

FRANKFURT MAIN, GM

Latitude = 50.03 N

Longitude = 8.54 E

Period of Record = 1988 To 2017

Station ID = ICAO_EDDF

Elevation = 364 Feet

Average Pressure = 29.62 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	95	70	68	7.4	VRB
0.4% Occurrence	89	68	68	7.2	VRB
1.0% Occurrence	84	66	67	7.2	E
2.0% Occurrence	81	65	67	7.6	VRB
Mean Daily Range	15	-	-	-	NNE
97.5% Occurrence	27	26	17	6	NNE
99.0% Occurrence	22	21	13	5.9	NE
99.6% Occurrence	18	17	11	6	NE
Median of Extreme Lows	14	13	9	5.6	NE

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	73	87	98	6.8	VRB
0.4% Occurrence	70	82	89	6.9	VRB
1.0% Occurrence	69	81	86	6.9	VRB
2.0% Occurrence	67	77	82	6.8	VRB

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	111	75	0.73	6.2	VRB
0.4% Occurrence	98	73	0.65	6.2	VRB
1.0% Occurrence	92	73	0.61	6.4	VRB
2.0% Occurrence	86	71	0.57	6.6	SSW

Air Conditioning/ Humid Area Criteria	Threshold	T ≥ 93 °F	T ≥ 80 °F	Twb ≥ 73 °F	Twb ≥ 67 °F
	# of Hours	14	242	6	219

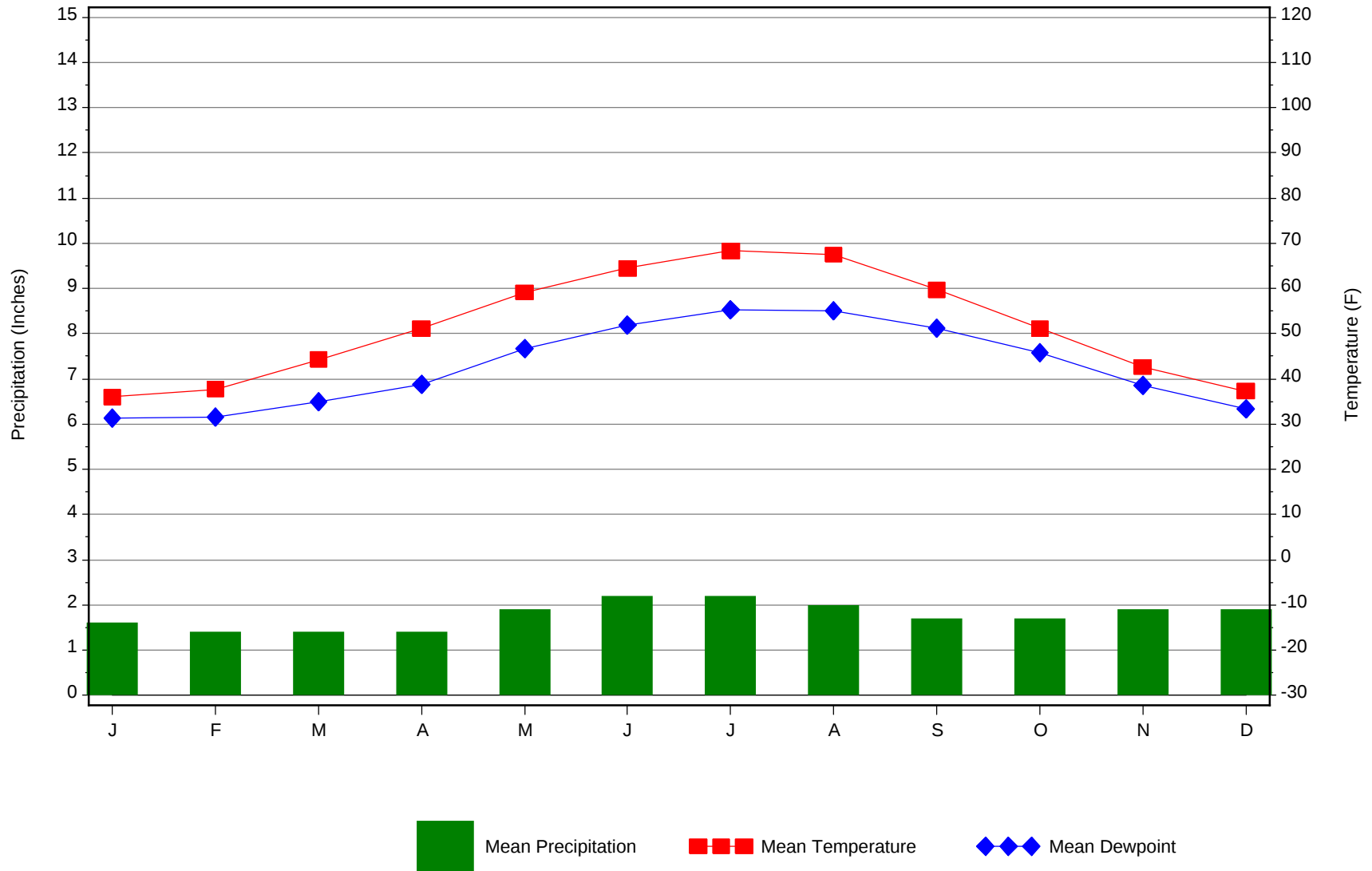
Other Site Data

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	N/A	N/A	0.2 + 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 (#)
54.2	N/A	N/A	37

