

PENANG INTL, MY

Latitude = 5.30 N

Longitude = 100.28 E

Period of Record = 1988 To 2017

Station ID = ICAO_WMKP

Elevation = 11 Feet

Average Pressure = 29.80 inches Hg

Design Criteria Data

Dry Bulb Temperature (T)	Mean Coincident (Average) Values				
	Design Value (°F)	Wet Bulb Temperature (°F)	Humidity Ratio (gr/lb)	Wind Speed (mph)	Prevailing Direction (NSEW)
Median of Extreme Highs	93	79	129	8	SSW
0.4% Occurrence	91	79	134	8	SSW
1.0% Occurrence	91	79	134	8	SSW
2.0% Occurrence	90	79	134	8	SSW
Mean Daily Range	11	-	-	-	N
97.5% Occurrence	75	74	125	2.5	N
99.0% Occurrence	74	74	122	2.6	N
99.6% Occurrence	73	73	120	2.7	N
Median of Extreme Lows	72	72	116	3	N

Wet Bulb Temperature (T _{wb})	Design Value (°F)	Dry Bulb Temperature (°F)	Humidity Ratio (gr/lb)	Wind Speed (mph)	Prevailing Direction (NSEW)
Median of Extreme Highs	83	89	155	7.5	SSW
0.4% Occurrence	82	88	151	7	SSW
1.0% Occurrence	82	88	151	7	SSW
2.0% Occurrence	81	87	147	6.2	SSW

Humidity Ratio (HR)	Design Value (gr/lb)	Dry Bulb Temperature (°F)	Vapor Pressure (in. Hg)	Wind Speed (mph)	Prevailing Direction (NSEW)
Median of Extreme Highs	162	89	1.07	7.8	SSW
0.4% Occurrence	160	87	1.05	5.9	SSW
1.0% Occurrence	154	86	1.02	5.3	SSW
2.0% Occurrence	151	85	0.99	4.7	SSW

Air Conditioning/ Humid Area Criteria	Threshold	T ≥ 93 °F	T ≥ 80 °F	Twb ≥ 73 °F	Twb ≥ 67 °F
	# of Hours	19	5488	8159	8437

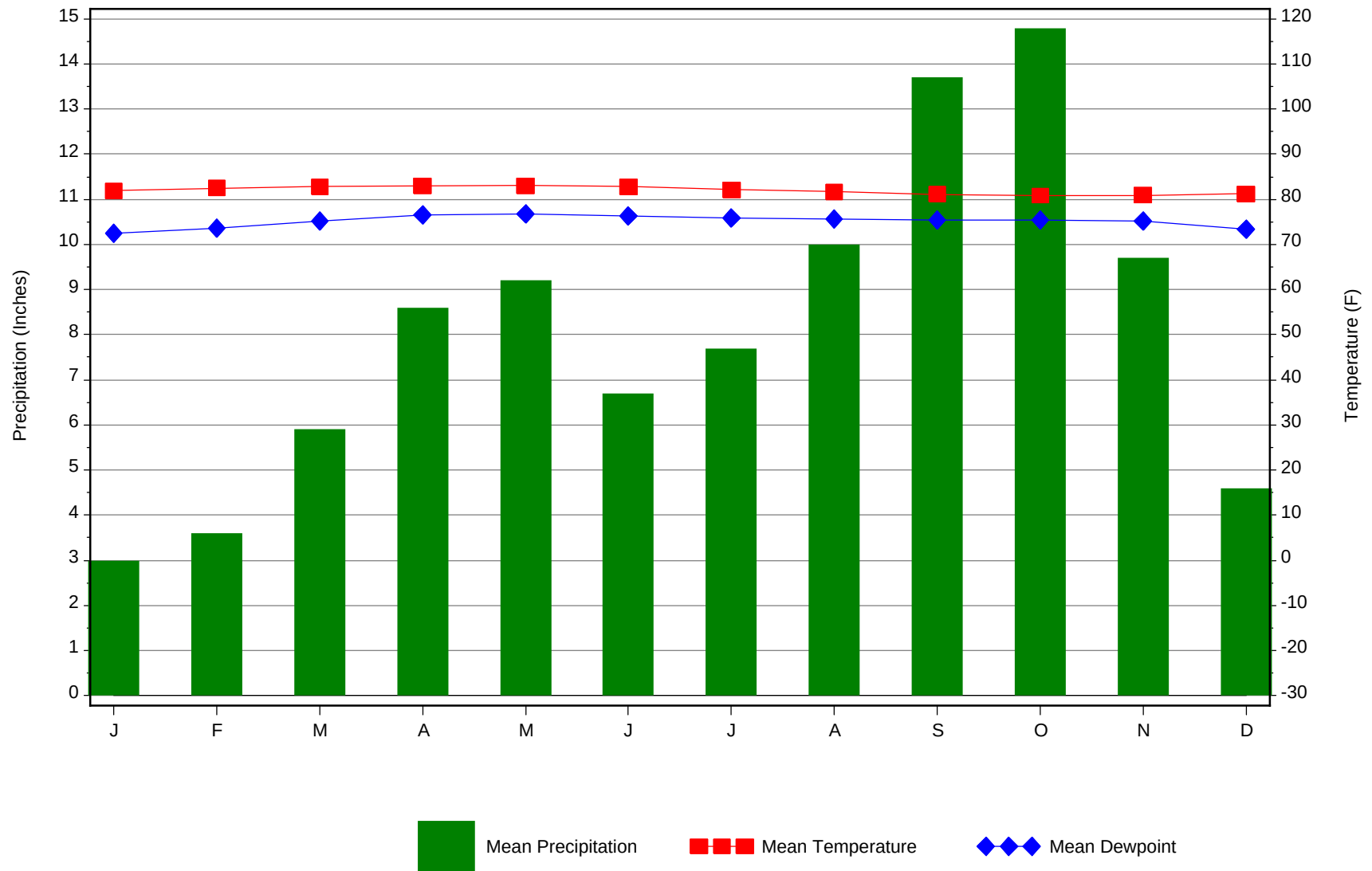
Other Site Data

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	N/A	N/A	26.6 + 5.5
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 (#)
84.5	N/A	N/A	0

