

**HOUGHTON MI**

Latitude = 47.17 N

Longitude = 88.50 W

Period of Record = 1973 to 1996

WMO No. 727440

Elevation = 1079 feet

Average Pressure = 28.78 inches Hg

**Design Criteria Data**

|                                                  | <b>Design Value</b> | Mean Coincident (Average) Values |                         |                        |                             |
|--------------------------------------------------|---------------------|----------------------------------|-------------------------|------------------------|-----------------------------|
|                                                  |                     | Wet Bulb Temperature (°F)        | Humidity Ratio (gr/lb)  | Wind Speed (mph)       | Prevailing Direction (NSEW) |
| <b>Dry Bulb Temperature (T)</b>                  | <b>(°F)</b>         |                                  |                         |                        |                             |
| Median of Extreme Highs                          | 92                  | 74                               | 104                     | 11.7                   | SSW                         |
| 0.4% Occurrence                                  | 85                  | 71                               | 95                      | 10.1                   | W                           |
| 1.0% Occurrence                                  | 81                  | 68                               | 87                      | 10.0                   | W                           |
| 2.0% Occurrence                                  | 78                  | 66                               | 83                      | 10.1                   | W                           |
| Mean Daily Range                                 | 14                  | -                                | -                       | -                      | -                           |
| 97.5% Occurrence                                 | 2                   | 1                                | 5                       | 10.4                   | W                           |
| 99.0% Occurrence                                 | -3                  | -3                               | 4                       | 11.0                   | W                           |
| 99.6% Occurrence                                 | -8                  | -8                               | 3                       | 11.5                   | NW                          |
| Median of Extreme Lows                           | -10                 | -10                              | 3                       | 11.7                   | WNW                         |
|                                                  | <b>Design Value</b> | Mean Coincident (Average) Values |                         |                        |                             |
|                                                  |                     | Dry Bulb Temperature (°F)        | Humidity Ratio (gr/lb)  | Wind Speed (mph)       | Prevailing Direction (NSEW) |
| <b>Wet Bulb Temperature (T<sub>wb</sub>)</b>     | <b>(°F)</b>         |                                  |                         |                        |                             |
| Median of Extreme Highs                          | 77                  | 88                               | 125                     | 10.4                   | S                           |
| 0.4% Occurrence                                  | 73                  | 82                               | 110                     | 9.8                    | W                           |
| 1.0% Occurrence                                  | 70                  | 77                               | 101                     | 9.3                    | W                           |
| 2.0% Occurrence                                  | 68                  | 75                               | 95                      | 9.0                    | W                           |
|                                                  | <b>Design Value</b> | Mean Coincident (Average) Values |                         |                        |                             |
|                                                  |                     | Dry Bulb Temperature (°F)        | Vapor Pressure (in. Hg) | Wind Speed (mph)       | Prevailing Direction (NSEW) |
| <b>Humidity Ratio (HR)</b>                       | <b>(gr/lb)</b>      |                                  |                         |                        |                             |
| Median of Extreme Highs                          | 130                 | 85                               | 0.82                    | 9.2                    | S                           |
| 0.4% Occurrence                                  | 114                 | 80                               | 0.74                    | 9.7                    | WSW                         |
| 1.0% Occurrence                                  | 106                 | 77                               | 0.69                    | 8.2                    | W                           |
| 2.0% Occurrence                                  | 99                  | 74                               | 0.65                    | 8.5                    | W                           |
| <b>Air Conditioning/<br/>Humid Area Criteria</b> | <b># of Hours</b>   | T ≥ 93°F                         | T ≥ 80°F                | T <sub>wb</sub> ≥ 73°F | T <sub>wb</sub> ≥ 67°F      |
|                                                  |                     | 3                                | 125                     | 41                     | 284                         |

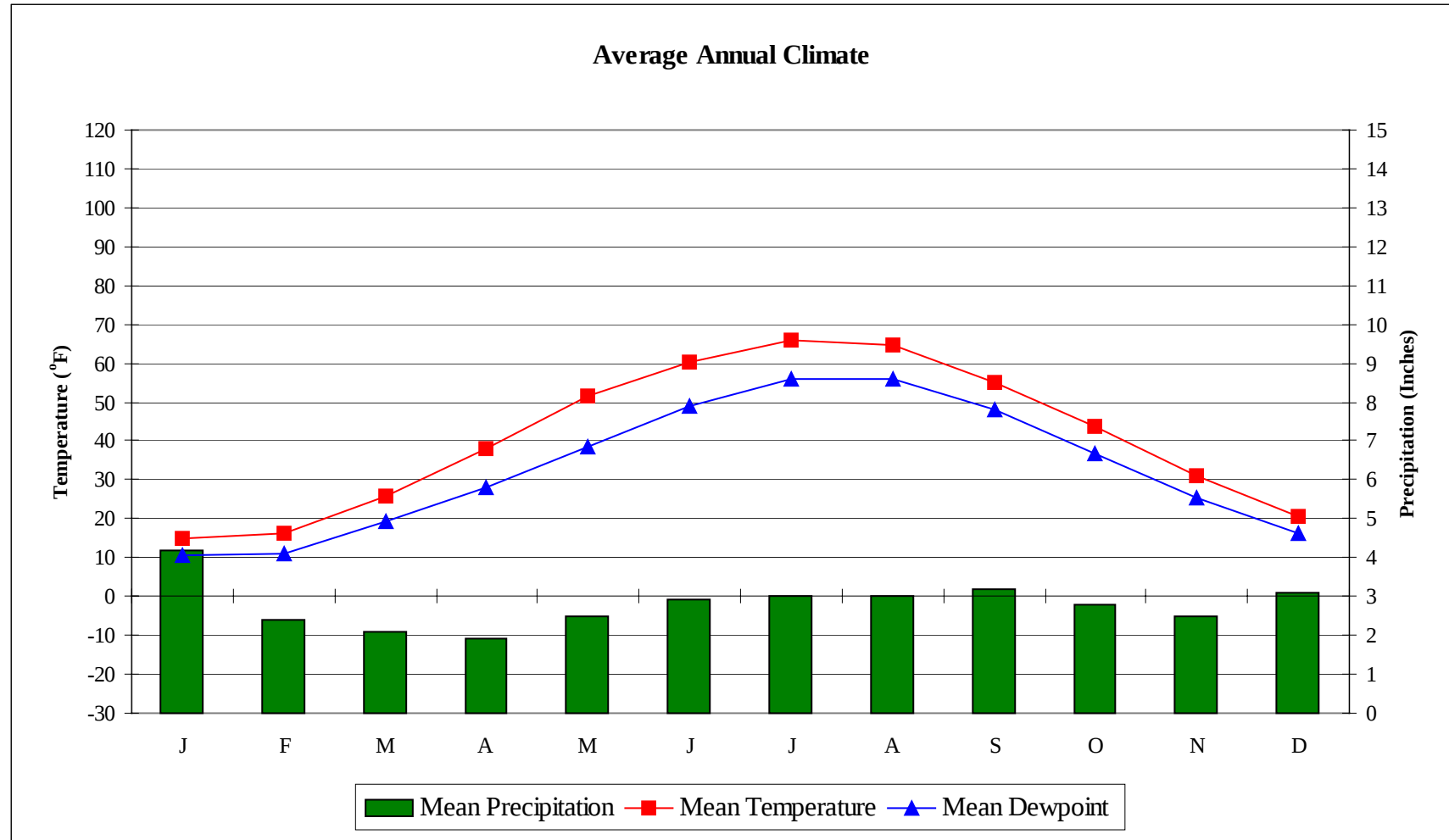
**Other Site Data**

| Weather Region                                      | Rain Rate<br>100 Year Recurrence<br>(in./hr) | Basic Wind Speed<br>3 sec gust @ 33 ft<br>50 Year Recurrence (mph) | Ventilation Cooling Load Index<br>(Ton-hr/cfm/yr) Base 75°F-RH 60%<br>Latent + Sensible |
|-----------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 5                                                   | 2.5                                          | 90                                                                 | 0.4 + 0.1                                                                               |
| Ground Water<br>Temperature (°F)<br>50 Foot Depth * | Frost Depth<br>50 Year Recurrence<br>(in.)   | Ground Snow Load<br>50 Year Recurrence<br>(lb/ft <sup>2</sup> )    | Average Annual<br>Freeze-Thaw Cycles<br>(#)                                             |
| 42.9                                                | N/A                                          | 48                                                                 | 49                                                                                      |

