

ULM, GERMANY

Latitude = 48.38 N

Longitude = 9.95 E

Period of Record = 1973 to 1996

WMO No. 108380

Elevation = 1716 feet

Average Pressure = 28.12 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	89	67	72	4.0	S
0.4% Occurrence	83	65	72	4.8	ENE
1.0% Occurrence	81	65	72	4.9	E
2.0% Occurrence	78	64	72	5.1	ENE
Mean Daily Range	13	-	-	-	-
97.5% Occurrence	20	19	14	4.7	ENE
99.0% Occurrence	15	14	11	5.0	NE
99.6% Occurrence	10	9	8	4.5	NE
Median of Extreme Lows	7	7	7	4.8	NNE
	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	71	83	98	4.2	S
0.4% Occurrence	68	79	88	4.7	S
1.0% Occurrence	66	76	83	4.6	SSW
2.0% Occurrence	65	75	81	4.6	SSW
	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	102	76	0.65	4.2	S
0.4% Occurrence	95	72	0.60	4.4	SSW
1.0% Occurrence	90	72	0.57	4.5	SSW
2.0% Occurrence	85	70	0.54	4.5	SSW
Air Conditioning/ Humid Area Criteria	# of Hours	T ≥ 93°F	T ≥ 80°F	T _{wb} ≥ 73°F	T _{wb} ≥ 67°F
		1	109	0	79

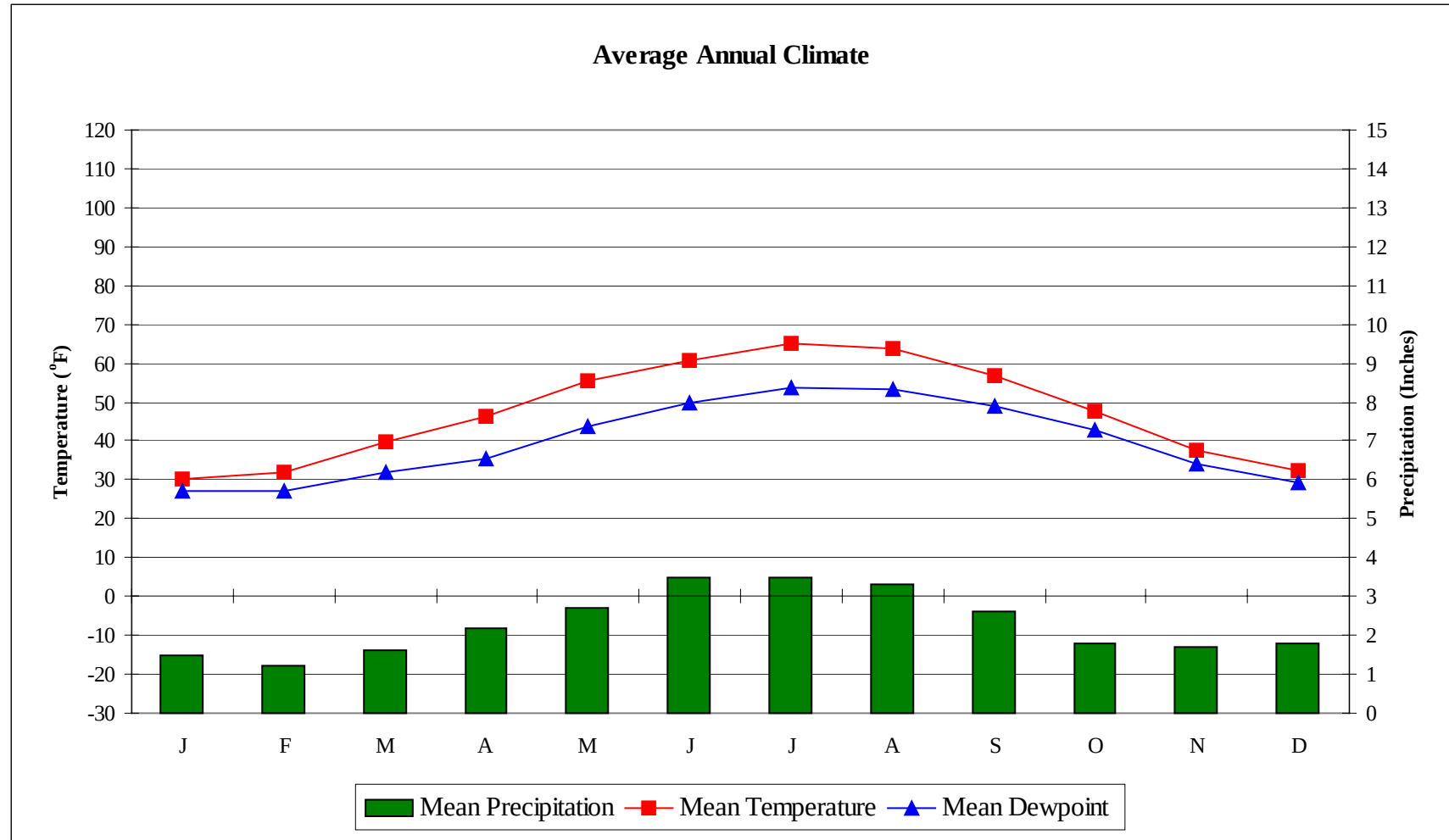
Other Site Data

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	0.0 + 0.1
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 (#)
50.0	N/A	N/A	46