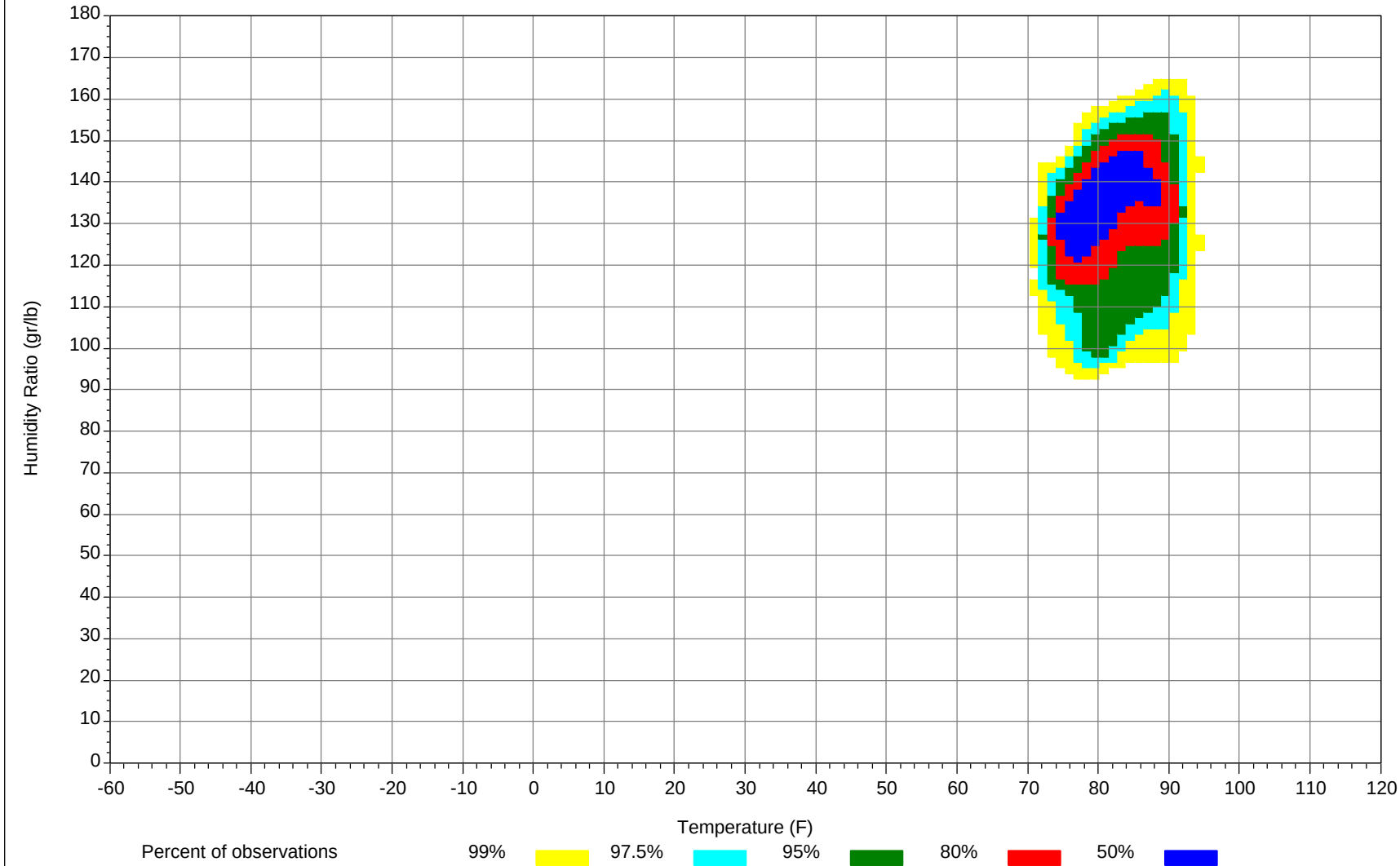
*Note: Temperatures at greater depths can be estimated by adding 1.5°F per 100 feet additional depth.