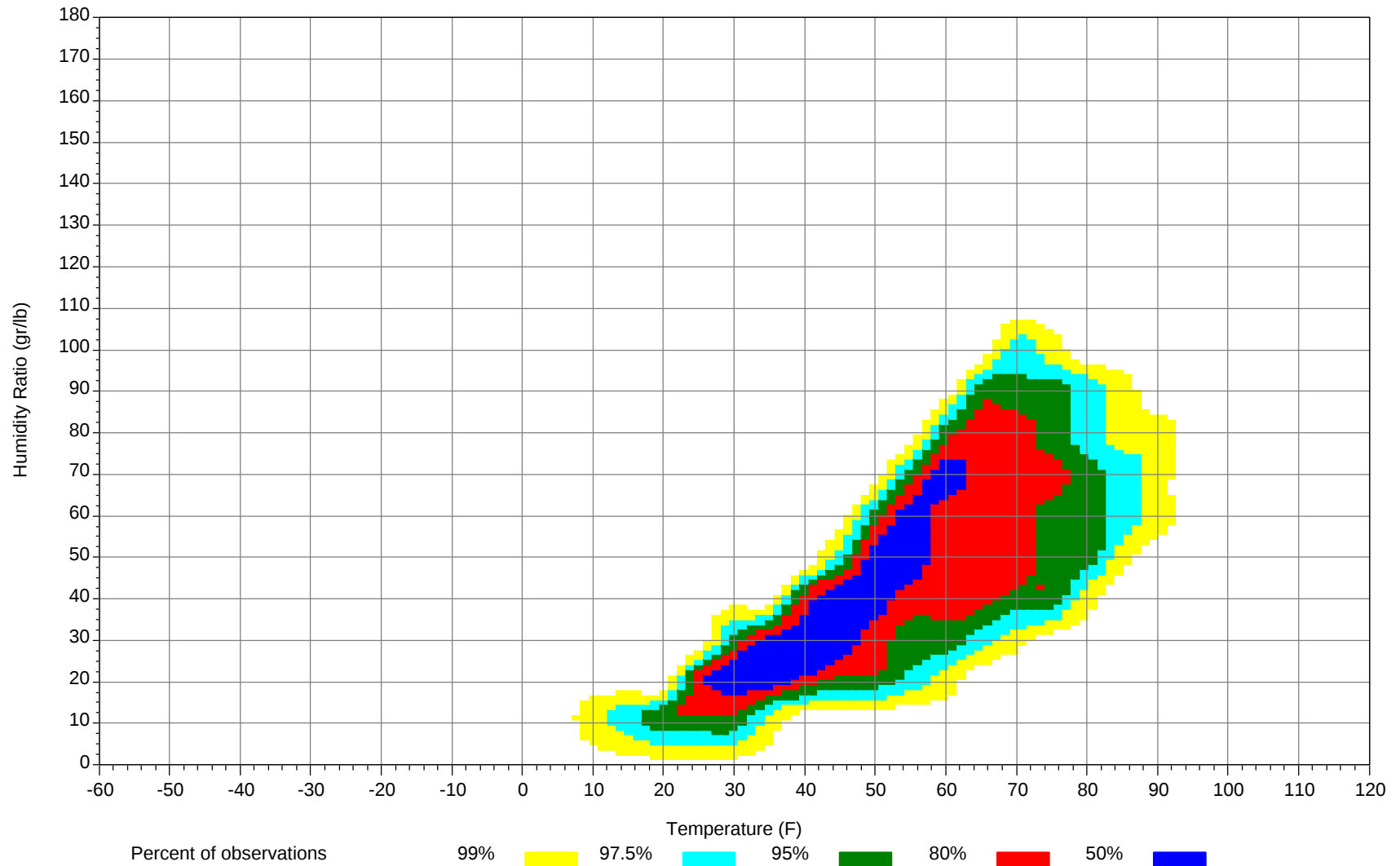
*Note: Temperatures at greater depths can be estimated by adding 1.5°F per 100 feet additional depth.