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

ULM, GERMANY

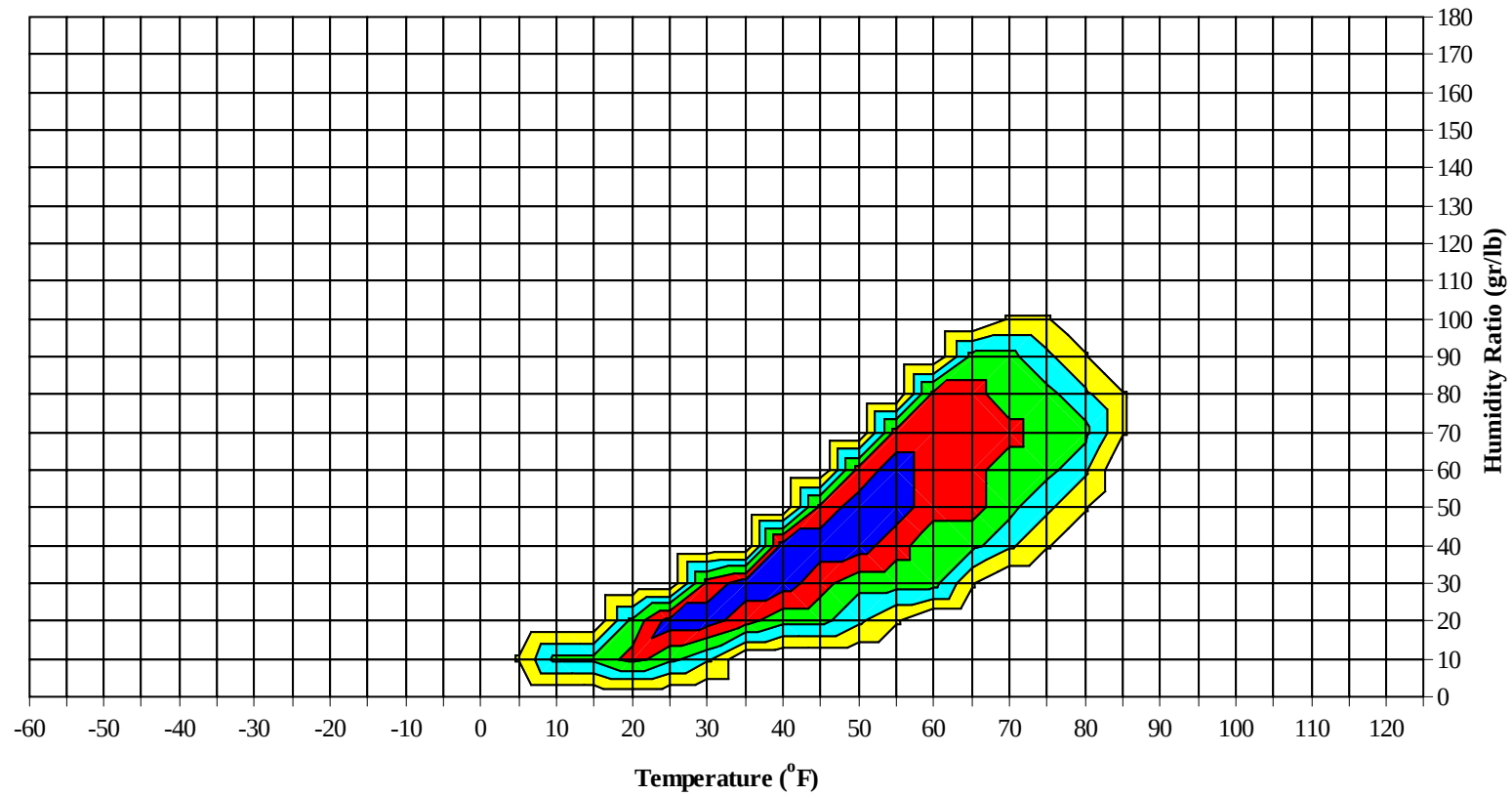
WMO No. 108380



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Long Term Psychrometric Summary

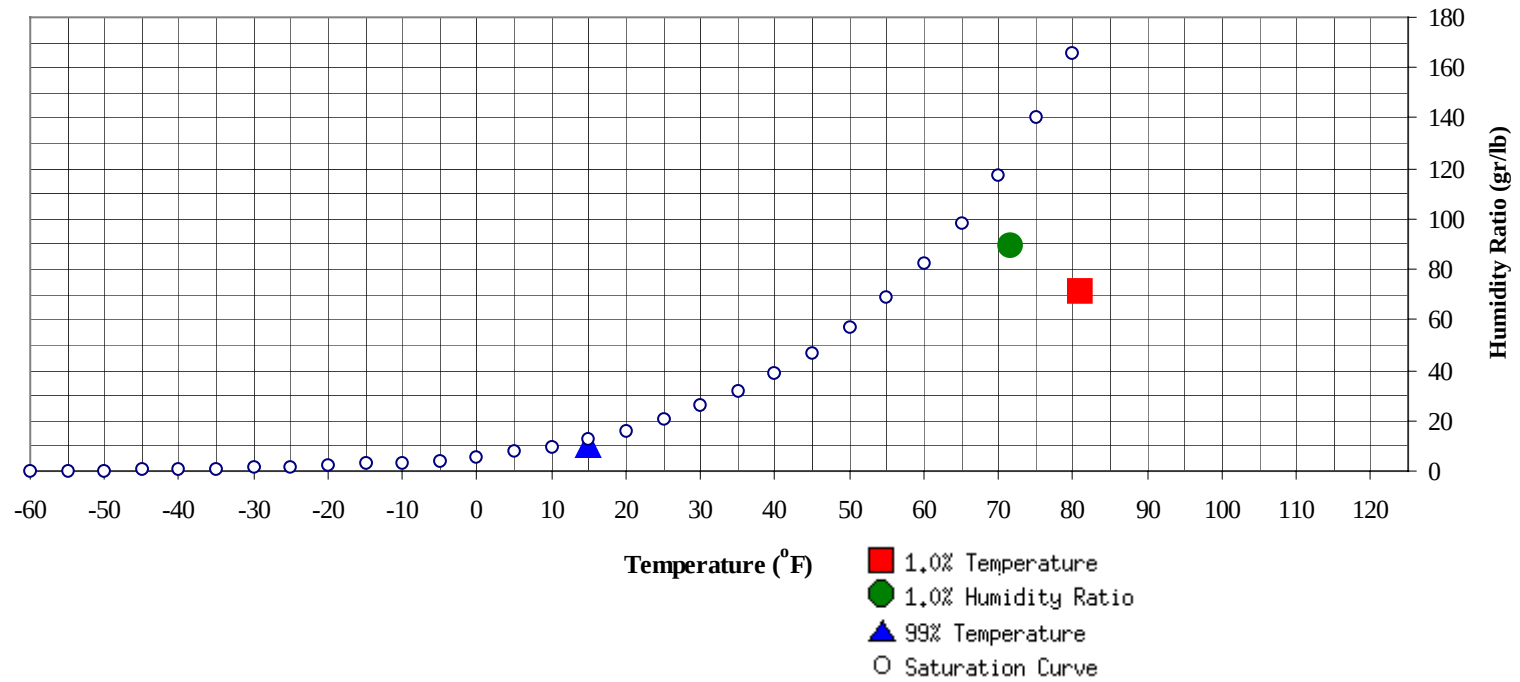


- 50% of all observations
- 80% of all observations
- 95% of all observations
- 97.5% of all observations
- 99% of all observations