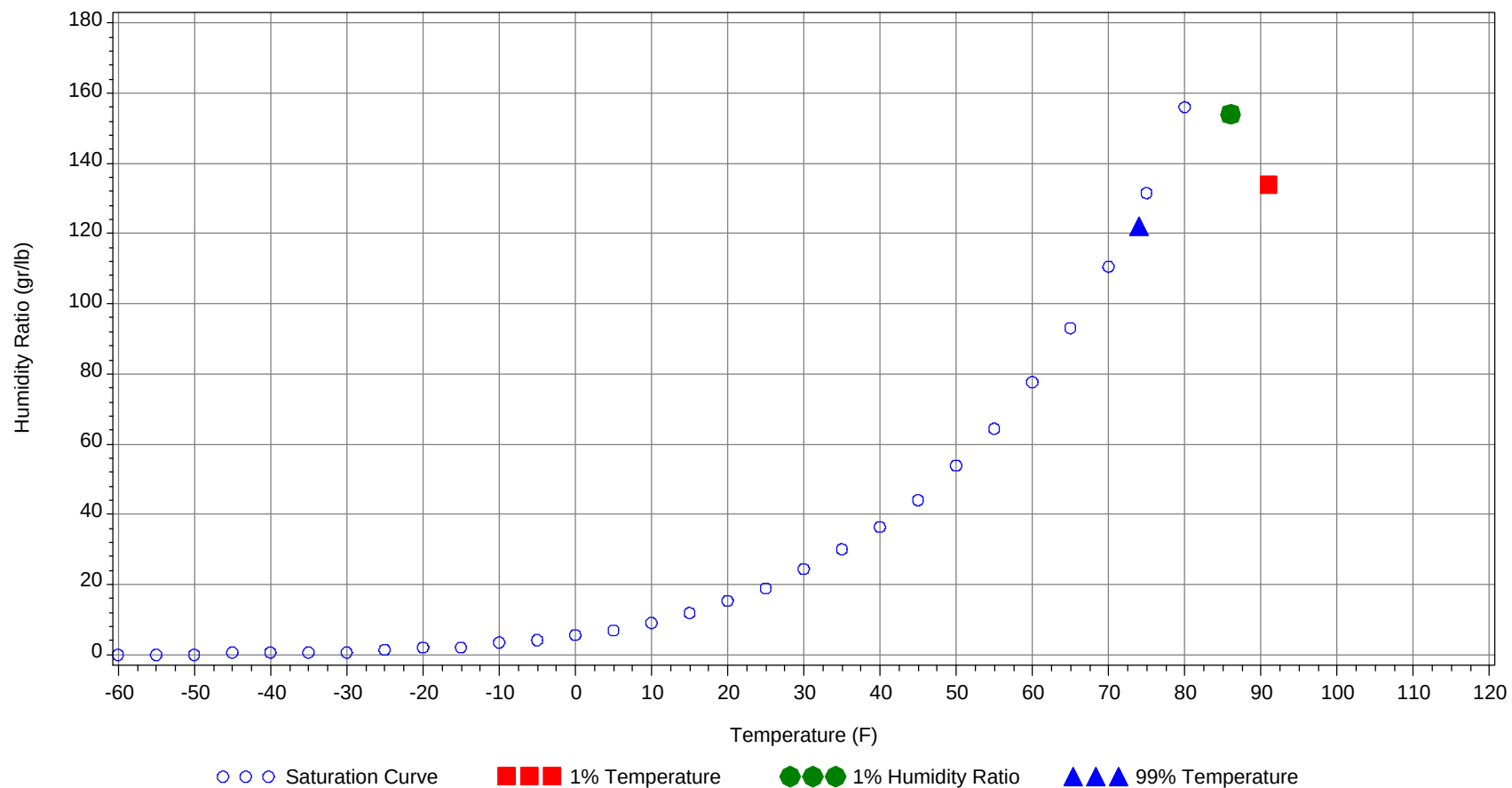
Average Annual Climate



Long Term Psychrometric Summary



Psychrometric Summary of Peak Design Values



	(° F) / (gr/lb)	MCDB (° F)	MCWB (° F)	MCDP (° F)	MCHR (gr/lb)	Enthalpy (btu/lb)
1.0% Dry Bulb	91.0		79		134.0	42.7
99.0% Dry Bulb	74.0				122.0	36.7
1.0% Humidity Ratio	154.0	86.0	81.2	79.5		44.8

Dry-Bulb Temperature Hours For An Average Year

	January					February					March				
Temperature Range (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)
95/ 99		0		0	77		0	0	0	77.3		1		1	77.7
90/ 94		32	6	38	77		48	12	60	77.8		60	15	75	79.2
85/ 89		121	57	178	76.8	0	104	58	162	77.5	0	113	72	185	78.6
80/ 84	38	75	139	252	75.5	50	58	124	232	76.3	78	63	126	267	77.3
75/ 79	203	20	45	268	73.8	167	13	30	210	74.3	163	11	34	208	75.4
70/ 74	6	0	0	6	71.7	7	0	0	7	72.1	6	0	1	7	72.8
65/ 69	0			0	68										

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.

Dry-Bulb Temperature Hours For An Average Year

	April					May					June				
Temperature Range (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)
95/ 99		0		0	83	0	0		0	81.5					
90/ 94		48	9	57	80.4	0	49	10	59	80.6		40	7	47	80.2
85/ 89	0	125	76	201	79.7	1	126	78	205	79.8	1	127	77	205	79.4
80/ 84	85	60	124	269	78.2	101	62	137	300	78.4	89	60	125	274	78.1
75/ 79	151	7	30	188	76.2	144	11	23	178	76.4	146	13	30	189	76
70/ 74	3	0	1	4	73.1	2	0	0	2	73.4	4	0	1	5	72.5
65/ 69											0			0	69

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.

Dry-Bulb Temperature Hours For An Average Year

	July					August					September				
Temperature Range (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)
95/ 99															
90/ 94		25	3	28	79.9		21	3	24	79.7		15	1	16	79.7
85/ 89	0	128	66	194	79	0	118	56	174	78.9	0	106	41	147	78.7
80/ 84	69	77	138	284	77.8	54	85	139	278	77.6	36	89	135	260	77.5
75/ 79	168	18	39	225	75.7	185	25	49	259	75.6	191	29	62	282	75.6
70/ 74	10	0	1	11	72.9	8	1	1	10	72.9	13	1	1	15	72.9
65/ 69			0	0	68							0	0	0	68.5

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.

