1.047	1.052
27	1.060	1.069	1.046	1.039	1.051	1.053	1.059
26	1.070	1.079	1.052	1.044	1.058	1.060	1.065
25	1.080	1.089	1.058	1.049	1.065	1.067	1.072
24	1.090	1.099	1.064	1.054	1.071	1.073	1.079
23	1.100	1.109	1.070	1.059	1.078	1.080	1.085
22	1.110	1.119	1.076	1.064	1.085	1.087	1.092
21	1.120	1.129	1.082	1.069	1.091	1.093	1.099
20	1.130	1.139	1.088	1.074	1.098	1.100	1.100
19	1.140	1.149	1.089	1.075	1.100	1.100	1.100
18 or less	1.150	1.150	1.089	1.075	1.100	1.100	1.100

TOP OUTLET "T" IS NOT AFFECTED.

The AHRI Ratings cataloged include the factor shown for the recommended mounting height.

If the unit is to be installed at a different height than that recommended, the AHRI Rating (except for Top Outlet) must be adjusted as follows: AHRI Rating multiplied by

$$\frac{\text{Factor from Table Above for actual mounting height}}{\text{Factor from Table Above for recommended mounting height}}$$

FORMULA:

$$\text{Catalog Rating} \times \frac{\text{Factor at 30" Height}}{\text{Factor at 18" Height}}$$

$$\text{SOLUTION: } 1950 \times \frac{1.039}{1.150} = 1760 \text{ BTU/Hr.}$$

DYNAMIC FORMULAS

$$\text{BTU} = \text{GPM} \times 500 \times \text{TD}$$

$$\text{GPM} = \left(\frac{\text{BTU}}{500} \right) \div \text{TD}$$

$$\text{TD} = \left(\frac{\text{BTU}}{500} \right) \div \text{GPM}$$

Design Data

COMMERCIAL FINNED TUBE RATING CORRECTION CHARTS

CATALOG FINNED TUBE RATINGS ARE BASED UPON THE FOLLOWING CONDITIONS:

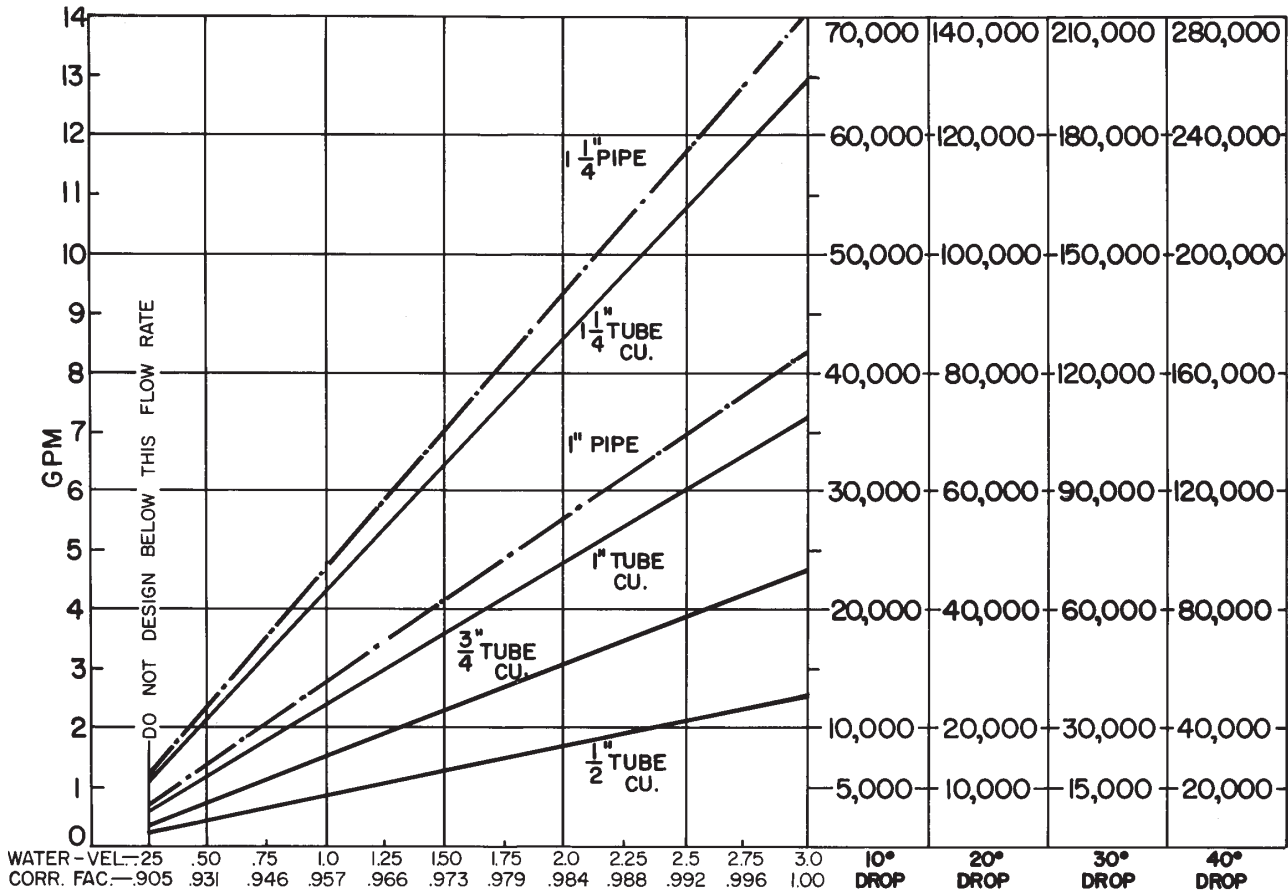
- 215°F AVERAGE WATER OR STEAM TEMPERATURE
- 65°F ENTERING AIR TEMPERATURE
- 3 FEET PER SECOND WATER FLOW RATE
- CATALOG MOUNTING HEIGHT

