

HONOLULU/OAHU HI

Latitude = 21.35 N

WMO No. 911820

Longitude = 157.90 W

Elevation = 16 feet

Period of Record = 1967 to 1996

Average Pressure = 29.96 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	91	74	101	14.8	ENE
0.4% Occurrence	90	74	100	15.2	ENE
1.0% Occurrence	89	74	99	15.3	ENE
2.0% Occurrence	88	73	98	15.4	ENE
Mean Daily Range	13	-	-	-	-
97.5% Occurrence	65	62	78	5.2	NW
99.0% Occurrence	63	60	74	4.9	NW
99.6% Occurrence	61	59	69	4.8	NW
Median of Extreme Lows	57	55	62	5.0	NW
	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	79	86	133	11.0	SE
0.4% Occurrence	77	85	123	11.5	ENE
1.0% Occurrence	76	84	118	11.6	ENE
2.0% Occurrence	75	84	113	12.0	ENE
	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	141	82	0.94	8.9	SSE
0.4% Occurrence	127	81	0.85	9.2	ENE
1.0% Occurrence	123	80	0.82	9.2	ENE
2.0% Occurrence	118	80	0.79	9.4	ENE
Air Conditioning/ Humid Area Criteria	# of Hours	T ≥ 93°F	T ≥ 80°F	T _{wb} ≥ 73°F	T _{wb} ≥ 67°F
		0	2574	1079	6722

Other Site Data

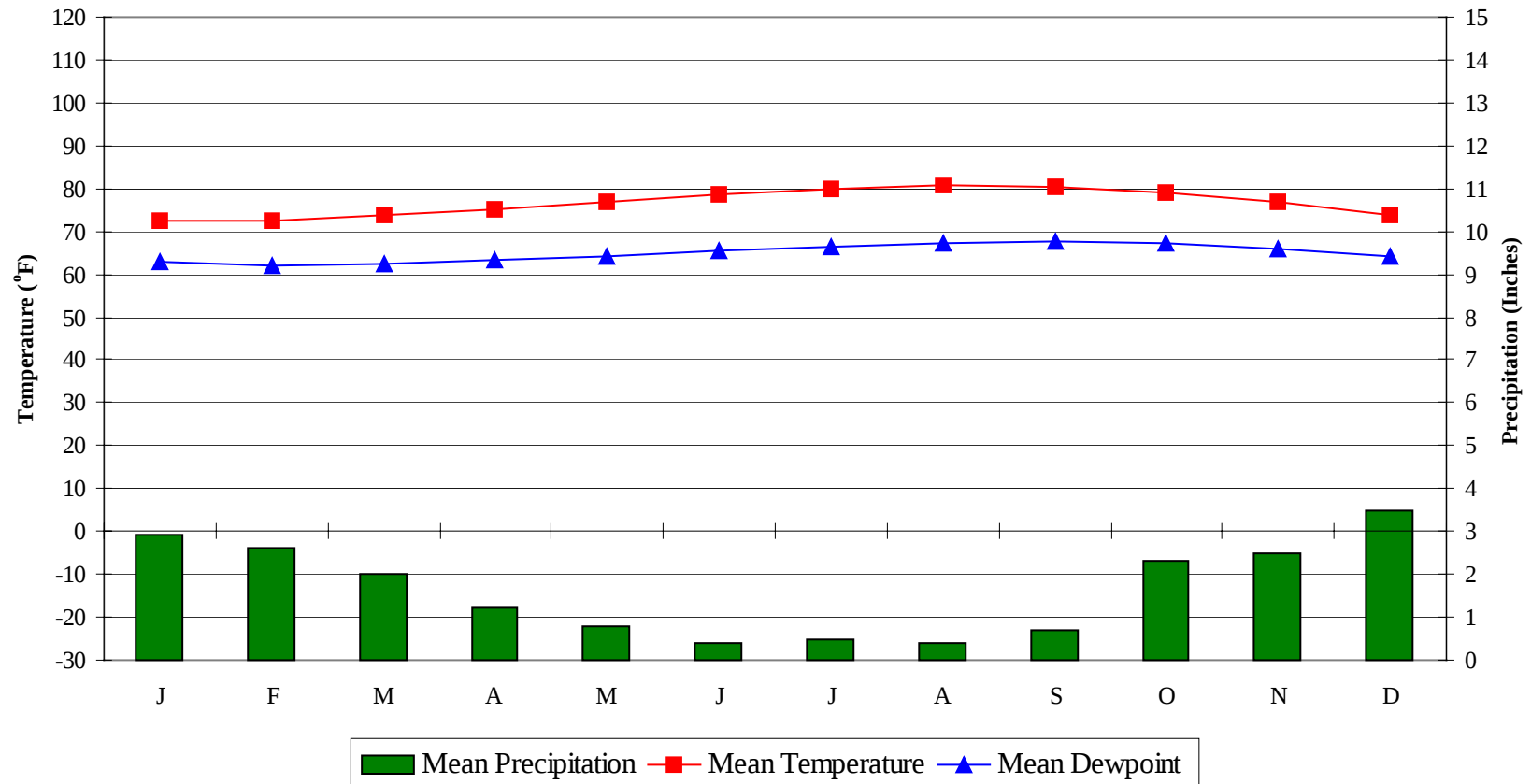
Weather Region	Rain Rate 100 Year Recurrence (in./hr)	Basic Wind Speed 3 sec gust @ 33 ft 50 Year Recurrence (mph)	Ventilation Cooling Load Index (Ton-hr/cfm/yr) Base 75°F-RH 60% Latent + Sensible
10	2.5	105	7.4 + 2.5
Ground Water Temperature (°F) 50 Foot Depth *	Frost Depth 50 Year Recurrence (in.)	Ground Snow Load 50 Year Recurrence (lb/ft ²)	Average Annual Freeze-Thaw Cycles (#)
79.1	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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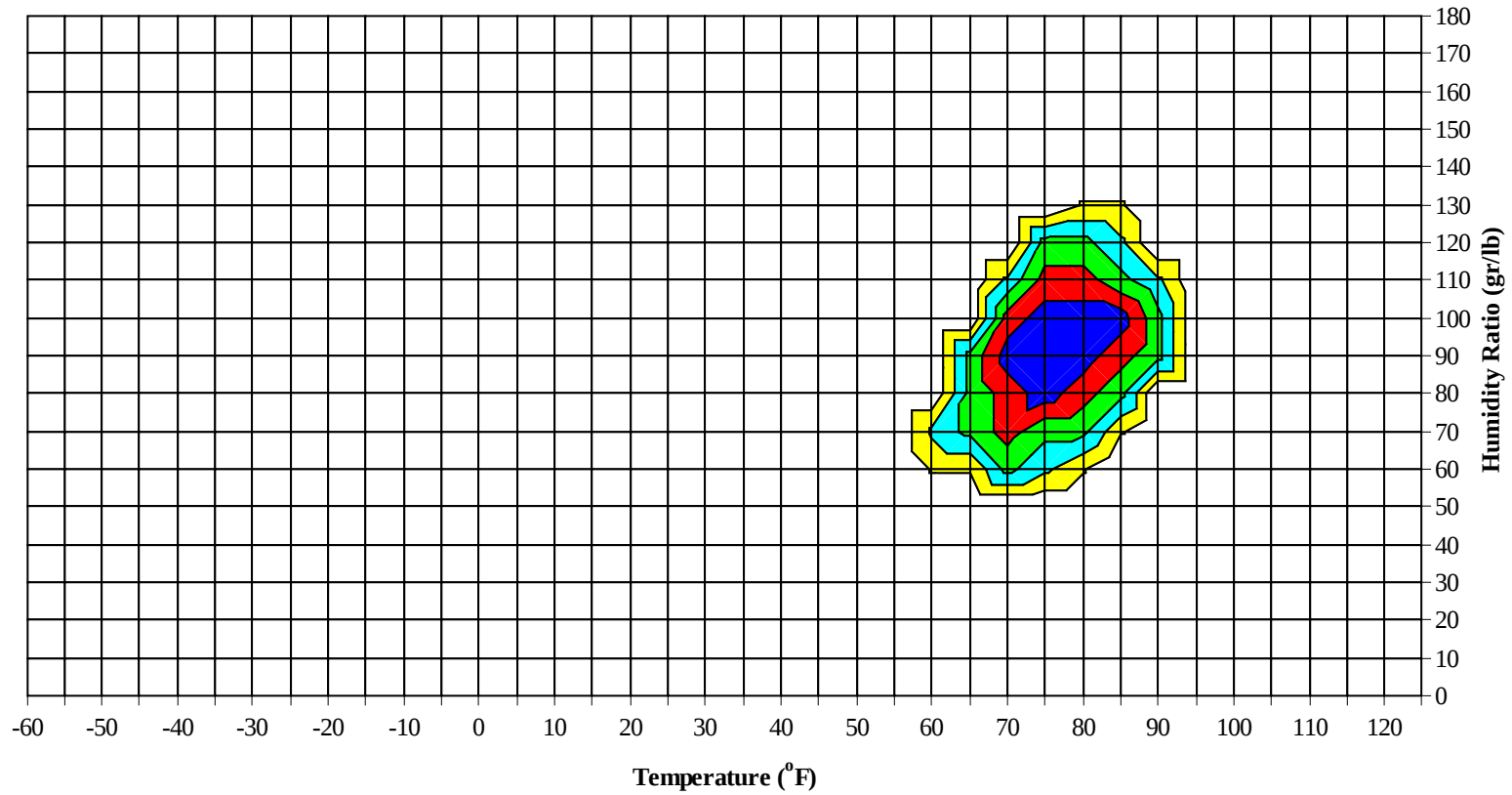
Average Annual Climate