Dry-Bulb Temperature Hours For An Average Year

	October					November					December				
Temperature Range (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)
95/ 99															
90/ 94		13	1	14	79.8		10	1	11	79.2		17	2	19	77.9
85/ 89	0	105	31	136	78.8		117	28	145	78.6	0	115	38	153	77.2
80/ 84	25	100	129	254	77.5	19	93	121	233	77.3	29	92	136	257	75.9
75/ 79	209	31	85	325	75.6	214	20	90	324	75.5	212	24	71	307	74.3
70/ 74	14	0	1	15	73	7	0	1	8	73.1	7	0	0	7	71.9
65/ 69							0		0	69		0	0	0	68.5

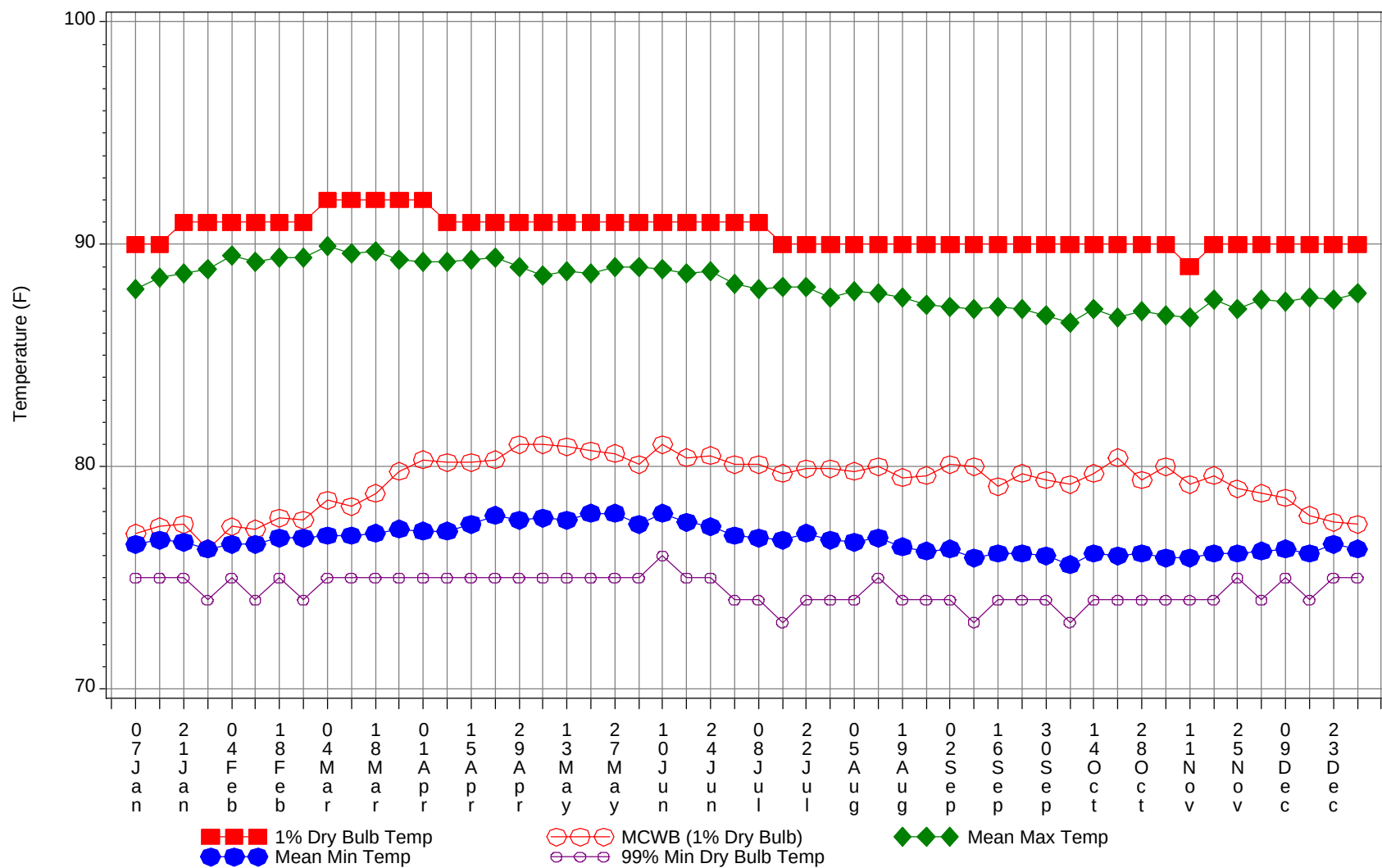
Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary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

