

PORTLAND OR

Latitude = 45.60 N

Longitude = 122.60 W

Period of Record = 1973 to 1996

WMO No. 726980

Elevation = 39 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	100	70	64	10.8	NNW
0.4% Occurrence	91	68	64	10.9	NNW
1.0% Occurrence	87	66	64	10.6	NNW
2.0% Occurrence	83	65	63	10.2	NNW
Mean Daily Range	16	-	-	-	-
97.5% Occurrence	31	29	21	7.9	ESE
99.0% Occurrence	27	25	16	9.7	ESE
99.6% Occurrence	22	19	10	13.1	ESE
Median of Extreme Lows	18	16	8	14.6	E
	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	73	93	87	10.2	NW
0.4% Occurrence	69	87	75	9.9	NNW
1.0% Occurrence	68	85	73	9.7	NNW
2.0% Occurrence	66	81	70	9.3	NNW
	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	96	79	0.64	7.2	WNW
0.4% Occurrence	84	75	0.56	7.8	NW
1.0% Occurrence	80	74	0.54	7.7	NW
2.0% Occurrence	75	71	0.50	7.4	NNW
Air Conditioning/ Humid Area Criteria	# of Hours	T ≥ 93°F	T ≥ 80°F	T _{wb} ≥ 73°F	T _{wb} ≥ 67°F
		26	304	4	138

Other Site Data

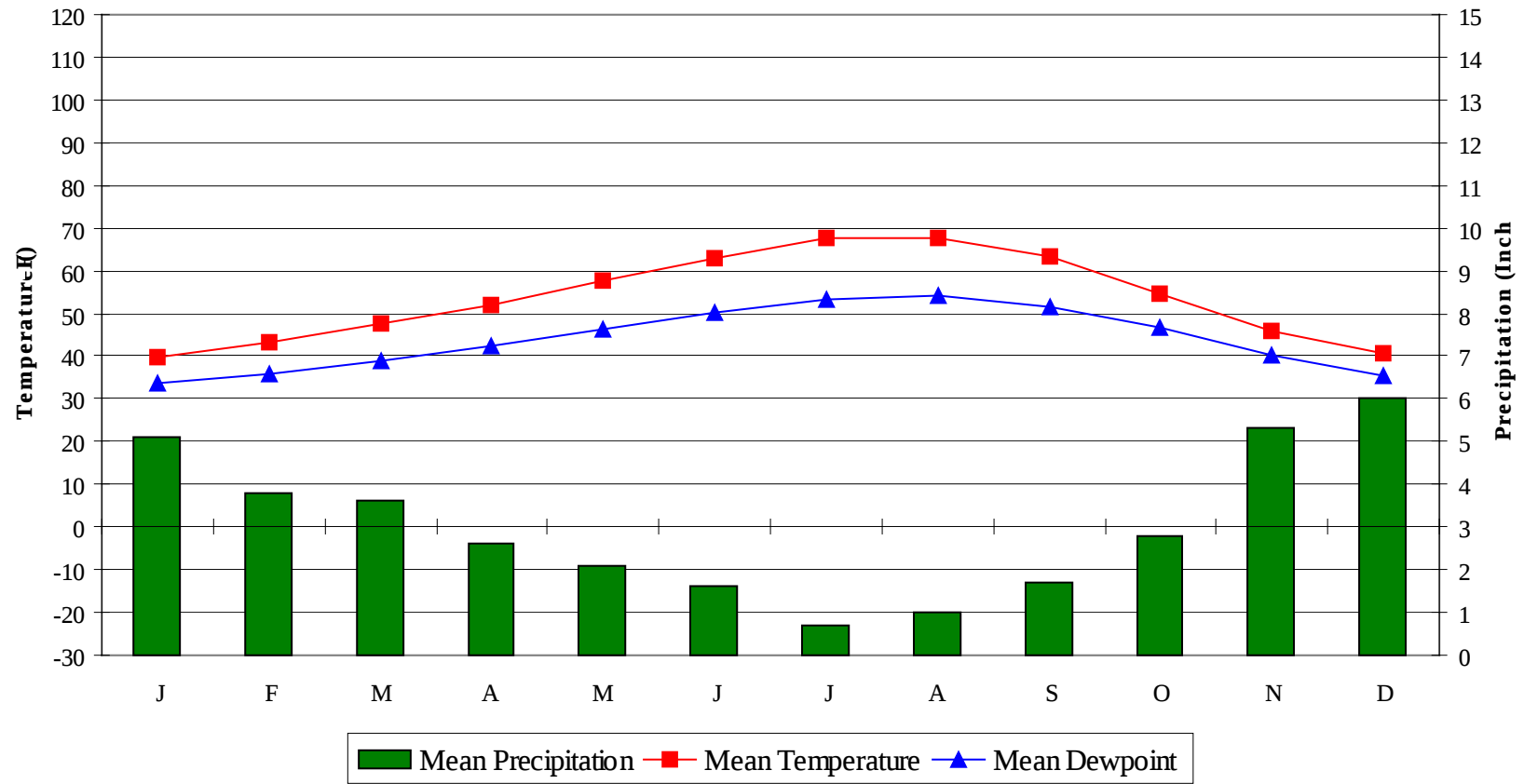
Weather Region	Rain Rate 100 Year Recurrence (in./hr)	Basic Wind Speed 3 sec gust @ 33 ft 50 Year Recurrence (mph)	Ventilation Cooling Load Index (Ton-hr/cfm/yr) Base 75°F-RH 60% Latent + Sensible
7	1.0	N/A	0.0 + 0.3
Ground Water Temperature (°F) 50 Foot Depth *	Frost Depth 50 Year Recurrence (in.)	Ground Snow Load 50 Year Recurrence (lb/ft ²)	Average Annual Freeze-Thaw Cycles (#)
56.1	14	8	24