HONOLULU/OAHU HI

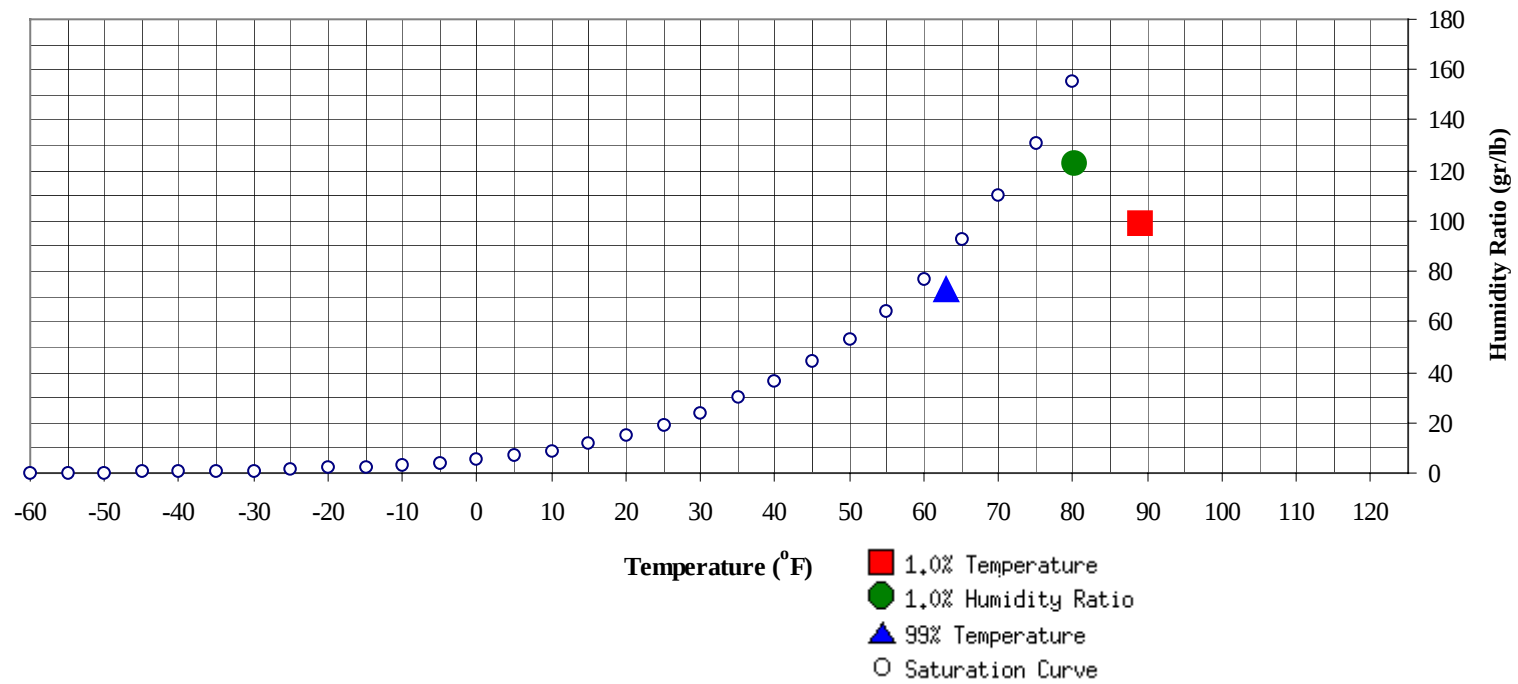
WMO No. 911820

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

Psychrometric Summary of Peak Design Values



	(°F)	MCHR	Enthalpy	1.0% Humidity Ratio	(gr/lb)	MCDB	MCWB	MC Dewpt	Enthalpy
		(gr/lb)	(btu/lb)			(°F)	(°F)	(°F)	(btu/lb)
99% Dry Bulb	63	73.2	26.5	Ratio	123.2	80.1	75.1	73.1	38.5

1.0% Dry Bulb	(°F)	MCHR	MCWB	Enthalpy
		(gr/lb)	(°F)	(btu/lb)
	89	99.5	73.7	37.0

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

Period of Record = 1967 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		
90 / 94															
85 / 89		1		1	72.1		1		1	73.0		5	0	5	70.4
80 / 84		67	3	70	70.2		63	4	67	69.9		96	7	103	69.3
75 / 79	14	126	63	203	68.7	7	115	53	175	68.0	8	117	65	190	67.7
70 / 74	88	46	125	259	66.3	87	40	121	248	66.0	140	29	147	315	65.8
65 / 69	93	8	49	150	63.5	88	5	40	134	63.2	80	2	27	109	63.5
60 / 64	48	0	8	56	60.1	35	0	6	41	59.5	19		2	21	59.6
55 / 59	6		0	6	55.9	6		0	6	55.6	1		0	1	55.6
50 / 54						0			0	53.0					

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.

HONOLULU/OAHU HI

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

Period of Record = 1967 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		
90 / 94		0		0	71.0		0		0	74.1		1	0	1	74.0
85 / 89		13	0	13	71.5		46	1	47	71.6	0	101	4	105	71.8
80 / 84	0	128	14	142	69.5	3	151	32	186	70.1	9	120	51	180	70.7
75 / 79	25	87	88	200	68.1	64	46	132	242	68.8	123	18	163	304	69.3
70 / 74	157	12	126	295	66.2	152	5	79	236	66.8	103	1	22	126	67.8
65 / 69	52	0	12	64	63.7	27	0	4	31	64.0	5	0	0	5	64.9
60 / 64	6		0	6	60.5	2		0	2	60.0	0			0	64.0
55 / 59	0			0	58.0										
50 / 54															

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 3 of 5)

Period of Record = 1967 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		
90 / 94		5		5	74.3		16	0	16	74.1		12		12	74.6
85 / 89		131	10	141	72.6		157	17	174	73.0	0	148	10	158	73.2
80 / 84	15	99	69	183	71.5	24	70	87	181	72.0	19	73	83	175	72.3
75 / 79	173	13	160	346	70.0	187	5	142	334	70.5	162	7	142	311	70.7
70 / 74	59	0	9	68	68.6	37	0	2	39	69.0	57	0	5	62	69.0
65 / 69	1			1	66.1	0			0	66.6	2			2	65.9
60 / 64															
55 / 59															
50 / 54															

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 4 of 5)

Period of Record = 1967 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		
90 / 94		4		4	74.4		0		0	75.3					
85 / 89		114	2	116	73.0		43	0	43	72.9		9		9	73.4
80 / 84	11	113	62	186	72.1	3	130	22	155	71.5	0	97	7	104	70.6
75 / 79	141	15	164	320	70.4	86	58	143	287	69.9	29	110	88	226	68.9
70 / 74	87	2	19	108	68.6	116	9	66	191	67.9	123	30	121	274	66.8
65 / 69	9	0	1	10	65.6	31	0	8	39	64.6	69	3	29	101	64.0
60 / 64	0		0	0	59.7	4	0	1	5	60.5	23		4	27	60.1
55 / 59						0			0	57.4	3		0	3	56.5
50 / 54															