Dry-Bulb Temperature Hours For An Average Year

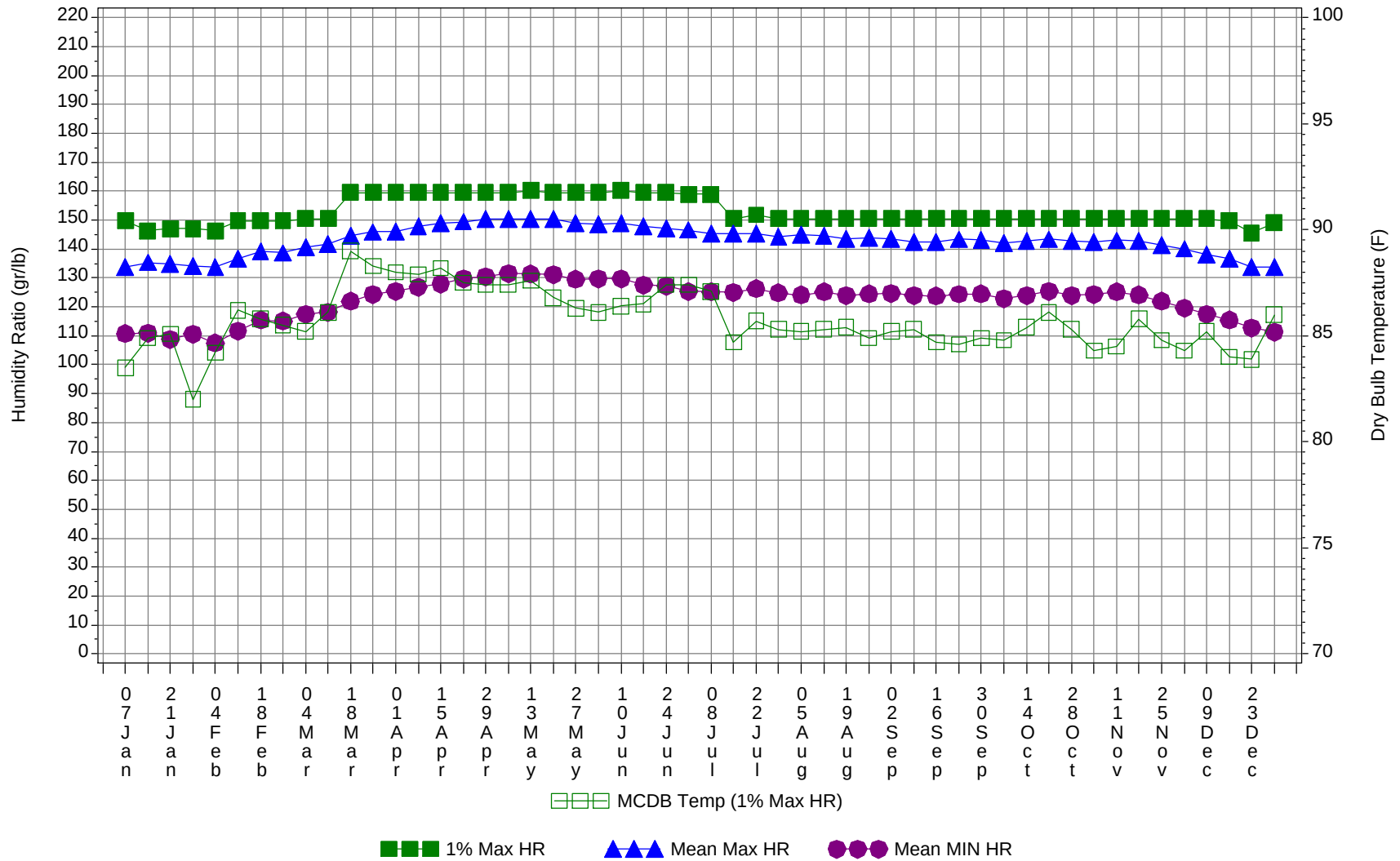
	Annual				
Temperature Range (° F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (° F)
95/ 99	0	1	0	1	78.1
90/ 94	0	378	70	448	79.3
85/ 89	3	1404	678	2085	78.6
80/ 84	674	914	1576	3164	77.3
75/ 79	2155	221	588	2964	75.3
70/ 74	89	3	7	99	72.7
65/ 69	0	0	0	0	68.5

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



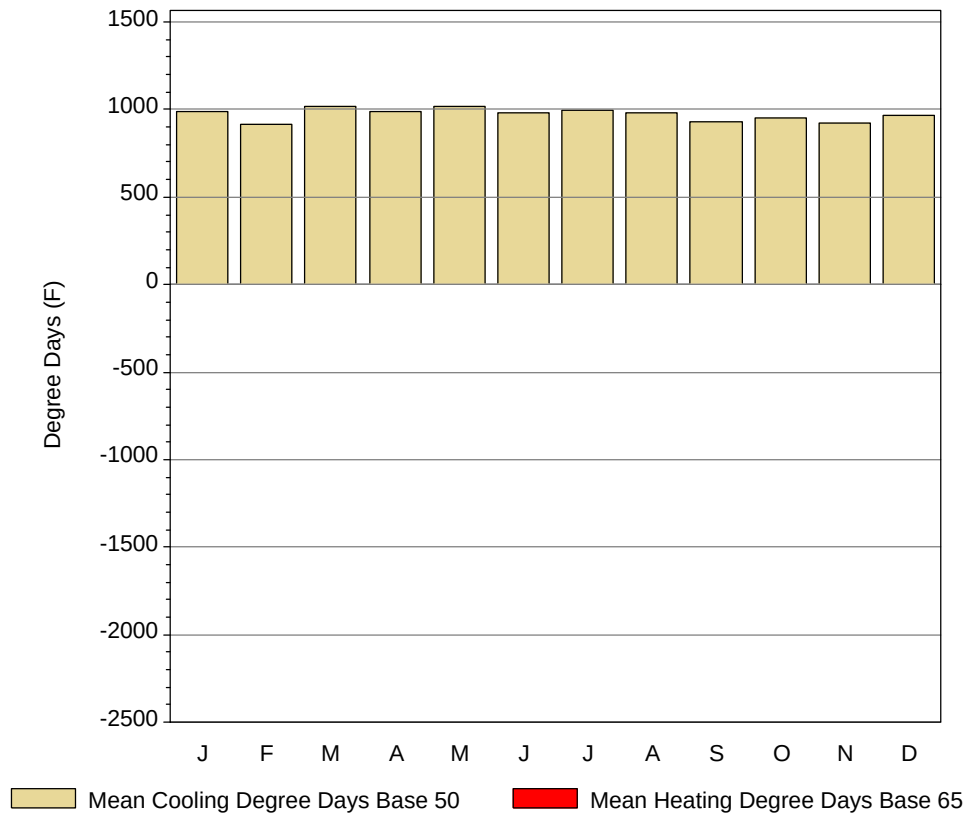
Long Term Humidity and Dry Bulb Temperature Summary