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Psychrometric Summary of Peak Design Values



	(°F)	MCHR	Enthalpy	1.0% Humidity Ratio	(gr/lb)	MCDB	MCWB	MC Dewpt	Enthalpy
		(gr/lb)	(btu/lb)			(°F)	(°F)	(°F)	(btu/lb)
99% Dry Bulb	15	10.4	5.2	Ratio	89.6	71.6	65.4	62.4	31.2

1.0% Dry Bulb	(°F)	MCHR	MCWB	Enthalpy
		(gr/lb)	(°F)	(btu/lb)
81	71.5	64.4	30.6	

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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	56.0
70 / 74												1	0	1	54.0
65 / 69							0		0	49.3		1	0	1	52.3
60 / 64							1	0	1	49.8		7	5	12	50.8
55 / 59		0	0	0	48.0		2	1	3	48.2	0	16	13	29	48.2
50 / 54	0	2	1	3	46.4	0	6	4	9	44.8	4	27	26	57	45.2
45 / 49	6	9	9	24	43.6	1	15	13	29	42.2	20	43	46	109	42.2
40 / 44	15	23	22	61	39.5	12	26	26	64	39.0	39	46	42	127	38.6
35 / 39	37	48	47	132	35.4	36	46	50	131	35.2	54	54	54	162	34.4
30 / 34	67	69	67	203	30.8	68	57	61	186	30.6	77	38	41	156	30.4
25 / 29	54	44	52	150	26.1	47	38	40	125	25.8	35	11	16	62	25.7
20 / 24	32	24	25	80	21.6	22	20	18	60	20.7	13	4	4	21	21.0
15 / 19	19	15	17	52	16.8	22	10	7	40	16.2	4	1	1	6	16.7
10 / 14	12	8	6	27	11.7	10	3	4	16	11.7	1	0	0	1	12.6
5 / 9	4	3	1	8	6.7	4	1		6	6.7	0	0		0	7.3
0 / 4	1	1	1	4	1.9	1	0		1	2.3	0			0	4.0
-5 / -1	0	1	0	1	-2.1										
-10 / -6	0	0	0	0	-7.8										
-15 / -11	0	0		0	-11.0										

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.

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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															
85 / 89												1	0	1	66.9
80 / 84							1	0	1	63.2		7	5	12	64.5
75 / 79		0	0	0	56.1		6	5	12	60.1		22	21	44	62.8
70 / 74		5	4	9	53.6		21	17	38	57.4	1	34	33	69	60.6
65 / 69		9	10	19	52.3	0	32	27	59	55.4	7	41	39	87	58.2
60 / 64	0	21	21	42	50.3	5	49	43	97	53.2	33	51	48	133	55.9
55 / 59	4	32	30	66	48.0	32	55	56	144	50.7	67	49	47	163	52.7
50 / 54	17	43	39	99	45.3	71	45	52	168	48.0	74	28	35	137	49.4
45 / 49	40	45	46	131	42.2	79	29	32	139	44.4	47	7	12	66	45.8
40 / 44	53	43	44	140	38.8	39	9	11	58	40.3	9	0	0	9	41.5
35 / 39	65	32	33	130	35.1	17	2	4	24	36.3	1	0		1	37.7
30 / 34	53	9	12	74	31.1	5	0	0	5	31.8					
25 / 29	9	1	1	11	26.4	0			0	28.0					
20 / 24	0			0	22.8										
15 / 19															
10 / 14															
5 / 9															
0 / 4															
-5 / -1															
-10 / -6															
-15 / -11															

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WMO No. 108380

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	09	17			01	09	17			01	09	17					
	To 08	To 16	To 00			To 08	To 16	To 00			To 08	To 16	To 00					
95 / 99	0			0	69.0	0			0	67.3	0			0	65.4			
90 / 94	1			0	1	68.4	0			0	66.9	0			0	64.4		
85 / 89	5			4	9	67.5	3			3	66.9	0			0	65.4		
80 / 84	18			12	30	65.2	15			11	26	65.4	3			1	5	64.4
75 / 79	0	35	33	68	64.0	0	34	23	57	63.7	10			6	16	63.7		
70 / 74	4	52	44	100	61.7	2	48	38	88	61.7	22			13	35	61.3		
65 / 69	21	47	47	115	59.8	12	48	50	110	59.7	30			24	54	59.1		
60 / 64	69	47	52	168	57.6	56	54	60	170	57.6	6	48	45	99	56.2			
55 / 59	80	33	38	151	54.1	88	34	41	163	54.3	43	61	61	166	53.2			
50 / 54	58	10	16	84	50.4	60	12	18	90	50.4	78	45	54	177	49.5			
45 / 49	16	1	1	18	46.2	22	1	4	27	45.9	69	16	31	116	45.5			
40 / 44	1			1	42.6	5		0	5	41.8	32	3	6	41	41.4			
35 / 39						1			1	37.9	12	0	0	12	37.0			
30 / 34											0			0	33.8			
25 / 29																		
20 / 24																		
15 / 19																		
10 / 14																		
5 / 9																		
0 / 4																		
-5 / -1																		
-10 / -6																		
-15 / -11																		

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ULM, GERMANY

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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	62.0										
75 / 79		1		1	61.1										
70 / 74		3	0	3	60.1										
65 / 69		5	4	9	58.3										
60 / 64	0	18	10	28	55.4		1	0	1	53.6					
55 / 59	7	37	33	76	52.8	0	4	1	5	51.1	0	1	0	1	49.9
50 / 54	43	59	59	162	49.3	6	16	12	33	48.0	3	4	3	9	47.0
45 / 49	60	57	60	177	44.7	21	35	35	90	44.3	9	18	17	44	43.7
40 / 44	56	39	50	145	40.5	41	47	55	143	40.4	19	27	29	75	39.9
35 / 39	54	22	28	104	36.5	61	65	62	187	35.8	44	50	52	146	35.5
30 / 34	24	6	4	34	31.8	65	46	48	159	31.4	72	69	69	210	31.0
25 / 29	4	1	0	5	27.4	28	19	19	65	26.1	56	49	46	151	26.2
20 / 24	0		0	0	22.7	12	7	7	27	21.3	21	16	17	54	21.5
15 / 19			0	0	18.0	6	1	1	8	17.1	15	9	9	32	16.9
10 / 14						1	0	0	1	12.1	5	3	4	13	11.6
5 / 9						0	0		0	7.4	3	1	3	7	6.6
0 / 4											1	1	0	2	1.8
-5 / -1															
-10 / -6															
-15 / -11															

