

OAKLAND CA

Latitude = 37.73 N

Longitude = 122.20 W

Period of Record = 1973 to 1996

WMO No. 724930

Elevation = 10 feet

Average Pressure = 29.99 inches Hg

Design Criteria Data

	Design Value	Mean Coincident (Average) Values			
		Wet Bulb Temperature (°F)	Humidity Ratio (gr/lb)	Wind Speed (mph)	Prevailing Direction (NSEW)
Dry Bulb Temperature (T)	(°F)				
Median of Extreme Highs	92	67	61	12.1	W
0.4% Occurrence	81	66	71	10.1	WNW
1.0% Occurrence	77	64	71	10.1	W
2.0% Occurrence	74	64	71	10.1	W
Mean Daily Range	13	-	-	-	-
97.5% Occurrence	43	41	33	5.5	E
99.0% Occurrence	40	38	30	5.3	E
99.6% Occurrence	38	36	28	5.5	E
Median of Extreme Lows	34	32	23	5.5	NE
	Design Value	Mean Coincident (Average) Values			
		Dry Bulb Temperature (°F)	Humidity Ratio (gr/lb)	Wind Speed (mph)	Prevailing Direction (NSEW)
Wet Bulb Temperature (T_{wb})	(°F)				
Median of Extreme Highs	71	82	93	8.9	W
0.4% Occurrence	67	76	82	9.5	W
1.0% Occurrence	66	75	80	9.6	W
2.0% Occurrence	64	71	76	10.0	W
	Design Value	Mean Coincident (Average) Values			
		Dry Bulb Temperature (°F)	Vapor Pressure (in. Hg)	Wind Speed (mph)	Prevailing Direction (NSEW)
Humidity Ratio (HR)	(gr/lb)				
Median of Extreme Highs	103	76	0.69	8.0	W
0.4% Occurrence	89	71	0.60	8.0	WNW
1.0% Occurrence	83	69	0.56	8.6	W
2.0% Occurrence	81	68	0.54	9.2	W
Air Conditioning/ Humid Area Criteria	# of Hours	T ≥ 93°F	T ≥ 80°F	T _{wb} ≥ 73°F	T _{wb} ≥ 67°F
		1	51	1	61

Other Site Data

Weather Region	Rain Rate 100 Year Recurrence (in./hr)	Basic Wind Speed 3 sec gust @ 33 ft 50 Year Recurrence (mph)	Ventilation Cooling Load Index (Ton-hr/cfm/yr) Base 75°F-RH 60% Latent + Sensible
8	1.5	85	0.1 + 0.1
Ground Water Temperature (°F) 50 Foot Depth *	Frost Depth 50 Year Recurrence (in.)	Ground Snow Load 50 Year Recurrence (lb/ft ²)	Average Annual Freeze-Thaw Cycles (#)
59.8	0	0	0

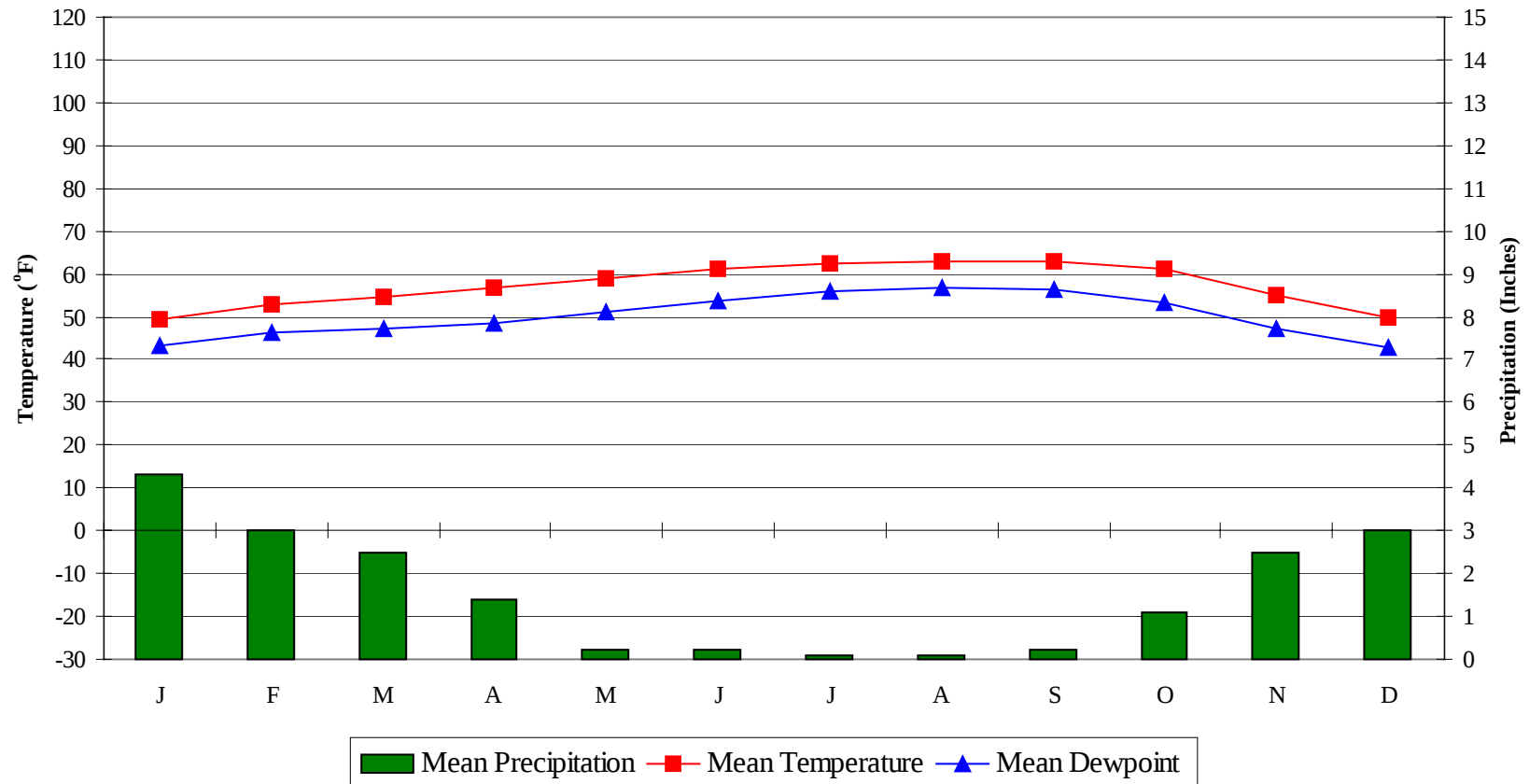
*Note: Temperatures at greater depths can be estimated by adding 1.5°F per 100 feet additional depth.