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

HOUGHTON MI

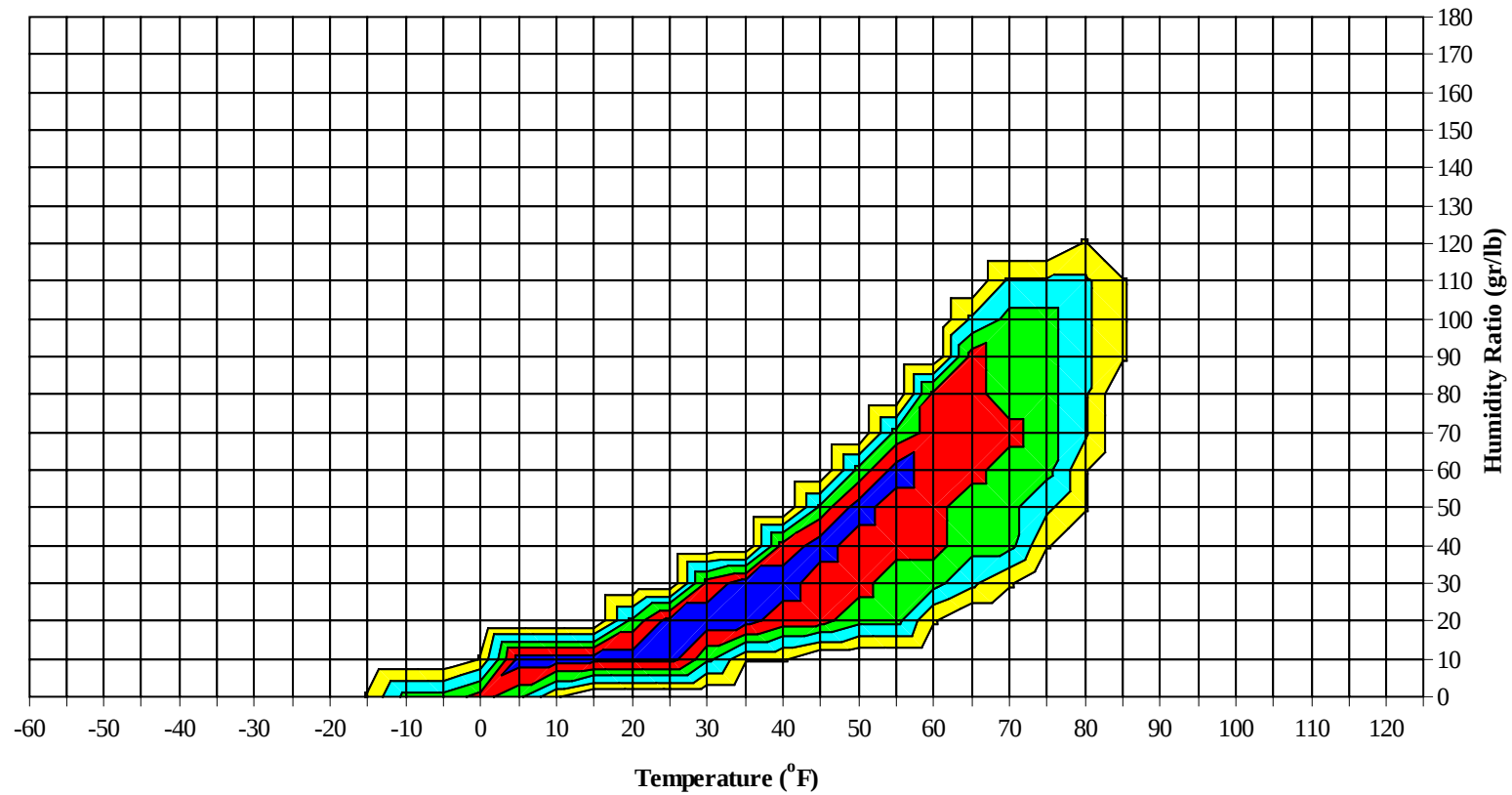
WMO No. 727440



HOUGHTON MI

WMO No. 727440

### Long Term Psychrometric Summary

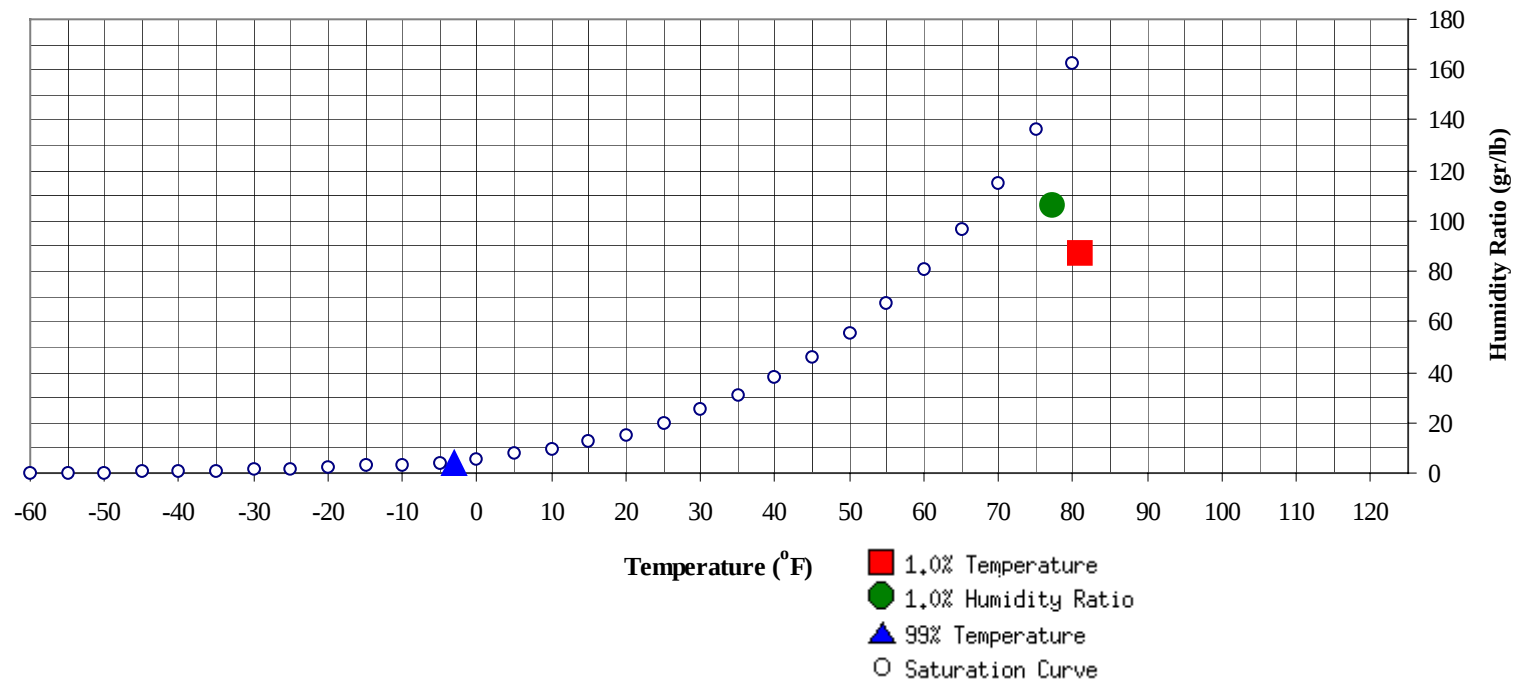


- 50% of all observations
- 80% of all observations
- 95% of all observations
- 97.5% of all observations
- 99% of all observations

HOUGHTON MI

WMO No. 727440

## Psychrometric Summary of Peak Design Values



| 99% Dry Bulb | (°F) | MCHR<br>(gr/lb) | Enthalpy<br>(btu/lb) | 1.0% Humidity<br>Ratio | (gr/lb) | MCDB<br>(°F) | MCWB<br>(°F) | MC Dewpt<br>(°F) | Enthalpy<br>(btu/lb) |
|--------------|------|-----------------|----------------------|------------------------|---------|--------------|--------------|------------------|----------------------|
|              | -3   | 3.8             | -0.1                 |                        | 106.4   | 77.1         | 70.7         | 68               | 35.2                 |

| 1.0% Dry Bulb | (°F) | MCHR<br>(gr/lb) | MCWB<br>(°F) | Enthalpy<br>(btu/lb) |
|---------------|------|-----------------|--------------|----------------------|
|               | 81   | 87.5            | 68.3         | 33.2                 |