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

Period of Record = 1973 to 1996

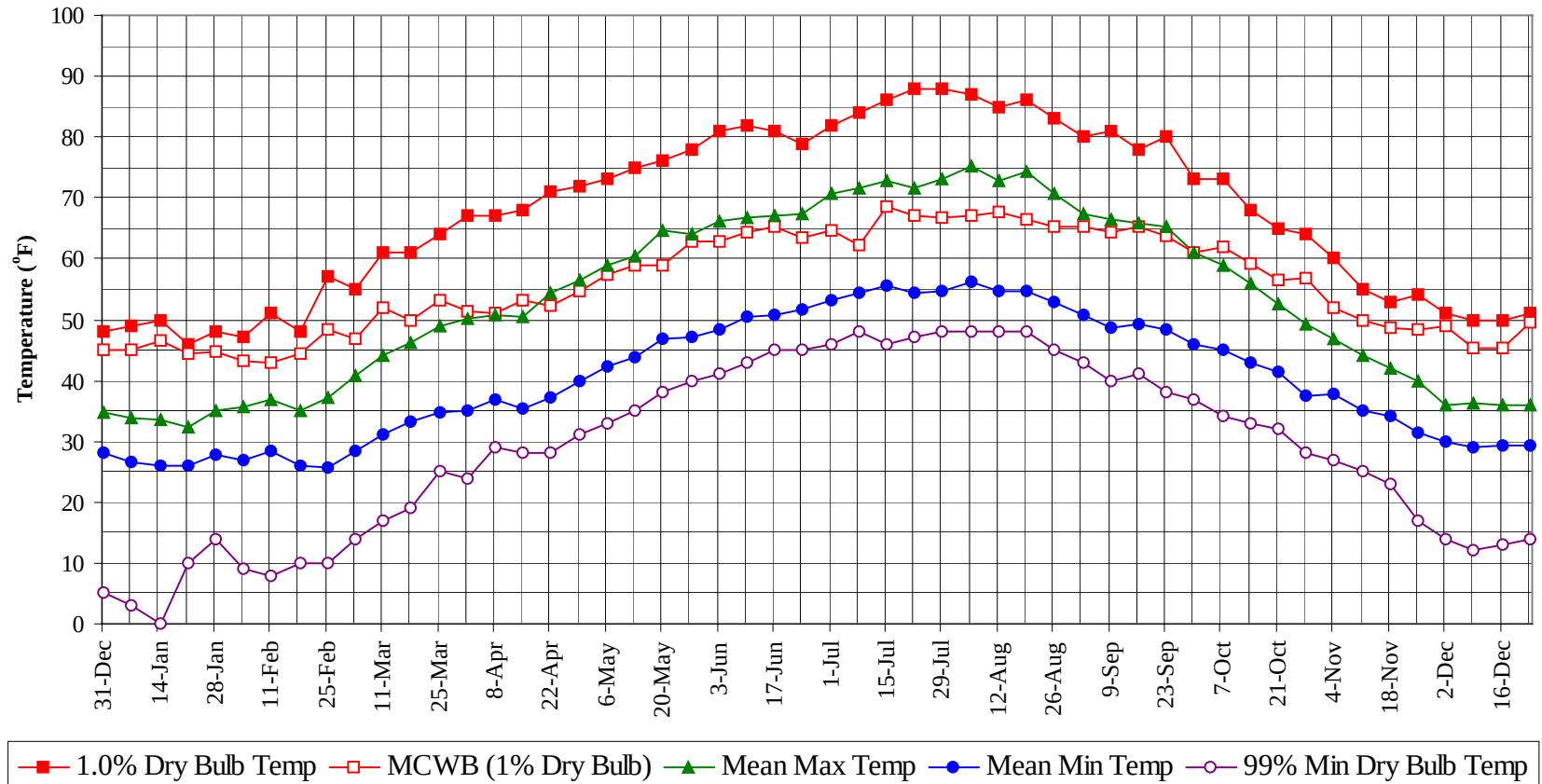
Annual Totals					
Temperature Range (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00		
95 / 99		0		0	69.0
90 / 94		1	1	3	68.1
85 / 89		10	7	16	67.2
80 / 84		45	30	75	65.0
75 / 79	0	109	86	195	63.4
70 / 74	6	187	145	339	60.7
65 / 69	44	215	194	453	58.4
60 / 64	182	299	278	759	55.8
55 / 59	339	326	318	984	52.4
50 / 54	435	297	317	1048	48.5
45 / 49	400	273	306	980	44.0
40 / 44	317	262	288	867	39.7
35 / 39	370	315	335	1020	35.4
30 / 34	410	291	309	1010	30.9
25 / 29	218	160	178	556	26.1
20 / 24	94	71	72	237	21.3
15 / 19	61	36	35	132	16.7
10 / 14	27	14	14	56	11.7
5 / 9	12	5	4	21	6.7
0 / 4	5	2	1	9	2.0
-5 / -1	0	1	0	1	-2.1
-10 / -6	0	0	0	0	-7.8
-15 / -11	0	0		0	-11.0

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.

