

MANNHEIN, GERMANY

Latitude = 49.52 N

Longitude = 8.55 E

Period of Record = 1973 to 1996

WMO No. 107290

Elevation = 328 feet

Average Pressure = 29.65 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	69	74	6.6	S
0.4% Occurrence	88	68	74	6.6	SSW
1.0% Occurrence	84	67	71	6.3	E
2.0% Occurrence	81	65	68	6.3	S
Mean Daily Range	15	-	-	-	-
97.5% Occurrence	25	24	15	4.0	N
99.0% Occurrence	19	18	12	3.7	N
99.6% Occurrence	15	14	9	4.0	N
Median of Extreme Lows	12	11	8	4.1	N
	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	85	100	5.9	S
0.4% Occurrence	70	82	89	5.8	S
1.0% Occurrence	69	81	87	5.8	S
2.0% Occurrence	67	78	81	5.8	S
	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	104	76	0.69	5.0	S
0.4% Occurrence	99	75	0.66	5.1	S
1.0% Occurrence	92	73	0.61	5.2	S
2.0% Occurrence	87	71	0.58	5.4	S
Air Conditioning/ Humid Area Criteria	# of Hours	T ≥ 93°F	T ≥ 80°F	T _{wb} ≥ 73°F	T _{wb} ≥ 67°F
		7	250	9	203

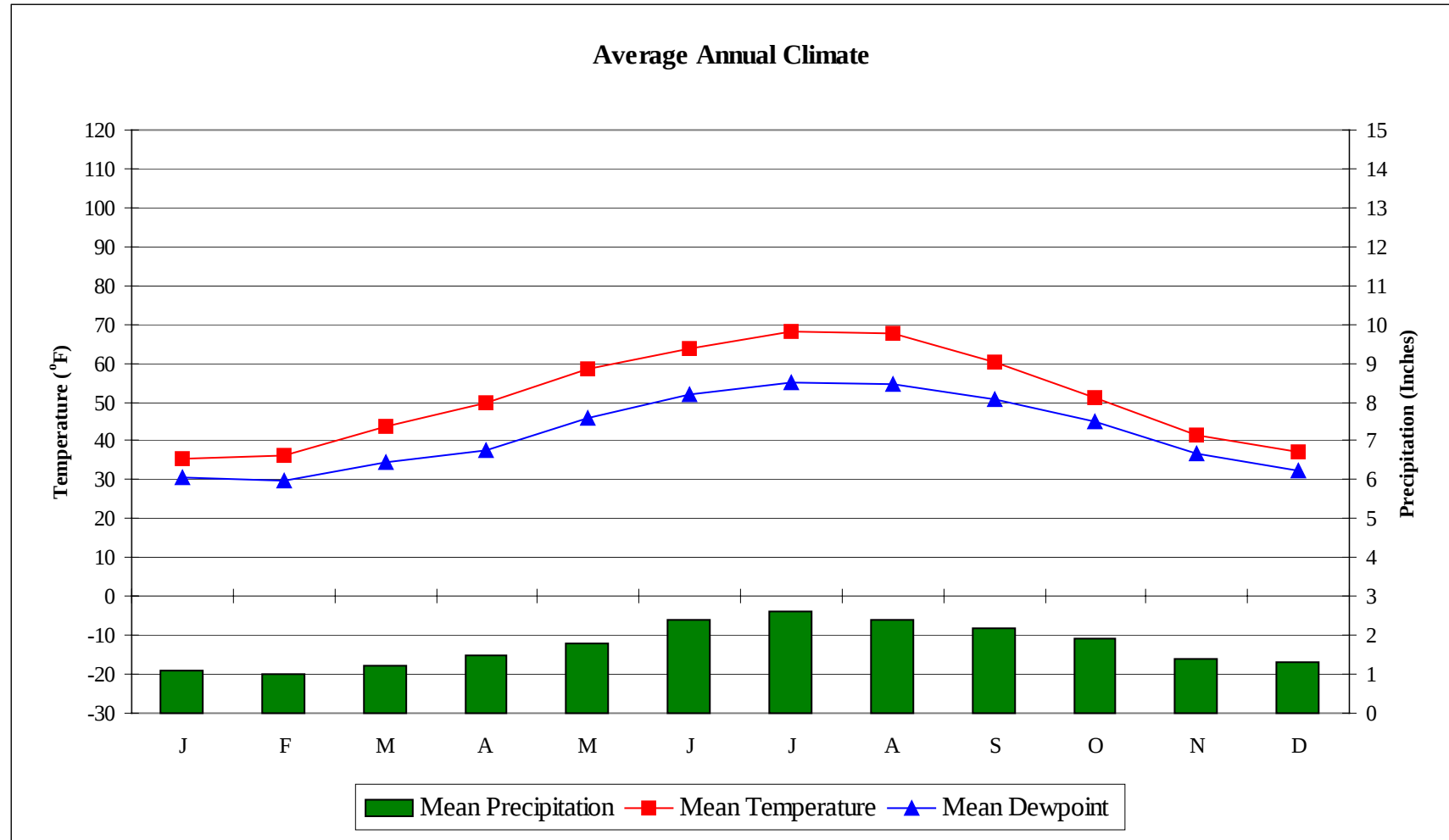
Other Site Data

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
6	N/A	N/A	0.1 + 0.2
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 (#)
53.6	N/A	N/A	38