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Average Annual Climate

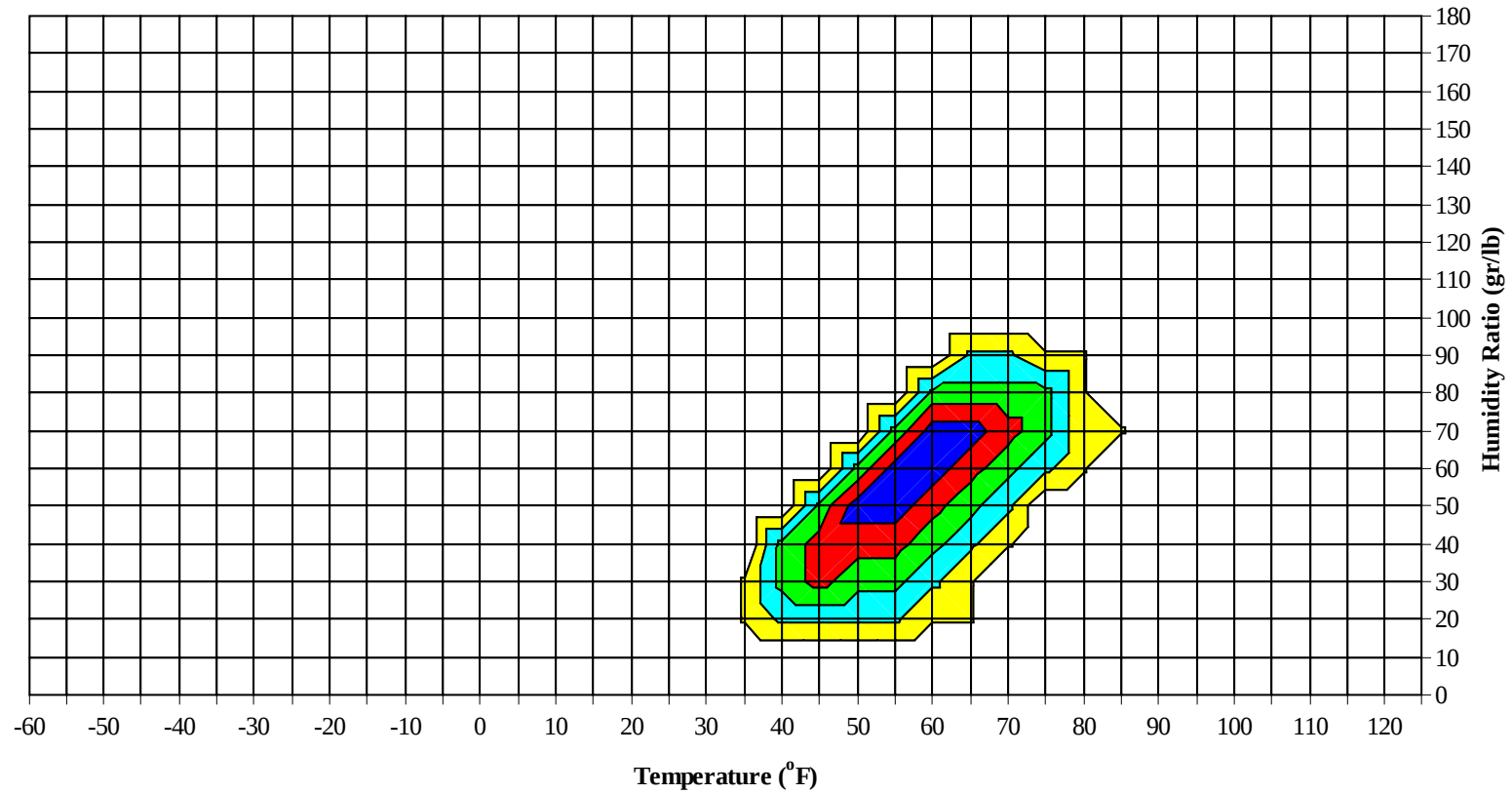


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Long Term Psychrometric Summary



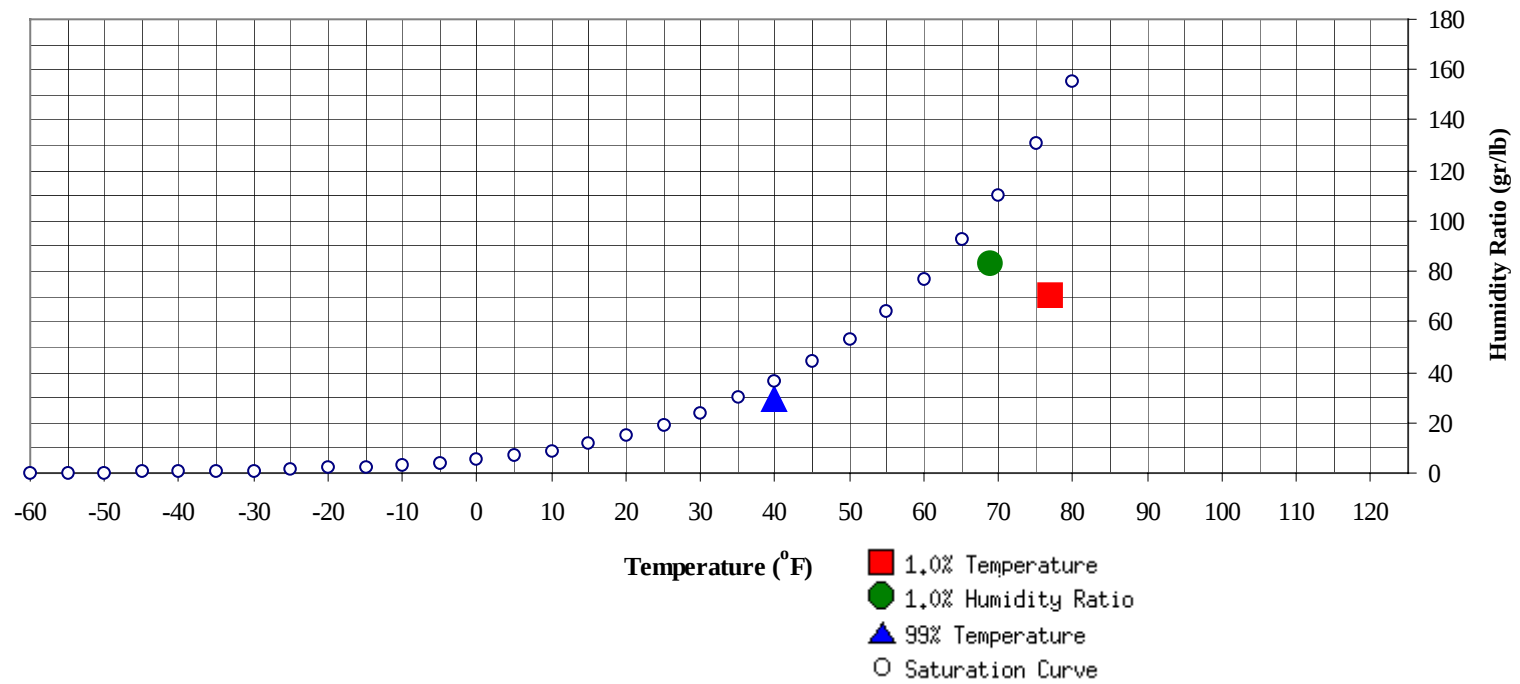
- 50% of all observations
- 80% of all observations
- 95% of all observations
- 97.5% of all observations
- 99% of all observations