Long Term Humidity and Dry Bulb Temperature Summary

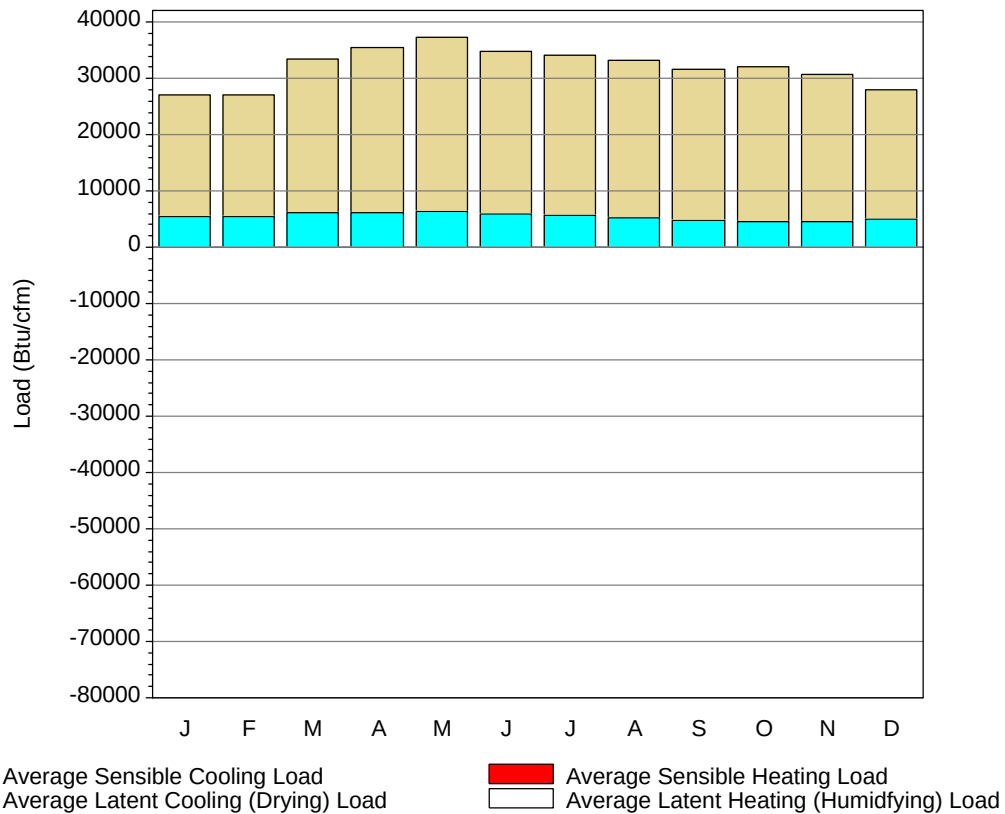
Week Ending	1.0% Temp (° F)	MCWB@ 1% Temp (° F)	Mean Max Temp (° F)	Mean Min Temp (° F)	99% Temp (° F)	1.0% HR (gr/lb)	MCDB@ 1% HR (° F)	Mean Max HR (gr/lb)	Mean Min HR (gr/lb)
7-Jan	90	77	88	76.5	75	149.8	83.5	133.9	110.7
14-Jan	90	77.3	88.5	76.7	75	146.3	84.9	135.4	111
21-Jan	91	77.4	88.7	76.6	75	147	85.1	134.9	108.8
28-Jan	91	76.3	88.9	76.3	74	147	82	134.2	110.6
4-Feb	91	77.3	89.5	76.5	75	146.3	84.2	133.9	107.5
11-Feb	91	77.2	89.2	76.5	74	149.8	86.2	136.6	111.6
18-Feb	91	77.7	89.4	76.8	75	149.8	85.8	139.1	115.5
25-Feb	91	77.6	89.4	76.8	74	149.8	85.5	138.7	115.1
4-Mar	92	78.5	89.9	76.9	75	150.5	85.2	140.8	117.5
11-Mar	92	78.2	89.6	76.9	75	150.5	86.1	141.7	118.2
18-Mar	92	78.8	89.7	77	75	159.6	89	144.5	121.9
25-Mar	92	79.8	89.3	77.2	75	159.6	88.3	145.9	124.3
1-Apr	92	80.3	89.2	77.1	75	159.6	88	146.2	125.4
8-Apr	91	80.2	89.2	77.1	75	159.6	87.9	147.8	126.8
15-Apr	91	80.2	89.3	77.4	75	159.6	88.2	148.9	128
22-Apr	91	80.3	89.4	77.8	75	159.6	87.5	149.5	129.8
29-Apr	91	81	89	77.6	75	159.6	87.4	150.4	130.4
6-May	91	81	88.6	77.7	75	159.6	87.4	150.5	131.5
13-May	91	80.9	88.8	77.6	75	160.3	87.6	150.4	131.3
20-May	91	80.7	88.7	77.9	75	159.6	86.8	150.3	131.1
27-May	91	80.6	89	77.9	75	159.6	86.3	149	129.5
4-Jun	91	80.1	89	77.4	75	159.6	86.1	148.6	129.7
10-Jun	91	81	88.9	77.9	76	160.3	86.4	149.1	129.8
17-Jun	91	80.4	88.7	77.5	75	159.6	86.5	148	127.5
24-Jun	91	80.5	88.8	77.3	75	159.6	87.4	147.1	127.2
1-Jul	91	80.1	88.2	76.9	74	158.9	87.4	146.6	125.3
8-Jul	91	80.1	88	76.8	74	158.9	87.1	145.4	125.2
15-Jul	90	79.7	88.1	76.7	73	150.5	84.7	145.4	125.1
22-Jul	90	79.9	88.1	77	74	151.9	85.7	145.4	126.3
29-Jul	90	79.9	87.6	76.7	74	150.5	85.3	144.4	124.9
5-Aug	90	79.8	87.9	76.6	74	150.5	85.2	145	124.1
12-Aug	90	80	87.8	76.8	75	150.5	85.3	144.5	125.2
19-Aug	90	79.5	87.6	76.4	74	150.5	85.4	143.6	124
26-Aug	90	79.6	87.3	76.2	74	150.5	84.9	143.8	124.5
2-Sep	90	80.1	87.2	76.3	74	150.5	85.2	143.5	124.6
9-Sep	90	80	87.1	75.9	73	150.5	85.3	142.5	123.9
16-Sep	90	79.1	87.2	76.1	74	150.5	84.7	142.6	123.8
23-Sep	90	79.7	87.1	76.1	74	150.5	84.6	143.4	124.4
30-Sep	90	79.4	86.8	76	74	150.5	84.9	143.2	124.5
7-Oct	90	79.2	86.5	75.6	73	150.5	84.8	142.1	122.8
14-Oct	90	79.7	87.1	76.1	74	150.5	85.4	142.7	124
21-Oct	90	80.4	86.7	76	74	150.5	86.1	143.4	125.4
28-Oct	90	79.4	87	76.1	74	150.5	85.3	142.8	124
4-Nov	90	80	86.8	75.9	74	150.5	84.3	142.6	124.3
11-Nov	89	79.2	86.7	75.9	74	150.5	84.5	143	125.2
18-Nov	90	79.6	87.5	76.1	74	150.5	85.8	142.8	124.2
25-Nov	90	79	87.1	76.1	75	150.5	84.8	141.4	122
2-Dec	90	78.8	87.5	76.2	74	150.5	84.3	140.1	119.6
9-Dec	90	78.6	87.4	76.3	75	150.5	85.2	138.2	117.5
16-Dec	90	77.8	87.6	76.1	74	149.8	84	136.6	115.4
23-Dec	90	77.5	87.5	76.5	75	145.6	83.9	133.9	112.7
31-Dec	90	77.4	87.8	76.3	75	149.1	86	133.8	111.3