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

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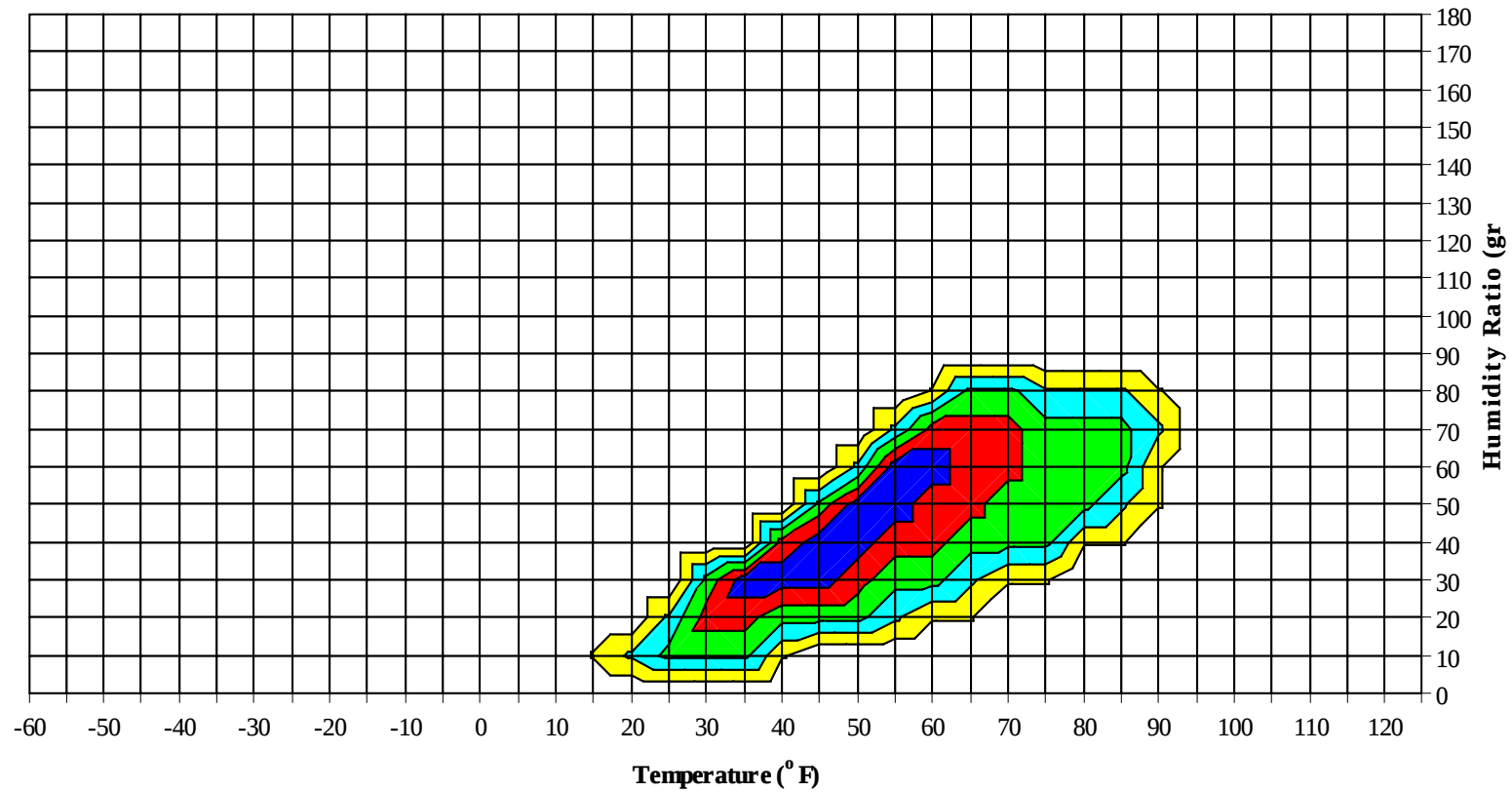
Average Annual Climate



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Long Term Psychrometric Summary

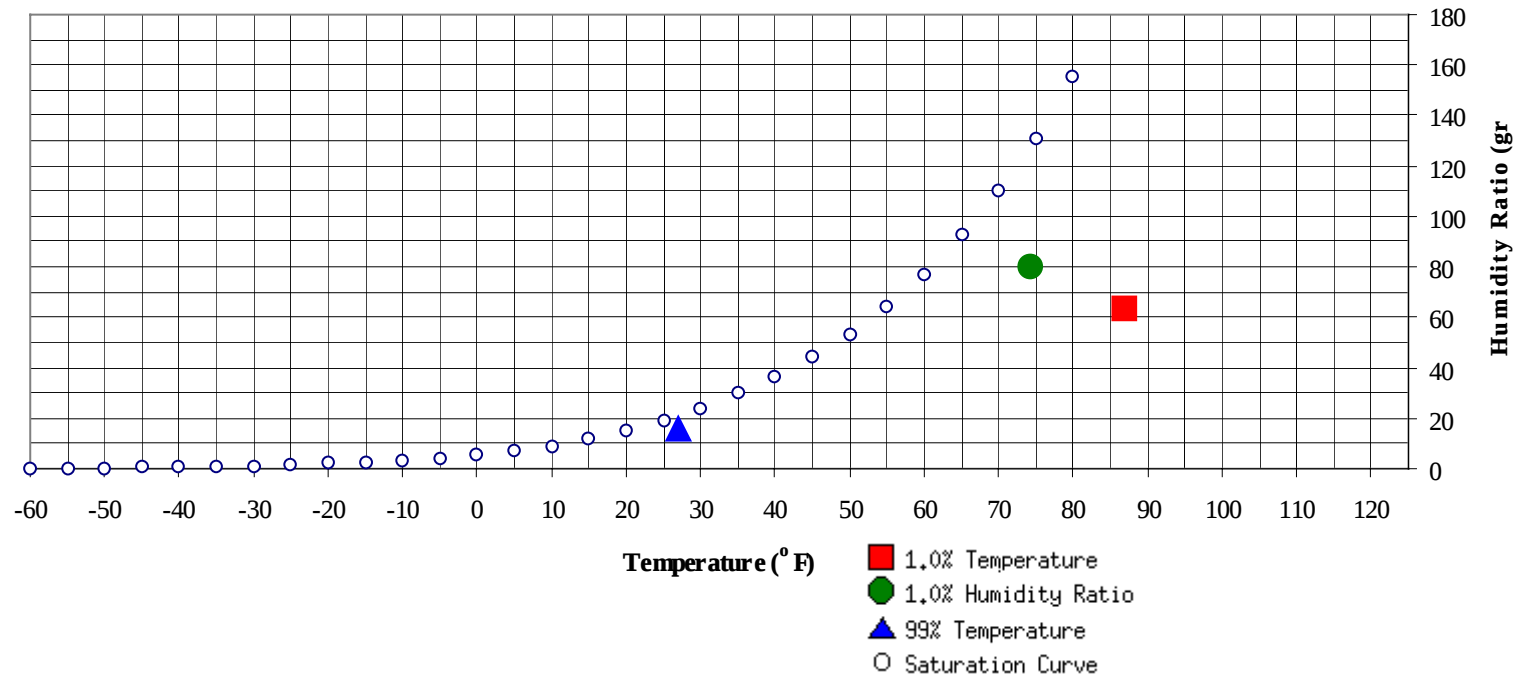


- 50% of all observations
- 80% of all observations
- 95% of all observations
- 97.5% of all observations
- 99% of all observations