HOUGHTON MI

WMO No. 727440

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

Period of Record = 1973 to 1996

| Temperature<br>Range<br>(°F) | January             |                |                |              |                          | February            |                |                |              |                          | March               |                |                |              |                          |
|------------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|
|                              | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
|                              | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          |
| 100 / 104                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 95 / 99                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 90 / 94                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 85 / 89                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 80 / 84                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 75 / 79                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 70 / 74                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 65 / 69                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                | 0              | 0            | 53.5                     |
| 60 / 64                      |                     |                |                |              |                          |                     |                |                |              |                          |                     | 0              | 0              | 0            | 53.0                     |
| 55 / 59                      |                     |                |                |              |                          |                     |                |                |              |                          |                     | 1              | 1              | 2            | 46.9                     |
| 50 / 54                      |                     |                |                |              |                          |                     | 0              |                | 0            | 44.0                     | 0                   | 3              | 2              | 5            | 44.9                     |
| 45 / 49                      |                     |                |                |              |                          | 0                   | 1              | 1              | 2            | 40.3                     | 1                   | 8              | 5              | 14           | 40.8                     |
| 40 / 44                      | 0                   | 1              | 0              | 1            | 36.7                     | 1                   | 3              | 3              | 7            | 36.8                     | 3                   | 20             | 13             | 36           | 37.3                     |
| 35 / 39                      | 3                   | 6              | 5              | 14           | 33.8                     | 3                   | 11             | 9              | 23           | 33.9                     | 20                  | 38             | 31             | 89           | 34.0                     |
| 30 / 34                      | 17                  | 22             | 22             | 61           | 30.5                     | 15                  | 26             | 24             | 64           | 30.6                     | 49                  | 54             | 50             | 152          | 30.4                     |
| 25 / 29                      | 28                  | 29             | 32             | 89           | 25.9                     | 24                  | 28             | 26             | 77           | 25.7                     | 48                  | 41             | 50             | 139          | 25.5                     |
| 20 / 24                      | 32                  | 40             | 33             | 106          | 20.9                     | 28                  | 33             | 31             | 93           | 20.7                     | 37                  | 31             | 33             | 101          | 20.5                     |
| 15 / 19                      | 39                  | 40             | 39             | 118          | 16.1                     | 32                  | 34             | 35             | 102          | 15.8                     | 34                  | 25             | 28             | 87           | 15.7                     |
| 10 / 14                      | 39                  | 42             | 41             | 122          | 11.1                     | 32                  | 32             | 33             | 98           | 11.0                     | 25                  | 15             | 18             | 58           | 10.9                     |
| 5 / 9                        | 37                  | 32             | 36             | 105          | 6.5                      | 40                  | 26             | 28             | 93           | 6.4                      | 17                  | 8              | 10             | 35           | 6.2                      |
| 0 / 4                        | 26                  | 18             | 22             | 66           | 1.6                      | 23                  | 17             | 21             | 60           | 1.4                      | 9                   | 3              | 5              | 16           | 1.5                      |
| -5 / -1                      | 12                  | 10             | 8              | 29           | -2.6                     | 13                  | 7              | 8              | 27           | -2.6                     | 4                   | 1              | 2              | 7            | -2.8                     |
| -10 / -6                     | 9                   | 6              | 6              | 20           | -6.9                     | 6                   | 4              | 4              | 14           | -6.8                     | 1                   | 1              | 1              | 3            | -6.9                     |
| -15 / -11                    | 4                   | 2              | 3              | 9            | -11.7                    | 3                   | 2              | 1              | 6            | -11.9                    | 0                   | 0              |                | 0            | -10.5                    |
| -20 / -16                    | 2                   | 1              | 1              | 4            | -16.8                    | 1                   | 1              | 1              | 3            | -16.1                    |                     |                |                |              |                          |
| -25 / -21                    | 0                   | 0              | 0              | 0            | -20.0                    | 1                   | 0              | 0              | 1            | -21.0                    |                     |                |                |              |                          |

**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.

HOUGHTON MI

WMO No. 727440

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

Period of Record = 1973 to 1996

| Temperature<br>Range<br>(°F) | April               |                |                |              |                          | May                 |                |                |              |                          | June                |                |                |              |                          |
|------------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|
|                              | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
|                              | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          |
| 100 / 104                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 95 / 99                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 90 / 94                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 85 / 89                      |                     | 0              |                | 0            | 67.5                     |                     | 0              |                | 0            | 74.0                     |                     | 0              | 0              | 0            | 68.5                     |
| 80 / 84                      |                     | 1              | 0              | 1            | 64.0                     |                     | 7              | 3              | 10           | 63.8                     |                     | 2              | 1              | 3            | 74.3                     |
| 75 / 79                      |                     | 1              | 0              | 1            | 62.8                     |                     | 7              | 3              | 10           | 63.8                     |                     | 4              | 2              | 6            | 71.2                     |
| 70 / 74                      |                     | 1              | 0              | 1            | 62.8                     | 0                   | 10             | 5              | 15           | 61.7                     | 0                   | 10             | 5              | 15           | 68.3                     |
| 65 / 69                      | 0                   | 4              | 1              | 5            | 57.0                     | 2                   | 20             | 11             | 33           | 58.7                     | 1                   | 24             | 13             | 38           | 64.5                     |
| 60 / 64                      | 0                   | 5              | 3              | 8            | 54.0                     | 7                   | 25             | 16             | 49           | 55.8                     | 6                   | 39             | 24             | 69           | 61.4                     |
| 55 / 59                      | 2                   | 8              | 4              | 14           | 51.3                     | 15                  | 31             | 25             | 71           | 52.8                     | 19                  | 43             | 35             | 97           | 58.4                     |
| 50 / 54                      | 2                   | 13             | 9              | 24           | 47.9                     | 24                  | 38             | 34             | 97           | 49.0                     | 37                  | 46             | 45             | 128          | 55.5                     |
| 45 / 49                      | 7                   | 20             | 15             | 41           | 44.6                     | 33                  | 36             | 40             | 109          | 45.7                     | 52                  | 37             | 46             | 135          | 51.8                     |
| 40 / 44                      | 14                  | 33             | 24             | 71           | 40.6                     | 46                  | 36             | 46             | 128          | 42.3                     | 57                  | 21             | 38             | 116          | 48.5                     |
| 35 / 39                      | 23                  | 40             | 36             | 98           | 36.9                     | 54                  | 22             | 39             | 116          | 38.8                     | 45                  | 10             | 22             | 77           | 44.5                     |
| 30 / 34                      | 53                  | 50             | 55             | 158          | 33.7                     | 42                  | 13             | 21             | 76           | 34.6                     | 18                  | 4              | 7              | 29           | 40.6                     |
| 25 / 29                      | 68                  | 39             | 52             | 159          | 30.0                     | 21                  | 6              | 7              | 34           | 30.5                     | 5                   | 1              | 2              | 8            | 36.2                     |
| 20 / 24                      | 38                  | 17             | 26             | 81           | 25.3                     | 3                   | 1              | 1              | 5            | 26.2                     | 0                   |                |                | 0            | 34.0                     |
| 15 / 19                      | 22                  | 8              | 11             | 40           | 20.5                     | 0                   |                |                | 0            | 23.0                     |                     |                |                |              |                          |
| 10 / 14                      | 8                   | 3              | 4              | 14           | 15.9                     |                     |                |                |              |                          |                     |                |                |              |                          |
| 5 / 9                        | 2                   | 1              | 1              | 4            | 11.1                     |                     |                |                |              |                          |                     |                |                |              |                          |
| 0 / 4                        | 1                   | 0              | 0              | 1            | 6.7                      |                     |                |                |              |                          |                     |                |                |              |                          |
| -5 / -1                      | 0                   | 0              |                | 0            | 2.4                      |                     |                |                |              |                          |                     |                |                |              |                          |
| -10 / -6                     |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -15 / -11                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -20 / -16                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -25 / -21                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |

**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.

HOUGHTON MI

WMO No. 727440

**Dry-Bulb Temperature Hours For An Average Year (Sheet 3 of 5)**

Period of Record = 1973 to 1996

| Temperature<br>Range<br>(°F) | July                |                |                |              |                          | August              |                |                |              |                          | September           |                |                |              |                          |
|------------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|
|                              | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
|                              | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          |
| 100 / 104                    |                     | 0              | 0              | 0            | 72.3                     |                     |                |                |              |                          |                     |                |                |              |                          |
| 95 / 99                      |                     | 1              | 0              | 1            | 74.3                     |                     | 0              |                | 0            | 74.5                     |                     |                |                |              |                          |
| 90 / 94                      |                     | 3              | 1              | 4            | 74.6                     |                     | 1              | 0              | 1            | 73.5                     |                     |                |                |              |                          |
| 85 / 89                      |                     | 7              | 4              | 11           | 72.8                     | 0                   | 5              | 2              | 7            | 71.9                     |                     | 1              | 0              | 1            | 73.8                     |
| 80 / 84                      | 1                   | 21             | 11             | 33           | 69.6                     | 0                   | 16             | 9              | 25           | 69.4                     |                     | 3              | 1              | 4            | 69.6                     |
| 75 / 79                      | 3                   | 43             | 25             | 71           | 66.0                     | 2                   | 35             | 18             | 56           | 66.9                     |                     | 0              | 10             | 4            | 14                       |
| 70 / 74                      | 15                  | 61             | 44             | 120          | 63.3                     | 14                  | 54             | 38             | 106          | 64.2                     | 3                   | 18             | 10             | 31           | 63.7                     |
| 65 / 69                      | 39                  | 56             | 56             | 151          | 60.9                     | 40                  | 60             | 55             | 156          | 61.7                     | 11                  | 27             | 21             | 58           | 60.7                     |
| 60 / 64                      | 69                  | 35             | 55             | 160          | 57.9                     | 67                  | 46             | 57             | 170          | 58.1                     | 25                  | 47             | 34             | 106          | 57.2                     |
| 55 / 59                      | 71                  | 13             | 36             | 121          | 54.2                     | 66                  | 24             | 45             | 135          | 54.2                     | 41                  | 52             | 50             | 144          | 53.1                     |
| 50 / 54                      | 39                  | 7              | 14             | 60           | 50.1                     | 45                  | 7              | 18             | 70           | 50.0                     | 62                  | 44             | 55             | 161          | 49.1                     |
| 45 / 49                      | 9                   | 1              | 2              | 12           | 45.8                     | 14                  | 0              | 4              | 18           | 45.4                     | 49                  | 26             | 37             | 111          | 44.6                     |
| 40 / 44                      | 1                   |                |                | 1            | 40.8                     | 1                   |                | 0              | 1            | 41.1                     | 32                  | 11             | 21             | 64           | 40.2                     |
| 35 / 39                      |                     |                |                |              |                          |                     |                |                |              |                          | 15                  | 2              | 6              | 23           | 35.6                     |
| 30 / 34                      |                     |                |                |              |                          |                     |                |                |              |                          | 2                   | 0              | 1              | 3            | 30.7                     |
| 25 / 29                      |                     |                |                |              |                          |                     |                |                |              |                          | 0                   |                |                | 0            | 28.0                     |
| 20 / 24                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 15 / 19                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 10 / 14                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 5 / 9                        |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 0 / 4                        |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -5 / -1                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -10 / -6                     |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -15 / -11                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -20 / -16                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| -25 / -21                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |