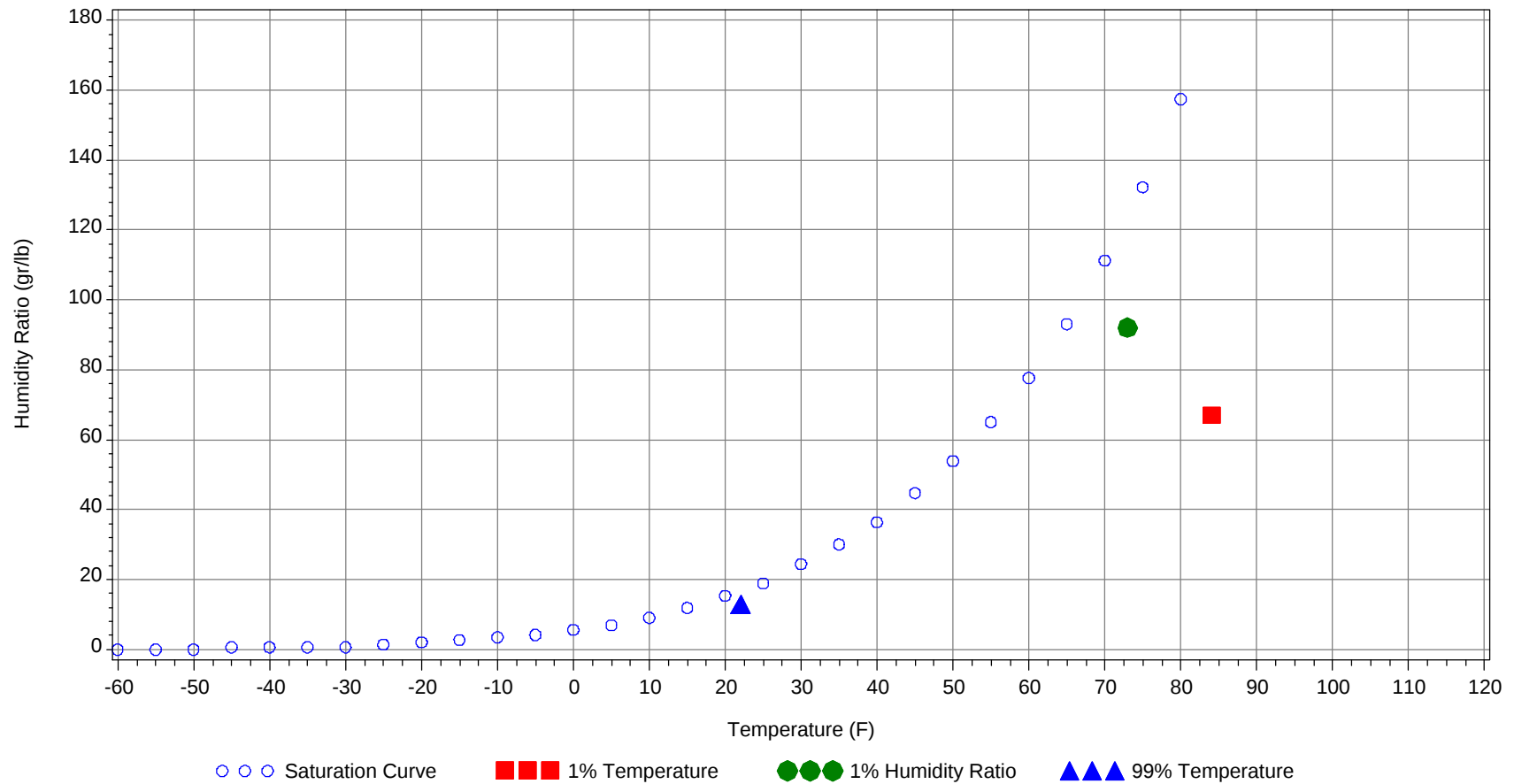
Average Annual Climate



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	84.0		66		67.0	30.9
99.0% Dry Bulb	22.0				13.0	7.3
1.0% Humidity Ratio	92.0	73.0	67.1	64.4		31.7

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)
100/104															
95/ 99															
90/ 94															
85/ 89															
80/ 84															
75/ 79												0		0	55.5
70/ 74												1	1	2	54.8
65/ 69												4	3	7	53
60/ 64	0			0	56	0	1	0	1	52.2		14	9	23	51
55/ 59	1	3	2	6	51.4	1	6	4	11	49.5	3	30	23	56	49
50/ 54	9	14	13	36	48.2	7	22	17	46	46.7	19	50	47	116	46.4
45/ 49	24	37	32	93	43.8	20	38	32	90	43.1	48	64	62	174	42.6
40/ 44	34	42	40	116	39.8	30	44	46	120	39.3	54	41	45	140	38.9
35/ 39	53	60	59	172	35.5	55	55	56	166	35.2	56	29	37	122	34.8
30/ 34	58	50	54	162	30.6	56	35	42	133	30.5	47	12	17	76	30.3
25/ 29	38	28	31	97	25.6	32	17	19	68	25.5	18	3	3	24	25.5
20/ 24	16	9	10	35	20.9	13	5	4	22	20.8	3	0	0	3	21
15/ 19	7	3	5	15	16.6	6	2	2	10	16.2	1	0	0	1	16.8
10/ 14	5	1	1	7	11.5	2	1	1	4	10.6	0			0	12.5
5/ 9	2	0	0	2	6.3	1	0	0	1	5.8					
0/ 4	0			0	2.8										

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)
100/104															
95/ 99												0	0	0	72.5
90/ 94							0	0	0	68.5		3	2	5	68.6
85/ 89							1	1	2	66.4		6	4	10	67.4
80/ 84		1	0	1	58.9		8	4	12	64.4	0	19	13	32	65.4
75/ 79		6	4	10	57.6		23	15	38	60.4	1	36	26	63	63.2
70/ 74		13	8	21	55.9	2	36	26	64	58.5	9	50	38	97	61.1
65/ 69	0	19	13	32	54.1	6	40	30	76	56.7	22	44	42	108	59
60/ 64	3	34	28	65	52	25	54	52	131	54.8	61	49	59	169	56.8
55/ 59	16	51	46	113	49.5	64	50	59	173	52.2	77	27	42	146	53.4
50/ 54	48	53	54	155	46.5	74	27	41	142	48.7	52	6	13	71	49.8
45/ 49	64	41	51	156	42.8	52	8	17	77	44.6	15	1	1	17	45.6
40/ 44	50	17	25	92	39	18	0	2	20	40.5	2		0	2	41.5
35/ 39	39	5	11	55	35.1	6		0	6	36.9	0			0	39
30/ 34	18	0	2	20	30.6	1			1	32.6					
25/ 29	3		0	3	26.4										
20/ 24															
15/ 19															
10/ 14															
5/ 9															
0/ 4															

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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)
100/104		0	0	0	70.5		0	0	0	69.5					
95/ 99		1	1	2	69.6		2	1	3	69.5					
90/ 94		7	5	12	68.3		5	3	8	68		0	0	0	67.7
85/ 89		14	9	23	66.9		10	7	17	66.6		1	1	2	66.1
80/ 84	0	32	22	54	65.6	0	28	19	47	65.5		6	3	9	65.2
75/ 79	4	45	37	86	64.1	3	46	33	82	63.9		15	8	23	63.6
70/ 74	20	58	52	130	62.1	14	59	53	126	62.3	1	31	19	51	61.3
65/ 69	48	43	47	138	60.9	38	48	51	137	60.8	6	42	32	80	59.2
60/ 64	83	38	52	173	58.3	90	39	53	182	58.6	36	70	64	170	57
55/ 59	68	9	22	99	54.7	70	10	23	103	54.9	73	54	68	195	53.8
50/ 54	22	0	2	24	50.8	28	0	4	32	50.7	76	17	37	130	50.3
45/ 49	2			2	46.4	5		0	5	46.5	38	2	7	47	45.8
40/ 44						0			0	42.7	9	0	1	10	41.7
35/ 39											2		0	2	37.8
30/ 34											0			0	34
25/ 29															
20/ 24															
15/ 19															
10/ 14															
5/ 9															
0/ 4															