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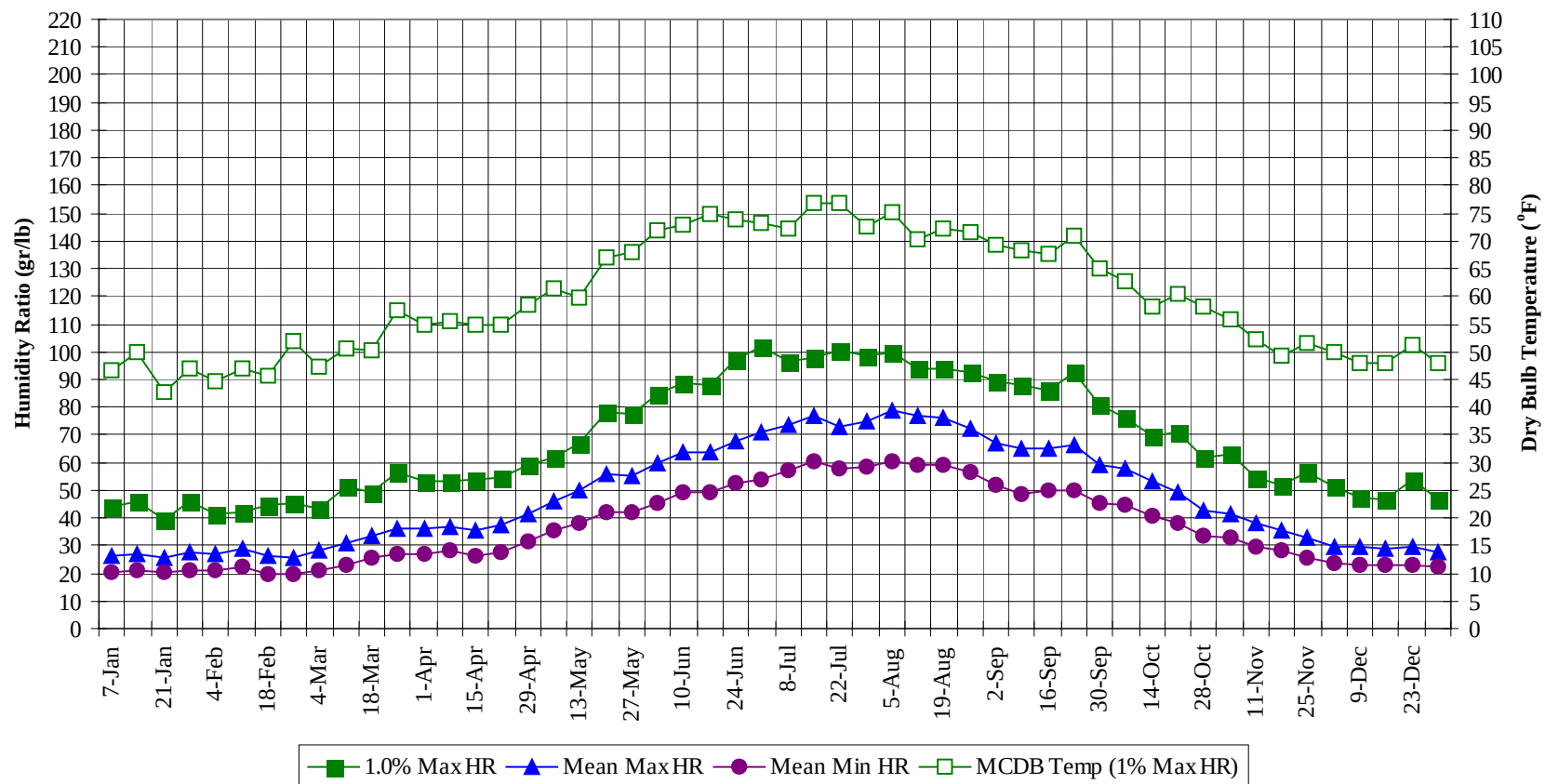
Annual Summary of Temperatures



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Long Term Humidity and Dry Bulb Temperature Summary



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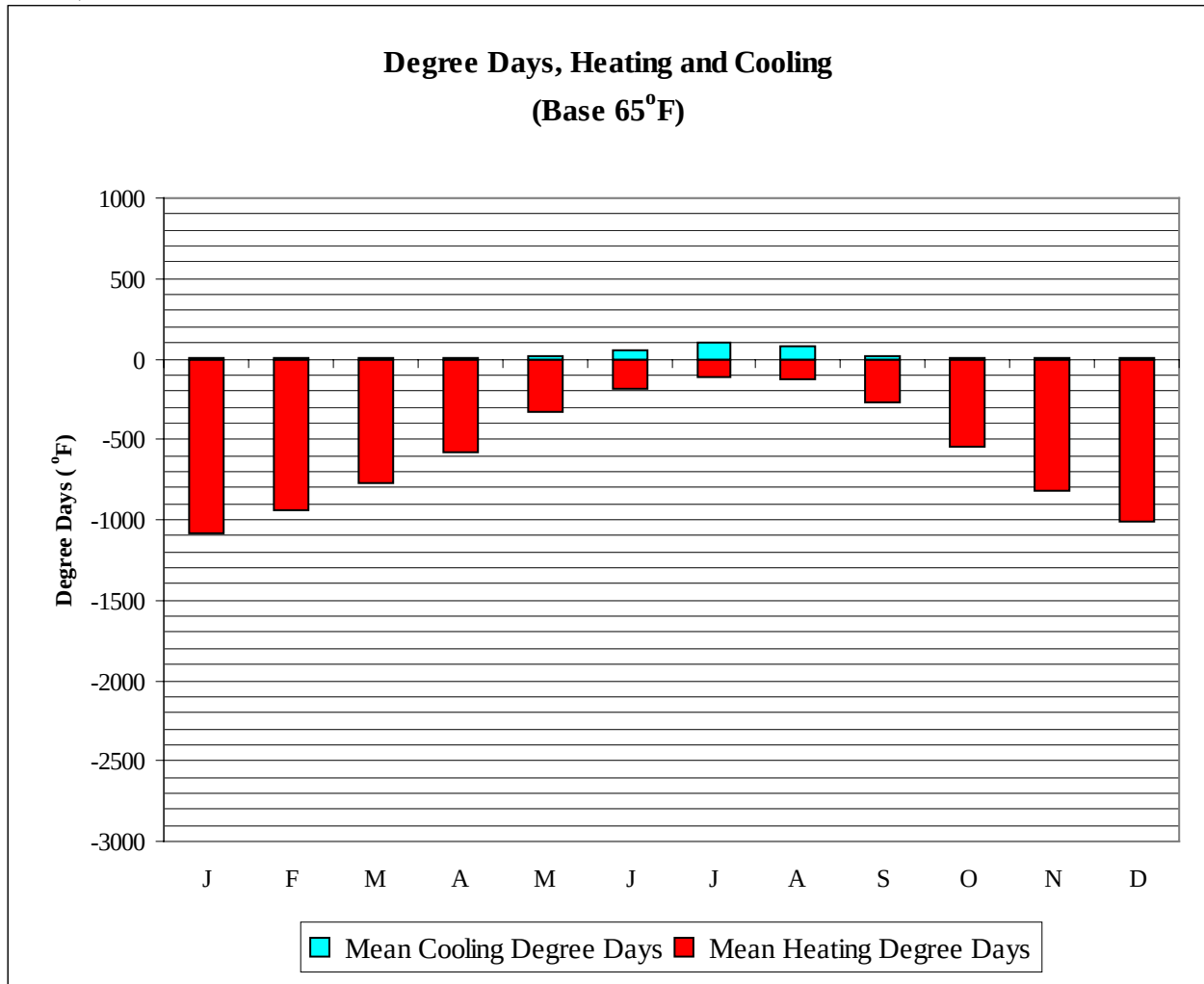
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Long Term Dry Bulb Temperature and Humidity Summary