**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.

HOUGHTON MI

WMO No. 727440

**Dry-Bulb Temperature Hours For An Average Year (Sheet 4 of 5)**

Period of Record = 1973 to 1996

| Temperature<br>Range<br>(°F) | October             |                |                |              |                          | November            |                |                |              |                          | December            |                |                |              |                          |
|------------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|---------------------|----------------|----------------|--------------|--------------------------|
|                              | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
|                              | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          |
| 100 / 104                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 95 / 99                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 90 / 94                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 85 / 89                      |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |
| 80 / 84                      |                     | 0              | 0              | 0            | 61.8                     |                     |                |                |              |                          |                     |                |                |              |                          |
| 75 / 79                      |                     | 1              | 0              | 1            | 63.4                     |                     |                |                |              |                          |                     |                |                |              |                          |
| 70 / 74                      | 0                   | 3              | 1              | 4            | 58.9                     |                     | 0              |                | 0            | 58.5                     |                     |                |                |              |                          |
| 65 / 69                      | 1                   | 6              | 3              | 10           | 57.4                     |                     | 0              | 0              | 0            | 55.5                     |                     |                |                |              |                          |
| 60 / 64                      | 3                   | 12             | 8              | 24           | 54.8                     | 0                   | 1              | 0              | 1            | 53.5                     |                     |                |                |              |                          |
| 55 / 59                      | 9                   | 24             | 15             | 48           | 51.1                     | 0                   | 2              | 1              | 3            | 49.9                     |                     |                |                |              |                          |
| 50 / 54                      | 21                  | 41             | 34             | 96           | 47.5                     | 2                   | 8              | 5              | 15           | 47.4                     |                     |                | 0              | 0            | 52.0                     |
| 45 / 49                      | 40                  | 48             | 46             | 134          | 43.6                     | 9                   | 13             | 10             | 32           | 43.1                     | 0                   | 1              | 0              | 1            | 44.8                     |
| 40 / 44                      | 57                  | 51             | 55             | 163          | 39.3                     | 19                  | 23             | 23             | 65           | 39.0                     | 1                   | 3              | 1              | 5            | 37.0                     |
| 35 / 39                      | 60                  | 43             | 51             | 153          | 34.8                     | 35                  | 40             | 37             | 112          | 34.6                     | 8                   | 14             | 12             | 34           | 34.2                     |
| 30 / 34                      | 44                  | 17             | 29             | 91           | 30.8                     | 60                  | 59             | 62             | 182          | 30.4                     | 37                  | 41             | 39             | 117          | 30.6                     |
| 25 / 29                      | 11                  | 3              | 6              | 19           | 26.4                     | 47                  | 45             | 47             | 139          | 25.7                     | 48                  | 46             | 46             | 141          | 26.0                     |
| 20 / 24                      | 1                   | 0              | 0              | 1            | 22.7                     | 38                  | 30             | 32             | 100          | 20.9                     | 42                  | 40             | 40             | 122          | 21.2                     |
| 15 / 19                      | 0                   | 0              |                | 0            | 17.7                     | 20                  | 12             | 16             | 48           | 16.2                     | 35                  | 36             | 35             | 106          | 16.2                     |
| 10 / 14                      |                     |                |                |              |                          | 9                   | 6              | 7              | 21           | 11.3                     | 34                  | 31             | 36             | 102          | 11.3                     |
| 5 / 9                        |                     |                |                |              |                          | 2                   | 1              | 1              | 4            | 7.6                      | 24                  | 22             | 25             | 70           | 6.5                      |
| 0 / 4                        |                     |                |                |              |                          | 0                   |                |                | 0            | 3.0                      | 13                  | 10             | 10             | 33           | 1.7                      |
| -5 / -1                      |                     |                |                |              |                          |                     |                |                |              |                          | 4                   | 3              | 2              | 9            | -2.9                     |
| -10 / -6                     |                     |                |                |              |                          |                     |                |                |              |                          | 2                   | 1              | 1              | 4            | -7.4                     |
| -15 / -11                    |                     |                |                |              |                          |                     |                |                |              |                          | 0                   | 0              |                | 0            | -11.4                    |
| -20 / -16                    |                     |                |                |              |                          |                     |                |                |              |                          | 0                   |                |                | 0            | -15.0                    |
| -25 / -21                    |                     |                |                |              |                          |                     |                |                |              |                          |                     |                |                |              |                          |

**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.

HOUGHTON MI

WMO No. 727440

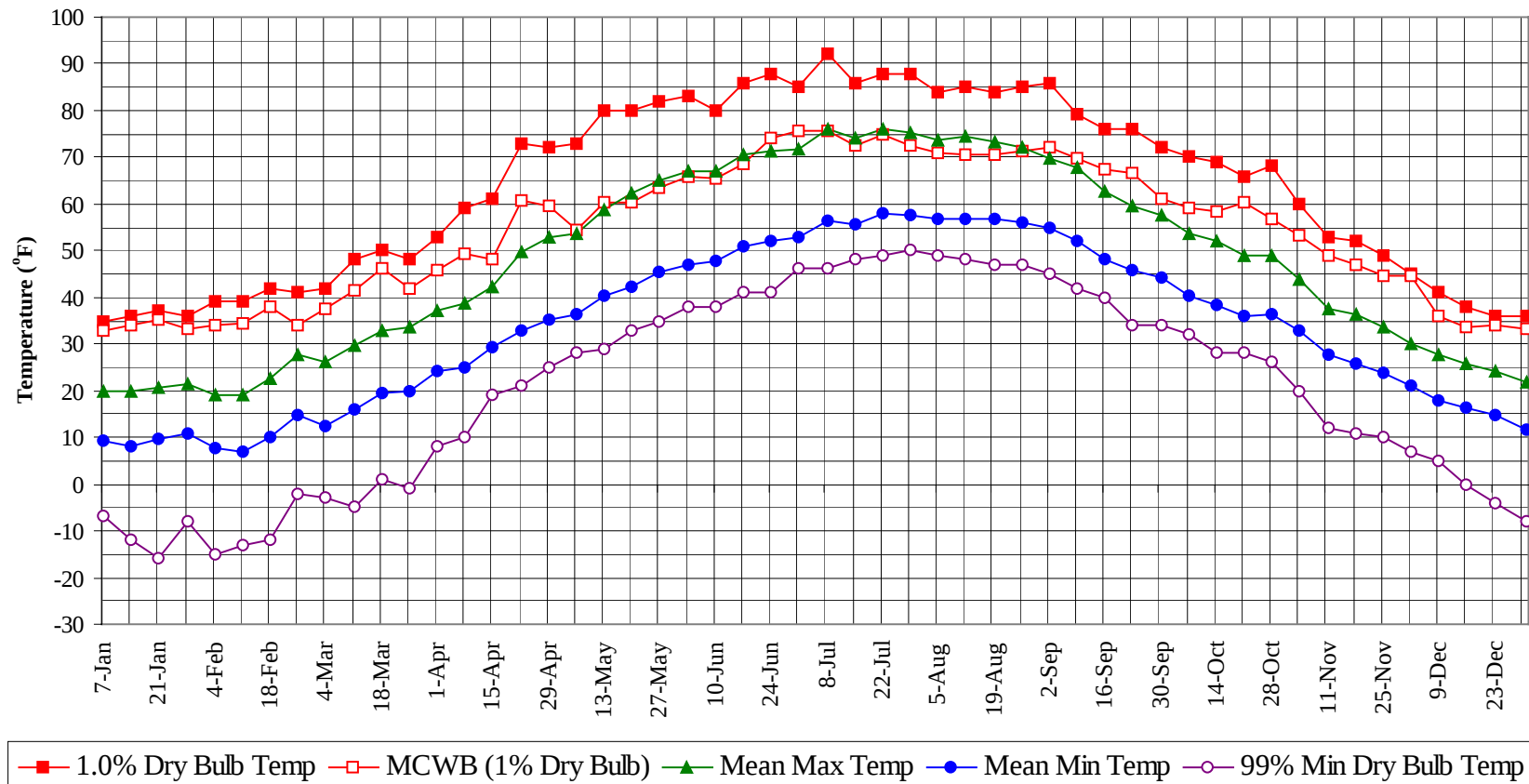
**Dry-Bulb Temperature Hours For An Average Year (Sheet 5 of 5)**