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

MANNHEIN, GERMANY

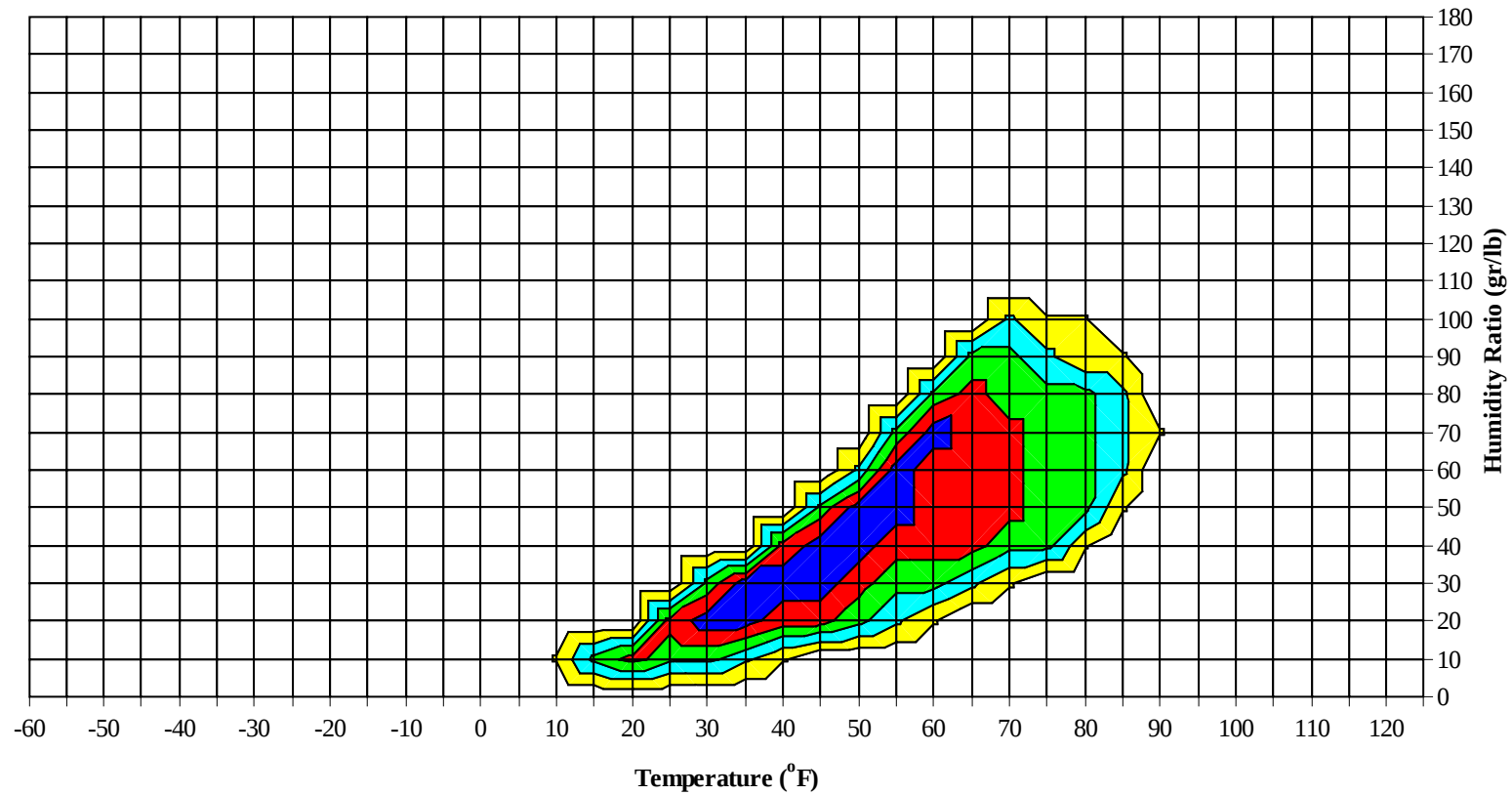
WMO No. 107290



MANNHEIN, GERMANY

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Long Term Psychrometric Summary

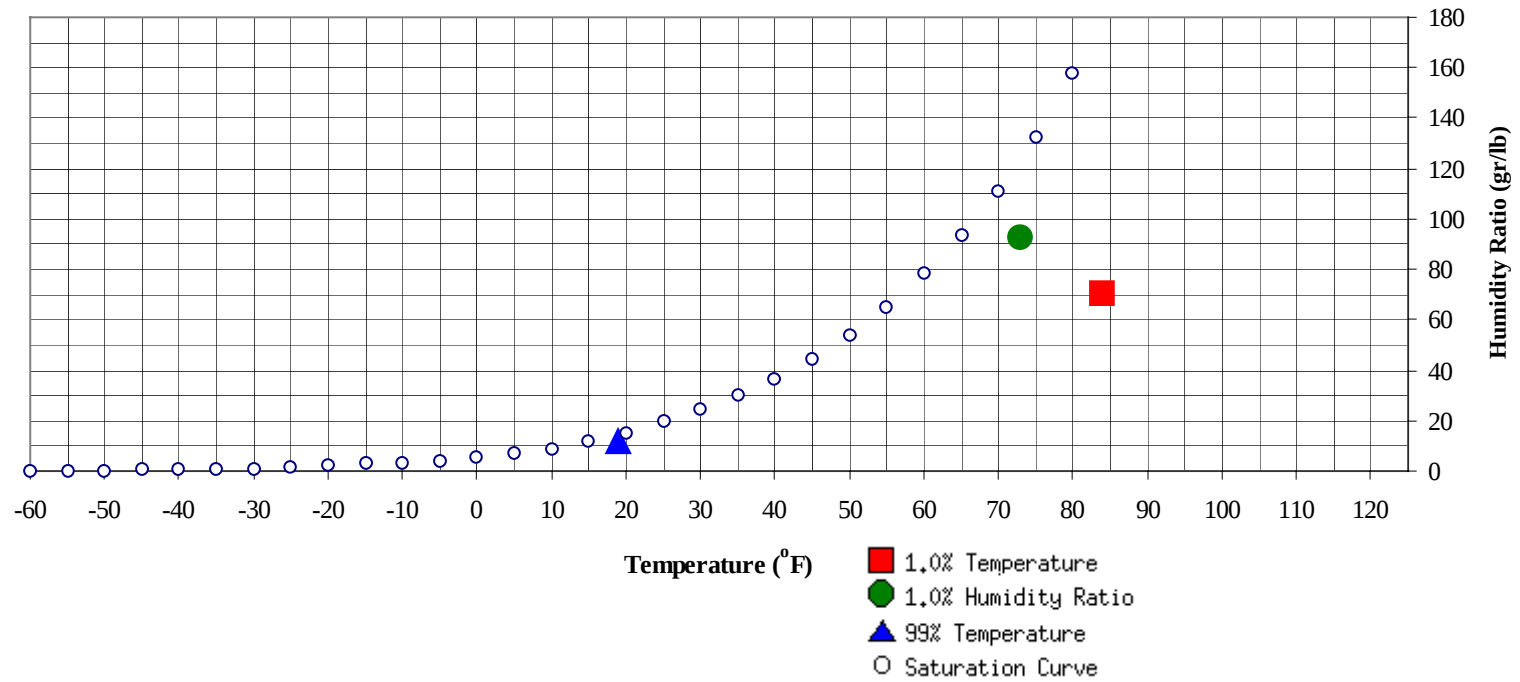


- 50% of all observations
- 80% of all observations
- 95% of all observations
- 97.5% of all observations
- 99% of all observations