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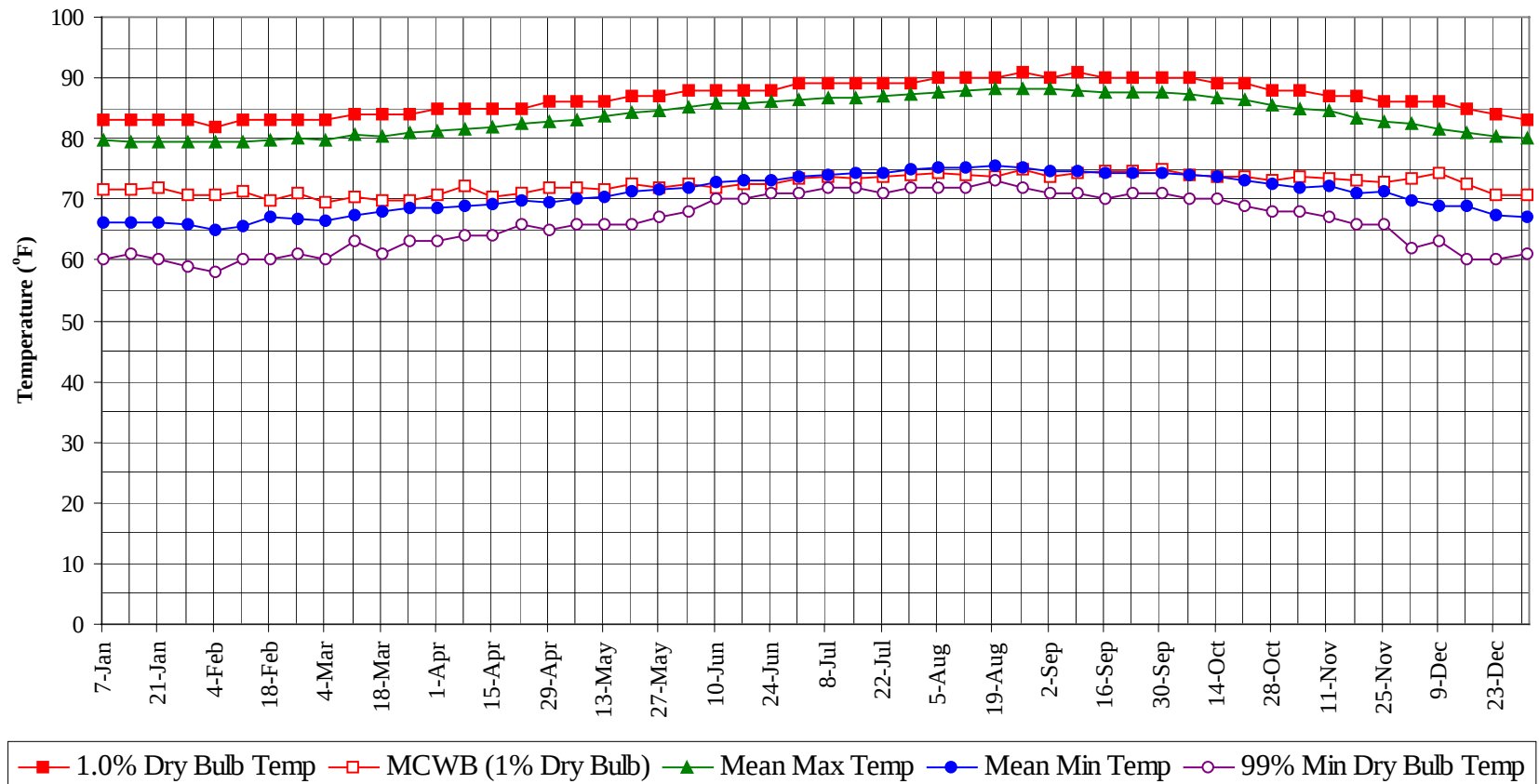
Dry-Bulb Temperature Hours For An Average Year (Sheet 5 of 5)

Period of Record = 1967 to 1996

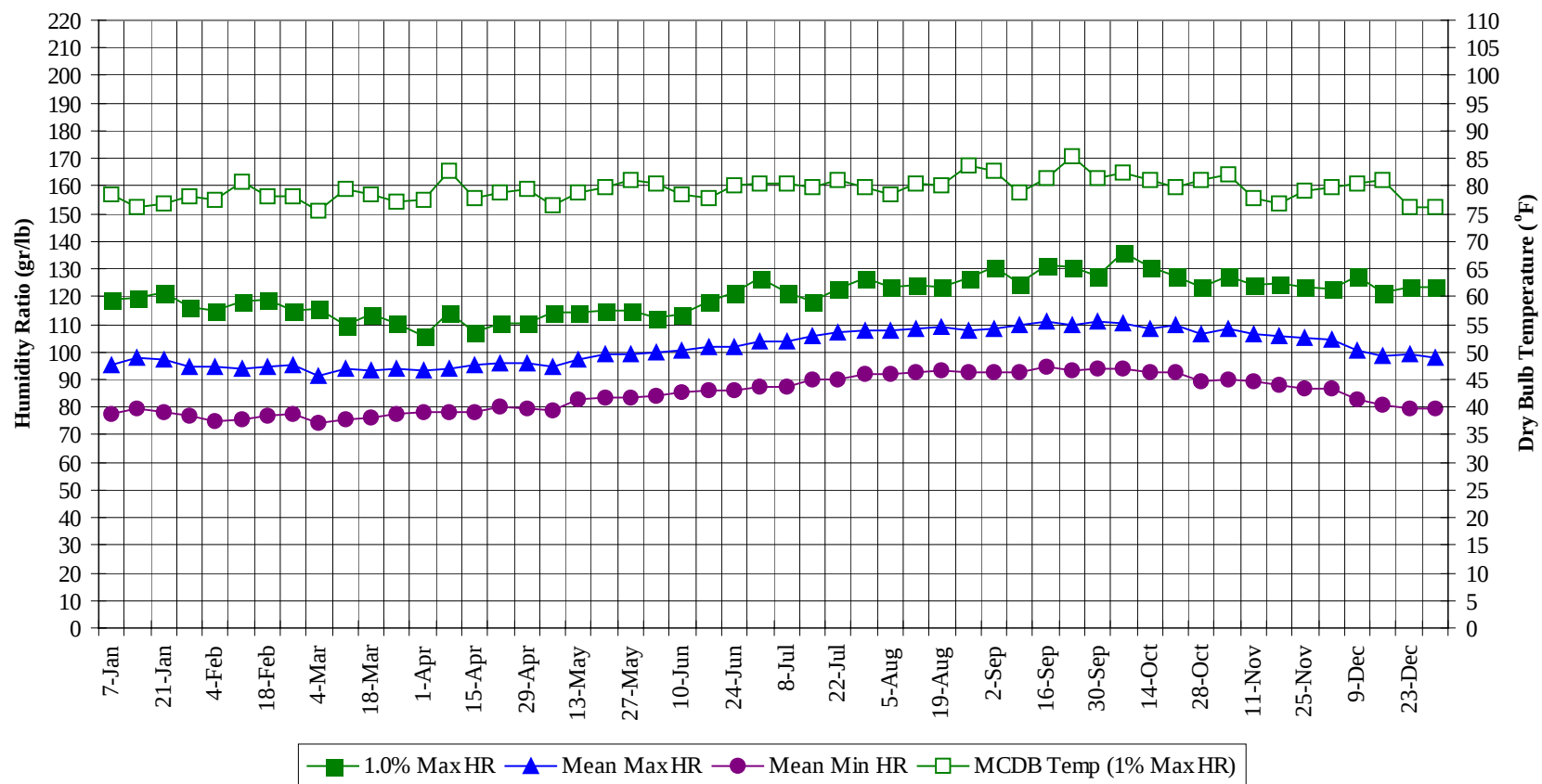
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Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate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