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Psychrometric Summary of Peak Design Values



99% Dry Bulb	(°F)	MCHR (gr/lb)	Enthalpy (btu/lb)	1.0% Humidity Ratio	(gr/lb)	MCDB (°F)	MCWB (°F)	MC Dewpt (°F)	Enthalpy (btu/lb)
	40	29.7	14.2		83.3	68.9	64.4	62.1	29.5

1.0% Dry Bulb	(°F)	MCHR (gr/lb)	MCWB (°F)	Enthalpy (btu/lb)
	77	70.3	64.4	29.5

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Dry-Bulb Temperature Hours For An Average Year (Sheet 1 of 5)

Period of Record = 1973 to 1996

Temperature Range (°F)	January					February					March				
	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00		
100 / 104															
95 / 99															
90 / 94															
85 / 89															
80 / 84															
75 / 79							1	0	1	57.9		1	0	1	58.8
70 / 74		0		0	54.3		1	1	2	60.2	0	4	1	5	58.1
65 / 69		2	0	2	52.3	0	8	4	12	57.5	0	17	6	23	57.3
60 / 64	1	13	5	19	53.9	3	31	17	51	55.6	6	62	28	96	55.4
55 / 59	17	62	41	120	52.3	32	87	71	191	53.0	55	101	98	254	52.9
50 / 54	50	100	88	238	48.6	82	74	91	247	49.2	109	54	94	257	49.0
45 / 49	81	56	87	224	44.6	71	18	34	122	44.7	64	7	21	92	44.8
40 / 44	75	13	25	113	40.2	30	3	5	38	40.1	12	1	1	14	40.7
35 / 39	23	1	3	27	35.9	5	1	1	7	34.8	1		0	1	37.0
30 / 34	1			1	31.9	1	0	0	1	28.0					
25 / 29						0	0		0	25.5					
20 / 24															

Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

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Dry-Bulb Temperature Hours For An Average Year (Sheet 2 of 5)

Period of Record = 1973 to 1996

Temperature Range (°F)	April					May					June				
	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00		
100 / 104														0	0 66.0
95 / 99							0		0	62.5			0	0	67.7
90 / 94							0		0	63.0			1	1	66.8
85 / 89		0		0	66.0		1	0	1	65.2		3	1	4	66.2
80 / 84		2	0	2	63.7		3	0	3	64.4	0	6	1	7	65.6
75 / 79		3	1	4	62.5	0	8	2	10	63.4	1	11	4	16	64.7
70 / 74		10	3	13	59.9	1	19	5	25	61.6	2	30	9	41	62.7
65 / 69	1	34	10	45	57.9	4	53	15	72	59.3	8	83	27	118	60.1
60 / 64	10	87	39	136	55.5	24	100	56	180	56.3	44	80	76	200	57.5
55 / 59	71	81	106	258	52.7	104	58	118	280	53.4	142	25	110	277	54.6
50 / 54	119	20	76	215	49.3	110	5	52	167	50.2	43	1	13	57	51.6
45 / 49	36	2	6	44	45.0	5		0	5	45.9					
40 / 44	2	0	0	2	41.1	0			0	42.0					
35 / 39															
30 / 34															
25 / 29															
20 / 24															

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Dry-Bulb Temperature Hours For An Average Year (Sheet 3 of 5)

Period of Record = 1973 to 1996

Temperature Range (°F)	July					August					September				
	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00		
100 / 104															
95 / 99		0		0	73.5		0		0	69.0					
90 / 94		0		0	68.7		0		0	68.7		1		1	68.7
85 / 89		2	0	2	67.8		1	0	1	68.8		2	0	2	67.7
80 / 84		4	1	5	67.5		4	1	5	66.6		7	1	8	66.4
75 / 79	0	13	3	16	65.7	0	12	2	14	65.5	0	19	4	23	65.3
70 / 74	2	42	10	54	63.4	1	53	9	63	63.5	2	51	13	66	63.4
65 / 69	7	106	37	150	60.9	8	104	42	154	61.2	12	91	42	144	61.1
60 / 64	69	71	106	245	58.5	93	64	122	279	58.7	86	58	109	252	58.5
55 / 59	165	10	91	266	55.7	142	10	71	223	56.1	126	12	69	207	55.7
50 / 54	5		1	6	53.0	4		1	5	53.0	14		3	17	52.2
45 / 49															
40 / 44															
35 / 39															
30 / 34															
25 / 29															
20 / 24															

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Dry-Bulb Temperature Hours For An Average Year (Sheet 4 of 5)

Period of Record = 1973 to 1996

Temperature Range (°F)	October					November					December				
	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01	09	17			01	09	17			01	09	17		
	To 08	To 16	To 00			To 08	To 16	To 00			To 08	To 16	To 00		
100 / 104															
95 / 99		0	0	0	68.0										
90 / 94		0	0	0	65.5										
85 / 89		2	0	2	64.8										
80 / 84		5	1	6	64.0										
75 / 79	0	13	3	16	62.9		1	0	1	57.0					
70 / 74	1	34	9	44	61.8		5	0	5	57.7		0		0	52.0
65 / 69	8	75	29	112	60.0	1	22	5	28	57.8	0	1	0	1	51.9
60 / 64	49	85	90	224	57.5	7	73	35	115	55.9	1	17	3	21	54.3
55 / 59	123	32	99	254	54.5	51	89	92	232	53.1	24	78	45	147	52.5
50 / 54	57	2	17	76	50.4	92	42	81	216	48.9	51	90	90	231	48.4
45 / 49	9		0	9	45.2	64	8	25	97	44.4	76	50	81	207	44.1
40 / 44	0			0	40.0	23	0	2	25	40.3	70	9	25	104	40.0
35 / 39	0			0		1			1	36.4	23	2	4	29	35.4
30 / 34											2	0	1	3	30.0
25 / 29											1	0	0	1	23.8
20 / 24											0			0	20.0

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Dry-Bulb Temperature Hours For An Average Year (Sheet 5 of 5)

Period of Record = 1973 to 1996

Annual Totals

Temperature Range (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00		
100 / 104		0		0	66.0
95 / 99		0	0	0	68.0
90 / 94		3	0	3	67.1
85 / 89		10	2	12	66.7
80 / 84	0	30	6	36	65.7
75 / 79	1	81	19	101	64.4
70 / 74	8	251	59	317	62.6
65 / 69	48	597	217	862	60.2
60 / 64	395	745	683	1823	57.3
55 / 59	1057	645	1009	2711	54.0
50 / 54	736	389	607	1731	49.2
45 / 49	404	139	252	795	44.5
40 / 44	211	26	58	294	40.2
35 / 39	54	4	8	66	35.6
30 / 34	5	0	1	6	30.0
25 / 29	1	0	0	1	23.9
20 / 24	0			0	20.0