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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	19	11.6	6.3		92.4	72.8	67.3	64.6	31.9

1.0% Dry Bulb	(°F)	MCHR (gr/lb)	MCWB (°F)	Enthalpy (btu/lb)
	84	70.6	66.6	31.2

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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		
95 / 99															
90 / 94															
85 / 89															
80 / 84															
75 / 79												0	0	0	58.3
70 / 74												1	0	1	56.5
65 / 69							0	0	0	54.8		4	2	7	53.5
60 / 64		0		0	52.0		2	0	2	51.5		13	8	20	51.5
55 / 59	1	2	1	4	49.8	1	4	3	9	49.1	3	27	19	49	49.2
50 / 54	7	11	9	28	47.6	3	15	10	28	46.2	14	48	44	106	46.1
45 / 49	20	35	28	83	43.6	15	36	28	79	42.8	45	65	61	170	42.4
40 / 44	34	43	40	117	39.5	30	41	45	115	39.0	49	49	56	153	38.6
35 / 39	59	65	61	186	35.1	49	53	55	156	34.7	64	30	39	133	34.7
30 / 34	59	48	60	167	30.9	59	45	49	153	30.1	48	10	16	73	30.3
25 / 29	33	22	26	80	25.8	37	20	23	80	25.3	19	3	3	25	25.1
20 / 24	15	10	11	36	20.9	18	5	8	31	20.4	5	0	0	5	20.6
15 / 19	8	7	7	22	16.5	8	2	2	12	16.0	1		0	1	16.9
10 / 14	6	4	3	14	11.4	3	1	1	5	11.2	0			0	13.0
5 / 9	3	1	1	5	7.1	1	0	0	1	7.1					
0 / 4	1	1	0	2	2.0	0			0	0.6					
-5 / -1	0			0	-2.0	0			0	-1.5					

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.

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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		
95 / 99															
90 / 94								0	0	66.0		1	1	2	65.5
85 / 89							1	0	1	66.9		5	3	8	68.1
80 / 84		0	0	0	59.2		6	3	9	63.3		20	12	32	65.5
75 / 79		4	2	6	58.0	0	20	14	34	60.6	0	33	25	59	63.3
70 / 74		11	8	19	55.6	0	33	24	57	58.2	4	43	34	82	60.9
65 / 69	1	17	11	29	53.5	3	39	31	73	56.2	19	43	41	103	58.9
60 / 64	2	32	23	57	51.3	23	56	52	132	54.2	53	52	57	162	56.5
55 / 59	10	44	36	90	48.8	57	46	55	158	52.0	78	32	46	157	53.5
50 / 54	33	52	51	137	46.0	75	32	44	151	48.6	64	10	18	92	50.1
45 / 49	58	49	58	165	42.6	56	12	19	88	44.6	19	0	2	21	45.7
40 / 44	63	23	34	121	39.3	24	3	5	31	40.4	3		0	3	41.8
35 / 39	51	7	14	73	35.3	9	0	1	10	36.4	0			0	37.7
30 / 34	18	1	2	21	30.9	1			1	32.4					
25 / 29	3		0	3	26.1										
20 / 24	0			0	22.3										
15 / 19															
10 / 14															
5 / 9															
0 / 4															
-5 / -1															

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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		
95 / 99		1	0	1	69.0		1	0	1	70.7					
90 / 94		5	3	9	69.4		4	2	7	68.8		0		0	66.0
85 / 89		17	12	30	67.7		13	8	21	67.5		2	1	3	65.6
80 / 84	0	31	23	54	66.1	0	30	21	51	65.4		8	3	11	65.6
75 / 79	2	44	34	80	64.0	1	48	37	86	63.4		19	11	29	63.5
70 / 74	15	53	48	117	61.7	9	55	50	114	61.9	0	35	23	58	61.1
65 / 69	47	44	51	141	60.5	37	45	53	135	60.5	6	45	36	86	58.7
60 / 64	75	38	50	163	58.0	87	39	49	174	58.4	32	64	60	156	56.6
55 / 59	76	14	23	113	54.6	73	12	22	107	54.6	71	47	63	181	53.5
50 / 54	28	1	3	32	50.6	31	1	4	36	50.3	76	19	34	129	50.0
45 / 49	5		0	5	46.5	9		1	10	46.2	39	3	9	50	45.8
40 / 44	0			0	42.3	2			2	41.4	14		1	15	41.7
35 / 39											2			2	37.7
30 / 34															
25 / 29															
20 / 24															
15 / 19															
10 / 14															
5 / 9															
0 / 4															
-5 / -1															

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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		
95 / 99															
90 / 94															
85 / 89															
80 / 84		0	0	0	61.8										
75 / 79		2	0	2	62.4										
70 / 74		5	2	8	61.2										
65 / 69	0	15	6	21	58.6										
60 / 64	5	37	24	67	56.2	1	3	0	4	54.7		0		0	54.0
55 / 59	32	60	54	147	53.2	4	15	7	26	52.0	1	4	3	8	51.0
50 / 54	59	64	63	186	49.2	16	37	27	81	48.4	13	17	14	45	48.3
45 / 49	62	42	57	161	44.7	43	60	56	159	44.3	22	36	29	87	44.2
40 / 44	47	17	28	91	40.8	56	53	56	166	40.1	39	46	41	126	39.9
35 / 39	30	5	11	46	36.4	56	42	50	147	35.7	60	66	66	191	35.5
30 / 34	11	1	2	14	31.8	34	21	29	84	30.9	60	50	57	166	30.7
25 / 29	2	0	0	2	27.2	22	7	14	43	26.3	28	19	23	70	26.0
20 / 24						7	1	1	9	21.9	13	6	9	28	20.9
15 / 19						1	0	0	1	18.0	9	4	4	17	16.8
10 / 14											2	1	1	4	12.0
5 / 9											1	0	0	1	7.3
0 / 4															
-5 / -1															