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	49.0	45.0	33.8	26.6	3.0	44.1	46.6	26.6	20.6
14-Jan	50.0	46.4	33.5	25.9	0.0	46.2	50.1	26.6	20.9
21-Jan	46.0	44.4	32.4	25.9	10.0	39.2	42.8	25.4	20.2
28-Jan	48.0	44.7	35.1	27.7	14.0	46.2	46.8	27.8	21.2
4-Feb	47.0	43.3	35.6	27.0	9.0	41.3	44.5	27.1	21.0
11-Feb	51.0	42.8	37.0	28.5	8.0	42.0	46.9	29.0	22.1
18-Feb	48.0	44.4	35.0	26.1	10.0	44.8	45.7	26.1	19.7
25-Feb	57.0	48.4	37.1	25.7	10.0	45.5	51.7	25.9	19.7
4-Mar	55.0	46.7	40.8	28.5	14.0	43.4	47.3	28.5	21.2
11-Mar	61.0	51.9	44.0	31.1	17.0	51.1	50.5	30.7	23.2
18-Mar	61.0	49.9	46.3	33.2	19.0	49.0	50.4	33.6	25.5
25-Mar	64.0	53.3	49.0	34.9	25.0	56.7	57.5	36.1	26.9
1-Apr	67.0	51.5	50.1	35.2	24.0	53.2	55.0	36.0	26.9
8-Apr	67.0	51.2	50.8	36.9	29.0	53.2	55.4	36.9	28.1
15-Apr	68.0	53.1	50.5	35.5	28.0	53.9	54.7	35.4	26.6
22-Apr	71.0	52.3	54.4	37.1	28.0	54.6	54.8	37.6	27.5
29-Apr	72.0	54.7	56.5	39.9	31.0	58.8	58.5	41.5	31.2
6-May	73.0	57.4	58.9	42.3	33.0	61.6	61.4	46.2	35.5
13-May	75.0	58.9	60.5	43.8	35.0	67.2	59.9	49.8	37.8
20-May	76.0	58.8	64.7	46.8	38.0	78.4	67.1	55.6	41.9
27-May	78.0	62.8	63.9	47.0	40.0	77.7	68.0	55.2	42.0
3-Jun	81.0	62.9	66.3	48.4	41.0	84.7	71.9	59.5	45.2
10-Jun	82.0	64.2	66.6	50.5	43.0	88.9	72.8	63.8	49.0
17-Jun	81.0	65.3	67.0	50.8	45.0	88.2	75.0	63.4	49.2
24-Jun	79.0	63.4	67.4	51.7	45.0	97.3	73.9	67.4	52.2
1-Jul	82.0	64.7	70.7	53.2	46.0	101.5	73.3	70.6	53.9
8-Jul	84.0	62.2	71.6	54.5	48.0	96.6	72.2	73.4	57.2
15-Jul	86.0	68.6	72.8	55.5	46.0	98.0	76.7	76.6	60.1
22-Jul	88.0	67.1	71.6	54.2	47.0	100.8	77.0	73.1	57.7
29-Jul	88.0	66.9	73.1	54.7	48.0	98.7	72.6	75.2	58.3
5-Aug	87.0	66.9	75.2	56.3	48.0	100.1	75.1	78.8	60.4
12-Aug	85.0	67.7	72.9	54.6	48.0	93.8	70.3	77.1	59.4
19-Aug	86.0	66.5	74.2	54.6	48.0	93.8	72.4	76.5	58.9
26-Aug	83.0	65.3	70.6	52.9	45.0	92.4	71.6	72.2	56.2
2-Sep	80.0	65.2	67.4	50.6	43.0	89.6	69.3	67.0	51.8
9-Sep	81.0	64.4	66.5	48.7	40.0	88.2	68.4	64.8	48.8
16-Sep	78.0	65.3	65.9	49.3	41.0	86.1	67.5	65.1	49.9
23-Sep	80.0	63.7	65.2	48.5	38.0	92.4	71.0	66.3	49.8
30-Sep	73.0	61.0	61.1	45.8	37.0	80.5	64.9	59.2	45.2
7-Oct	73.0	61.8	58.9	45.2	34.0	76.3	62.7	57.6	44.8
14-Oct	68.0	59.2	55.9	43.0	33.0	69.3	58.3	52.9	40.7
21-Oct	65.0	56.5	52.5	41.4	32.0	70.7	60.3	49.2	37.8
28-Oct	64.0	56.8	49.4	37.6	28.0	61.6	58.1	42.9	33.3
4-Nov	60.0	52.0	46.8	37.7	27.0	63.0	55.9	41.5	32.7
11-Nov	55.0	50.0	44.0	35.1	25.0	54.6	52.3	37.9	29.6
18-Nov	53.0	48.6	42.1	34.0	23.0	51.8	49.1	35.8	28.1
25-Nov	54.0	48.3	39.9	31.4	17.0	56.7	51.4	33.0	25.4
2-Dec	51.0	49.0	36.1	29.8	14.0	51.1	49.9	29.4	23.9
9-Dec	50.0	45.2	36.2	29.0	12.0	47.6	47.9	29.3	23.0
16-Dec	50.0	45.4	35.9	29.4	13.0	46.9	47.8	29.1	23.0
23-Dec	51.0	49.4	35.9	29.4	14.0	53.9	51.1	29.8	23.1
31-Dec	48.0	45.1	34.7	28.1	5.0	46.9	47.9	27.7	22.2