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Psychrometric Summary of Peak Design Values



	(°F)	MCHR (gr/lb)	Enthalpy (btu/lb)	1.0% Humidity Ratio	(gr/lb)	MCDB (°F)	MCWB (°F)	MC Dewpt (°F)	Enthalpy (btu/lb)
99% Dry Bulb	27	15.5	8.9		79.8	74.2	65.5	61	30.3

	(°F)	MCHR (gr/lb)	MCWB (°F)	Enthalpy (btu/lb)
1.0% Dry Bulb	87	63.8	66.4	30.9

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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		
105 / 109															
100 / 104															
95 / 99															
90 / 94															
85 / 89															
80 / 84															
75 / 79												0	0	0	57.4
70 / 74												2	1	2	54.0
65 / 69							1	0	1	53.0		9	3	13	53.1
60 / 64	0	1		2	54.2	0	7	2	9	52.4		21	10	31	51.1
55 / 59	3	9	4	16	52.3	3	22	9	33	50.7	2	43	24	69	49.0
50 / 54	9	27	15	51	47.9	12	43	31	86	47.0	20	73	62	155	46.8
45 / 49	32	63	46	141	43.8	41	64	64	169	43.6	75	67	82	224	43.9
40 / 44	62	65	71	198	39.9	62	44	61	167	39.6	87	26	51	165	40.0
35 / 39	60	43	57	160	35.2	56	26	38	121	35.1	48	5	13	67	35.9
30 / 34	49	27	37	113	30.2	33	11	15	60	30.4	14	1	2	17	31.5
25 / 29	22	9	10	41	25.0	10	2	2	15	25.3	2	0	0	2	27.3
20 / 24	7	2	6	15	19.5	2	1	1	5	19.9	0			0	23.0
15 / 19	4	1	2	6	15.5	2	0	1	3	14.6					
10 / 14	1		0	1	12.0	1	1	1	2	10.2					
5 / 9						0			0	7.3					

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		
105 / 109															
100 / 104															
95 / 99							0	0	0	68.2		1	0	1	69.6
90 / 94							1	0	1	69.1		2	1	4	68.2
85 / 89			0	0	65.0		4	2	5	65.7		8	4	12	65.8
80 / 84		1	0	1	62.5		8	4	12	63.6		17	10	26	64.2
75 / 79		5	2	7	59.9		15	8	23	60.9	0	22	17	39	62.1
70 / 74		11	6	17	57.6	0	24	16	40	58.8	2	37	27	66	59.9
65 / 69	0	21	12	33	55.2	3	33	24	59	56.6	8	54	42	105	57.7
60 / 64	1	35	24	60	52.5	14	53	42	109	54.0	40	62	62	165	55.6
55 / 59	14	55	43	112	50.4	45	68	62	175	51.7	103	32	57	191	53.1
50 / 54	45	68	67	180	47.6	94	37	62	193	48.6	74	5	17	96	49.6
45 / 49	91	39	59	189	44.4	74	6	25	105	45.1	12	0	1	13	45.6
40 / 44	66	6	25	97	40.6	17	0	3	20	41.4	1		0	1	41.3
35 / 39	20	0	2	22	36.5	1		0	1	37.4					
30 / 34	3	0		3	32.3										
25 / 29															
20 / 24															
15 / 19															
10 / 14															
5 / 9															

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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		
105 / 109							0	0	0	72.2					
100 / 104		1	0	1	70.9		1	0	2	70.2		0	0	0	68.8
95 / 99		3	2	5	69.8		3	2	5	69.8		1	0	1	65.5
90 / 94		9	5	13	69.1		8	4	12	68.0		5	1	6	65.6
85 / 89		18	11	29	67.0		16	10	25	66.8		11	4	15	64.5
80 / 84		27	20	47	65.3	0	28	19	47	65.1		19	8	27	63.3
75 / 79	1	39	31	71	63.2	1	42	31	73	63.1	0	27	16	43	61.9
70 / 74	7	54	46	107	61.2	5	55	47	108	61.3	1	43	29	73	60.1
65 / 69	28	54	55	136	59.2	25	56	62	144	59.7	6	54	49	109	58.6
60 / 64	97	37	57	191	56.9	113	34	56	204	57.6	56	53	69	178	57.0
55 / 59	99	6	21	125	54.0	85	4	16	105	54.4	94	23	49	166	54.1
50 / 54	17	0	1	18	50.7	17		0	17	50.7	62	4	14	80	50.4
45 / 49	1		0	1	47.7	1			1	46.8	19	0	2	21	46.3
40 / 44						0			0	43.0	2			2	42.4
35 / 39															
30 / 34															
25 / 29															
20 / 24															
15 / 19															
10 / 14															
5 / 9															

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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 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		
105 / 109															
100 / 104															
95 / 99															
90 / 94		0		0	65.5										
85 / 89		1	0	1	62.7										
80 / 84		3	0	4	61.0										
75 / 79		7	1	8	59.5										
70 / 74	0	16	6	22	57.7		0		0	59.8					
65 / 69	0	32	13	45	56.1		1	0	2	58.8					
60 / 64	6	60	36	102	54.9	1	11	2	14	55.2	1	1	0	2	57.5
55 / 59	42	63	71	176	52.9	12	35	20	67	52.4	4	6	5	15	53.2
50 / 54	75	43	69	187	49.5	34	61	45	140	48.6	12	25	13	50	48.6
45 / 49	75	20	41	135	45.8	61	70	73	204	44.7	36	67	46	149	44.3
40 / 44	41	3	9	53	41.7	68	39	61	168	40.2	69	71	77	217	39.8
35 / 39	8	0	1	10	36.9	38	14	23	76	35.8	60	47	63	171	35.4
30 / 34	1			1	31.6	18	6	10	33	30.6	42	21	32	95	30.9
25 / 29	0			0	28.0	6	2	3	10	25.7	16	4	6	26	26.1
20 / 24						3	1	2	5	20.2	3	3	3	8	19.6
15 / 19						1	0	0	1	15.9	4	2	3	9	14.2
10 / 14						0			0	12.7	1	0	1	2	11.0
5 / 9															