Annual Summary of Temperatures



Long Term Humidity and Dry Bulb Temperature Summary

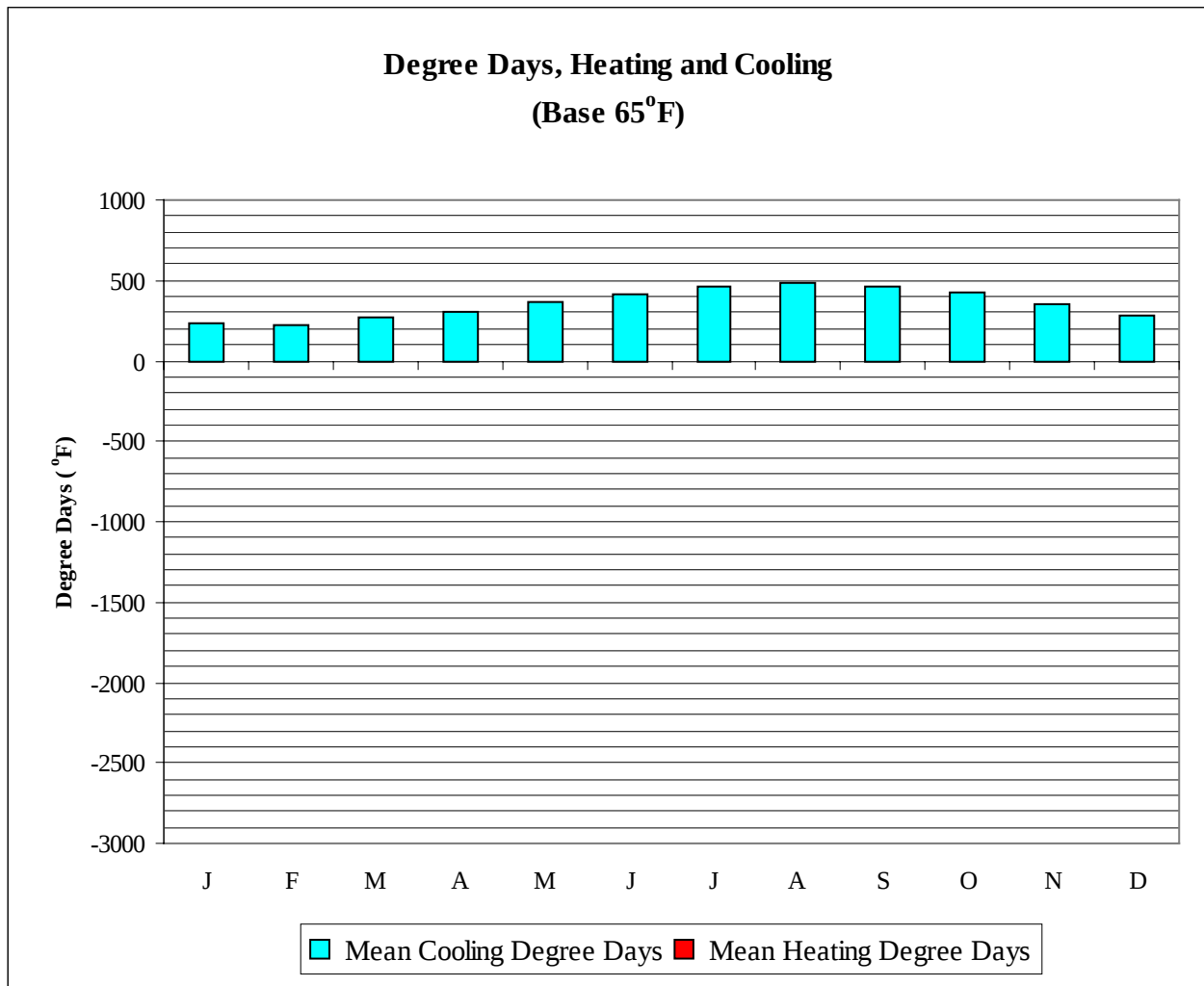


HONOLULU/OAHU HI

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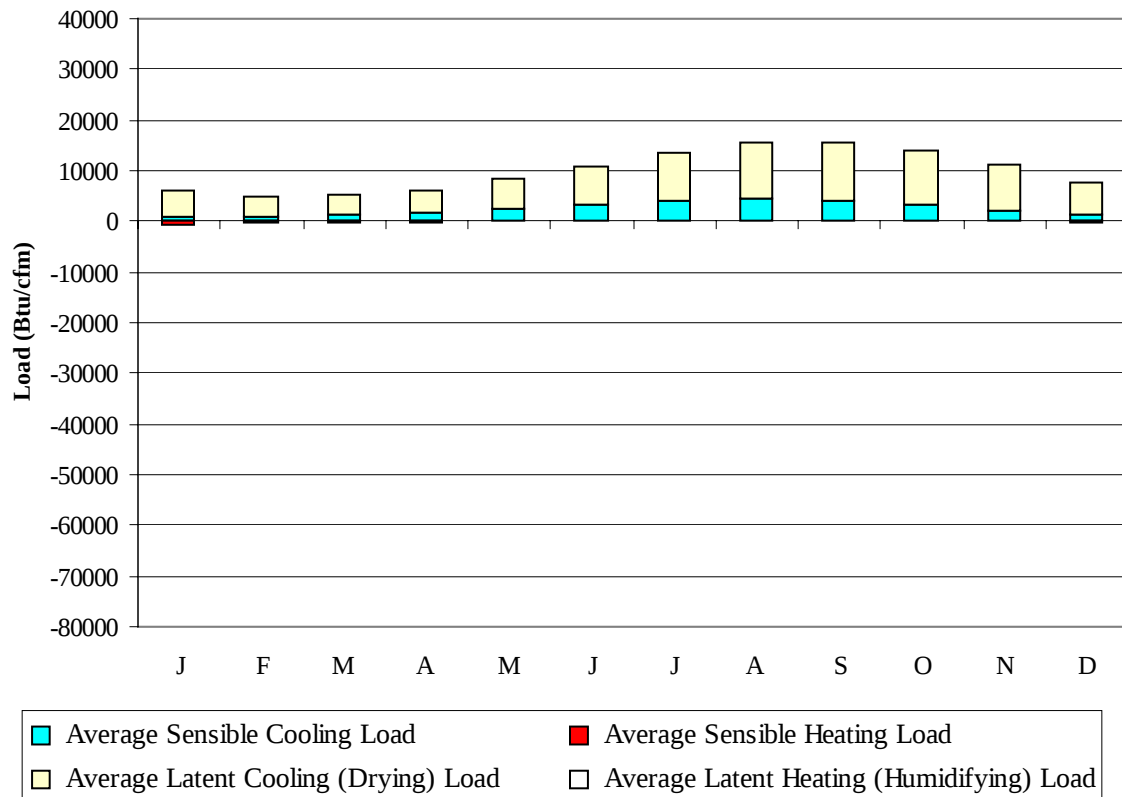
Long Term Dry Bulb Temperature and Humidity Summary

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	83.0	71.7	79.6	66.2	60.0	119.0	78.6	95.5	77.5
14-Jan	83.0	71.7	79.5	66.3	61.0	119.7	76.3	97.8	79.8
21-Jan	83.0	72.0	79.4	66.3	60.0	121.8	76.9	97.2	78.3
28-Jan	83.0	70.7	79.4	66.0	59.0	116.2	78.0	94.9	76.9
4-Feb	82.0	70.6	79.5	64.9	58.0	114.8	77.4	94.3	75.2
11-Feb	83.0	71.4	79.5	65.5	60.0	118.3	80.7	94.2	75.2
18-Feb	83.0	69.9	79.6	67.1	60.0	119.0	78.0	94.6	76.6
25-Feb	83.0	70.9	80.0	66.9	61.0	114.8	78.1	95.0	77.4
4-Mar	83.0	69.6	79.8	66.4	60.0	115.5	75.7	91.5	74.0
11-Mar	84.0	70.3	80.7	67.3	63.0	109.9	79.4	93.8	75.8
18-Mar	84.0	69.8	80.4	67.9	61.0	113.4	78.5	93.2	76.3
25-Mar	84.0	69.9	80.9	68.6	63.0	110.6	77.2	93.6	77.5
1-Apr	85.0	70.7	81.3	68.7	63.0	105.7	77.5	93.0	77.9
8-Apr	85.0	72.3	81.6	69.0	64.0	114.1	82.6	93.7	78.2
15-Apr	85.0	70.5	82.0	69.2	64.0	107.1	77.8	94.9	78.4
22-Apr	85.0	70.9	82.4	69.7	66.0	110.6	78.7	95.9	79.8
29-Apr	86.0	71.9	82.8	69.6	65.0	110.6	79.4	95.7	79.8
6-May	86.0	72.1	83.1	70.2	66.0	114.1	76.4	94.8	78.7
13-May	86.0	71.5	83.7	70.5	66.0	114.1	78.8	96.9	82.8
20-May	87.0	72.4	84.2	71.2	66.0	114.8	79.8	99.1	83.5
27-May	87.0	72.0	84.6	71.5	67.0	114.8	81.0	99.5	83.4
3-Jun	88.0	72.5	85.2	71.8	68.0	112.0	80.4	100.1	84.0
10-Jun	88.0	72.0	85.7	72.9	70.0	113.4	78.5	100.6	85.3