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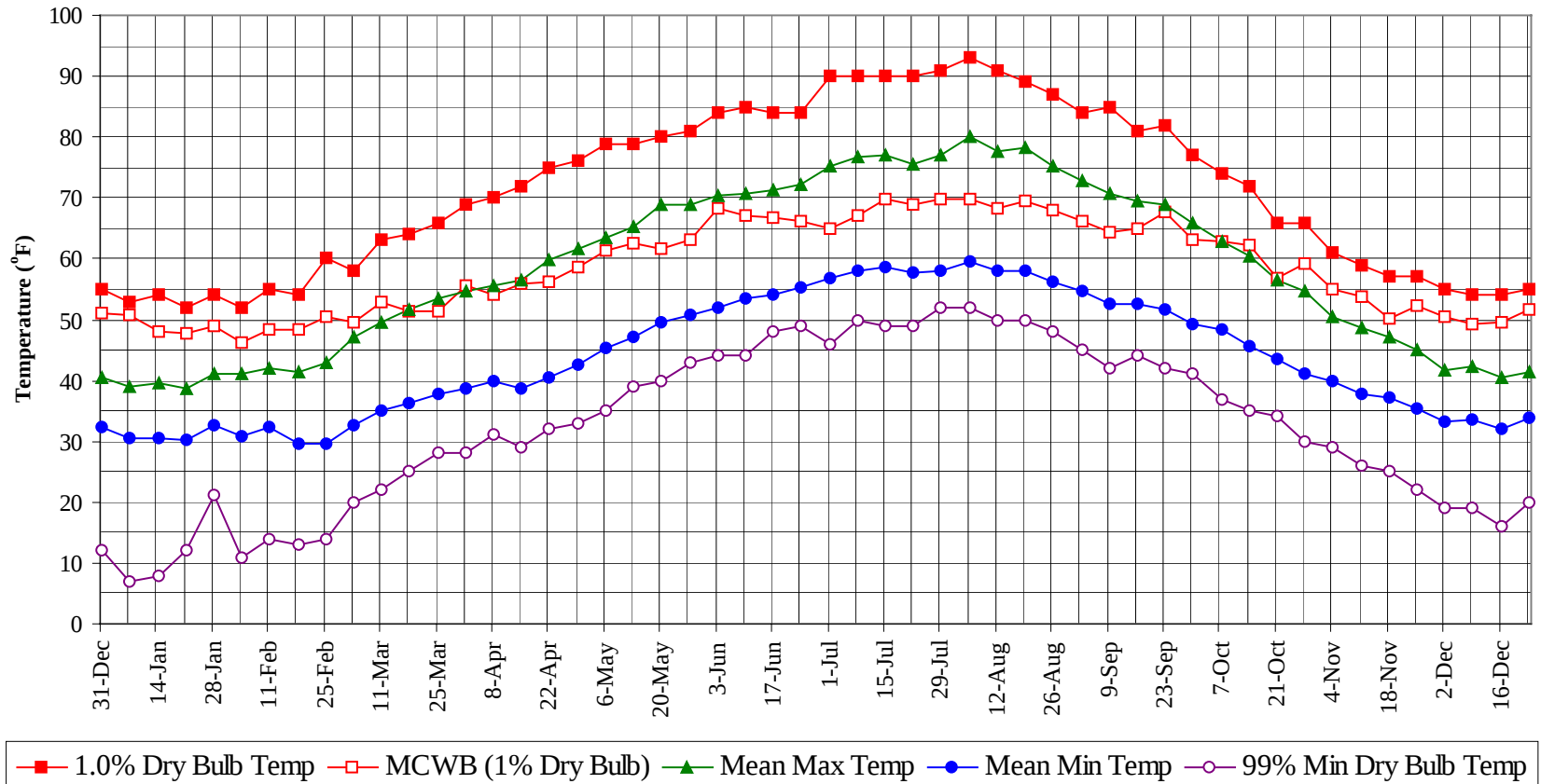
Dry-Bulb Temperature Hours For An Average Year (Sheet 5 of 5)