USE THE FOLLOWING CALCULATION WITH CORRECTION FACTORS FOR JOB CONDITIONS TO DETERMINE CORRECTED RATING:

$$\text{CORRECTED RATING} = (\text{215°F CATALOG RATING}) \times \left(\frac{\text{CORRECTION FACTOR FOR STEAM OR WATER AND AVERAGE AIR TEMP.}}{\text{CORRECTION FACTOR FOR MOUNTING HTG.-SEE CATALOG RATING}} \right) \times \left(\frac{\text{CORRECTION FACTOR FOR FLOW RATE}}{\text{CORRECTION FACTOR FOR MOUNTING HTG.-SEE CATALOG RATING}} \right)$$

USE THE FOLLOWING CHARTS TO SELECT CORRECTION FACTORS

CHART/WATER VEL./CORR. FACTOR / PRESS. DROP/TOTAL BTU.

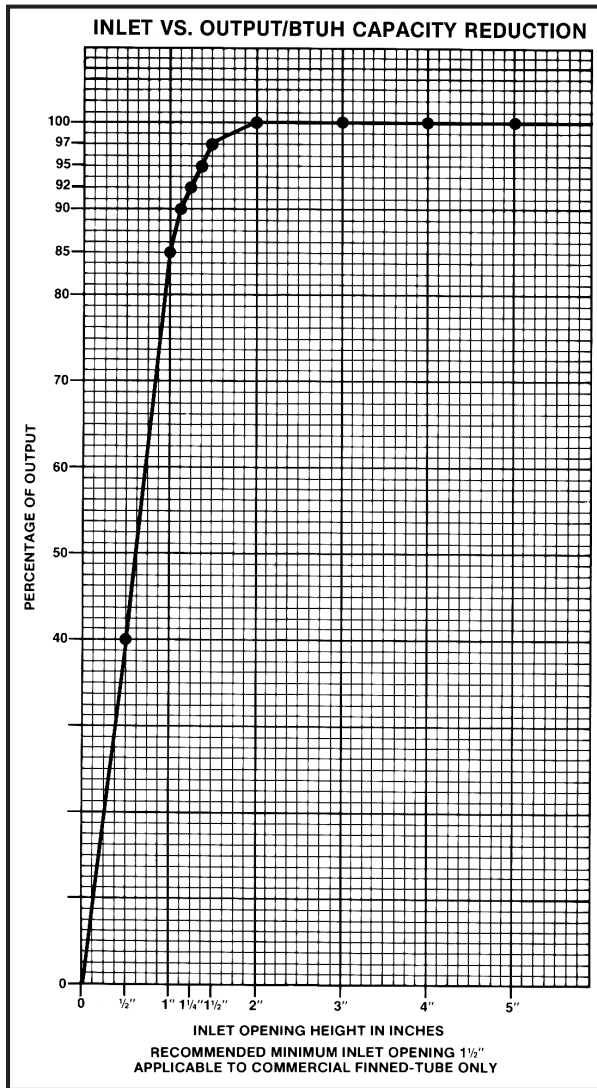


1/2" COP. ALUM.	1.80	2.33	5.33	9.16									
3/4" COP. ALUM.	.5	1.5	3.16	5.4	6.25								
1" COP. ALUM.	.233	.41	.83	1.45	2.16	2.83	3.66						
1" PIPE		.37	.79	1.3	2.00	2.70	3.70	4.80					
1 1/4" COP. ALUM.	.16	.33	.55	.79	1.08	1.33	1.8	2.25	2.26	2.91	3.3		
1 1/4" PIPE	.09	.18	.31	.5	.70	1.0	1.1	1.3	1.6	1.8	2.58	2.3	3.3

PRESSURE DROP PER 100 LINEAR FT., IN FEET OF HEAD

Design Data