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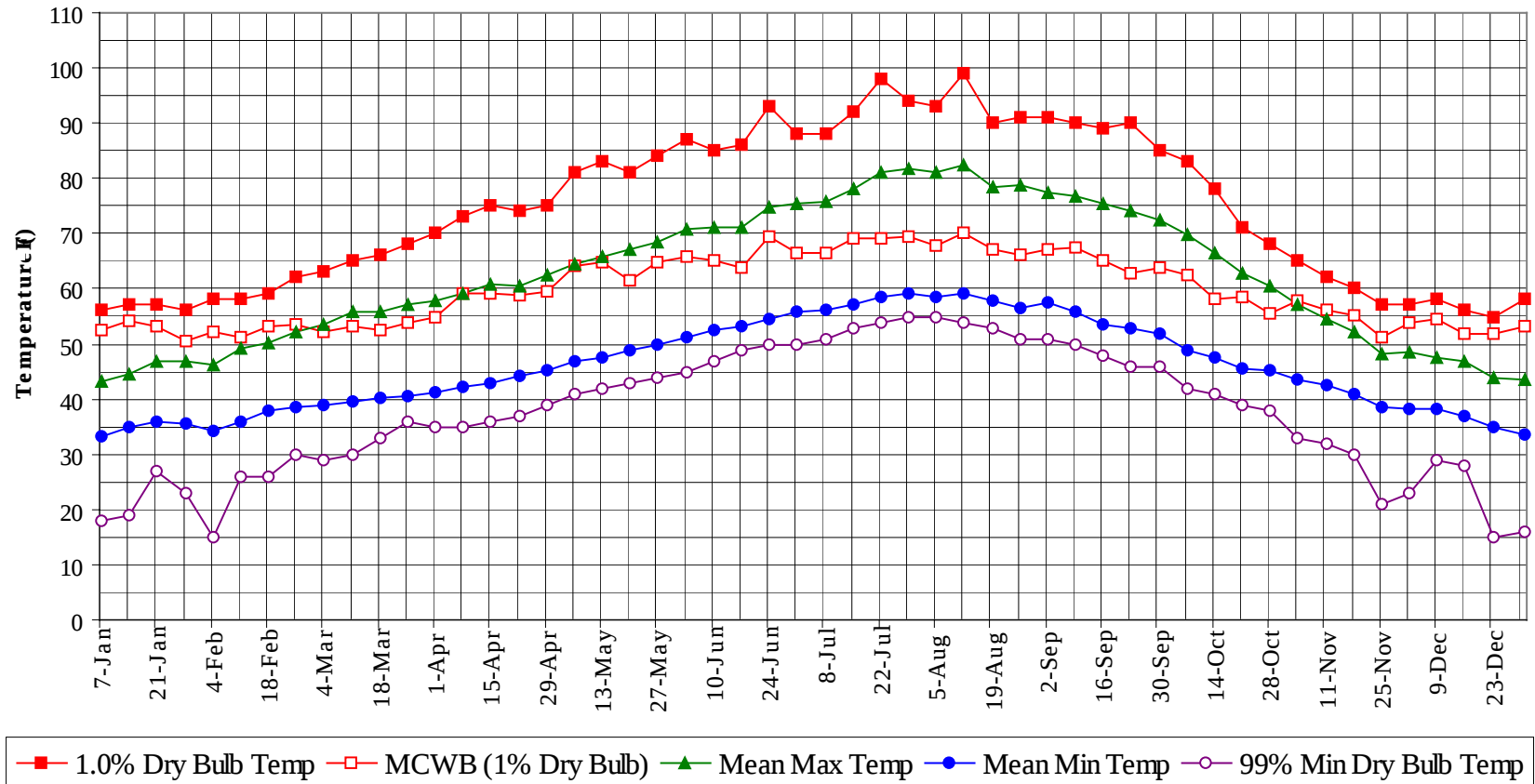
Annual Totals

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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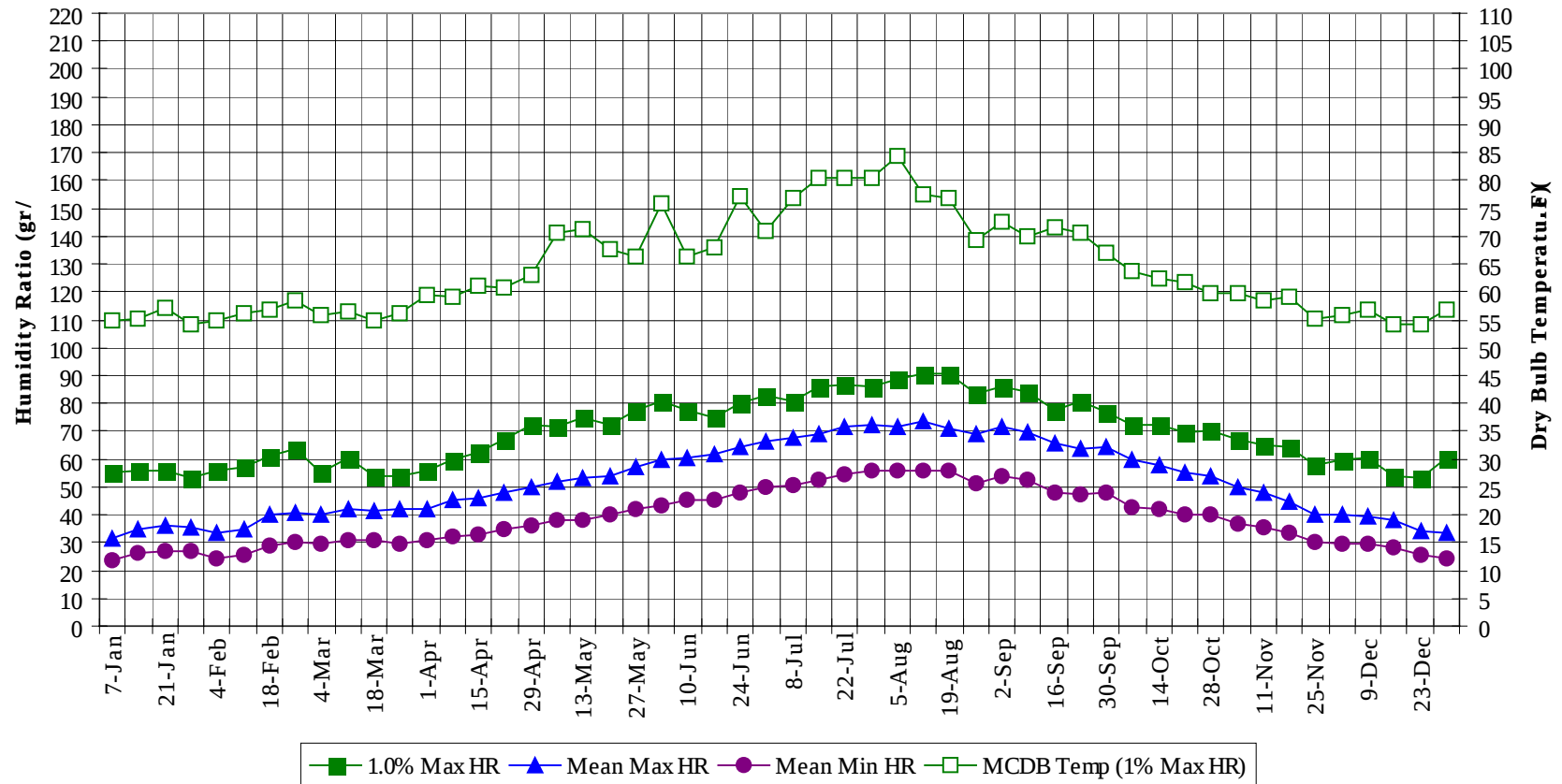
Annual Summary of Temperatures