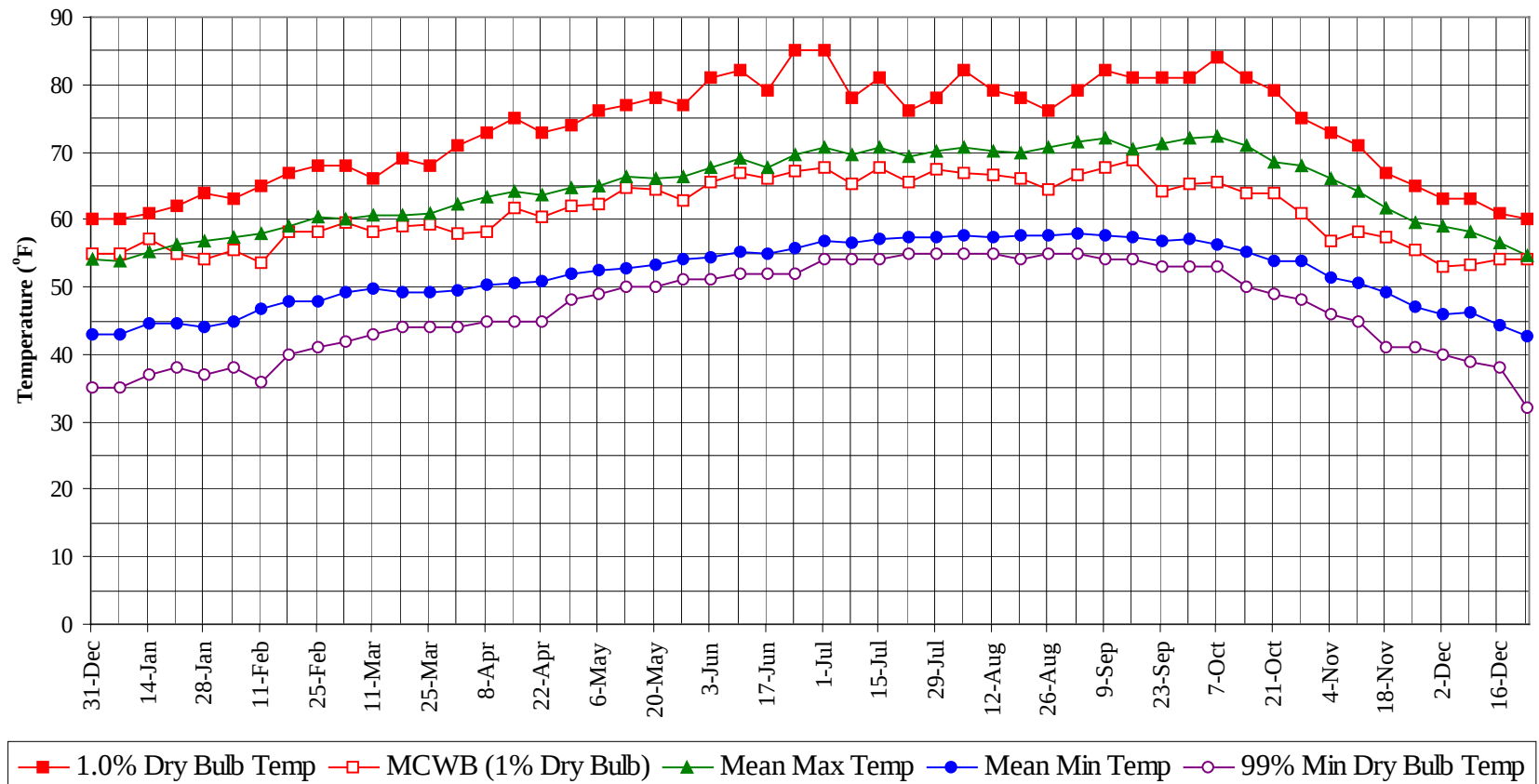
Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

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Annual Summary of Temperatures