Period of Record = 1973 to 1996

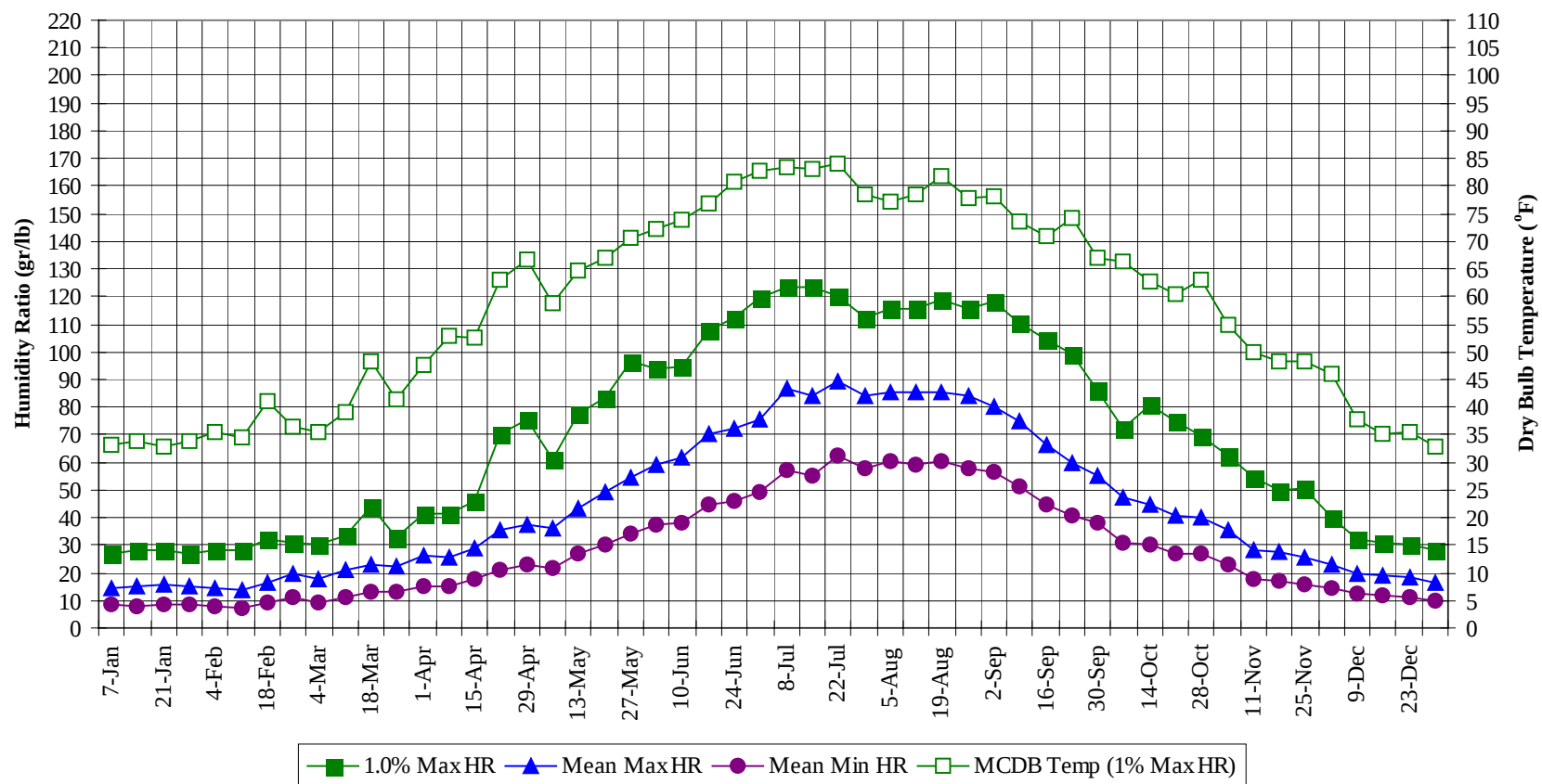
| Annual Totals                |                     |                |                |              |                          |
|------------------------------|---------------------|----------------|----------------|--------------|--------------------------|
| Temperature<br>Range<br>(°F) | Hour<br>Group (LST) |                |                | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
|                              | 01<br>To<br>08      | 09<br>To<br>16 | 17<br>To<br>00 |              |                          |
| 100 / 104                    |                     | 0              | 0              | 0            | 72.3                     |
| 95 / 99                      |                     | 1              | 0              | 1            | 73.9                     |
| 90 / 94                      |                     | 6              | 2              | 8            | 74.3                     |
| 85 / 89                      | 0                   | 17             | 8              | 25           | 71.8                     |
| 80 / 84                      | 1                   | 57             | 29             | 87           | 68.6                     |
| 75 / 79                      | 7                   | 123            | 64             | 195          | 65.7                     |
| 70 / 74                      | 41                  | 195            | 126            | 361          | 62.7                     |
| 65 / 69                      | 117                 | 219            | 185            | 522          | 60.0                     |
| 60 / 64                      | 221                 | 222            | 224            | 667          | 56.6                     |
| 55 / 59                      | 267                 | 202            | 232            | 701          | 52.3                     |
| 50 / 54                      | 266                 | 183            | 216            | 665          | 48.0                     |
| 45 / 49                      | 225                 | 175            | 189            | 589          | 43.2                     |
| 40 / 44                      | 207                 | 176            | 192            | 575          | 38.7                     |
| 35 / 39                      | 238                 | 218            | 227            | 683          | 34.3                     |
| 30 / 34                      | 312                 | 266            | 290            | 867          | 30.4                     |
| 25 / 29                      | 245                 | 214            | 241            | 700          | 25.7                     |
| 20 / 24                      | 201                 | 184            | 186            | 572          | 20.8                     |
| 15 / 19                      | 169                 | 153            | 164            | 486          | 16.0                     |
| 10 / 14                      | 142                 | 130            | 142            | 414          | 11.1                     |
| 5 / 9                        | 122                 | 90             | 103            | 315          | 6.4                      |
| 0 / 4                        | 73                  | 50             | 59             | 182          | 1.5                      |
| -5 / -1                      | 34                  | 21             | 22             | 77           | -2.7                     |
| -10 / -6                     | 19                  | 11             | 12             | 43           | -6.9                     |
| -15 / -11                    | 9                   | 5              | 4              | 17           | -11.7                    |
| -20 / -16                    | 3                   | 2              | 2              | 7            | -16.4                    |
| -25 / -21                    | 1                   | 0              | 0              | 1            | -20.7                    |