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Long Term Humidity and Dry Bulb Temperature Summary



PORTLAND OR

WMO No. 726980

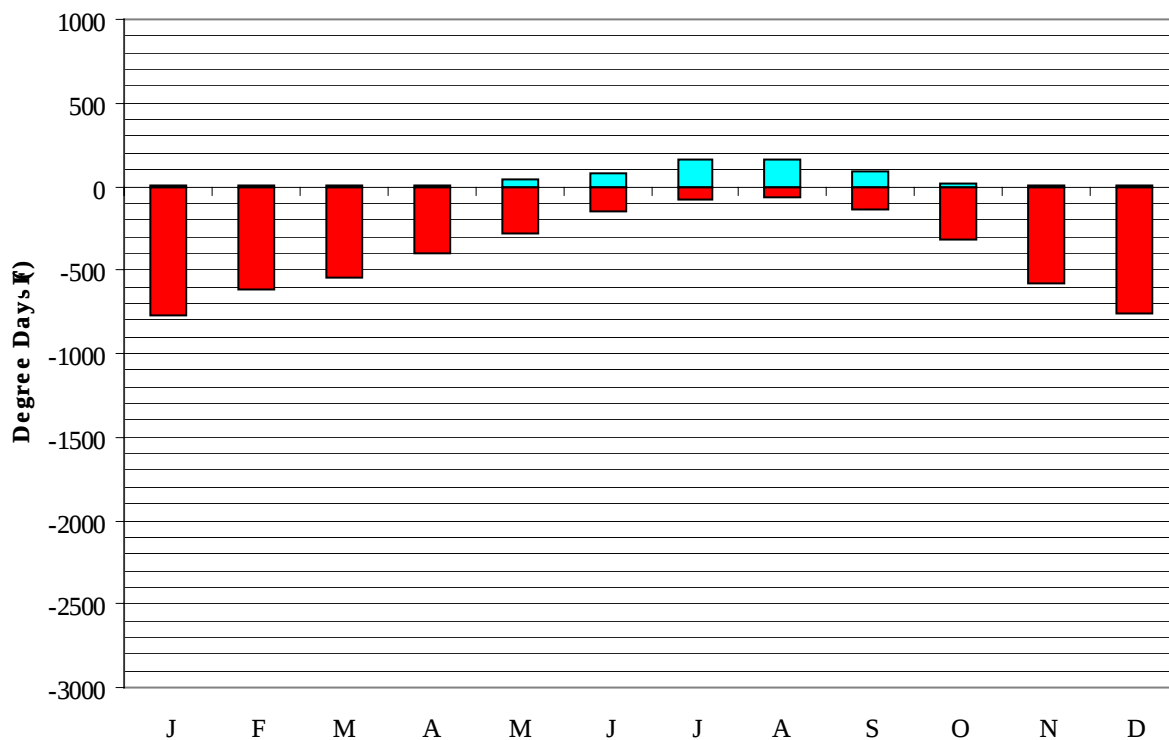
Long Term Dry Bulb Temperature and Humidity Summary