INLET AIR CORRECTION FACTOR



GUARANTEED WORKING PRESSURES

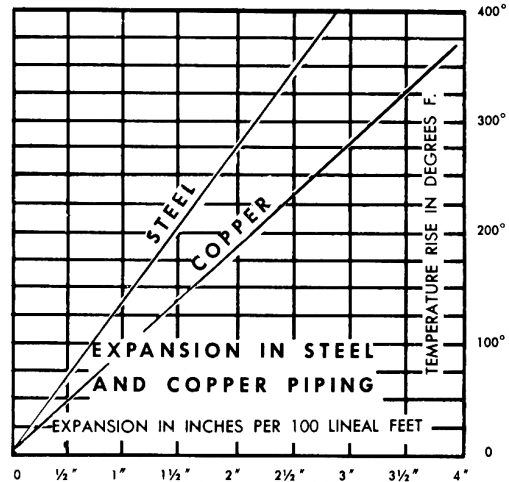
- 1" IPS — 780 AT TEMPERATURES UP TO 650°F.
 - 1 1/4" IPS — 660 AT TEMPERATURES UP TO 650°F.
 - 2" IPS — 405 AT TEMPERATURES UP TO 650°F.
 - 1 1/4" CU — 194 AT TEMPERATURES UP TO 300°F.
 - 1" CU — 204 AT TEMPERATURES UP TO 300°F.
 - 3/4" CU — 218 PSI AT TEMPERATURES UP TO 300°F.
- MAXIMUM PRESSURES AT OTHER TEMPERATURES ARE AVAILABLE UPON REQUEST.

RATE OF PITCH FOR STEAM 1/2" DROP OVER 20 FT. RUN.

PIPE WATER CAPACITIES AND QUANTITIES CIRCULATED AT VELOCITY OF 3* FEET PER SECOND			
Pipe Size	Gals. Per Linear Ft.	Gals./Min. @ 3' Sec. Vel.*	Lbs./Hr. @ 3' Sec. Vel.*
1/2"	.016	2.88	1440
3/4"	.023	4.14	2070
1"	.040	7.20	3600
1 1/4"	.063	11.34	5660
1 1/2"	.102	18.36	9160
2"	.170	30.60	15300
2 1/2"	.275	49.50	24850
3"	.390	70.20	35000

*3 Ft./Sec. Velocity is Basic for Hot Water Rating Factors Shown on this Page.

$$\text{VELOCITY FT./SEC.} = \frac{\text{LBS. PER HOUR}}{(\text{GALS. PER FT.}) (3600) (8.3)}$$



