

# Ameren Missouri Heating and Cooling Program

## Wet Bulb Temperature to Enthalpy Conversion Table

| Wet Bulb Temperature °F | Tenths of a Degree Fahrenheit |       |       |       |       |       |       |       |       |       |
|-------------------------|-------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                         | 0                             | 0.1   | 0.2   | 0.3   | 0.4   | 0.5   | 0.6   | 0.7   | 0.8   | 0.9   |
| 35                      | 13.01                         | 13.05 | 13.1  | 13.14 | 13.18 | 13.23 | 13.27 | 13.31 | 13.35 | 13.4  |
| 36                      | 13.44                         | 13.48 | 13.53 | 13.57 | 13.61 | 13.66 | 13.7  | 13.75 | 13.79 | 13.83 |
| 37                      | 13.87                         | 13.91 | 13.96 | 14    | 14.05 | 14.09 | 14.14 | 14.18 | 14.23 | 14.27 |
| 38                      | 14.32                         | 14.37 | 14.41 | 14.46 | 14.5  | 14.55 | 14.59 | 14.64 | 14.68 | 14.73 |
| 39                      | 14.77                         | 14.82 | 14.86 | 14.91 | 14.95 | 15    | 15.05 | 15.09 | 15.14 | 15.18 |
| 40                      | 15.23                         | 15.28 | 15.32 | 15.37 | 15.42 | 15.46 | 15.51 | 15.56 | 15.6  | 15.65 |
| 41                      | 15.7                          | 15.75 | 15.8  | 15.84 | 15.89 | 15.94 | 15.99 | 16.03 | 16.08 | 16.13 |
| 42                      | 16.17                         | 16.22 | 16.27 | 16.32 | 16.36 | 16.41 | 16.46 | 16.51 | 16.56 | 16.61 |
| 43                      | 16.66                         | 16.71 | 16.76 | 16.81 | 16.86 | 16.91 | 16.96 | 17    | 17.05 | 17.1  |
| 44                      | 17.15                         | 17.2  | 17.25 | 17.3  | 17.35 | 17.4  | 17.45 | 17.5  | 17.55 | 17.6  |
| 45                      | 17.65                         | 17.7  | 17.75 | 17.8  | 17.85 | 17.91 | 17.96 | 18.01 | 18.06 | 18.11 |
| 46                      | 18.16                         | 18.21 | 18.26 | 18.32 | 18.37 | 18.42 | 18.47 | 18.52 | 18.58 | 18.63 |
| 47                      | 18.68                         | 18.73 | 18.79 | 18.84 | 18.89 | 18.95 | 19    | 19.05 | 19.1  | 19.16 |
| 48                      | 19.21                         | 19.26 | 19.32 | 19.37 | 19.43 | 19.48 | 19.53 | 19.59 | 19.64 | 19.7  |
| 49                      | 19.75                         | 19.81 | 19.86 | 19.92 | 19.97 | 20.03 | 20.08 | 20.14 | 20.19 | 20.25 |
| 50                      | 20.3                          | 20.36 | 20.41 | 20.47 | 20.52 | 20.58 | 20.64 | 20.69 | 20.75 | 20.8  |
| 51                      | 20.86                         | 20.92 | 20.97 | 21.03 | 21.09 | 21.15 | 21.2  | 21.26 | 21.32 | 21.38 |
| 52                      | 21.44                         | 21.5  | 21.56 | 21.62 | 21.67 | 21.73 | 21.79 | 21.85 | 21.91 | 21.97 |
| 53                      | 22.02                         | 22.08 | 22.14 | 22.2  | 22.26 | 22.32 | 22.38 | 22.44 | 22.5  | 22.56 |
| 54                      | 22.62                         | 22.68 | 22.74 | 22.8  | 22.86 | 22.92 | 22.98 | 23.04 | 23.1  | 23.16 |
| 55                      | 23.22                         | 23.28 | 23.34 | 23.41 | 23.47 | 23.53 | 23.59 | 23.65 | 23.72 | 23.78 |
| 56                      | 23.84                         | 23.9  | 23.97 | 24.03 | 24.1  | 24.16 | 24.22 | 24.29 | 24.35 | 24.42 |
| 57                      | 24.48                         | 24.54 | 24.61 | 24.67 | 24.74 | 24.8  | 24.86 | 24.93 | 24.99 | 25.06 |
| 58                      | 25.12                         | 25.19 | 25.25 | 25.32 | 25.38 | 25.45 | 25.52 | 25.58 | 25.65 | 25.71 |
| 59                      | 25.78                         | 25.85 | 25.92 | 25.98 | 26.05 | 26.12 | 26.19 | 26.26 | 26.32 | 26.39 |