Period of Record = 1973 to 1996

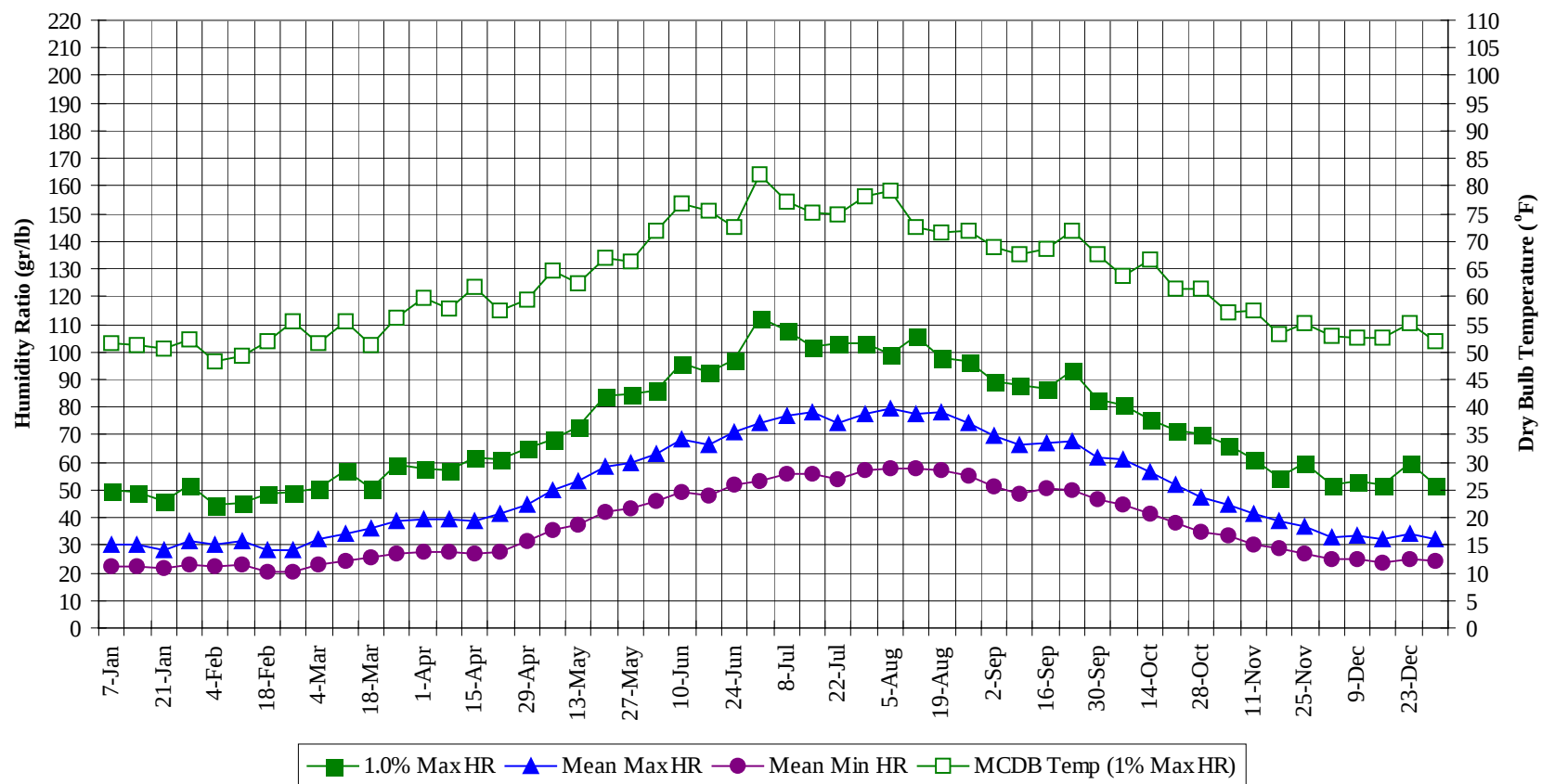
Annual Totals					
Temperature Range (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00		
95 / 99		2	1	3	69.9
90 / 94		11	7	17	68.8
85 / 89		38	23	61	67.6
80 / 84	0	95	63	159	65.5
75 / 79	4	169	122	295	63.1
70 / 74	28	239	188	455	60.8
65 / 69	108	255	228	590	58.9
60 / 64	267	338	324	930	56.3
55 / 59	393	309	333	1035	52.7
50 / 54	414	305	323	1042	48.4
45 / 49	397	335	350	1082	43.8
40 / 44	370	273	307	949	39.6
35 / 39	391	265	298	954	35.2
30 / 34	295	173	214	682	30.6
25 / 29	146	70	90	306	25.7
20 / 24	61	23	28	111	20.8
15 / 19	29	12	13	55	16.5
10 / 14	11	6	7	24	11.5
5 / 9	4	2	1	7	7.1
0 / 4	2	1	0	3	1.7
-5 / -1	0			0	-1.7
	</				

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Annual Summary of Temperatures



Long Term Humidity and Dry Bulb Temperature Summary

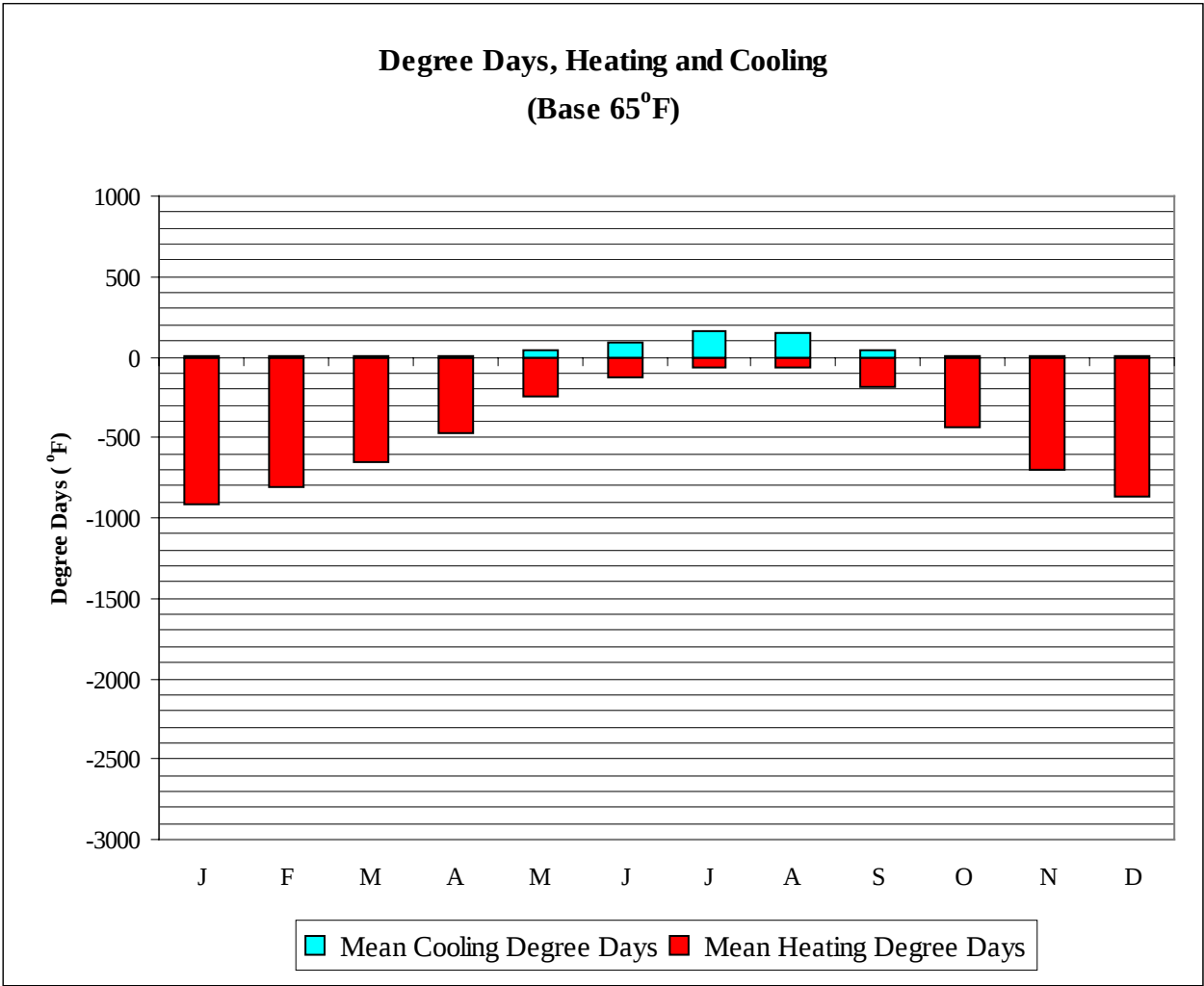


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Long Term Dry Bulb Temperature and Humidity Summary