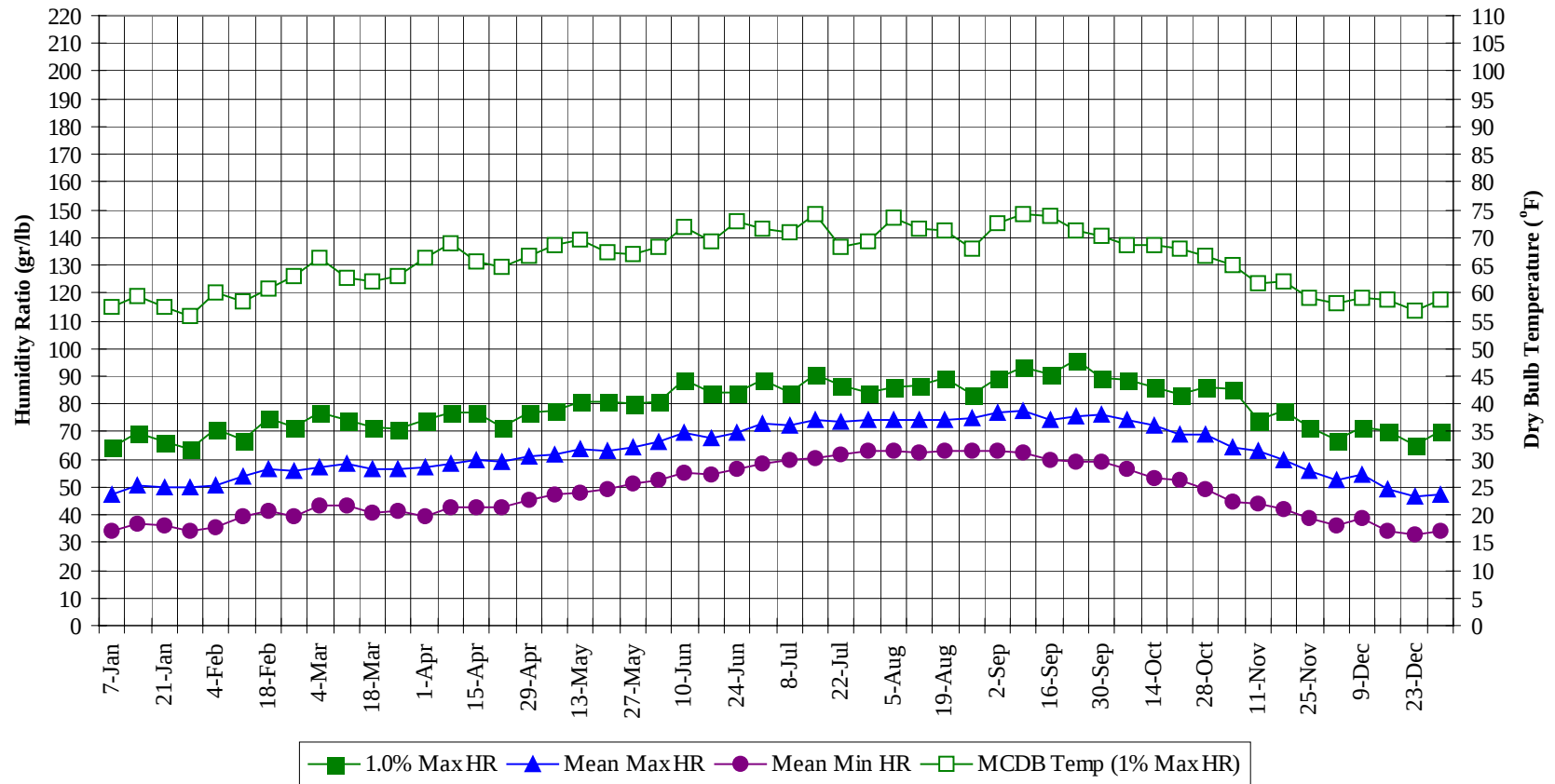


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Long Term Humidity and Dry Bulb Temperature Summary



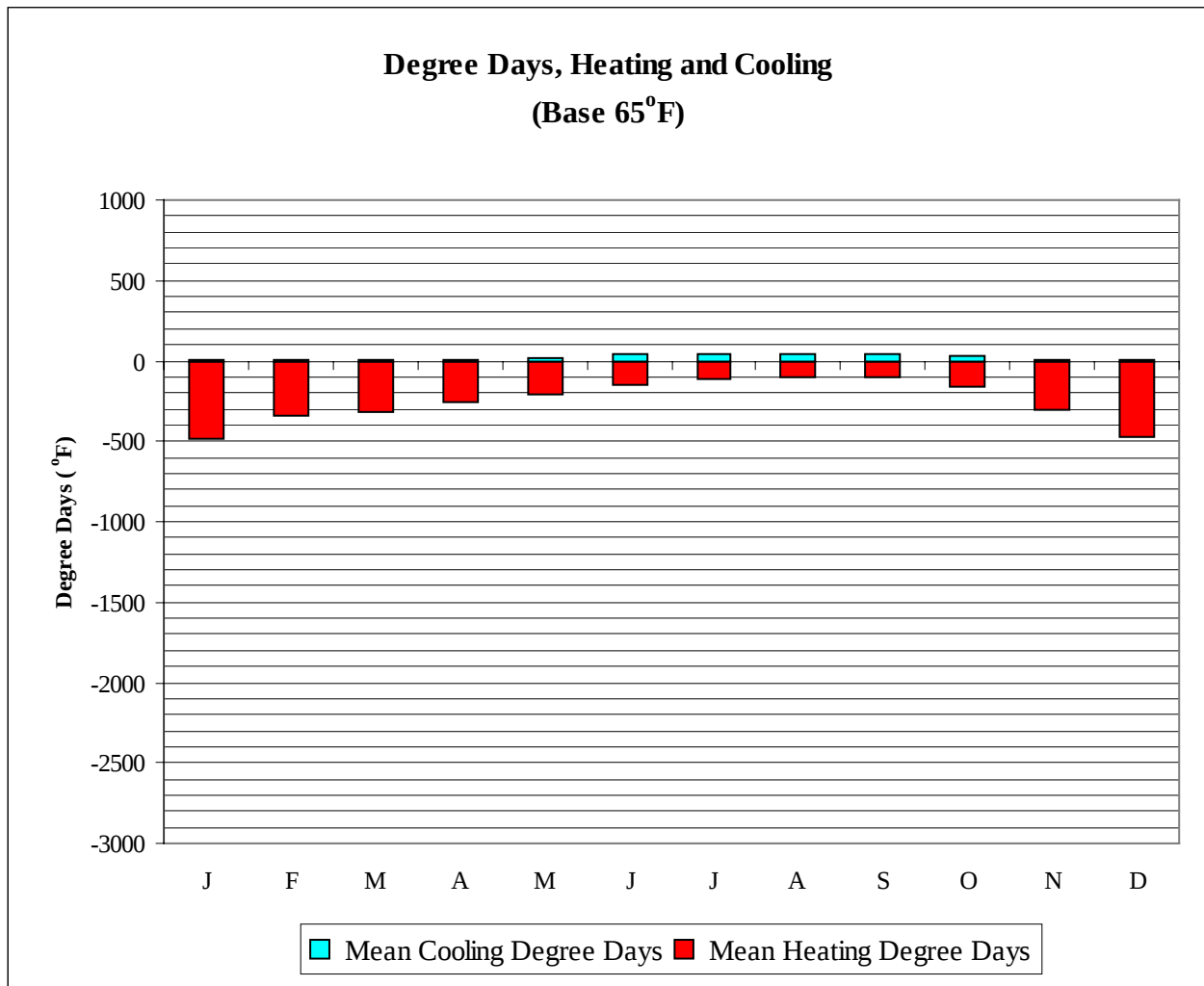
OAKLAND**CA****WMO No. 724930****Long Term Dry Bulb Temperature and Humidity Summary**