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	56.0	52.6	43.1	33.4	18.0	55.3	55.0	31.8	23.4
14-Jan	57.0	54.2	44.5	35.0	19.0	56.0	55.2	35.0	26.1
21-Jan	57.0	53.3	47.0	36.0	27.0	56.0	57.1	35.9	27.2
28-Jan	56.0	50.4	46.7	35.7	23.0	53.2	54.2	35.8	26.9
4-Feb	58.0	52.2	46.2	34.1	15.0	56.0	54.8	33.6	24.4
11-Feb	58.0	51.2	49.2	35.8	26.0	57.4	56.1	35.0	25.4
18-Feb	59.0	53.1	50.2	37.8	26.0	60.9	56.7	39.8	28.9
25-Feb	62.0	53.6	52.2	38.6	30.0	63.7	58.4	41.0	30.0
4-Mar	63.0	52.0	53.5	39.0	29.0	55.3	55.8	40.0	29.4
11-Mar	65.0	53.2	55.7	39.7	30.0	60.2	56.5	42.1	30.7
18-Mar	66.0	52.4	55.9	40.2	33.0	53.9	54.8	41.5	30.7
25-Mar	68.0	53.7	57.2	40.5	36.0	53.9	56.1	42.3	29.4
1-Apr	70.0	54.7	58.0	41.1	35.0	56.0	59.6	42.2	30.7
8-Apr	73.0	59.1	59.1	42.1	35.0	59.5	59.0	45.1	32.5
15-Apr	75.0	59.0	60.9	43.0	36.0	62.3	61.0	46.3	32.8
22-Apr	74.0	58.9	60.6	44.3	37.0	67.2	60.7	48.1	34.8
29-Apr	75.0	59.4	62.6	45.3	39.0	72.1	62.9	50.0	35.8
6-May	81.0	64.1	64.6	46.7	41.0	71.4	70.7	52.2	37.8
13-May	83.0	64.9	65.8	47.6	42.0	74.9	71.2	53.3	38.2
20-May	81.0	61.4	67.2	48.9	43.0	72.1	67.8	54.0	40.2
27-May	84.0	64.6	68.5	49.9	44.0	77.7	66.2	57.3	42.3
3-Jun	87.0	65.8	70.8	51.1	45.0	80.5	75.7	59.5	43.2
10-Jun	85.0	65.0	71.2	52.4	47.0	77.7	66.2	60.5	45.3
17-Jun	86.0	63.9	71.1	53.3	49.0	74.9	67.9	61.8	45.6
24-Jun	93.0	69.3	74.8	54.7	50.0	79.8	77.2	64.3	48.1
1-Jul	88.0	66.4	75.3	55.8	50.0	82.6	70.9	66.1	50.0
8-Jul	88.0	66.4	75.8	56.2	51.0	80.5	76.9	67.5	50.6
15-Jul	92.0	69.1	78.1	57.1	53.0	86.1	80.5	69.0	52.3
22-Jul	98.0	69.0	81.1	58.6	54.0	86.8	80.6	71.7	54.6
29-Jul	94.0	69.5	81.6	59.0	55.0	86.1	80.3	72.2	55.7
5-Aug	93.0	67.6	81.2	58.5	55.0	88.9	84.3	71.3	55.5
12-Aug	99.0	70.0	82.3	59.0	54.0	90.3	77.5	73.3	55.9
19-Aug	90.0	67.3	78.5	57.9	53.0	90.3	77.0	71.2	55.7
26-Aug	91.0	66.1	78.7	56.6	51.0	83.3	69.3	69.2	51.0
2-Sep	91.0	67.3	77.3	57.4	51.0	86.1	72.6	71.6	54.1
9-Sep	90.0	67.6	76.9	55.7	50.0	84.0	70.0	69.6	52.8
16-Sep	89.0	65.2	75.4	53.5	48.0	77.7	71.6	65.5	48.1
23-Sep	90.0	62.9	74.2	52.7	46.0	80.5	70.8	63.6	47.6
30-Sep	85.0	63.7	72.5	51.9	46.0	77.0	67.1	64.5	47.8
7-Oct	83.0	62.4	69.7	49.0	42.0	72.1	63.5	60.0	42.9
14-Oct	78.0	58.0	66.6	47.5	41.0	72.1	62.3	57.7	42.1
21-Oct	71.0	58.3	62.9	45.6	39.0	69.3	61.7	55.1	39.9
28-Oct	68.0	55.4	60.6	45.2	38.0	70.0	59.9	53.8	39.9
4-Nov	65.0	57.9	57.1	43.4	33.0	67.2	59.6	50.0	36.5
11-Nov	62.0	56.2	54.5	42.4	32.0	65.1	58.5	47.8	35.7
18-Nov	60.0	55.2	52.1	41.0	30.0	64.4	59.1	44.7	33.4
25-Nov	57.0	51.1	48.1	38.6	21.0	58.1	55.1	40.3	30.2
2-Dec	57.0	53.9	48.4	38.1	23.0	59.5	56.0	40.1	29.2
9-Dec	58.0	54.6	47.4	38.2	29.0	60.2	56.9	39.6	29.6
16-Dec	56.0	51.8	46.8	36.9	28.0	53.9	54.2	38.4	28.4
23-Dec	55.0	51.7	44.0	34.7	15.0	53.2	54.2	33.9	25.5
31-Dec	58.0	53.3	43.6	33.7	16.0	60.2	56.8	33.8	24.6

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Degree Days, Heating and Cooling
(Base 65°F)



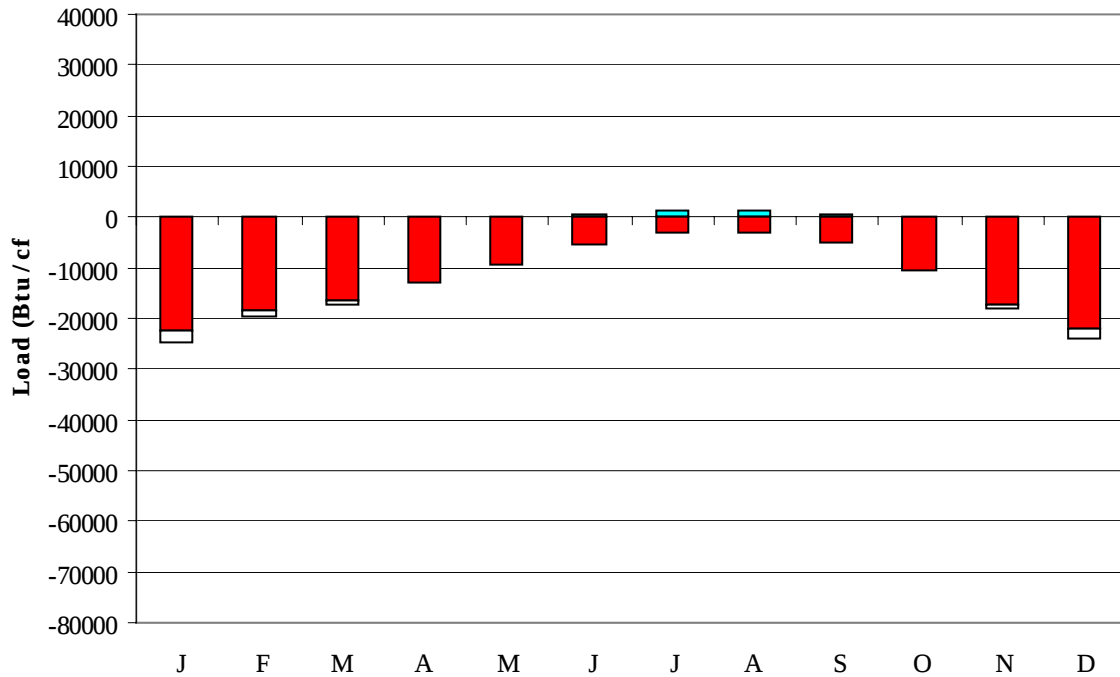
Mean Cooling Degree Days Mean Heating Degree Days