17-Jun	88.0	72.6	85.8	73.0	70.0	118.3	77.8	101.8	86.2
24-Jun	88.0	72.5	86.2	73.2	71.0	121.8	80.2	101.9	86.4
1-Jul	89.0	73.3	86.4	73.6	71.0	126.7	80.4	103.5	87.5
8-Jul	89.0	73.6	86.8	74.0	72.0	121.8	80.6	104.1	87.4
15-Jul	89.0	73.5	86.8	74.3	72.0	118.3	79.7	105.5	90.1
22-Jul	89.0	73.7	86.9	74.3	71.0	122.5	81.0	107.1	90.1
29-Jul	89.0	74.1	87.2	74.8	72.0	126.7	79.7	107.9	92.2
5-Aug	90.0	74.4	87.7	75.2	72.0	123.2	78.5	107.6	91.8
12-Aug	90.0	74.1	87.9	75.1	72.0	123.9	80.6	108.1	92.3
19-Aug	90.0	73.8	88.1	75.4	73.0	123.2	80.2	109.1	93.1
26-Aug	91.0	75.0	88.2	75.2	72.0	126.7	83.8	107.8	92.4
2-Sep	90.0	73.6	88.2	74.7	71.0	130.9	82.7	108.4	92.5
9-Sep	91.0	74.4	88.1	74.7	71.0	124.6	78.7	109.9	92.9
16-Sep	90.0	74.5	87.8	74.4	70.0	131.6	81.5	111.3	94.4
23-Sep	90.0	74.5	87.7	74.4	71.0	130.9	85.3	109.6	93.0
30-Sep	90.0	74.9	87.6	74.2	71.0	127.4	81.4	110.9	93.6
7-Oct	90.0	74.1	87.2	73.9	70.0	135.8	82.3	110.4	93.6
14-Oct	89.0	73.7	86.8	73.8	70.0	130.9	81.1	108.5	92.6
21-Oct	89.0	73.7	86.3	73.2	69.0	127.4	79.9	109.9	92.8
28-Oct	88.0	73.0	85.4	72.6	68.0	123.2	81.0	106.3	89.3
4-Nov	88.0	73.9	84.9	72.0	68.0	127.4	82.2	108.5	90.2
11-Nov	87.0	73.4	84.5	72.2	67.0	123.9	77.9	106.3	89.0
18-Nov	87.0	73.0	83.2	71.1	66.0	124.6	77.0	105.6	87.8
25-Nov	86.0	72.9	82.9	71.2	66.0	123.2	79.1	105.0	86.7
2-Dec	86.0	73.3	82.5	69.7	62.0	122.5	79.8	104.6	86.4
9-Dec	86.0	74.2	81.7	68.9	63.0	127.4	80.4	100.7	82.5
16-Dec	85.0	72.5	81.0	68.7	60.0	121.8	81.0	98.5	81.0
23-Dec	84.0	70.7	80.3	67.4	60.0	123.2	76.3	98.9	79.7
31-Dec	83.0	70.8	80.1	67.1	61.0	123.2	76.3	98.1	79.6