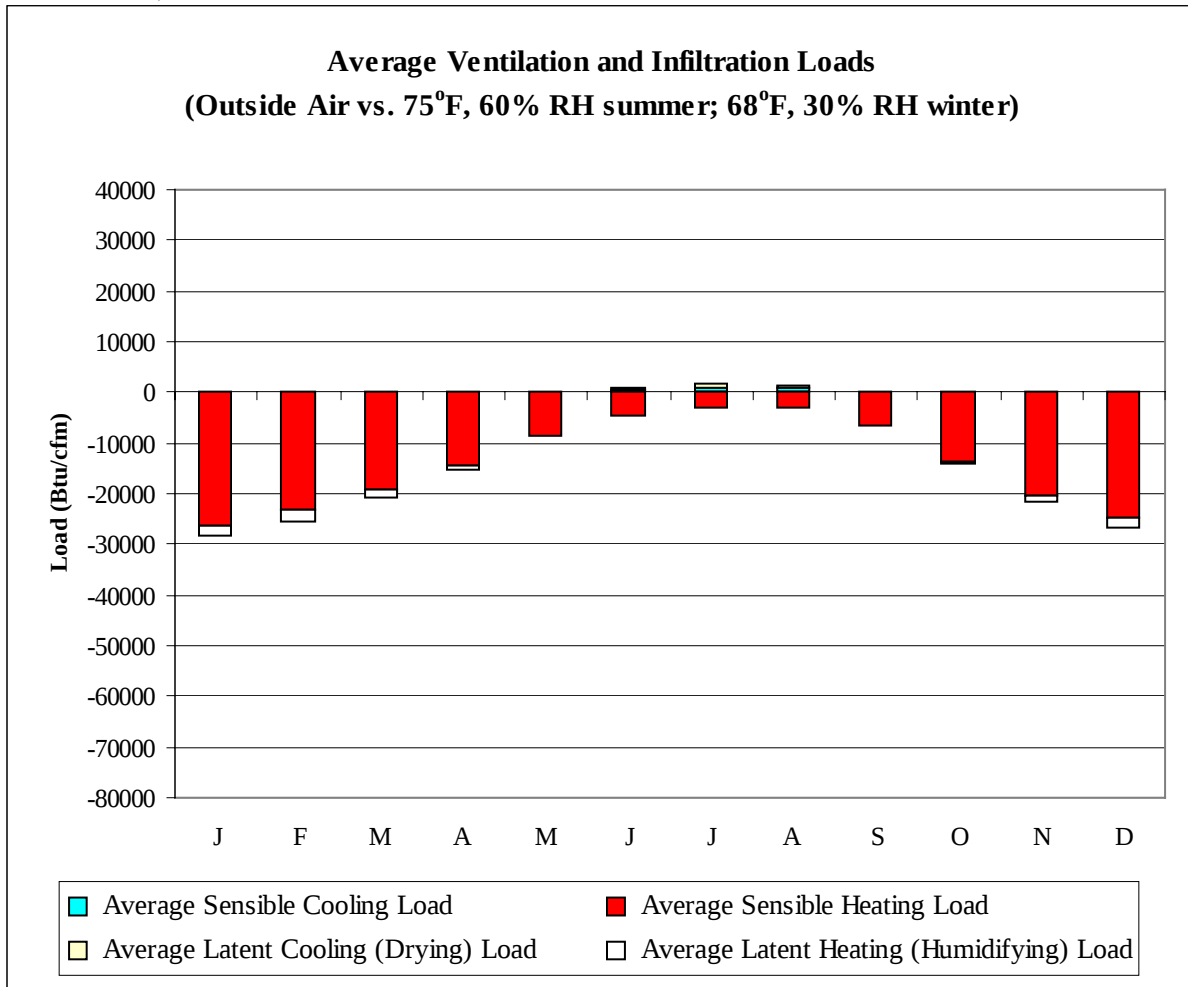
Week Ending	1.0% Temp (°F)	MCWB @ 1% Temp (°F)	Mean Max Temp (°F)	Mean Min Temp (°F)	99% Temp (°F)	1.0% HR (gr/lb)	MCDB @ 1% HR (°F)	Mean Max HR (gr/lb)	Mean Min HR (gr/lb)
7-Jan	53.0	50.7	39.0	30.6	7.0	49.7	51.5	30.3	22.6
14-Jan	54.0	48.2	39.6	30.6	8.0	49.0	51.4	30.4	22.3
21-Jan	52.0	47.8	38.5	30.3	12.0	46.2	50.4	28.4	21.8
28-Jan	54.0	49.0	41.0	32.6	21.0	51.8	52.1	31.8	23.1
4-Feb	52.0	46.2	41.1	31.0	11.0	44.8	48.2	30.0	22.1
11-Feb	55.0	48.4	41.9	32.4	14.0	45.5	49.2	31.7	23.0
18-Feb	54.0	48.3	41.3	29.7	13.0	48.3	51.9	28.3	20.5
25-Feb	60.0	50.5	42.8	29.5	14.0	49.0	55.5	28.1	20.3
4-Mar	58.0	49.7	47.0	32.7	20.0	50.4	51.7	32.4	22.8
11-Mar	63.0	53.0	49.7	34.9	22.0	57.4	55.4	34.4	24.2
18-Mar	64.0	51.4	51.6	36.2	25.0	50.4	51.3	36.3	25.7
25-Mar	66.0	51.3	53.3	37.9	28.0	58.8	56.0	38.8	27.2
1-Apr	69.0	55.7	54.6	38.6	28.0	58.1	59.7	39.4	27.9
8-Apr	70.0	54.2	55.6	39.8	31.0	57.4	57.6	39.3	27.7
15-Apr	72.0	55.8	56.6	38.8	29.0	61.6	61.6	38.4	26.8
22-Apr	75.0	56.1	59.7	40.4	32.0	60.9	57.5	41.1	27.6
29-Apr	76.0	58.6	61.5	42.6	33.0	65.1	59.3	44.9	31.3
6-May	79.0	61.3	63.4	45.3	35.0	68.6	64.6	50.2	35.3
13-May	79.0	62.6	65.1	47.1	39.0	72.8	62.5	53.1	37.5
20-May	80.0	61.6	68.7	49.5	40.0	84.0	66.9	58.5	41.8
27-May	81.0	63.3	68.8	50.6	43.0	84.7	66.3	59.5	43.0
3-Jun	84.0	68.3	70.4	51.9	44.0	86.1	71.9	62.9	45.8
10-Jun	85.0	67.1	70.7	53.4	44.0	95.9	76.8	68.2	49.3
17-Jun	84.0	66.6	71.4	54.0	48.0	92.8	75.6	66.4	47.7
24-Jun	84.0	66.0	72.3	55.4	49.0	97.3	72.7	70.9	52.2
1-Jul	90.0	64.9	75.2	56.8	46.0	112.0	82.0	74.0	53.0
8-Jul	90.0	67.0	76.8	58.2	50.0	107.8	77.2	76.8	55.8
15-Jul	90.0	69.8	77.1	58.5	49.0	101.5	75.1	78.4	56.1
22-Jul	90.0	68.9	75.5	57.7	49.0	102.9	75.0	74.5	54.2
29-Jul	91.0	69.7	77.2	57.9	52.0	102.9	78.1	77.6	57.0
5-Aug	93.0	69.9	80.0	59.6	52.0	99.4	79.0	79.6	57.7
12-Aug	91.0	68.2	77.7	58.1	50.0	105.7	72.6	77.4	57.5
19-Aug	89.0	69.5	78.3	58.1	50.0	98.0	71.6	78.1	57.3
26-Aug	87.0	68.0	75.1	56.3	48.0	96.6	71.9	74.4	55.3
2-Sep	84.0	66.2	72.8	54.6	45.0	89.6	68.9	69.6	51.4
9-Sep	85.0	64.3	70.7	52.4	42.0	88.2	67.7	66.2	48.4
16-Sep	81.0	64.9	69.6	52.5	44.0	86.8	68.6	67.1	50.4
23-Sep	82.0	67.7	68.9	51.8	42.0	93.1	72.0	67.4	49.8
30-Sep	77.0	63.3	65.9	49.4	41.0	82.6	67.8	62.0	46.8
7-Oct	74.0	62.8	63.0	48.4	37.0	80.5	63.6	61.0	45.0
14-Oct	72.0	62.3	60.5	45.6	35.0	75.6	66.7	56.3	41.6
21-Oct	66.0	56.8	56.6	43.4	34.0	71.4	61.5	51.9	38.3
28-Oct	66.0	59.3	54.6	41.0	30.0	70.0	61.4	47.0	34.7
4-Nov	61.0	54.9	50.5	39.8	29.0	66.5	57.2	44.5	33.3
11-Nov	59.0	53.8	48.7	37.7	26.0	60.9	57.5	41.2	30.3
18-Nov	57.0	50.1	47.2	37.3	25.0	54.6	53.2	38.8	28.9
25-Nov	57.0	52.4	45.0	35.3	22.0	59.5	55.2	36.7	27.0
2-Dec	55.0	50.5	41.7	33.2	19.0	51.8	53.0	32.8	24.8
9-Dec	54.0	49.1	42.4	33.5	19.0	53.2	52.4	33.5	25.1
16-Dec	54.0	49.5	40.6	32.1	16.0	51.8	52.6	32.2	23.6
23-Dec	55.0	51.5	41.4	33.9	20.0	59.5	55.2	34.0	25.1
31-Dec	55.0	51.1	40.4	32.2	12.0	51.8	51.8	32.0	24.3