**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

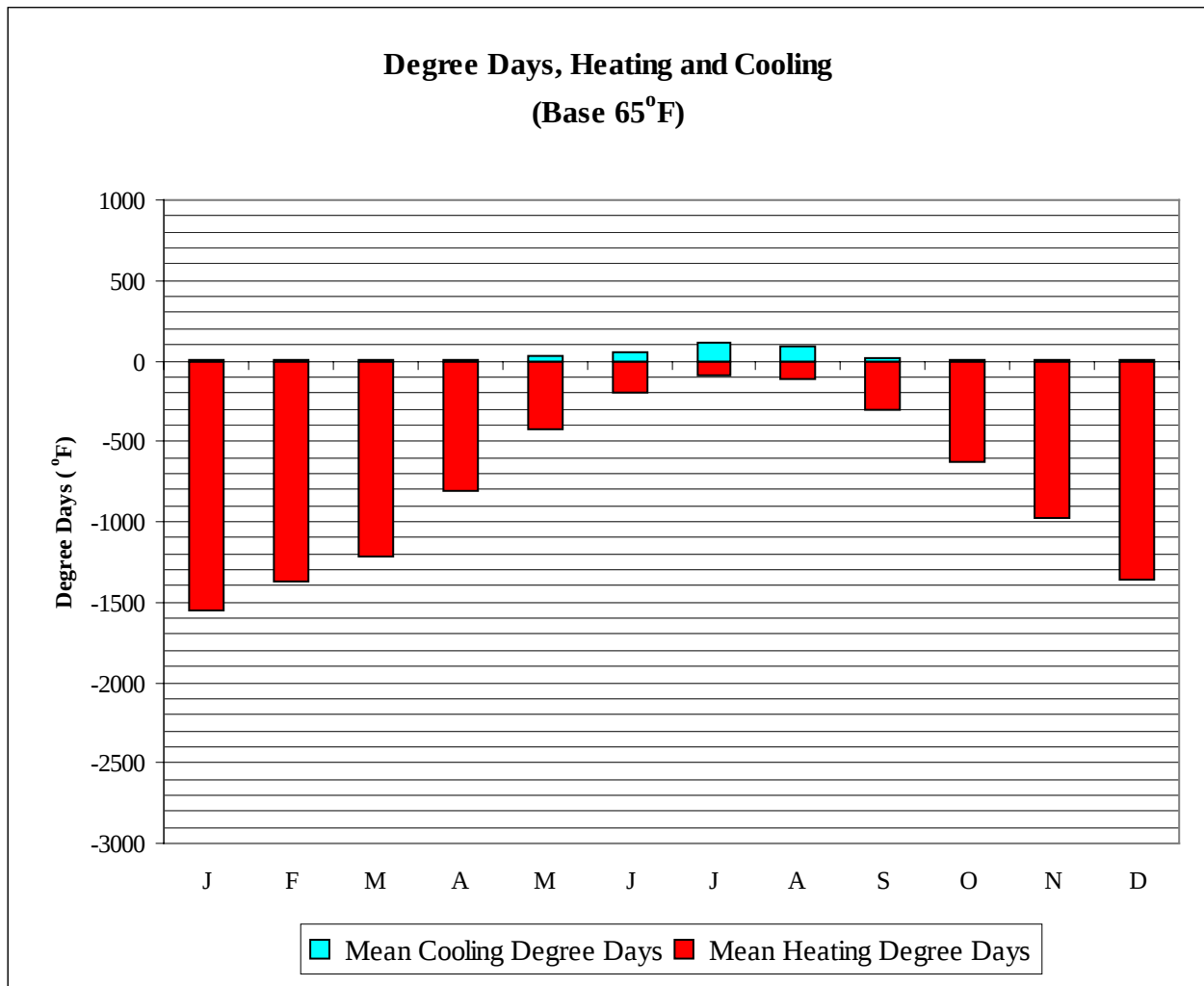


## Long Term Humidity and Dry Bulb Temperature Summary



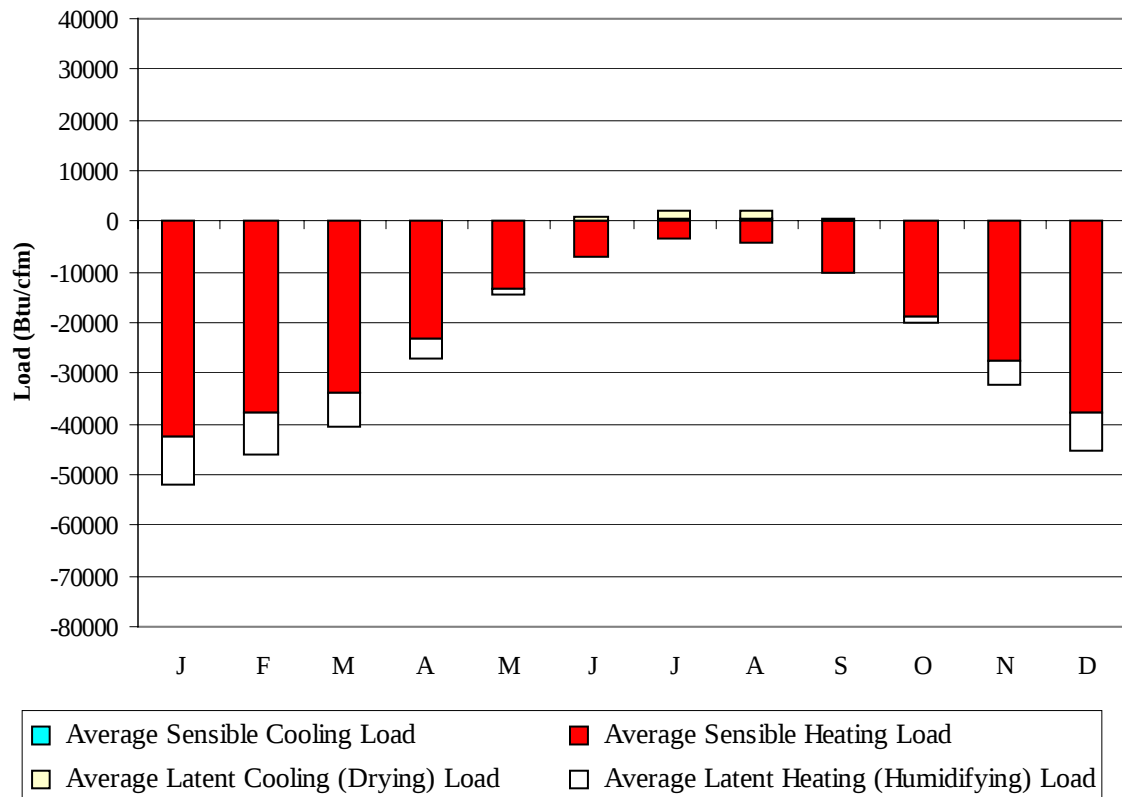
**HOUGHTON****MI****WMO No. 727440****Long Term Dry Bulb Temperature and Humidity Summary**

| Week<br>Ending | 1.0%<br>Temp (°F) | MCWB @<br>1% Temp (°F) | Mean Max<br>Temp (°F) | Mean Min<br>Temp (°F) | 99%<br>Temp (°F) | 1.0%<br>HR (gr/lb) | MCDB @<br>1% HR (°F) | Mean Max<br>HR (gr/lb) | Mean Min<br>HR (gr/lb) |
|----------------|-------------------|------------------------|-----------------------|-----------------------|------------------|--------------------|----------------------|------------------------|------------------------|
| 7-Jan          | 35.0              | 32.7                   | 20.1                  | 9.3                   | -7.0             | 26.6               | 33.1                 | 14.7                   | 8.6                    |
| 14-Jan         | 36.0              | 34.2                   | 19.8                  | 8.0                   | -12.0            | 28.0               | 33.8                 | 14.8                   | 8.1                    |
| 21-Jan         | 37.0              | 35.2                   | 20.8                  | 9.5                   | -16.0            | 28.0               | 33.0                 | 15.6                   | 8.9                    |
| 28-Jan         | 36.0              | 33.1                   | 21.4                  | 10.7                  | -8.0             | 26.6               | 33.9                 | 15.4                   | 8.8                    |
| 4-Feb          | 39.0              | 34.0                   | 19.3                  | 7.7                   | -15.0            | 28.0               | 35.5                 | 14.1                   | 7.9                    |
| 11-Feb         | 39.0              | 34.3                   | 18.9                  | 6.9                   | -13.0            | 28.0               | 34.4                 | 13.6                   | 7.4                    |
| 18-Feb         | 42.0              | 38.1                   | 22.8                  | 10.0                  | -12.0            | 32.2               | 40.9                 | 16.2                   | 9.0                    |
| 25-Feb         | 41.0              | 34.2                   | 27.7                  | 14.6                  | -2.0             | 30.8               | 36.4                 | 19.9                   | 11.2                   |
| 4-Mar          | 42.0              | 37.6                   | 26.0                  | 12.3                  | -3.0             | 30.1               | 35.6                 | 17.5                   | 9.4                    |
| 11-Mar         | 48.0              | 41.5                   | 29.6                  | 15.9                  | -5.0             | 33.6               | 39.1                 | 20.8                   | 11.4                   |
| 18-Mar         | 50.0              | 46.0                   | 32.8                  | 19.5                  | 1.0              | 44.1               | 48.2                 | 23.2                   | 13.2                   |
| 25-Mar         | 48.0              | 41.9                   | 33.7                  | 19.9                  | -1.0             | 32.9               | 41.4                 | 22.4                   | 13.1                   |
| 1-Apr          | 53.0              | 45.9                   | 37.1                  | 24.3                  | 8.0              | 41.3               | 47.8                 | 26.1                   | 15.3                   |
| 8-Apr          | 59.0              | 49.4                   | 38.8                  | 25.1                  | 10.0             | 41.3               | 52.8                 | 25.6                   | 15.0                   |
| 15-Apr         | 61.0              | 48.2                   | 42.1                  | 29.4                  | 19.0             | 46.2               | 52.7                 | 28.7                   | 18.0                   |
| 22-Apr         | 73.0              | 60.8                   | 49.8                  | 32.9                  | 21.0             | 70.0               | 63.2                 | 35.1                   | 21.1                   |
| 29-Apr         | 72.0              | 59.5                   | 53.0                  | 35.3                  | 25.0             | 75.6               | 66.6                 | 37.5                   | 22.7                   |
| 6-May          | 73.0              | 54.5                   | 53.6                  | 36.3                  | 28.0             | 60.9               | 58.9                 | 36.2                   | 21.7                   |
| 13-May         | 80.0              | 60.4                   | 58.6                  | 40.1                  | 29.0             | 77.7               | 64.6                 | 43.6                   | 26.9                   |
| 20-May         | 80.0              | 60.3                   | 62.1                  | 42.4                  | 33.0             | 83.3               | 67.1                 | 49.5                   | 30.5                   |
| 27-May         | 82.0              | 63.5                   | 65.1                  | 45.3                  | 35.0             | 96.6               | 70.7                 | 54.7                   | 34.1                   |
| 3-Jun          | 83.0              | 66.0                   | 66.8                  | 47.1                  | 38.0             | 93.8               | 72.1                 | 59.3                   | 37.6                   |
| 10-Jun         | 80.0              | 65.3                   | 67.1                  | 47.6                  | 38.0             | 94.5               | 73.8                 | 61.6                   | 38.0                   |
| 17-Jun         | 86.0              | 68.8                   | 70.6                  | 51.0                  | 41.0             | 107.8              | 77.0                 | 70.0                   | 44.6                   |
| 24-Jun         | 88.0              | 74.0                   | 71.2                  | 52.0                  | 41.0             | 112.0              | 80.9                 | 72.6                   | 46.1                   |
| 1-Jul          | 85.0              | 75.7                   | 71.6                  | 52.8                  | 46.0             | 119.7              | 82.8                 | 75.3                   | 49.3                   |
| 8-Jul          | 92.0              | 75.8                   | 76.0                  | 56.5                  | 46.0             | 123.2              | 83.3                 | 86.6                   | 57.4                   |
| 15-Jul         | 86.0              | 72.7                   | 74.2                  | 55.7                  | 48.0             | 123.2              | 83.1                 | 84.1                   | 55.4                   |
| 22-Jul         | 88.0              | 74.7                   | 76.2                  | 57.9                  | 49.0             | 120.4              | 84.0                 | 89.2                   | 62.1                   |
| 29-Jul         | 88.0              | 72.4                   | 75.2                  | 57.5                  | 50.0             | 112.0              | 78.4                 | 84.4                   | 58.1                   |
| 5-Aug          | 84.0              | 71.0                   | 73.6                  | 56.9                  | 49.0             | 115.5              | 77.2                 | 85.3                   | 60.5                   |
| 12-Aug         | 85.0              | 70.7                   | 74.6                  | 56.8                  | 48.0             | 115.5              | 78.6                 | 85.4                   | 59.2                   |
| 19-Aug         | 84.0              | 70.6                   | 73.1                  | 56.6                  | 47.0             | 119.0              | 81.8                 | 85.5                   | 60.1                   |
| 26-Aug         | 85.0              | 71.5                   | 72.2                  | 55.9                  | 47.0             | 115.5              | 77.9                 | 84.1                   | 58.0                   |
| 2-Sep          | 86.0              | 72.2                   | 69.6                  | 54.9                  | 45.0             | 118.3              | 78.1                 | 80.2                   | 56.4                   |
| 9-Sep          | 79.0              | 69.8                   | 67.7                  | 52.0                  | 42.0             | 110.6              | 73.6                 | 75.1                   | 51.1                   |
| 16-Sep         | 76.0              | 67.5                   | 62.6                  | 48.1                  | 40.0             | 104.3              | 70.9                 | 66.1                   | 44.4                   |
| 23-Sep         | 76.0              | 66.4                   | 59.6                  | 45.6                  | 34.0             | 99.4               | 74.3                 | 59.5                   | 40.4                   |
| 30-Sep         | 72.0              | 61.0                   | 57.7                  | 44.3                  | 34.0             | 86.1               | 67.1                 | 55.1                   | 38.0                   |
| 7-Oct          | 70.0              | 59.1                   | 53.6                  | 40.3                  | 32.0             | 72.1               | 66.3                 | 47.1                   | 31.0                   |
| 14-Oct         | 69.0              | 58.3                   | 52.1                  | 38.4                  | 28.0             | 80.5               | 62.7                 | 44.7                   | 30.1                   |
| 21-Oct         | 66.0              | 60.1                   | 48.8                  | 36.1                  | 28.0             | 74.9               | 60.3                 | 40.8                   | 26.7                   |
| 28-Oct         | 68.0              | 56.8                   | 49.1                  | 36.5                  | 26.0             | 69.3               | 63.1                 | 40.0                   | 26.8                   |
| 4-Nov          | 60.0              | 53.3                   | 43.9                  | 33.0                  | 20.0             | 62.3               | 54.9                 | 35.4                   | 22.9                   |
| 11-Nov         | 53.0              | 48.8                   | 37.4                  | 27.8                  | 12.0             | 54.6               | 49.8                 | 28.5                   | 18.0                   |
| 18-Nov         | 52.0              | 47.0                   | 36.2                  | 25.9                  | 11.0             | 49.7               | 48.2                 | 27.5                   | 17.1                   |
| 25-Nov         | 49.0              | 44.7                   | 33.6                  | 23.7                  | 10.0             | 50.4               | 48.3                 | 25.5                   | 15.6                   |
| 2-Dec          | 45.0              | 44.5                   | 30.2                  | 21.0                  | 7.0              | 39.9               | 46.0                 | 22.9                   | 14.4                   |
| 9-Dec          | 41.0              | 36.2                   | 27.6                  | 18.0                  | 5.0              | 32.2               | 37.9                 | 20.0                   | 12.3                   |
| 16-Dec         | 38.0              | 33.8                   | 25.6                  | 16.2                  | 0.0              | 30.8               | 35.2                 | 19.2                   | 11.8                   |
| 23-Dec         | 36.0              | 33.9                   | 24.3                  | 14.7                  | -4.0             | 30.1               | 35.4                 | 18.1                   | 11.2                   |
| 31-Dec         | 36.0              | 33.3                   | 22.0                  | 11.7                  | -8.0             | 28.0               | 32.8                 | 16.1                   | 9.6                    |