Week Ending	1.0% Temp (°F)	MCWB @ 1% Temp (°F)	Mean Max Temp (°F)	Mean Min Temp (°F)	99% Temp (°F)	1.0% HR (gr/lb)	MCDB @ 1% HR (°F)	Mean Max HR (gr/lb)	Mean Min HR (gr/lb)
7-Jan	60.0	54.9	53.9	43.0	35.0	64.4	57.6	47.1	34.2
14-Jan	61.0	57.0	55.2	44.5	37.0	69.3	59.6	50.4	37.0
21-Jan	62.0	54.8	56.2	44.5	38.0	66.5	57.4	49.9	35.8
28-Jan	64.0	54.0	57.0	44.0	37.0	63.7	55.9	49.9	34.3
4-Feb	63.0	55.4	57.3	44.9	38.0	70.7	60.0	50.6	35.7
11-Feb	65.0	53.7	57.9	46.9	36.0	67.2	58.5	53.7	39.5
18-Feb	67.0	58.3	59.1	47.8	40.0	74.9	60.7	56.7	41.5
25-Feb	68.0	58.3	60.3	47.9	41.0	71.4	63.0	55.8	39.3
4-Mar	68.0	59.7	60.0	49.2	42.0	77.0	66.5	57.4	43.1
11-Mar	66.0	58.2	60.7	49.7	43.0	74.2	62.7	58.3	43.5
18-Mar	69.0	59.0	60.7	49.2	44.0	71.4	62.0	56.3	41.0
25-Mar	68.0	59.2	60.8	49.3	44.0	70.7	63.1	56.7	41.6
1-Apr	71.0	57.9	62.4	49.4	44.0	74.2	66.5	57.1	39.6
8-Apr	73.0	58.1	63.4	50.3	45.0	77.0	69.0	58.4	42.6
15-Apr	75.0	61.6	64.2	50.6	45.0	77.0	65.8	59.8	42.6
22-Apr	73.0	60.3	63.6	50.8	45.0	71.4	64.9	59.2	42.6
29-Apr	74.0	61.9	64.8	51.8	48.0	77.0	66.8	60.9	45.4
6-May	76.0	62.4	65.1	52.4	49.0	77.7	68.7	62.0	47.4
13-May	77.0	64.7	66.3	52.8	50.0	80.5	69.7	63.4	48.0
20-May	78.0	64.4	65.9	53.4	50.0	80.5	67.3	63.2	49.2
27-May	77.0	62.8	66.4	54.0	51.0	79.8	66.9	64.6	51.3
3-Jun	81.0	65.6	67.7	54.5	51.0	80.5	68.4	66.1	52.4
10-Jun	82.0	66.9	69.0	55.3	52.0	88.9	71.9	69.6	55.1
17-Jun	79.0	66.0	67.8	55.0	52.0	84.0	69.2	67.6	54.4
24-Jun	85.0	67.1	69.6	55.8	52.0	84.0	72.8	69.8	56.8
1-Jul	85.0	67.6	70.7	56.8	54.0	88.9	71.4	73.1	58.3
8-Jul	78.0	65.2	69.7	56.6	54.0	84.0	70.9	72.4	59.6
15-Jul	81.0	67.6	70.6	57.1	54.0	90.3	74.3	74.0	60.7
22-Jul	76.0	65.4	69.4	57.3	55.0	86.8	68.1	73.5	61.5
29-Jul	78.0	67.5	70.0	57.3	55.0	84.0	69.2	74.4	63.0
5-Aug	82.0	66.8	70.8	57.7	55.0	86.1	73.5	74.4	62.9
12-Aug	79.0	66.7	70.2	57.5	55.0	86.8	71.6	74.1	62.4
19-Aug	78.0	66.1	69.9	57.6	54.0	89.6	71.2	74.3	63.1
26-Aug	76.0	64.5	70.7	57.7	55.0	83.3	68.1	74.7	63.0
2-Sep	79.0	66.5	71.4	57.9	55.0	89.6	72.6	77.0	62.8
9-Sep	82.0	67.7	72.0	57.8	54.0	93.1	74.3	77.3	62.5
16-Sep	81.0	68.8	70.5	57.4	54.0	90.3	74.0	74.4	59.7
23-Sep	81.0	64.2	71.1	56.8	53.0	95.9	71.3	75.4	59.1
30-Sep	81.0	65.1	72.1	57.2	53.0	89.6	70.4	76.0	58.9
7-Oct	84.0	65.4	72.2	56.4	53.0	88.9	68.7	74.1	56.3
14-Oct	81.0	64.0	70.9	55.2	50.0	86.1	68.6	72.1	53.3
21-Oct	79.0	63.8	68.5	54.0	49.0	83.3	68.0	69.0	52.4
28-Oct	75.0	60.9	67.9	53.7	48.0	86.1	66.8	69.0	49.6
4-Nov	73.0	56.7	66.1	51.3	46.0	85.4	64.9	64.6	44.5
11-Nov	71.0	58.1	64.2	50.6	45.0	74.2	61.6	63.0	43.9
18-Nov	67.0	57.4	61.6	49.1	41.0	77.7	62.1	59.8	41.9
25-Nov	65.0	55.4	59.6	47.1	41.0	71.4	59.3	55.9	38.8
2-Dec	63.0	53.1	58.9	45.9	40.0	67.2	58.1	52.5	36.1
9-Dec	63.0	53.2	58.3	46.3	39.0	71.4	59.2	54.3	38.6
16-Dec	61.0	54.1	56.5	44.4	38.0	70.0	58.7	49.5	34.2
23-Dec	60.0	54.2	54.6	42.6	32.0	65.1	56.8	46.9	33.1
31-Dec	60.0	54.8	54.2	43.1	35.0	70.0	58.9	47.1	34.0

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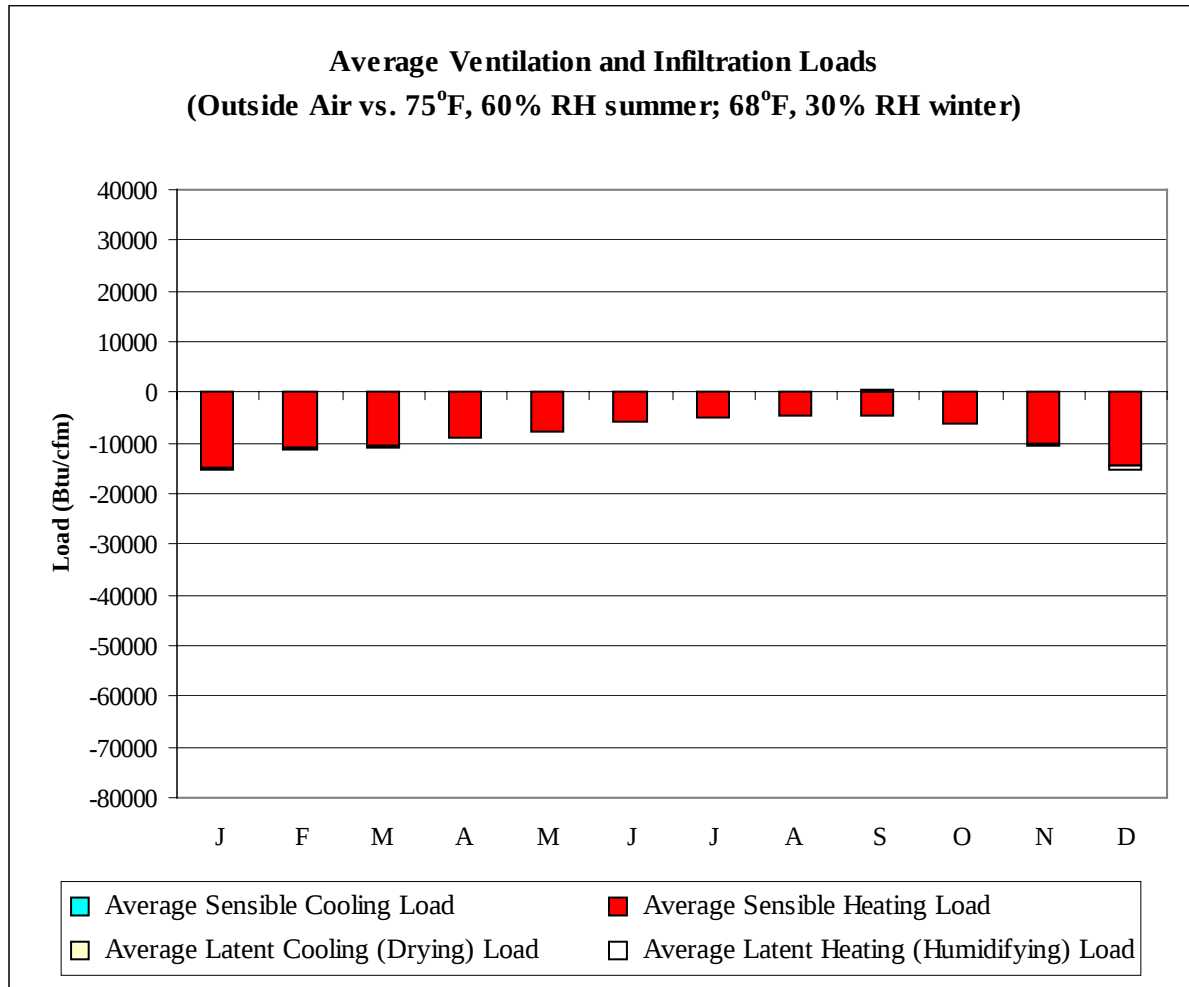