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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)
100/104															
95/ 99															
90/ 94															
85/ 89															
80/ 84		0		0	61										
75/ 79		1	0	1	63.5										
70/ 74		4	2	6	62.2										
65/ 69	1	13	5	19	59.5		0		0	59.4					
60/ 64	6	42	25	73	57.1	0	3	1	4	56		0		0	53.8
55/ 59	34	65	56	155	53.6	6	15	10	31	52.4	1	3	3	7	51
50/ 54	64	63	70	197	49.5	21	44	34	99	48.9	12	16	14	42	48.6
45/ 49	66	39	54	159	44.9	54	67	64	185	44.7	26	42	34	102	44.3
40/ 44	38	14	23	75	40.7	51	48	53	152	40.3	39	45	44	128	40.1
35/ 39	27	5	11	43	36.5	58	41	48	147	36.1	60	65	63	188	35.8
30/ 34	12	1	2	15	31.5	34	17	23	74	31.3	60	49	56	165	31
25/ 29	2	0	0	2	27.1	12	4	5	21	26.1	30	19	24	73	26
20/ 24						4	1	1	6	21.7	11	5	6	22	21.2
15/ 19						1		0	1	17.8	6	2	3	11	16.8
10/ 14											1	1	0	2	11.3
5/ 9											1	0	0	1	6.1
0/ 4											0	0		0	2.8

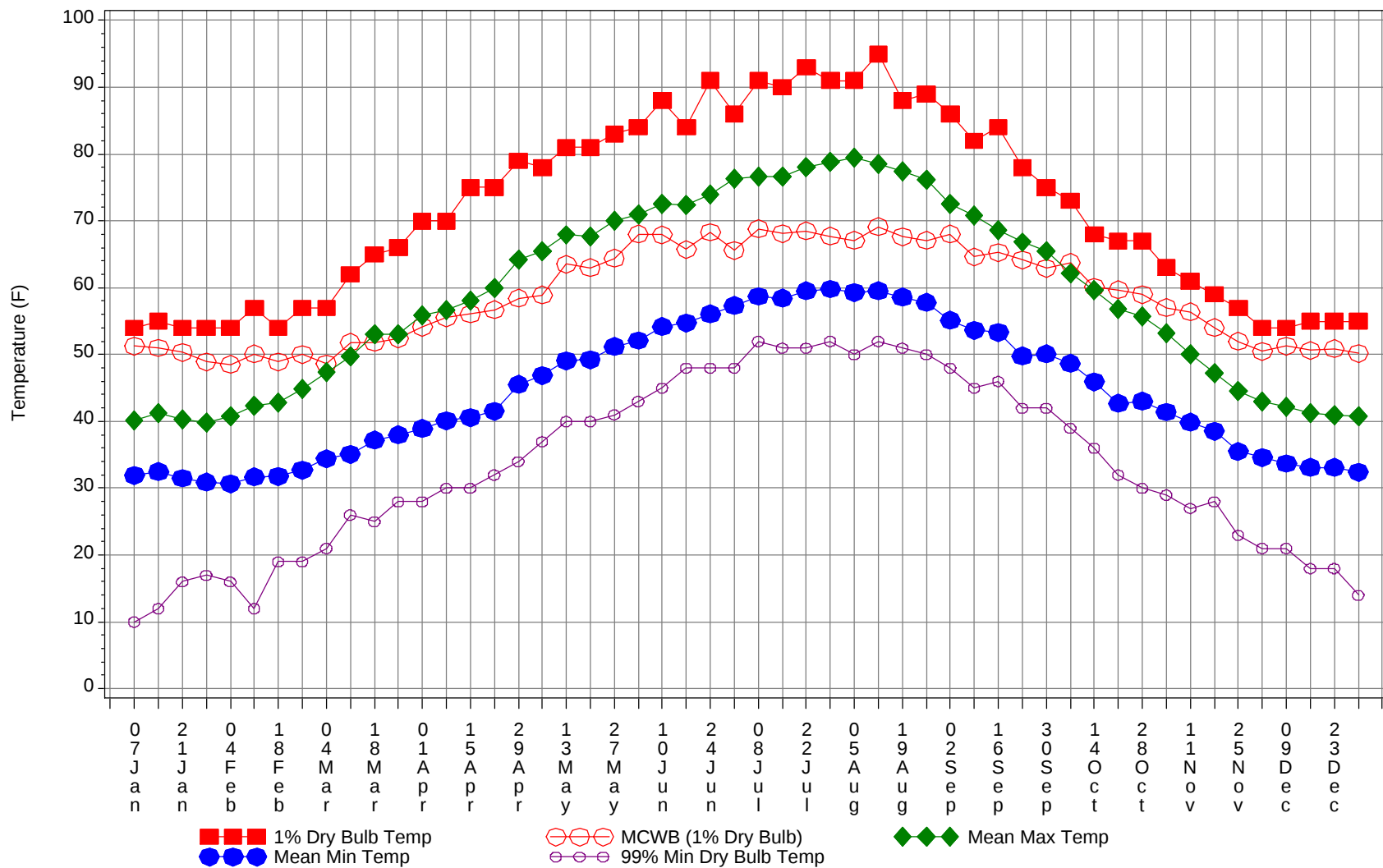
Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary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