Degree Days, Heating and Cooling (Base 65 F) & Cooling (Base 50F)



	Mean Cooling Degree Days (°F) Base 50	Mean Cooling Degree Days (°F) Base 65	Mean Heating Degree Days (°F) Base 65
JAN	987.8	523	0
FEB	917.6	493.6	0
MAR	1016.3	551.3	0
APR	987.1	537.1	0
MAY	1021.6	556.6	0
JUN	982.6	532.6	0
JUL	994.8	529.8	0
AUG	980.3	515.3	0
SEP	933.4	483.4	0
OCT	953	488	0
NOV	925.8	475.8	0
DEC	966.9	501.9	0
ANN	11667.2	6188.4	0

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



Month	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	5535	0	21516	0
FEB	5480	0	21483	0
MAR	6266	0	27198	0
APR	6150	0	29414	0
MAY	6396	0	30966	0
JUN	6039	0	28742	0
JUL	5716	0	28493	0
AUG	5338	0	27963	0
SEP	4777	0	26731	0
OCT	4639	0	27397	0
NOV	4569	0	26091	0
DEC	4987	0	22999	0
ANN	65892	0	318993	0

Station Information		Shading Geometry in Dimensionless Units	
City, State, WBAN	N/A	N/A	N/A
Lat, Lon, Elev	N/A	N/A	N/A
Press Stn Type	N/A	N/A	N/A

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													
	Std.Dev.													
	Minimum													
	Maximum													
	Diffuse													
Clear Day	Global													
NORTH	Global													
	Diffuse													
Clear Day	Global													
EAST	Global													
	Diffuse													
Clear Day	Global													
SOUTH	Global													
	Diffuse													
Clear Day	Global													
WEST	Global													
	Diffuse													
Clear Day	Global													

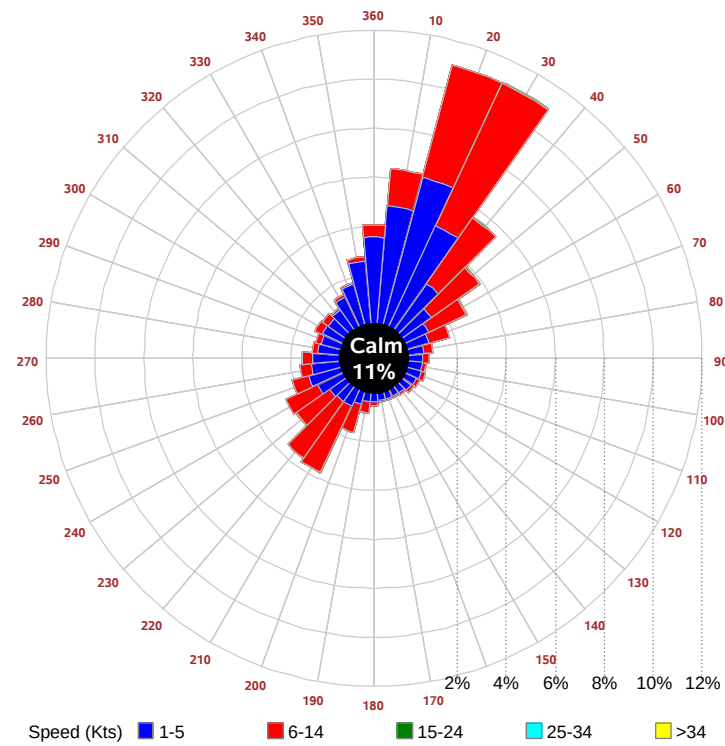
Average Annual Solar Radiation - Nearest Available Site Source: National Renewable Energy Laboratory, Golden CO, 1995