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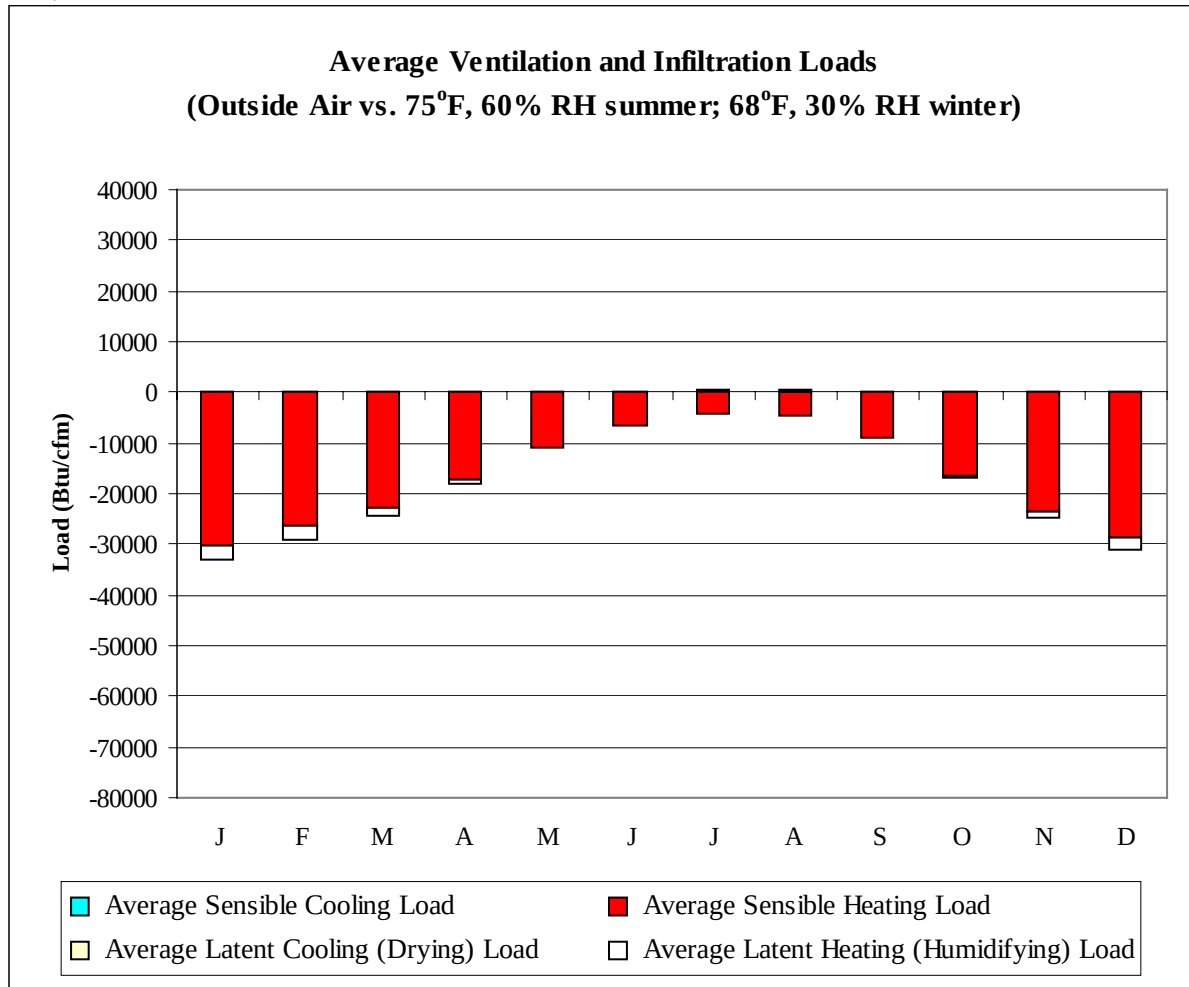
WMO No. 108380



	Mean Cooling Degree Days (°F)	Mean Heating Degree Days (°F)
JAN	0	1078
FEB	0	936
MAR	0	778
APR	3	576
MAY	17	329
JUN	49	186
JUL	96	108
AUG	81	120
SEP	22	266
OCT	2	543
NOV	0	822
DEC	0	1015
ANN	270	6757

ULM, GERMANY

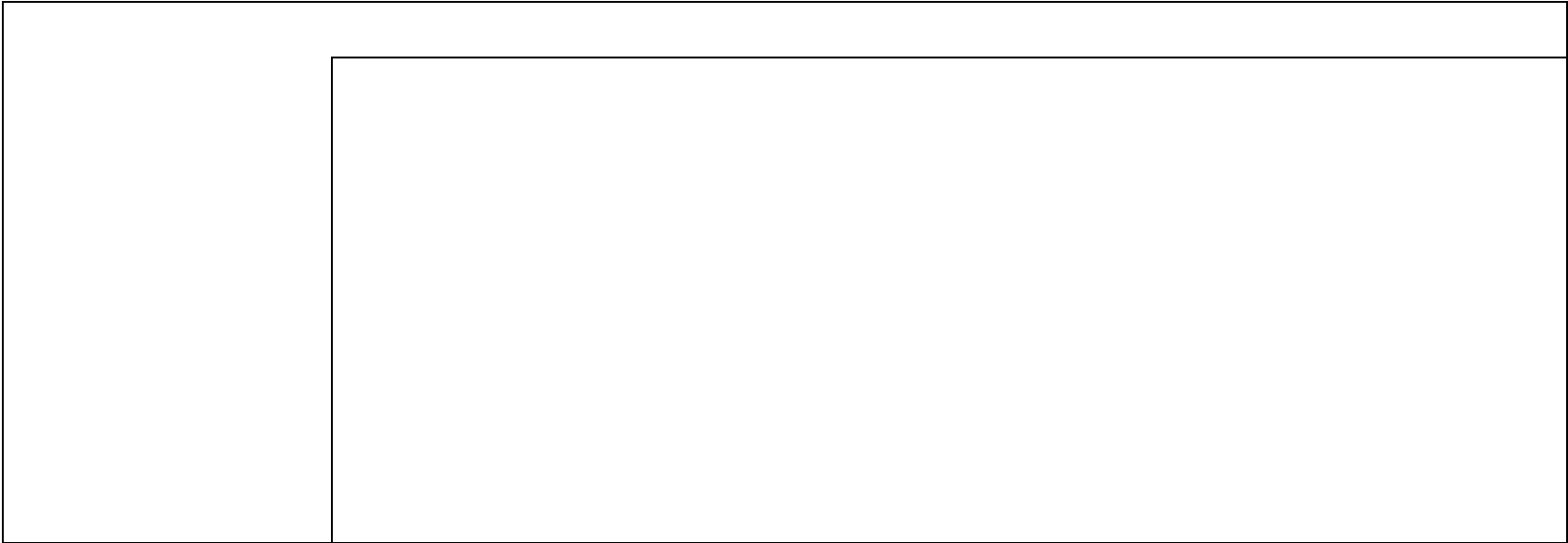
WMO No. 108380



	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	-30331	0	-2622
FEB	0	-26462	0	-2483
MAR	0	-22576	0	-1663
APR	0	-17286	0	-906
MAY	23	-10794	2	-124
JUN	137	-6672	81	-5
JUL	383	-4321	216	0
AUG	299	-4754	122	0
SEP	47	-9014	30	-12
OCT	1	-16457	0	-194
NOV	0	-23646	0	-1136
DEC	0	-28713	0	-2147
ANN	890	-201026	451	-11292