	Mean Cooling Degree Days (°F)	Mean Heating Degree Days (°F)
JAN	237	7
FEB	220	6
MAR	271	2
APR	304	1
MAY	368	0
JUN	410	0
JUL	457	0
AUG	485	0
SEP	458	0
OCT	421	0
NOV	351	0
DEC	282	4
ANN	4263	20

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



	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	858	-548	5177	0
FEB	806	-447	4103	0
MAR	1133	-220	4010	0
APR	1555	-79	4454	0
MAY	2368	-31	6147	0
JUN	3158	-1	7444	0
JUL	3951	0	9668	0
AUG	4630	0	10732	0
SEP	4244	0	11130	0
OCT	3470	-3	10431	0
NOV	2206	-55	8839	0
DEC	1237	-285	6506	0
ANN	29616	-1669	88641	0

Average Annual Solar Radiation – Nearest Available Site

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

City: HONOLULU
 State: HI
 WBAN No: 22521
 Lat(N): 21.33
 Long(W): 157.92
 Elev(ft): 16

Stn Type: Primary
 SHADING GEOMETRY IN DIMENSIONLESS UNITS
 Window: 1
 Overhang: 1.193
 Vert Gap: 0.2

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	1240	1490	1710	1870	2010	2070	2090	2050	1880	1590	1310	1180	1710
	Std Dev	89	118	135	115	98	60	69	78	73	68	73	81	37
	Minimum	1020	1180	1410	1600	1780	1950	1940	1850	1700	1470	1150	1020	1590
	Maximum	1390	1630	1930	2060	2170	2170	2200	2180	2000	1710	1430	1300	1780
	Diffuse	500	550	660	750	740	740	700	670	650	590	530	470	630
Clear Day	Global	1650	1930	2250	2490	2600	2620	2600	2510	2320	2000	1700	1560	2190
NORTH	Global	320	370	410	480	630	780	710	530	430	380	340	310	470
	Diffuse	320	370	410	460	490	530	500	460	420	380	340	310	420
Clear Day	Global	280	310	350	430	680	910	800	500	350	320	280	260	460
EAST	Global	750	890	980	1030	1090	1100	1110	1110	1070	950	780	730	970
	Diffuse	410	460	520	580	590	590	580	570	550	490	430	390	510
Clear Day	Global	1020	1160	1300	1390	1410	1400	1400	1390	1320	1190	1040	970	1250
SOUTH	Global	1330	1280	1010	680	490	460	450	580	890	1180	1300	1350	920
	Diffuse	520	540	540	510	460	460	450	470	520	550	540	510	500
Clear Day	Global	2000	1780	1320	740	420	390	380	570	1070	1620	1930	2030	1180
WEST	Global	740	860	950	1000	1050	1090	1110	1110	1030	890	760	690	940
	Diffuse	400	460	530	580	590	590	580	570	550	490	430	390	510
Clear Day	Global	1020	1160	1300	1390	1410	1400	1400	1390	1320	1190	1040	970	1250

Average Annual Solar Heat and Illumination – Nearest Available Site

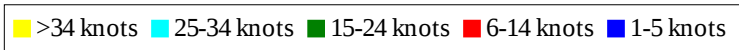
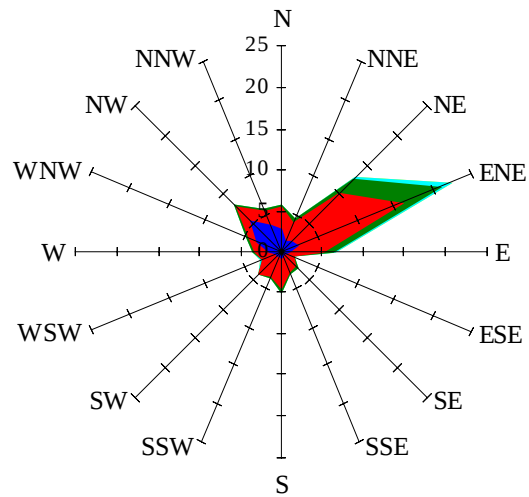
(Source: National Renewable Energy Laboratory, Golden CO, 1995)

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	880	1070	1240	1360	1470	1520	1540	1500	1370	1150	930	830	1240
NORTH	Unshaded	220	250	290	320	380	450	410	330	290	270	240	210	310
	Shaded	170	190	220	240	270	300	290	260	230	210	180	160	230
EAST	Unshaded	520	630	700	740	780	780	790	800	770	670	550	510	690
	Shaded	310	370	400	410	440	440	440	450	440	390	330	300	390
SOUTH	Unshaded	960	870	620	400	320	320	310	350	520	770	920	990	610
	Shaded	300	250	260	260	250	250	250	260	270	260	270	330	270
WEST	Unshaded	520	600	680	710	750	780	790	790	740	630	530	480	670
	Shaded	310	350	380	400	420	440	440	450	420	370	310	290	380