Dry-Bulb Temperature Hours For An Average Year

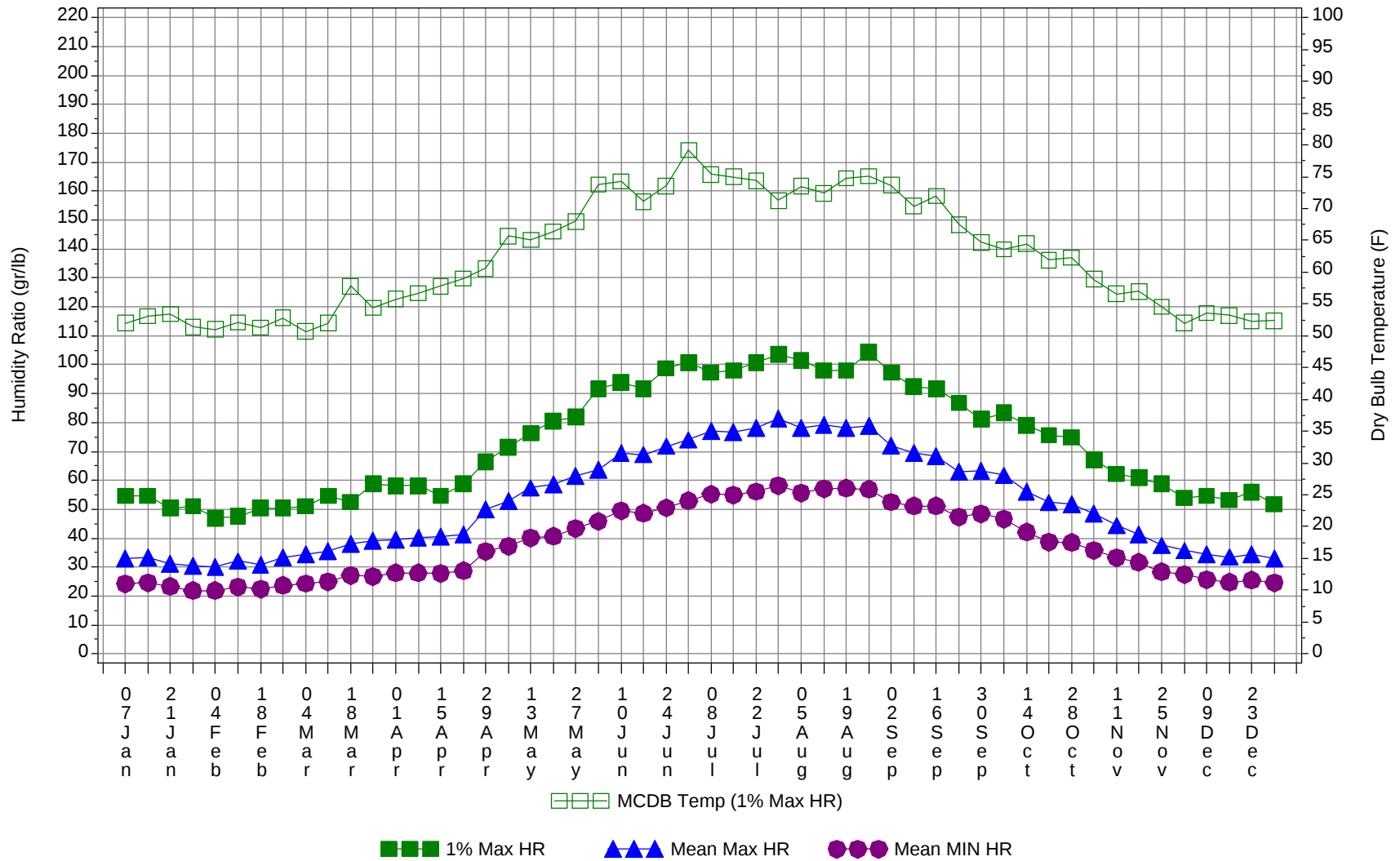
	Annual				
Temperature Range (°F)	01 To 08 LST	09 To 16 LST	17 to 00 LST	Total Obs	M C W B (°F)
100/104		0	0	0	69.7
95/ 99		4	2	6	69.8
90/ 94		15	10	25	68.2
85/ 89		33	21	54	66.8
80/ 84	0	95	62	157	65.4
75/ 79	8	172	122	302	63.1
70/ 74	45	252	198	495	61.1
65/ 69	121	253	222	596	59.3
60/ 64	304	344	344	992	56.7
55/ 59	415	323	358	1096	52.8
50/ 54	431	314	347	1092	48.6
45/ 49	414	339	354	1107	43.9
40/ 44	325	252	279	856	39.7
35/ 39	355	261	286	902	35.6
30/ 34	287	164	198	649	30.8
25/ 29	135	70	84	289	25.7
20/ 24	46	19	22	87	21
15/ 19	21	7	10	38	16.6
10/ 14	9	3	2	14	11.3
5/ 9	3	1	1	5	6.1
0/ 4	0	0		0	2.8