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

No Solar Radiation
Data Available

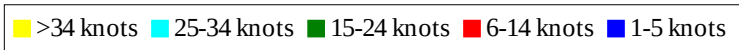
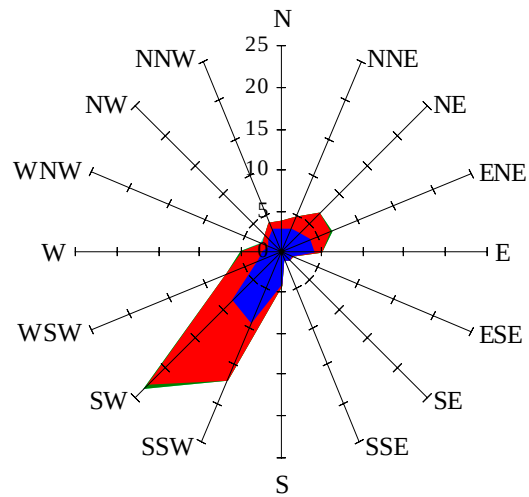


Average Annual Solar Heat and Illumination – Nearest Available Site

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

Wind Summary - December, January, and February

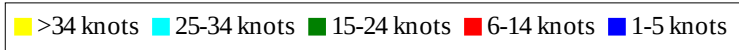
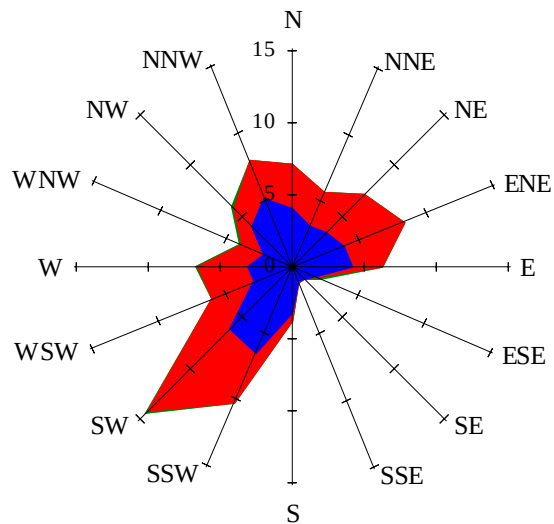
Labels of Percent Frequency on North Axis



Percent Calm = 4.78

Wind Summary - March, April, and May

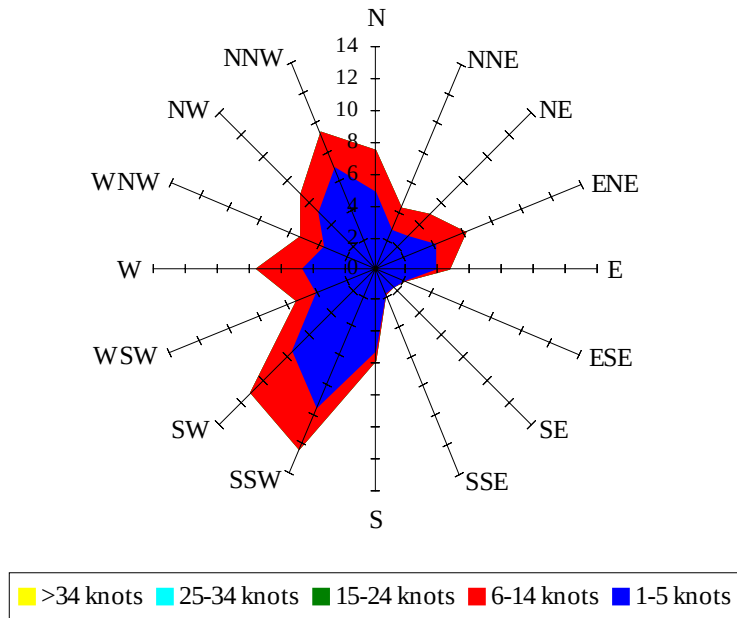
Labels of Percent Frequency on North Axis



Percent Calm = 3.42

Wind Summary - June, July, and August

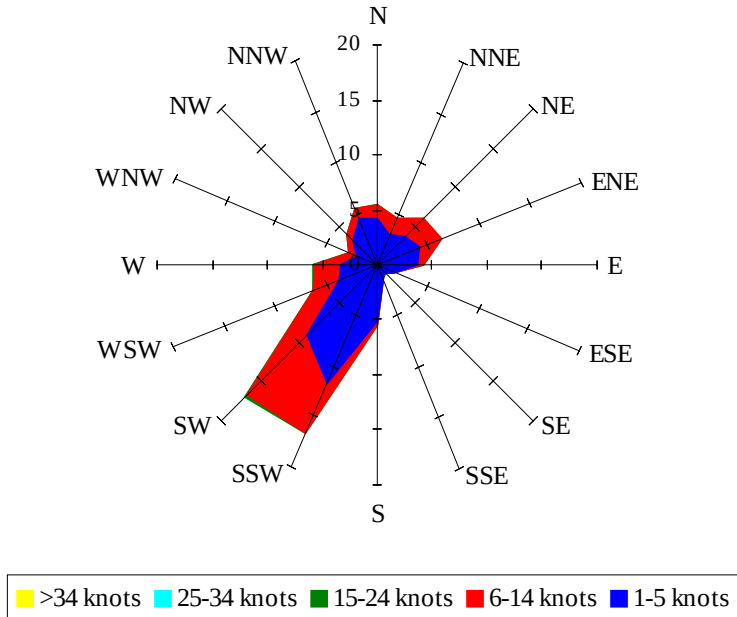
Labels of Percent Frequency on North Axis



Percent Calm = 4.65

Wind Summary - September, October, and November

Labels of Percent Frequency on North Axis



Percent Calm = 6.44