|     | Mean Cooling<br>Degree Days (°F) | Mean Heating<br>Degree Days (°F) |
|-----|----------------------------------|----------------------------------|
| JAN | 0                                | 1548                             |
| FEB | 0                                | 1373                             |
| MAR | 0                                | 1216                             |
| APR | 3                                | 808                              |
| MAY | 26                               | 429                              |
| JUN | 58                               | 203                              |
| JUL | 111                              | 90                               |
| AUG | 89                               | 111                              |
| SEP | 20                               | 310                              |
| OCT | 2                                | 632                              |
| NOV | 0                                | 981                              |
| DEC | 0                                | 1360                             |
| ANN | 309                              | 9061                             |

**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 | 0                             | -42530                        | 0                           | -9248                       |
| FEB | 0                             | -37793                        | 0                           | -8366                       |
| MAR | 0                             | -33932                        | 0                           | -6731                       |
| APR | 9                             | -23247                        | 1                           | -3978                       |
| MAY | 107                           | -13188                        | 76                          | -1419                       |
| JUN | 268                           | -6911                         | 529                         | -116                        |
| JUL | 565                           | -3596                         | 1553                        | -1                          |
| AUG | 368                           | -4330                         | 1612                        | -3                          |
| SEP | 50                            | -10054                        | 425                         | -147                        |
| OCT | 3                             | -18659                        | 6                           | -1385                       |
| NOV | 0                             | -27667                        | 0                           | -4477                       |
| DEC | 0                             | -37630                        | 0                           | -7589                       |
| ANN | 1370                          | -259537                       | 4202                        | -43460                      |

## Average Annual Solar Radiation – Nearest Available Site

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

City: HOUGHTON  
 State: MI  
 WBAN No: 94814  
 Lat(N): 47.17  
 Long(W): 88.5  
 Elev(ft): 1079

Stn Type: Secondary  
 SHADING GEOMETRY IN DIMENSIONLESS UNITS  
 Window: 1  
 Overhang: 0.741  
 Vert Gap: 0.327

| 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  | 420  | 700  | 1120 | 1460 | 1740 | 1910 | 1900 | 1590 | 1140 | 730  | 420  | 340  | 1130 |
|                                                                               | Std Dev | 53   | 81   | 106  | 104  | 153  | 144  | 91   | 115  | 98   | 51   | 40   | 46   | 42   |
|                                                                               | Minimum | 320  | 550  | 890  | 1250 | 1460 | 1640 | 1740 | 1380 | 930  | 640  | 340  | 230  | 1040 |
|                                                                               | Maximum | 490  | 820  | 1300 | 1670 | 2090 | 2220 | 2130 | 1800 | 1360 | 840  | 500  | 390  | 1190 |
|                                                                               | Diffuse | 300  | 430  | 630  | 710  | 730  | 770  | 740  | 650  | 530  | 390  | 290  | 260  | 540  |
| Clear Day                                                                     | Global  | 620  | 990  | 1540 | 2110 | 2490 | 2650 | 2550 | 2180 | 1650 | 1090 | 680  | 520  | 1590 |
| NORTH                                                                         | Global  | 160  | 240  | 350  | 440  | 540  | 620  | 580  | 460  | 330  | 230  | 160  | 140  | 360  |
|                                                                               | Diffuse | 160  | 240  | 350  | 430  | 480  | 520  | 500  | 430  | 330  | 230  | 160  | 140  | 330  |
| Clear Day                                                                     | Global  | 130  | 200  | 290  | 410  | 580  | 710  | 640  | 460  | 310  | 210  | 140  | 120  | 350  |
| EAST                                                                          | Global  | 290  | 470  | 720  | 920  | 1040 | 1120 | 1130 | 970  | 730  | 490  | 280  | 220  | 700  |
|                                                                               | Diffuse | 200  | 300  | 440  | 520  | 560  | 600  | 590  | 520  | 410  | 280  | 190  | 170  | 400  |
| Clear Day                                                                     | Global  | 550  | 800  | 1130 | 1410 | 1540 | 1600 | 1550 | 1410 | 1160 | 850  | 580  | 470  | 1090 |
| SOUTH                                                                         | Global  | 690  | 940  | 1120 | 1050 | 950  | 900  | 950  | 1030 | 1020 | 910  | 600  | 530  | 890  |
|                                                                               | Diffuse | 320  | 430  | 540  | 560  | 550  | 570  | 570  | 530  | 460  | 370  | 280  | 280  | 460  |
| Clear Day                                                                     | Global  | 1770 | 1990 | 2000 | 1660 | 1320 | 1170 | 1210 | 1470 | 1760 | 1890 | 1760 | 1640 | 1630 |
| WEST                                                                          | Global  | 300  | 470  | 730  | 900  | 1040 | 1130 | 1130 | 990  | 750  | 500  | 280  | 230  | 710  |
|                                                                               | Diffuse | 200  | 300  | 450  | 520  | 570  | 610  | 600  | 530  | 410  | 290  | 190  | 170  | 410  |
| Clear Day                                                                     | Global  | 550  | 800  | 1130 | 1410 | 1540 | 1600 | 1550 | 1410 | 1160 | 850  | 580  | 470  | 1090 |