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



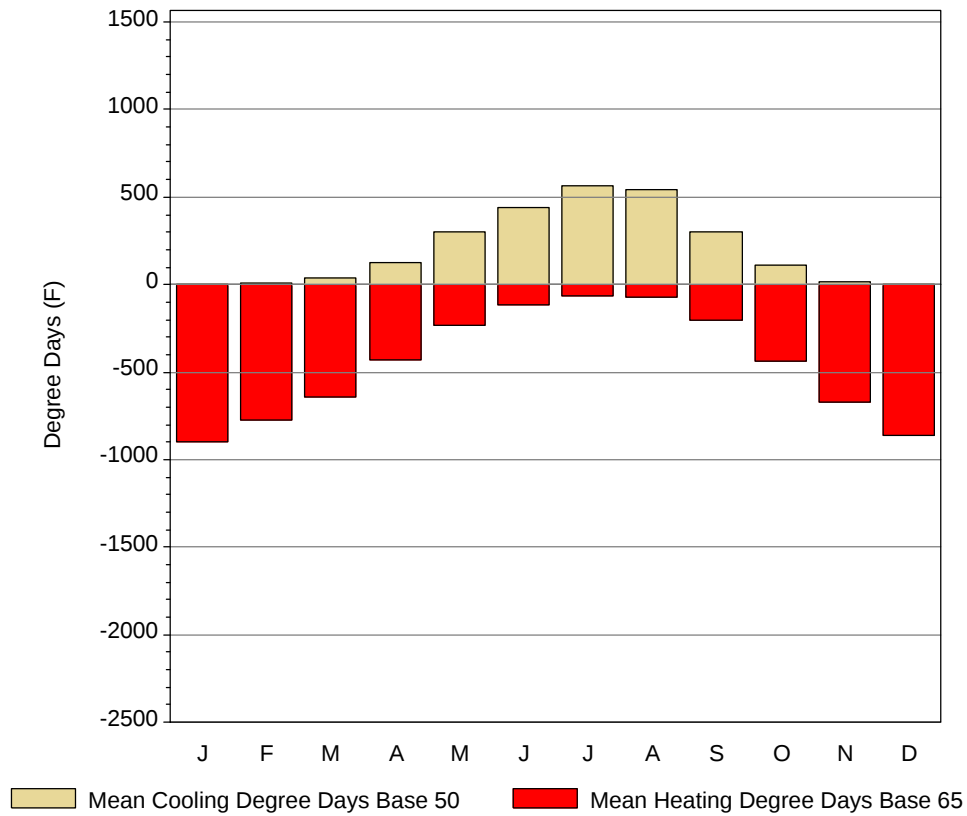
Long Term Humidity and Dry Bulb Temperature Summary