	Mean Cooling Degree Days (°F)	Mean Heating Degree Days (°F)
JAN	0	482
FEB	2	344
MAR	3	320
APR	10	254
MAY	19	209
JUN	36	145
JUL	38	118
AUG	38	106
SEP	47	104
OCT	33	157
NOV	3	305
DEC	0	470
ANN	229	3014

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	Average Sensible Cooling Load	Average Sensible Heating Load	Average Latent Cooling Load	Average Latent Heating Load
	(Btu/cfm)	(Btu/cfm)	(Btu/cfm)	(Btu/cfm)
JAN	0	-14894	0	-332
FEB	2	-11086	1	-195
MAR	1	-10661	5	-98
APR	20	-8793	11	-50
MAY	55	-7602	24	-9
JUN	143	-5676	83	-4
JUL	96	-4964	146	0
AUG	64	-4635	142	0
SEP	125	-4448	238	-1
OCT	104	-6092	95	-41
NOV	1	-10178	7	-192
DEC	0	-14583	0	-498
ANN	611	-103612	752	-1420

Average Annual Solar Radiation – Nearest Available Site

(Source: National Renewable Energy Laboratory, Golden CO, 1995)

City: SAN FRANCISCO
 State: CA
 WBAN No: 23234
 Lat(N): 37.62
 Long(W): 122.38
 Elev(ft): 16

Stn Type: Secondary
 SHADING GEOMETRY IN DIMENSIONLESS UNITS
 Window: 1
 Overhang: 0.466
 Vert Gap: 0.307

AVERAGE INCIDENT SOLAR RADIATION (Btu/sq.ft./day), Percentage Uncertainty = 9		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
HORIZ	Global	680	940	1340	1800	2120	2270	2330	2060	1700	1230	790	620	1490
	Std Dev	66	122	147	163	126	144	84	109	101	79	84	75	33
	Minimum	570	740	1060	1390	1790	1920	2190	1810	1480	1020	670	450	1400
	Maximum	790	1240	1680	2030	2360	2520	2490	2300	1910	1400	930	760	1540
Clear Day	Diffuse	310	420	530	640	710	720	650	610	500	410	330	280	510
	Global	940	1280	1760	2230	2530	2640	2570	2310	1900	1410	1010	840	1790
	Global	200	270	350	440	550	620	590	470	380	300	220	180	380
	Diffuse	200	270	350	430	490	520	500	450	380	300	220	180	360
Clear Day	Global	200	260	340	430	580	680	630	480	370	290	220	190	390
	Global	430	580	780	1000	1100	1120	1140	1030	930	720	500	400	810
	Diffuse	250	330	430	530	590	610	590	550	470	370	280	220	440
	Global	670	860	1100	1310	1420	1440	1410	1330	1170	930	710	610	1080
Clear Day	Global	1050	1140	1170	1070	900	800	860	1050	1300	1370	1150	1050	1080
	Diffuse	350	430	500	540	550	540	530	530	510	470	390	330	470
	Global	1790	1840	1710	1340	1020	870	920	1180	1550	1790	1790	1740	1460
	Global	460	600	820	1060	1200	1260	1320	1210	1060	810	530	430	900
Clear Day	Diffuse	250	330	440	550	610	630	610	570	480	380	280	230	450
	Global	670	860	1100	1310	1420	1440	1410	1330	1170	930	710	610	1080

Average Annual Solar Heat and Illumination – Nearest Available Site

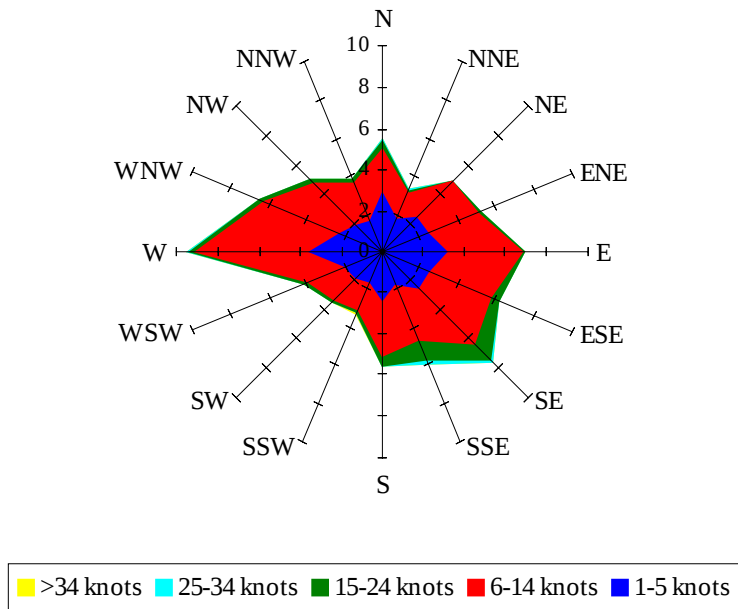
(Source: National Renewable Energy Laboratory, Golden CO, 1995)

AVERAGE TRANSMITTED SOLAR RADIATION (Btu/sq.ft./day) FOR DOUBLE GLAZING, Percentage Uncertainty = 9		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
HORIZ	Unshaded	450	650	960	1300	1560	1670	1720	1520	1240	860	530	400	1070
NORTH	Unshaded	140	190	240	300	360	400	380	320	260	210	150	130	260
	Shaded	130	170	220	280	330	360	350	290	240	190	140	120	240
EAST	Unshaded	290	400	550	710	780	790	800	730	650	500	350	270	570
	Shaded	260	360	490	630	670	680	690	630	580	450	310	250	500
SOUTH	Unshaded	790	830	810	680	530	460	490	640	870	990	860	790	730
	Shaded	770	780	650	460	350	350	340	400	630	880	830	780	600
WEST	Unshaded	320	420	580	750	850	900	940	860	750	570	360	290	640
	Shaded	290	380	520	660	740	780	820	750	670	510	330	270	560