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	81	98	86	46	53	90	105	90	54
	M.Cloudy	27	59	75	64	32	41	73	87	75	42
NORTH	M.Clear	10	15	17	16	12	29	24	19	24	29
	M.Cloudy	10	17	19	18	12	23	24	19	24	23
EAST	M.Clear	76	69	22	16	12	77	63	16	16	13
	M.Cloudy	38	47	22	18	12	52	52	17	18	14
SOUTH	M.Clear	25	49	59	52	30	13	16	15	16	13
	M.Cloudy	16	36	46	39	20	14	18	17	18	14
WEST	M.Clear	10	15	17	62	77	13	16	15	61	77
	M.Cloudy	10	17	19	46	40	14	18	17	52	52
M.Clear	(% hrs)	45	40	38	38	39	41	37	35	37	40
		Sept					Dec				
		9am	11am	1pm	3pm	5pm	9am	11am	1pm	3pm	5pm
HORIZ.	M.Clear	47	87	100	85	44	25	63	76	61	23
	M.Cloudy	36	70	84	69	33	17	44	55	43	16
NORTH	M.Clear	12	16	17	16	11	8	14	15	14	8
	M.Cloudy	13	18	19	18	12	7	14	17	15	7
EAST	M.Clear	79	65	17	16	11	56	55	16	14	8
	M.Cloudy	51	53	19	18	12	25	35	17	15	7
SOUTH	M.Clear	22	42	49	41	20	41	74	83	72	36
	M.Cloudy	19	38	44	36	17	19	44	54	43	17
WEST	M.Clear	12	16	18	66	76	8	14	17	56	51
	M.Cloudy	13	18	20	54	46	7	14	18	35	22
M.Clear	(% hrs)	50	44	39	40	42	48	45	39	41	42

Wind Summary - December, January, and February

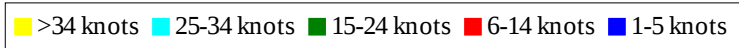
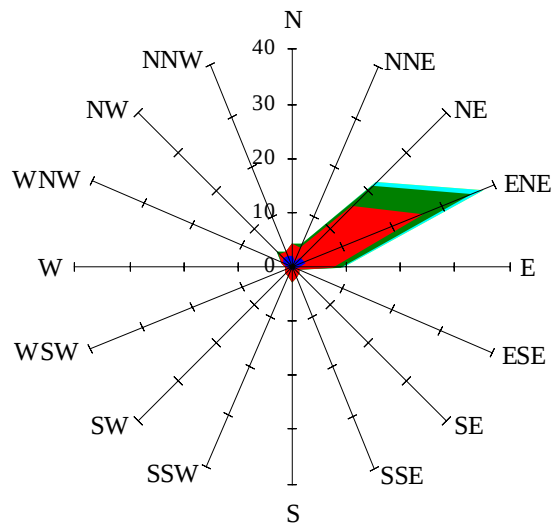
Labels of Percent Frequency on North Axis



Percent Calm = 5.61

Wind Summary - March, April, and May

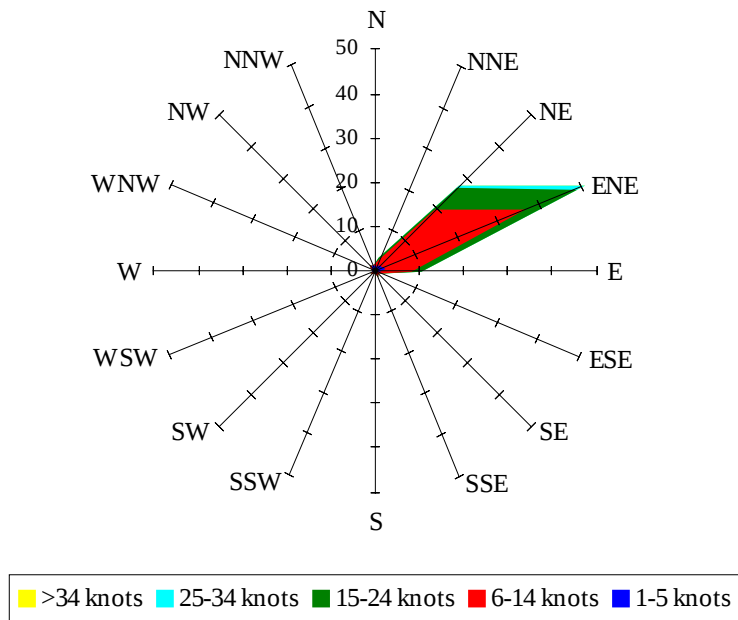
Labels of Percent Frequency on North Axis



Percent Calm = 2.84

Wind Summary - June, July, and August

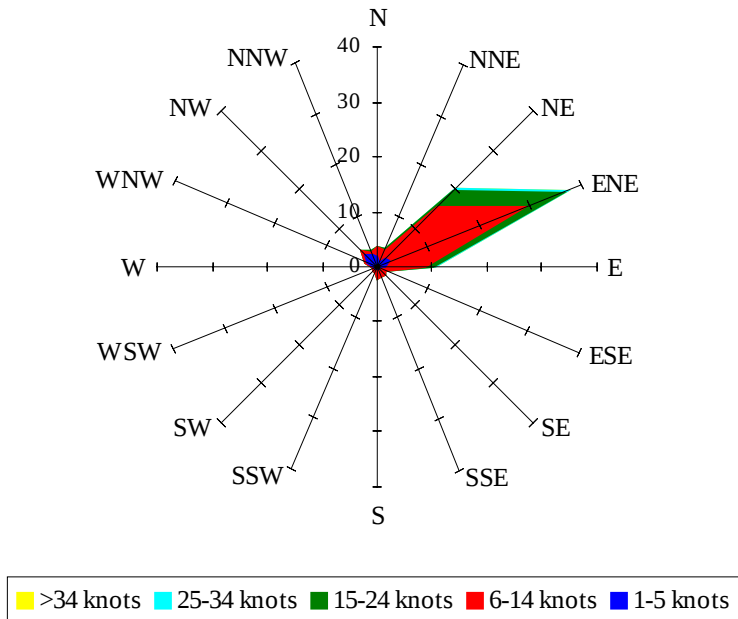
Labels of Percent Frequency on North Axis



Percent Calm = 1.24

Wind Summary - September, October, and November

Labels of Percent Frequency on North Axis



Percent Calm = 3.36