	Mean Cooling Degree Days (°F)	Mean Heating Degree Days (°F)
JAN	0	917
FEB	0	807
MAR	1	655
APR	9	469
MAY	41	250
JUN	93	124
JUL	158	67
AUG	148	71
SEP	46	183
OCT	4	440
NOV	0	701
DEC	0	866
ANN	500	5550

MANNHEIN, GERMANY

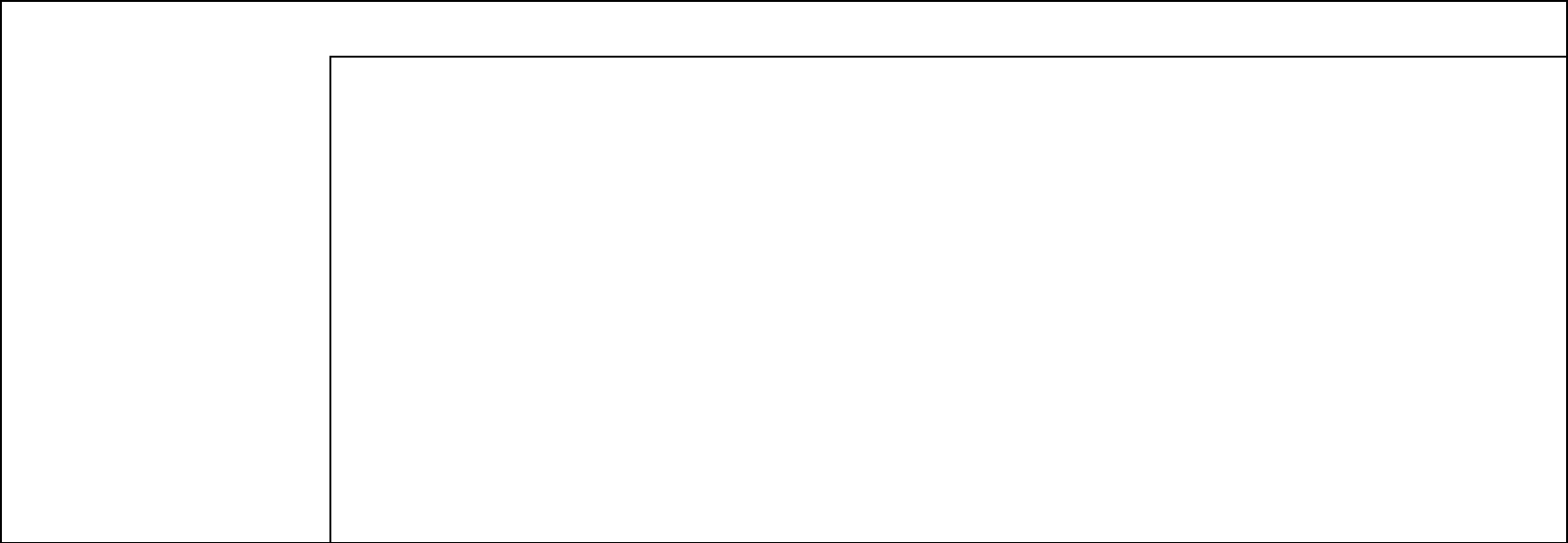
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	Average Sensible Cooling Load	Average Sensible Heating Load	Average Latent Cooling Load	Average Latent Heating Load
	(Btu/cfm)	(Btu/cfm)	(Btu/cfm)	(Btu/cfm)
JAN	0	-26170	0	-2214
FEB	0	-23111	0	-2406
MAR	1	-19384	0	-1494
APR	12	-14383	0	-762
MAY	120	-8458	18	-95
JUN	442	-4707	288	-5
JUL	1032	-2865	672	-1
AUG	866	-3019	459	0
SEP	134	-6565	94	-4
OCT	3	-13769	5	-180
NOV	0	-20508	0	-967
DEC	0	-24869	0	-1819
ANN	2610	-167808	1536	-9947