GLYCOL CORRECTION FACTORS

Fluid Temperature 200°F

% Solution	Ethylene Glycol	Propylene Glycol
20	.952	.988
30	.921	.968
40	.888	.943
50	.852	.912

Fluid Temperature 180°F

% Solution	Ethylene Glycol	Propylene Glycol
20	.946	.982
30	.913	.961
40	.879	.934
50	.842	.902

Fluid Temperature 140°F

% Solution	Ethylene Glycol	Propylene Glycol
20	.934	.97
30	.898	.946
40	.861	.916
50	.821	.881

ALTITUDE FACTORS

Approximate factors for convective heat value at varying altitudes

Altitude	Ferrous Units	Copper Alum. Units
Sea Level	1.000	1.000
1,000 ft.	.984	.969
2,000 ft.	.968	.938
3,000 ft.	.952	.908
4,000 ft.	.936	.878
5,000 ft.	.920	.850
6,000 ft.	.904	.822
7,000 ft.	.889	.795
8,000 ft.	.874	.768
9,000 ft.	.859	.743
10,000 ft.	.844	.718
15,000 ft.	.771	.603
20,000 ft.	.703	.502

Design Data

CORRECTION FACTORS FOR STEAM PRESSURES AND AIR TEMPERATURES OTHER THAN STANDARD

STEAM		ENTERING AIR TEMPERATURE, °F														
Pressure		Temp.			STD											
Gauge	Abs. Psi	°F	45	55	65	70	75	80	85	90	100	110	120	130	140	150
(Vac) 15" Hg	7.32	178.9	0.90	0.80	0.70	0.65	0.60	0.56	0.51	0.45	0.39	0.32	0.25	0.18	0.13	0.08
(Vac) 10"	9.78	192.2	1.02	0.91	0.81	0.76	0.71	0.66	0.62	0.55	0.48	0.40	0.33	0.26	0.20	0.14
(Vac) 5"	12.25	202.9	1.11	1.00	0.90	0.85	0.79	0.75	0.70	0.63	0.56	0.48	0.40	0.33	0.27	0.20
(Vac) 0 Psi	14.696	212.0	1.19	1.09	0.97	0.92	0.87	0.82	0.77	0.70	0.63	0.54	0.46	0.38	0.31	0.25
▶ .899	15.595	215.0	1.22	1.11	1.00	0.95	0.90	0.84	0.80	0.75	0.65	0.57	0.48	0.40	0.33	0.26
5	19.70	227.1	1.34	1.22	1.11	1.05	1.00	0.95	0.90	0.81	0.75	0.66	0.57	0.49	0.41	0.34
10	24.70	239.4	1.45	1.33	1.22	1.17	1.11	1.05	1.00	0.91	0.85	0.75	0.66	0.58	0.50	0.42
15	29.70	249.8	1.55	1.43	1.31	1.26	1.20	1.14	1.09	1.00	0.94	0.84	0.75	0.66	0.57	0.49
20	34.70	258.8	1.63	1.52	1.40	1.33	1.28	1.23	1.17	1.07	1.02	0.92	0.82	0.73	0.64	0.55
25	39.70	266.8	1.71	1.59	1.47	1.41	1.36	1.30	1.25	1.15	1.09	0.98	0.89	0.80	0.71	0.62
30	44.70	274.0	1.78	1.66	1.54	1.48	1.42	1.37	1.31	1.21	1.15	1.05	0.95	0.85	0.76	0.68
40	54.70	286.7	1.91	1.79	1.66	1.61	1.54	1.49	1.43	1.32	1.27	1.16	1.06	0.97	0.87	0.78
50	64.70	297.7	2.02	1.90	1.77	1.71	1.65	1.60	1.54	1.42	1.37	1.26	1.16	1.06	0.96	0.87
60	74.70	307.3	2.10	2.00	1.87	1.81	1.75	1.69	1.63	1.51	1.47	1.35	1.25	1.15	1.05	0.95
70	84.70	316.0	2.20	2.09	1.95	1.89	1.83	1.77	1.71	1.59	1.55	1.44	1.33	1.23	1.12	1.03
80	94.70	323.9	2.27	2.17	2.03	1.97	1.91	1.85	1.80	1.69	1.63	1.52	1.41	1.31	1.20	1.10
90	104.70	331.2	2.36	2.24	2.11	2.05	1.98	1.93	1.87	1.74	1.70	1.59	1.48	1.38	1.28	1.17
100	114.70	337.9	2.43	2.31	2.18	2.11	2.05	2.00	1.94	1.81	1.77	1.65	1.54	1.44	1.33	1.23
125	139.70	352.9	2.59	2.47	2.33	2.27	2.21	2.16	2.10	1.96	1.92	1.80	1.69	1.59	1.48	1.38
150	164.70	365.9	2.73	2.62	2.47	2.43	2.35	2.29	2.23	2.08	2.05	1.94	1.82	1.72	1.61	1.51
175	189.70	377.4	2.86	2.74	2.60	2.54	2.47	2.41	2.35	2.21	2.17	2.05	1.95	1.85	1.73	1.63
200	214.70	387.8	2.95	2.85	2.71	2.63	2.58	2.52	2.47	2.31	2.29	2.17	2.06	1.96	1.84	1.75