Long Term Humidity and Dry Bulb Temperature Summary

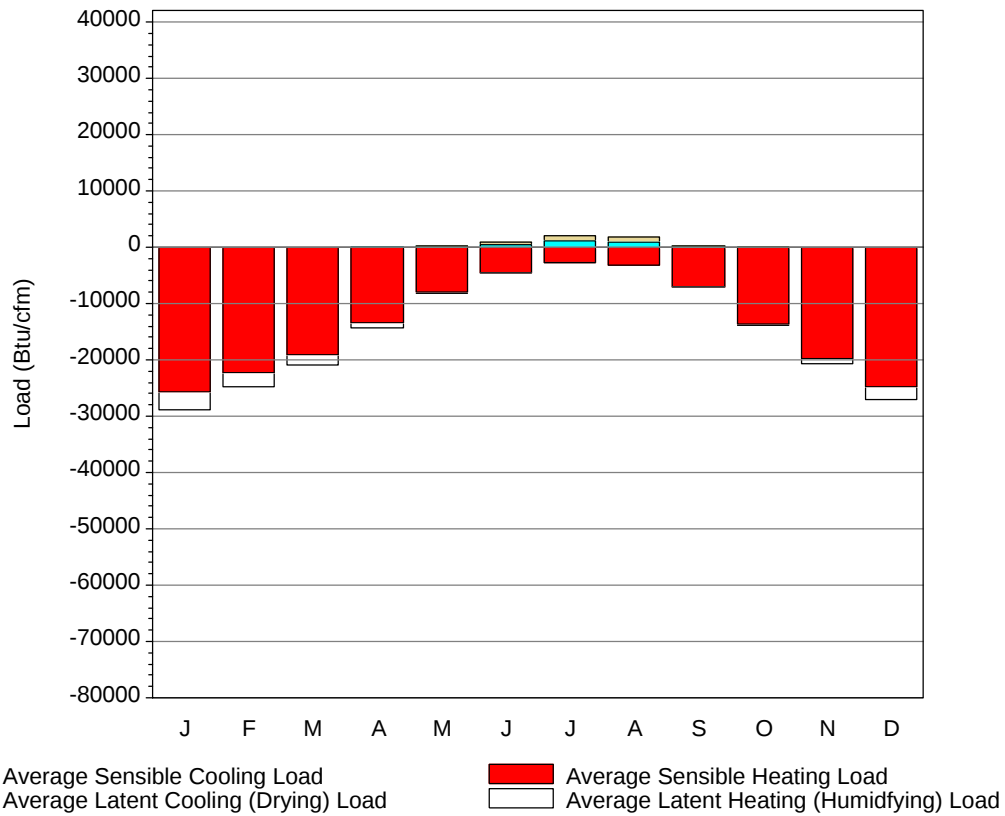
Week Ending	1.0% Temp (° F)	MCWB@ 1% Temp (° F)	Mean Max Temp (° F)	Mean Min Temp (° F)	99% Temp (° F)	1.0% HR (gr/lb)	MCDB@ 1% HR (° F)	Mean Max HR (gr/lb)	Mean Min HR (gr/lb)
7-Jan	54	51.3	40.1	31.9	10	54.6	52	32.9	24.2
14-Jan	55	51	41.3	32.5	12	54.6	53.1	33.2	24.5
21-Jan	54	50.3	40.3	31.5	16	50.4	53.4	31.3	23.3
28-Jan	54	48.9	39.9	30.9	17	51.1	51.4	30.5	21.9
4-Feb	54	48.5	40.7	30.7	16	46.9	51	30.1	21.9
11-Feb	57	50.1	42.3	31.7	12	47.6	52.1	32.1	23.1
18-Feb	54	48.9	42.8	31.8	19	50.4	51.3	30.9	22.4
25-Feb	57	50	44.9	32.7	19	50.4	52.8	33.4	23.7
4-Mar	57	48.6	47.3	34.4	21	51.1	50.7	34.5	24.3
11-Mar	62	51.8	49.7	35.1	26	54.6	52	35.5	24.9
18-Mar	65	51.8	53.1	37.2	25	52.5	57.8	37.9	27.1
25-Mar	66	52.4	53.1	38	28	58.8	54.4	39.1	26.8
1-Apr	70	54.1	55.9	38.9	28	58.1	55.8	39.4	28
8-Apr	70	55.5	56.6	40.1	30	58.1	56.7	40.1	28
15-Apr	75	56.1	58.1	40.6	30	54.6	57.8	40.7	27.9
22-Apr	75	56.7	59.9	41.5	32	58.8	59	41.4	28.8
29-Apr	79	58.4	64.2	45.5	34	66.5	60.6	49.9	35.4
6-May	78	58.9	65.4	46.9	37	71.4	65.7	52.9	37.2
13-May	81	63.5	67.9	49.1	40	76.3	65.1	57.4	40.1
20-May	81	63	67.7	49.2	40	80.5	66.4	58.5	40.6
27-May	83	64.4	70	51.2	41	81.9	68	61.5	43.3
4-Jun	84	68	71	52.1	43	91.7	73.8	63.8	45.8
10-Jun	88	67.9	72.6	54.2	45	93.8	74.3	69.6	49.5
17-Jun	84	65.7	72.4	54.7	48	91.7	71.1	68.9	48.6
24-Jun	91	68.3	74	56.1	48	98.7	73.6	71.8	50.5
1-Jul	86	65.6	76.3	57.3	48	100.8	79.2	74	52.9
8-Jul	91	68.8	76.6	58.7	52	97.3	75.4	77.1	55.2
15-Jul	90	68.1	76.6	58.4	51	98	75	76.8	55
22-Jul	93	68.5	78.1	59.5	51	100.8	74.4	78.2	56.1
29-Jul	91	67.7	78.8	59.8	52	103.6	71.3	81.4	58.2
5-Aug	91	67.1	79.5	59.3	50	101.5	73.5	78.1	55.7
12-Aug	95	69.1	78.5	59.5	52	98	72.4	79.2	57.1
19-Aug	88	67.6	77.4	58.6	51	98	74.8	78.1	57.3
26-Aug	89	67.1	76.2	57.8	50	104.3	75.1	78.9	56.9
2-Sep	86	68	72.5	55.1	48	97.3	73.7	71.9	52.5
9-Sep	82	64.6	70.8	53.6	45	92.4	70.4	69.4	51.2
16-Sep	84	65.3	68.6	53.3	46	91.7	72	68.5	51.1
23-Sep	78	64.2	66.8	49.8	42	86.8	67.5	63	47.3
30-Sep	75	62.9	65.4	50.1	42	81.2	64.7	63.2	48.5
7-Oct	73	63.8	62.2	48.7	39	83.3	63.6	61.7	46.6
14-Oct	68	60.1	59.6	45.9	36	79.1	64.5	56.2	42.1
21-Oct	67	59.7	56.8	42.7	32	75.6	61.9	52.3	38.6
28-Oct	67	59	55.7	43	30	74.9	62.3	51.7	38.5
4-Nov	63	57	53.2	41.4	29	67.2	58.9	48.4	35.8
11-Nov	61	56.4	50.1	39.9	27	62.3	56.6	44.4	33.2
18-Nov	59	54	47.2	38.5	28	60.9	57	41.3	31.7
25-Nov	57	52	44.6	35.5	23	58.8	54.6	37.5	28.4
2-Dec	54	50.5	43	34.6	21	53.9	52	35.7	27.4
9-Dec	54	51.3	42.2	33.7	21	54.6	53.6	34.3	25.7
16-Dec	55	50.6	41.2	33.1	18	53.2	53.2	33.5	24.8
23-Dec	55	50.9	41	33.1	18	56	52.3	34.5	25.5
31-Dec	55	50.2	40.7	32.4	14	51.8	52.4	33	24.6

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



Month	Mean Cooling Degree Days (°F) Base 50	Mean Cooling Degree Days (°F) Base 65	Mean Heating Degree Days (°F) Base 65
JAN	4	0	898.2
FEB	6.2	0	772.9
MAR	41.1	1	644.4
APR	129.5	13.4	431.1
MAY	302	52.5	235.8
JUN	437.6	102.6	117.5
JUL	565.7	164.1	63.7
AUG	542.5	149.3	72.4
SEP	299	39.5	199.9
OCT	114.9	3.3	434
NOV	16.5	0	672
DEC	4.5	0	859
ANN	2463.5	525.7	5400.9

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	0	-25692	0	-3058
FEB	0	-22231	0	-2636
MAR	0	-19094	0	-1858
APR	25	-13343	0	-999
MAY	188	-7995	50	-103
JUN	560	-4486	443	-7
JUL	1131	-2784	914	-1
AUG	966	-3087	815	0
SEP	137	-7085	156	-3
OCT	2	-13604	16	-231
NOV	0	-19752	0	-922
DEC	0	-24675	0	-2345
ANN	3009	-163828	2394	-12163