	Mean Cooling Degree Days (°F)	Mean Heating Degree Days (°F)
JAN	0	776
FEB	0	619
MAR	1	540
APR	11	406
MAY	40	276
JUN	79	145
JUL	157	73
AUG	156	68
SEP	90	136
OCT	15	323
NOV	0	575
DEC	0	758
ANN	551	4695

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Average Ventilation and Infiltration Loads
(Outside Air vs. 75°F, 60% RH summer; 68°F, 30% RH winter)



	Average Sensible Cooling Load (Btu/cfm)	Average Sensible Heating Load (Btu/cfm)	Average Latent Cooling Load (Btu/cfm)	Average Latent Heating Load (Btu/cfm)
JAN	0	-22528	0	-2218
FEB	0	-18239	0	-1446
MAR	0	-16388	0	-652
APR	17	-12714	2	-172
MAY	210	-9192	12	-15
JUN	501	-5412	21	-3
JUL	1238	-3175	100	-1
AUG	1193	-3031	151	-2
SEP	597	-5123	33	-38
OCT	47	-10519	0	-131
NOV	0	-17241	0	-790
DEC	0	-22062	0	-1750
ANN	3803	-145624	319	-7218

Average Annual Solar Radiation – Nearest Available Site

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

City: PORTLAND
 State: OR
 WBAN No: 24229
 Lat(N): 45.6
 Long(W): 122.6
 Elev(ft): 39

Stn Type: Primary
 SHADING GEOMETRY IN DIMENSIONLESS UNITS

Window: 1
 Overhang: 0.695
 Vert Gap: 0.33

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	370	590	940	1330	1670	1870	1990	1720	1310	810	430	310	1110
	Std Dev	52	75	108	109	154	184	177	148	116	94	53	38	51
	Minimum	280	430	760	1070	1370	1540	1590	1470	1020	580	290	230	990
	Maximum	460	750	1210	1520	1940	2180	2270	2010	1550	1000	530	420	1200
	Diffuse	260	380	550	750	860	890	780	670	530	410	290	220	550
Clear Day	Global	640	980	1500	2080	2480	2640	2550	2200	1690	1130	710	540	1600
NORTH	Global	140	210	310	430	540	620	600	470	350	250	160	120	350
	Diffuse	140	210	310	420	500	540	520	440	350	250	160	120	330
Clear Day	Global	140	200	290	410	580	690	640	470	330	230	160	120	360
EAST	Global	240	360	560	750	900	980	1040	920	760	470	260	200	620
	Diffuse	170	250	370	510	600	630	610	530	430	300	190	150	390
Clear Day	Global	530	750	1050	1330	1490	1540	1510	1370	1140	830	580	470	1050
SOUTH	Global	550	720	890	920	900	870	970	1070	1170	960	590	470	840
	Diffuse	250	340	450	550	590	600	580	550	490	390	270	220	440
Clear Day	Global	1660	1840	1850	1580	1290	1140	1200	1430	1730	1830	1690	1560	1570
WEST	Global	250	390	590	800	1000	1110	1230	1100	880	560	290	210	700
	Diffuse	170	250	380	520	610	640	630	550	440	310	190	150	400
Clear Day	Global	530	750	1050	1330	1490	1540	1510	1370	1140	830	580	470	1050

Average Annual Solar Heat and Illumination – Nearest Available Site

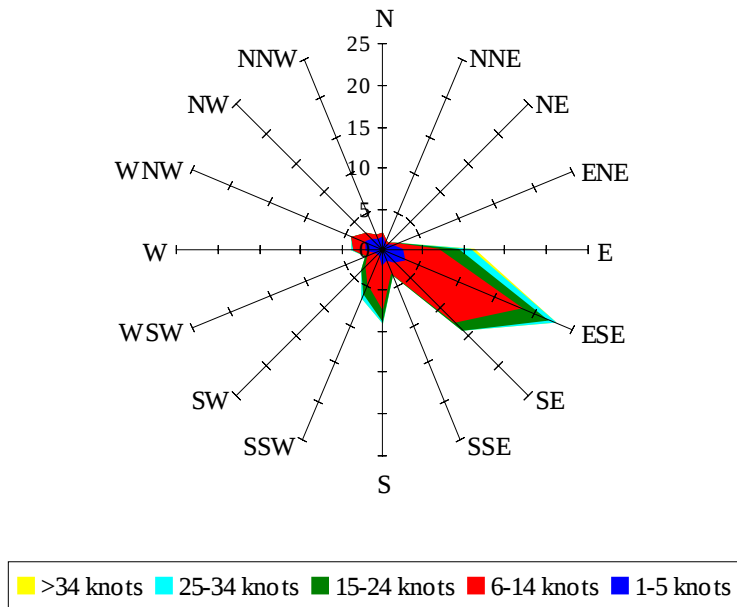
(Source: National Renewable Energy Laboratory, Golden CO, 1995)

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	240	400	660	940	1200	1350	1440	1240	930	550	280	200	790
NORTH	Unshaded	99	150	220	290	360	410	390	310	240	170	110	85	240
	Shaded	79	120	180	240	300	340	330	270	210	140	89	67	200
EAST	Unshaded	160	250	390	530	640	690	740	650	530	320	180	130	440
	Shaded	130	210	320	420	500	540	580	520	430	270	150	110	350
SOUTH	Unshaded	410	530	630	630	580	550	610	700	810	700	440	350	580
	Shaded	390	470	470	380	340	340	340	360	530	580	410	330	410
WEST	Unshaded	170	270	420	570	710	790	880	790	620	390	200	140	500
	Shaded	140	220	340	450	560	630	700	630	510	330	160	120	400

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	32	62	72	58	25	46	80	98	95	71
	M.Cloudy	17	36	41	34	14	26	48	62	61	44
NORTH	M.Clear	9	13	14	12	8	15	15	16	16	14
	M.Cloudy	7	13	15	13	6	12	17	20	19	15
EAST	M.Clear	66	55	14	12	8	79	73	34	16	14
	M.Cloudy	19	25	15	13	6	27	36	27	19	15
SOUTH	M.Clear	36	73	87	69	28	11	38	56	52	28
	M.Cloudy	13	31	38	30	11	11	24	36	35	21
WEST	M.Clear	9	13	19	61	60	11	15	16	49	80
	M.Cloudy	7	13	16	27	19	11	17	20	33	39
M.Clear	(% hrs)	15	17	18	17	18	24	28	31	34	37