## Average Annual Solar Heat and Illumination – Nearest Available Site

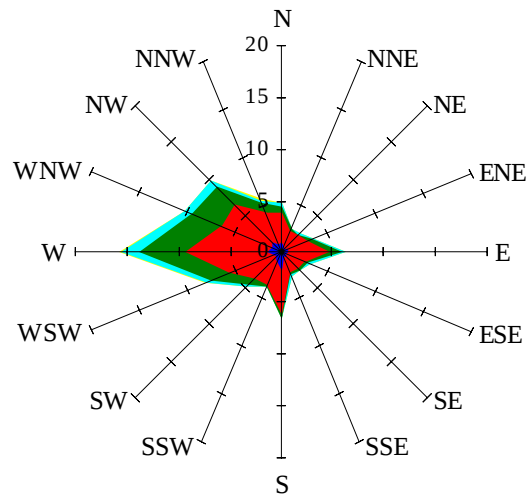
(Source: National Renewable Energy Laboratory, Golden CO, 1995)

| 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 | 270 | 460 | 770 | 1040 | 1250 | 1380 | 1370 | 1140 | 800 | 490 | 270 | 220 | 790  |
| NORTH                                                                                               | Unshaded | 110 | 170 | 250 | 300  | 350  | 410  | 380  | 300  | 230 | 160 | 110 | 95  | 240  |
|                                                                                                     | Shaded   | 87  | 130 | 200 | 250  | 300  | 340  | 320  | 260  | 190 | 130 | 87  | 73  | 200  |
| EAST                                                                                                | Unshaded | 200 | 330 | 510 | 660  | 740  | 800  | 800  | 700  | 520 | 340 | 190 | 150 | 490  |
|                                                                                                     | Shaded   | 160 | 270 | 410 | 520  | 580  | 620  | 630  | 550  | 420 | 280 | 160 | 130 | 390  |
| SOUTH                                                                                               | Unshaded | 520 | 700 | 800 | 710  | 620  | 570  | 600  | 680  | 710 | 670 | 450 | 400 | 620  |
|                                                                                                     | Shaded   | 490 | 620 | 580 | 400  | 320  | 330  | 330  | 340  | 460 | 560 | 410 | 370 | 430  |
| WEST                                                                                                | Unshaded | 200 | 330 | 520 | 640  | 740  | 810  | 800  | 710  | 530 | 350 | 200 | 160 | 500  |
|                                                                                                     | Shaded   | 170 | 270 | 420 | 510  | 580  | 630  | 630  | 560  | 430 | 290 | 160 | 130 | 400  |

| 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  | 19    | 53   | 71  | 66  | 39  | 33   | 69   | 90  | 94  | 79  |
|                                                                                                                  | M.Cloudy | 12    | 35   | 47  | 44  | 26  | 20   | 41   | 60  | 64  | 50  |
| NORTH                                                                                                            | M.Clear  | 6     | 12   | 14  | 13  | 10  | 20   | 14   | 16  | 16  | 15  |
|                                                                                                                  | M.Cloudy | 6     | 14   | 17  | 16  | 11  | 11   | 14   | 18  | 18  | 16  |
| EAST                                                                                                             | M.Clear  | 56    | 68   | 28  | 13  | 10  | 72   | 80   | 49  | 16  | 15  |
|                                                                                                                  | M.Cloudy | 17    | 31   | 22  | 16  | 11  | 26   | 38   | 34  | 18  | 16  |
| SOUTH                                                                                                            | M.Clear  | 22    | 66   | 89  | 83  | 48  | 9    | 28   | 52  | 57  | 40  |
|                                                                                                                  | M.Cloudy | 9     | 30   | 41  | 39  | 22  | 8    | 20   | 35  | 39  | 27  |
| WEST                                                                                                             | M.Clear  | 6     | 12   | 14  | 50  | 72  | 9    | 14   | 16  | 30  | 71  |
|                                                                                                                  | M.Cloudy | 6     | 14   | 17  | 28  | 29  | 8    | 14   | 18  | 26  | 40  |
| M.Clear                                                                                                          | (% hrs)  | 26    | 26   | 27  | 25  | 27  | 39   | 38   | 34  | 31  | 36  |
|                                                                                                                  |          | Sept  |      |     |     |     | Dec  |      |     |     |     |
|                                                                                                                  |          | 9am   | 11am | 1pm | 3pm | 5pm | 9am  | 11am | 1pm | 3pm | 5pm |
| HORIZ.                                                                                                           | M.Clear  | 11    | 46   | 69  | 73  | 55  | 0    | 19   | 32  | 25  | 4   |
|                                                                                                                  | M.Cloudy | 6     | 25   | 42  | 45  | 32  | 0    | 13   | 20  | 17  | 3   |
| NORTH                                                                                                            | M.Clear  | 4     | 11   | 14  | 14  | 12  | 0    | 7    | 9   | 8   | 2   |
|                                                                                                                  | M.Cloudy | 3     | 10   | 15  | 15  | 12  | 0    | 6    | 9   | 7   | 2   |
| EAST                                                                                                             | M.Clear  | 38    | 73   | 46  | 14  | 12  | 0    | 36   | 15  | 8   | 2   |
|                                                                                                                  | M.Cloudy | 9     | 26   | 26  | 15  | 12  | 0    | 11   | 10  | 7   | 2   |
| SOUTH                                                                                                            | M.Clear  | 7     | 46   | 75  | 79  | 57  | 0    | 53   | 77  | 63  | 15  |
|                                                                                                                  | M.Cloudy | 4     | 19   | 36  | 39  | 26  | 0    | 15   | 23  | 19  | 4   |
| WEST                                                                                                             | M.Clear  | 4     | 11   | 14  | 31  | 68  | 0    | 7    | 9   | 32  | 17  |
|                                                                                                                  | M.Cloudy | 3     | 10   | 15  | 22  | 29  | 0    | 6    | 9   | 13  | 4   |
| M.Clear                                                                                                          | (% hrs)  | 33    | 33   | 31  | 29  | 32  | 12   | 13   | 13  | 12  | 15  |

### Wind Summary - December, January, and February

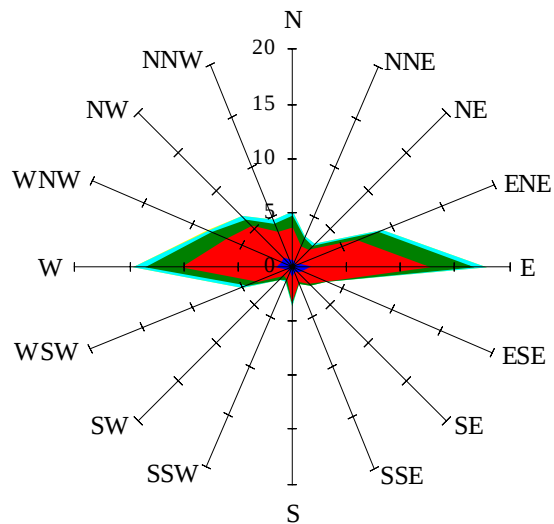
Labels of Percent Frequency on North Axis



Percent Calm = 10.63

### Wind Summary - March, April, and May

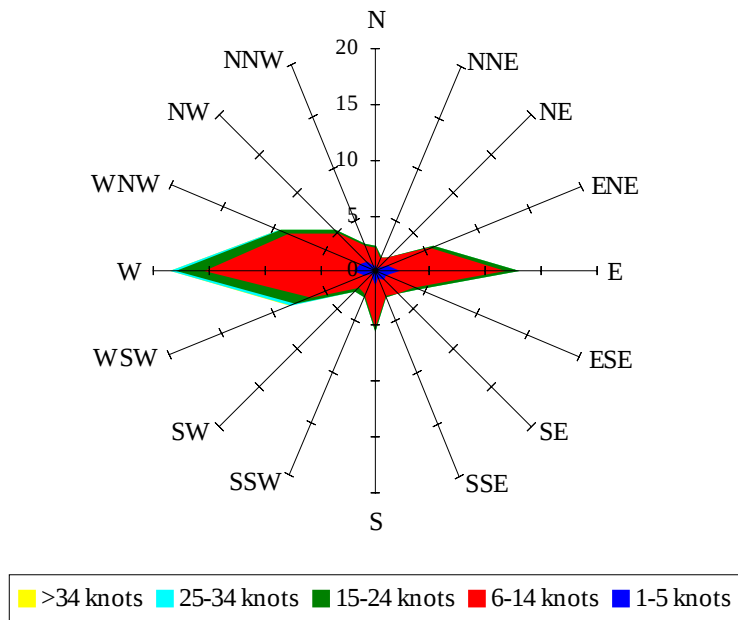
Labels of Percent Frequency on North Axis



Percent Calm = 10.53

### Wind Summary - June, July, and August

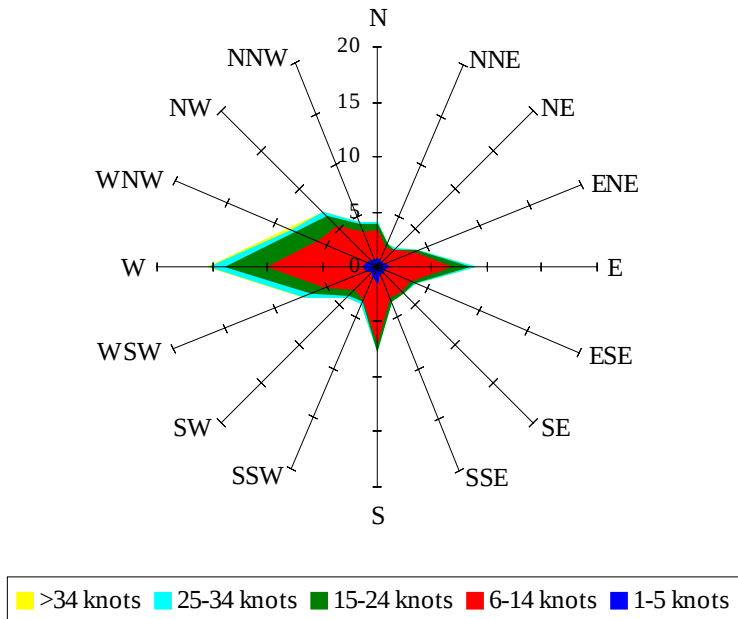
Labels of Percent Frequency on North Axis



Percent Calm = 13.52

### Wind Summary - September, October, and November

Labels of Percent Frequency on North Axis



Percent Calm = 10.81