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													

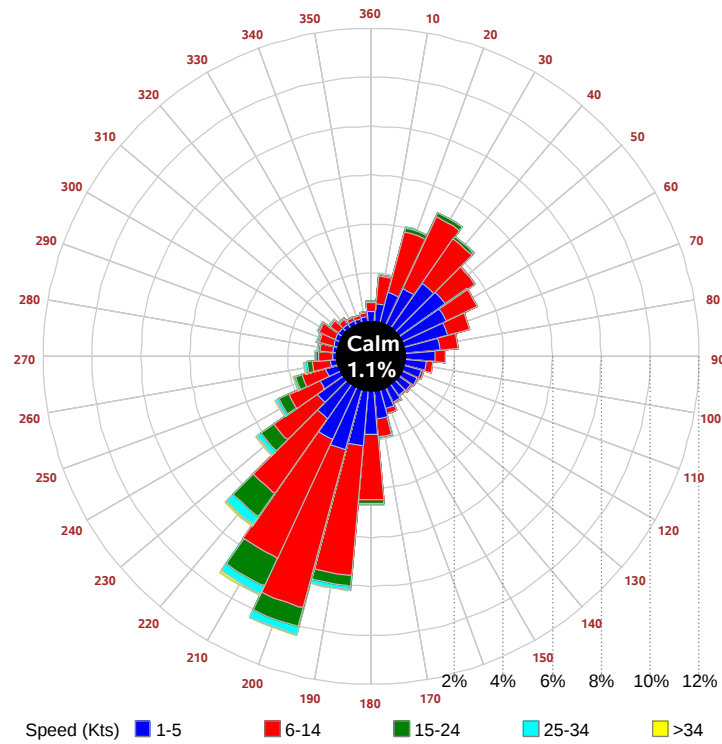
Average Annual Solar Radiation - Nearest Available Site Source: National Renewable Energy Laboratory, Golden CO, 1995

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													

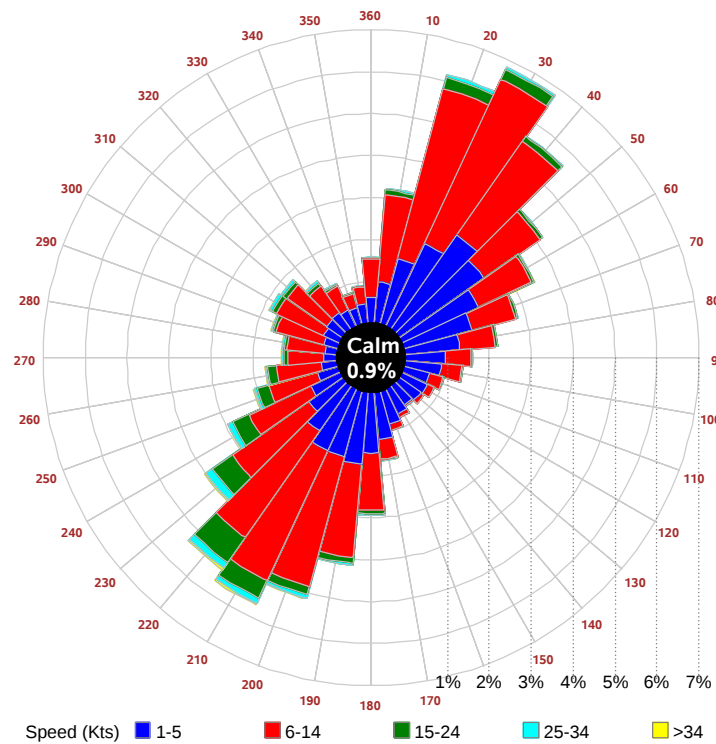
AVERAGE INCIDENT ILLUMINANCE (klux-hr) FOR MOSTLY CLEAR AND MOSTLY CLOUDY CONDITIONS, Percentage Uncertainty = 9												
				March						June		
		9am	11am	1pm	3pm	5pm	9am	11am	1pm	3pm	5pm	
HORIZ.	M.Clear											
	M.Cloudy											
NORTH	M.Clear											
	M.Cloudy											
EAST	M.Clear			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

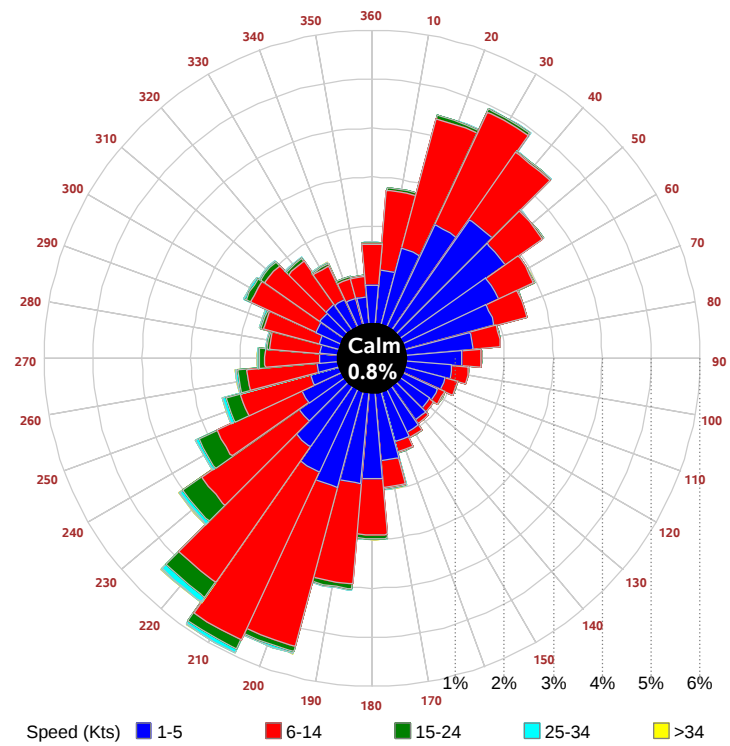
Wind Summary - December, January, and February



Wind Summary - March, April, and May



Wind Summary - June, July, and August



Wind Summary - September, October, and November