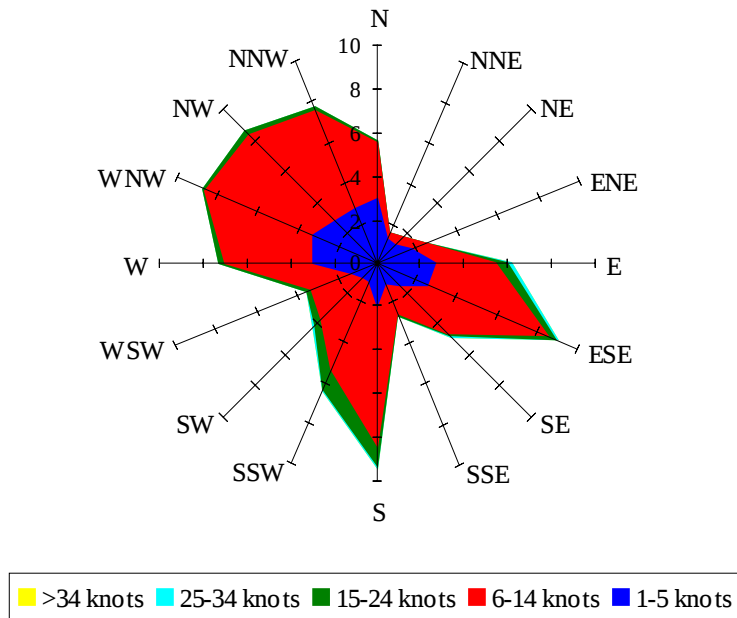
		Sept					Dec				
		9am	11am	1pm	3pm	5pm	9am	11am	1pm	3pm	5pm
HORIZ.	M.Clear	23	59	77	73	46	6	28	34	20	0
	M.Cloudy	13	34	49	46	28	4	15	18	11	0
NORTH	M.Clear	8	13	15	14	11	3	8	9	7	0
	M.Cloudy	6	13	16	16	11	2	7	8	5	0
EAST	M.Clear	59	69	30	14	11	20	34	9	7	0
	M.Cloudy	16	29	22	16	11	4	11	8	5	0
SOUTH	M.Clear	19	59	80	75	44	18	68	78	51	0
	M.Cloudy	8	26	42	39	22	4	16	19	13	0
WEST	M.Clear	8	13	15	49	74	3	8	16	37	0
	M.Cloudy	6	13	16	29	32	2	7	9	10	0
M.Clear	(% hrs)	33	39	46	49	48	10	12	14	13	16

Wind Summary - December, January, and February **Labels of Percent Frequency on North Axis**



Percent Calm = 10.40

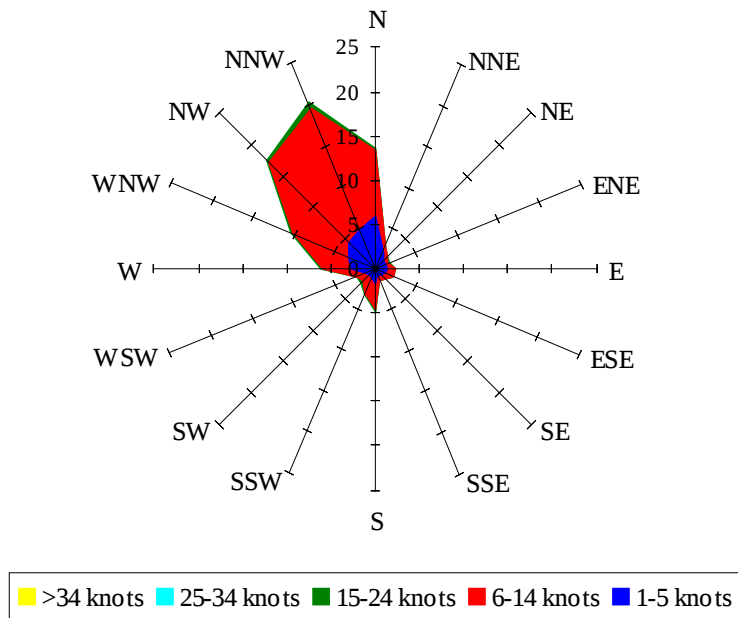
Wind Summary - March, April, and May **Labels of Percent Frequency on North Axis**



Percent Calm = 10.76

Wind Summary - June, July, and August

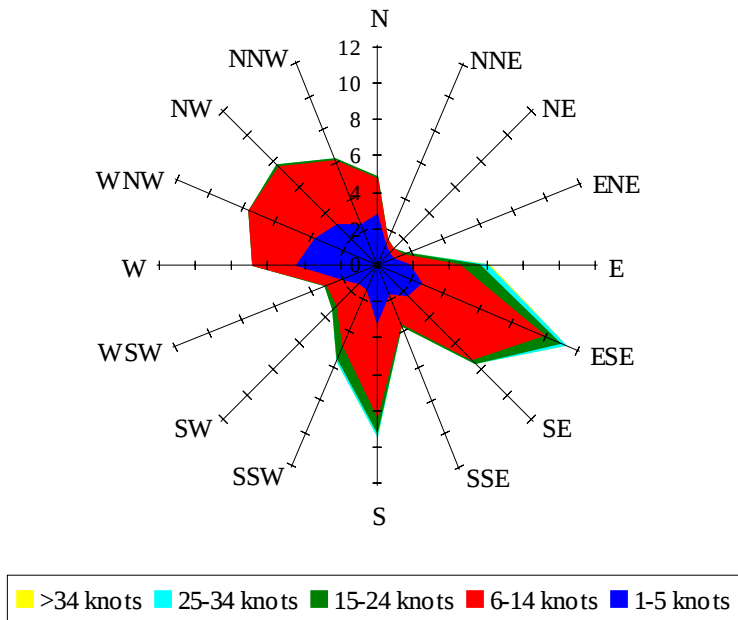
Labels of Percent Frequency on North Axis



Percent Calm = 6.70

Wind Summary - September, October, and November

Labels of Percent Frequency on North Axis



Percent Calm = 12.73