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

No Solar Radiation
Data Available

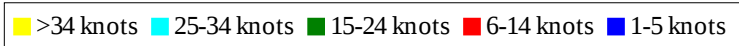
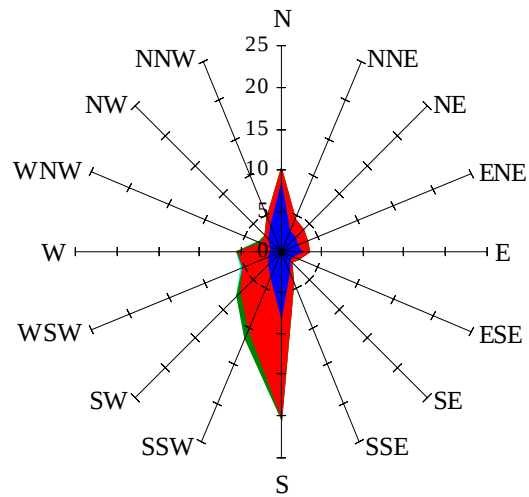


Average Annual Solar Heat and Illumination – Nearest Available Site

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

Wind Summary - December, January, and February

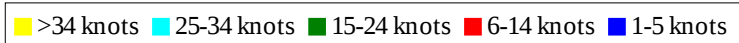
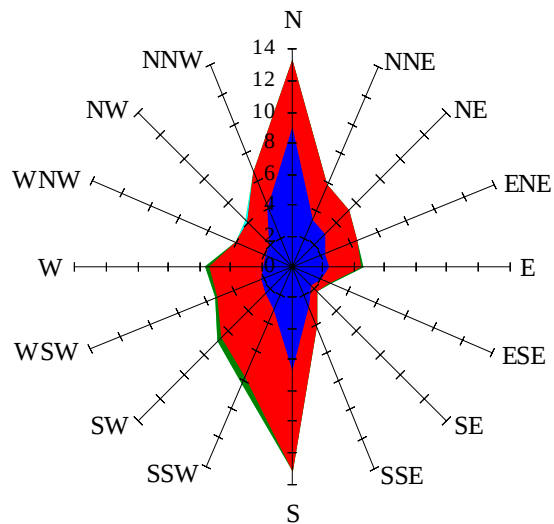
Labels of Percent Frequency on North Axis



Percent Calm = 7.41

Wind Summary - March, April, and May

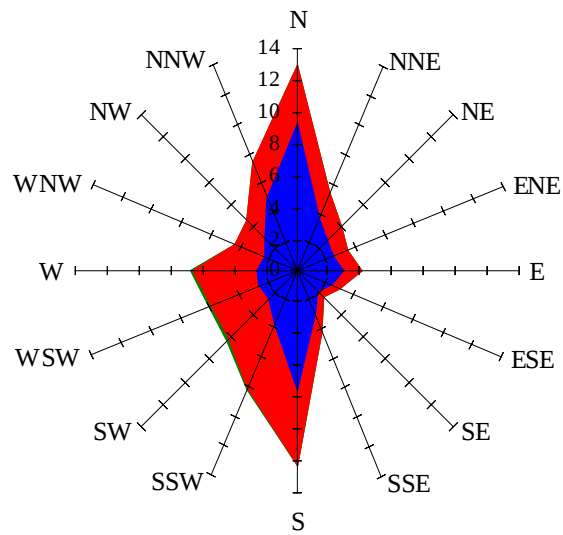
Labels of Percent Frequency on North Axis



Percent Calm = 4.95

Wind Summary - June, July, and August

Labels of Percent Frequency on North Axis

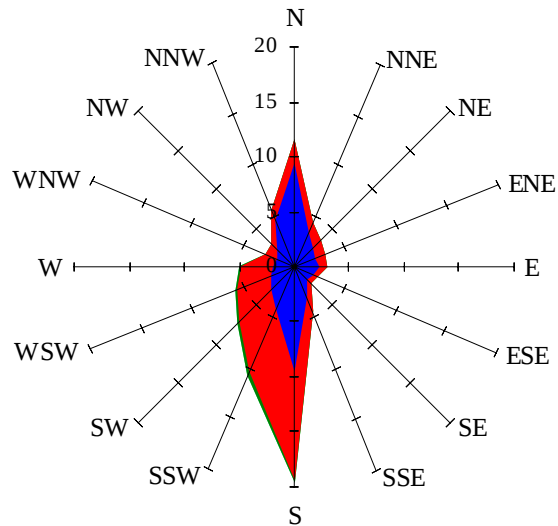


■ >34 knots
 ■ 25-34 knots
 ■ 15-24 knots
 ■ 6-14 knots
 ■ 1-5 knots

Percent Calm = 6.02

Wind Summary - September, October, and November

Labels of Percent Frequency on North Axis



■ >34 knots
 ■ 25-34 knots
 ■ 15-24 knots
 ■ 6-14 knots
 ■ 1-5 knots

Percent Calm = 7.75