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													
NORTH	Unshaded													
	Shaded													
EAST	Unshaded													
	Shaded													
SOUTH	Unshaded													
	Shaded													
WEST	Unshaded													
	Shaded													

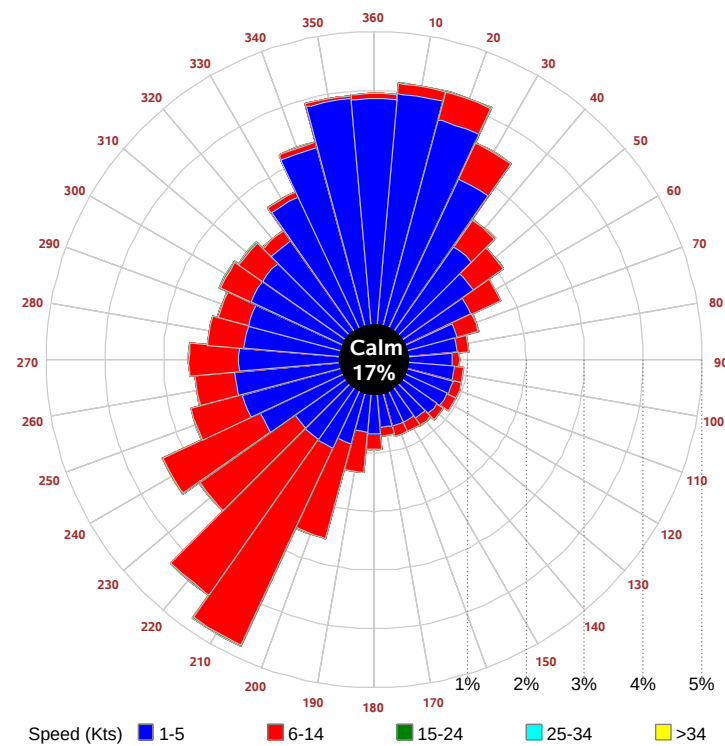
AVERAGE INCIDENT ILLUMINANCE (klux-hr) FOR MOSTLY CLEAR AND MOSTLY CLOUDY CONDITIONS, Percentage Uncertainty = 9												
		March						June				
		9am	11am	1pm	3pm	5pm		9am	11am	1pm	3pm	5pm
HORIZ.	M.Clear											
	M.Cloudy											
NORTH	M.Clear											
	M.Cloudy											
EAST	M.Clear											
	M.Cloudy											
SOUTH	M.Clear											
	M.Cloudy											
WEST	M.Clear											
	M.Cloudy											
M.Clear	(% hrs)											

		Sept						Dec				
		9am	11am	1pm	3pm	5pm		9am	11am	1pm	3pm	5pm
HORIZ.	M.Clear											
	M.Cloudy											
NORTH	M.Clear											
	M.Cloudy											
EAST	M.Clear											
	M.Cloudy											
SOUTH	M.Clear											
	M.Cloudy											
WEST	M.Clear											
	M.Cloudy											
M.Clear	(% hrs)											

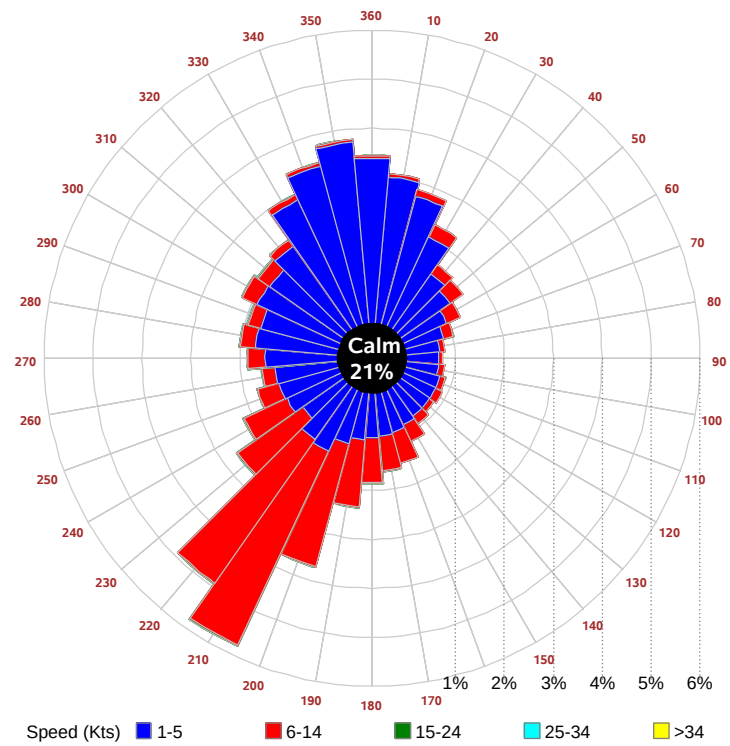
Wind Summary - December, January, and February



Wind Summary - March, April, and May



Wind Summary - June, July, and August



Wind Summary - September, October, and November