AVERAGE INCIDENT ILLUMINANCE (klux-hr) FOR MOSTLY CLEAR AND MOSTLY CLOUDY CONDITIONS, Percentage Uncertainty = 9		March					June				
		9am	11am	1pm	3pm	5pm	9am	11am	1pm	3pm	5pm
HORIZ.	M.Clear	38	73	84	68	30	44	83	103	99	72
	M.Cloudy	22	46	54	44	18	26	51	74	75	51
NORTH	M.Clear	10	14	15	14	9	20	16	17	17	15
	M.Cloudy	9	15	16	14	7	13	17	19	18	16
EAST	M.Clear	71	59	15	14	9	75	74	34	17	15
	M.Cloudy	28	34	16	14	7	29	40	29	18	16
SOUTH	M.Clear	36	69	80	64	28	11	28	43	40	20
	M.Cloudy	17	38	46	38	14	10	22	34	33	18
WEST	M.Clear	10	14	21	65	66	11	16	17	50	80
	M.Cloudy	9	15	18	38	26	10	17	19	40	50
M.Clear	(% hrs)	36	38	40	41	42	46	60	67	71	70
		Sept					Dec				
		9am	11am	1pm	3pm	5pm	9am	11am	1pm	3pm	5pm
HORIZ.	M.Clear	26	67	88	83	52	14	41	49	32	3
	M.Cloudy	15	42	61	59	34	8	24	29	19	3
NORTH	M.Clear	8	14	16	16	12	5	10	11	9	2
	M.Cloudy	7	14	17	17	12	4	9	11	8	1
EAST	M.Clear	61	72	32	16	12	37	40	11	9	2
	M.Cloudy	20	37	26	17	12	11	18	11	8	1
SOUTH	M.Clear	18	54	73	68	40	33	76	86	63	8
	M.Cloudy	9	30	50	47	25	10	29	36	25	3
WEST	M.Clear	8	14	16	52	77	5	10	20	47	12
	M.Cloudy	7	14	17	38	41	4	9	14	20	4
M.Clear	(% hrs)	48	63	72	77	76	35	39	43	42	44

Wind Summary - December, January, and February

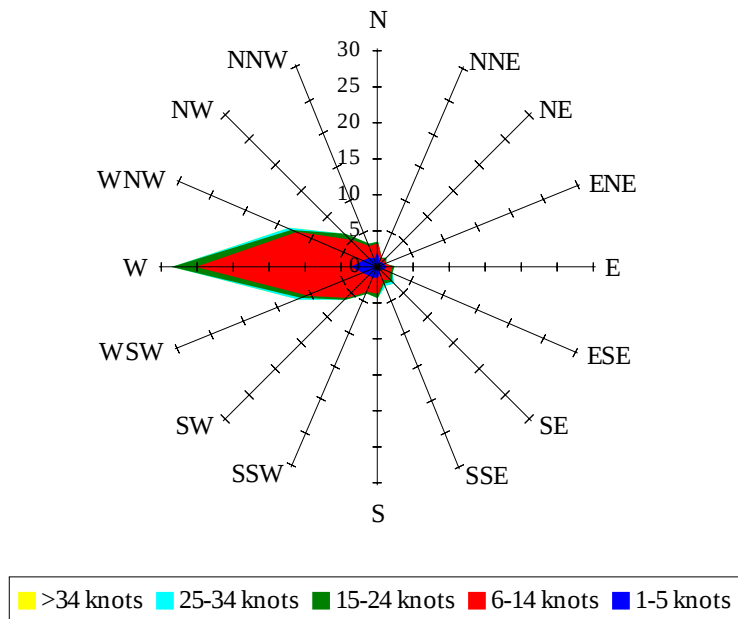
Labels of Percent Frequency on North Axis



Percent Calm = 13.90

Wind Summary - March, April, and May

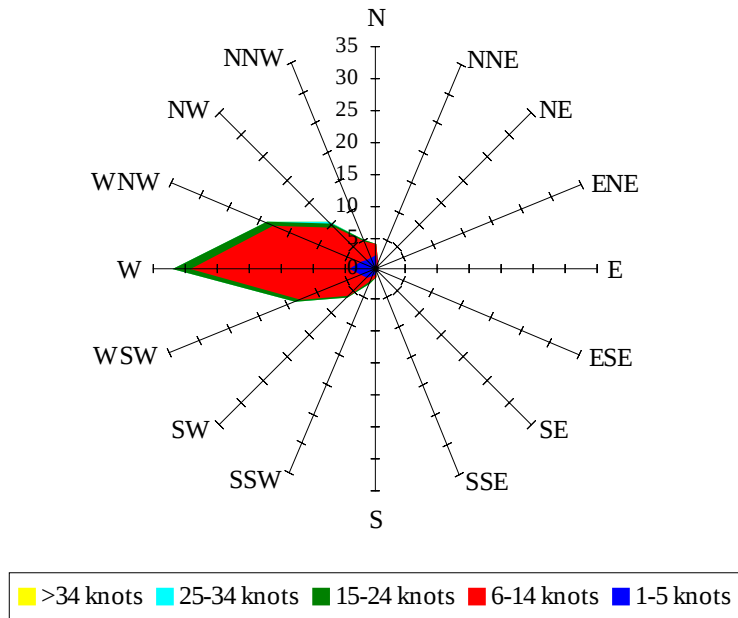
Labels of Percent Frequency on North Axis



Percent Calm = 7.00

Wind Summary - June, July, and August

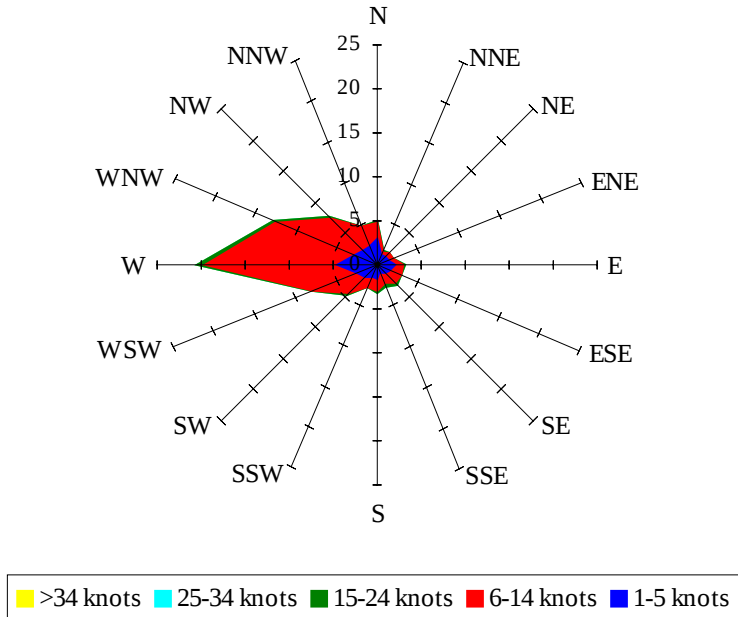
Labels of Percent Frequency on North Axis



Percent Calm = 5.07

Wind Summary - September, October, and November

Labels of Percent Frequency on North Axis



Percent Calm = 12.29