From Keenan and Keyes — Linear Interpolation.

Note: Gauge pressure should be corrected for altitude.

CORRECTION FACTORS FOR WATER TEMPERATURES AND AIR TEMPERATURES OTHER THAN STANDARD

AVERAGE WATER TEMP. °F	ENTERING AIR TEMPERATURE, °F														
	45	55	STD	70	75	80	85	90	95	100	110	120	130	140	150
90	.19	.13	.11	.06											
100	.25	.19	.15	.11	.08	.06									
110	.31	.25	.20	.16	.13	.11	.08	.06							
120	.38	.31	.26	.21	.19	.16	.13	.11	.08	.06					
130	.45	.38	.33	.28	.25	.21	.19	.16	.13	.11	.06				
140	.53	.45	.40	.34	.31	.28	.25	.21	.19	.16	.11	.06			
150	.61	.53	.45	.41	.38	.34	.31	.28	.25	.21	.16	.11	.06		
160	.69	.61	.53	.49	.45	.41	.38	.34	.31	.28	.21	.16	.11	.06	
170	.77	.69	.61	.57	.53	.49	.45	.41	.38	.34	.28	.21	.16	.11	.06
180	.86	.77	.69	.65	.61	.57	.53	.49	.45	.41	.34	.28	.21	.16	.11
190	.95	.86	.78	.73	.69	.65	.61	.57	.53	.49	.41	.34	.28	.21	.16
200	1.05	.95	.86	.82	.77	.73	.69	.65	.61	.57	.49	.41	.34	.28	.21
210	1.14	1.05	.95	.91	.86	.82	.77	.73	.69	.65	.57	.49	.41	.34	.28
▶ 215 (STD.)	1.19	1.09	1.00	.95	.91	.86	.82	.77	.73	.69	.61	.53	.45	.38	.31
220	1.24	1.14	1.05	1.00	.95	.91	.86	.82	.77	.73	.65	.57	.49	.41	.34
230	1.34	1.24	1.14	1.09	1.05	1.00	.95	.91	.86	.82	.73	.65	.57	.49	.41
240	1.44	1.34	1.25	1.19	1.14	1.09	1.05	1.00	.95	.91	.82	.73	.65	.57	.49
250	1.55	1.44	1.34	1.29	1.24	1.19	1.14	1.09	1.05	1.00	.91	.82	.73	.65	.57
260	1.66	1.55	1.44	1.39	1.34	1.29	1.24	1.19	1.14	1.09	1.00	.91	.82	.73	.65
270	1.76	1.66	1.55	1.50	1.44	1.39	1.34	1.29	1.24	1.19	1.09	1.00	.91	.82	.73
280	1.87	1.76	1.66	1.60	1.55	1.50	1.44	1.39	1.34	1.29	1.19	1.09	1.00	.91	.82
290	1.99	1.87	1.76	1.71	1.66	1.60	1.55	1.50	1.44	1.39	1.29	1.19	1.09	1.00	.91
300	2.10	1.99	1.87	1.82	1.76	1.71	1.66	1.60	1.55	1.50	1.39	1.29	1.19	1.09	1.00