| 60                      | 26.46                         | 26.53 | 26.6  | 26.67 | 26.74 | 26.81 | 26.87 | 26.94 | 27.01 | 27.08 |
| 61                      | 27.15                         | 27.22 | 27.29 | 27.36 | 27.43 | 27.5  | 27.57 | 27.64 | 27.71 | 27.78 |
| 62                      | 27.85                         | 27.92 | 27.99 | 28.07 | 28.14 | 28.21 | 28.28 | 28.35 | 28.43 | 28.5  |
| 63                      | 28.57                         | 28.64 | 28.72 | 28.79 | 28.87 | 28.94 | 29.01 | 29.09 | 29.16 | 29.24 |
| 64                      | 29.31                         | 29.39 | 29.46 | 29.54 | 29.61 | 29.69 | 29.76 | 29.84 | 29.91 | 29.99 |
| 65                      | 30.06                         | 30.14 | 30.21 | 30.29 | 30.37 | 30.45 | 30.52 | 30.6  | 30.68 | 30.75 |
| 66                      | 30.83                         | 30.91 | 30.99 | 31.07 | 31.15 | 31.23 | 31.3  | 31.38 | 31.46 | 31.54 |
| 67                      | 31.62                         | 31.7  | 31.78 | 31.86 | 31.94 | 32.02 | 32.1  | 32.18 | 32.26 | 32.34 |
| 68                      | 32.42                         | 32.5  | 32.59 | 32.67 | 32.75 | 32.84 | 32.92 | 33    | 33.08 | 33.17 |
| 69                      | 33.25                         | 33.33 | 33.42 | 33.5  | 33.59 | 33.67 | 33.75 | 33.84 | 33.92 | 34.01 |
| 70                      | 34.09                         | 34.18 | 34.26 | 34.35 | 34.43 | 34.52 | 34.61 | 34.69 | 34.78 | 34.86 |
| 71                      | 34.95                         | 35.04 | 35.13 | 35.21 | 35.3  | 35.39 | 35.48 | 35.57 | 35.65 | 35.74 |
| 72                      | 35.83                         | 35.92 | 36.01 | 36.1  | 36.19 | 36.29 | 36.38 | 36.47 | 36.56 | 36.65 |
| 73                      | 36.74                         | 36.83 | 36.92 | 37.02 | 37.11 | 37.2  | 37.29 | 37.38 | 37.48 | 37.57 |
| 74                      | 37.66                         | 37.76 | 37.85 | 37.95 | 38.04 | 38.14 | 38.23 | 38.33 | 38.42 | 38.52 |
| 75                      | 38.61                         | 38.71 | 38.8  | 38.9  | 38.99 | 39.09 | 39.19 | 39.28 | 39.38 | 39.47 |
| 76                      | 39.57                         | 39.67 | 39.77 | 39.87 | 39.97 | 40.07 | 40.17 | 40.27 | 40.37 | 40.47 |
| 77                      | 40.57                         | 40.67 | 40.77 | 40.87 | 40.97 | 41.08 | 41.18 | 41.28 | 41.38 | 41.48 |
| 78                      | 41.58                         | 41.68 | 41.79 | 41.89 | 42    | 42.1  | 42.2  | 42.31 | 42.41 | 42.52 |
| 79                      | 42.62                         | 42.73 | 42.83 | 42.94 | 43.05 | 43.16 | 43.26 | 43.37 | 43.48 | 43.58 |
| 80                      | 43.69                         | 43.8  | 43.91 | 44.02 | 44.13 | 44.24 | 44.34 | 44.45 | 44.56 | 44.67 |
| 81                      | 44.78                         | 44.89 | 45    | 45.12 | 45.23 | 45.34 | 45.45 | 45.56 | 45.68 | 45.79 |
| 82                      | 45.9                          | 46.01 | 46.13 | 46.24 | 46.36 | 46.47 | 46.58 | 46.7  | 46.81 | 46.93 |
| 83                      | 47.04                         | 47.16 | 47.28 | 47.39 | 47.51 | 47.63 | 47.75 | 47.87 | 47.98 | 48.1  |
| 84                      | 48.22                         | 48.34 | 48.46 | 48.58 | 48.7  | 48.83 | 48.95 | 49.07 | 49.19 | 49.31 |
| 85                      | 49.43                         | 49.55 | 49.68 | 49.8  | 49.92 | 50.05 | 50.17 | 50.29 | 50.41 | 50.54 |

Enthalpy in BTU per Pound of Dry Air

## How to Calculate Air Conditioning Coil Capacity

1. **MEASURE** coil airflow. Please do not assume 400 cubic feet per minute (CFM) per ton. Be able to defend your answer. The accuracy of this number is important and has a high chance for error.
  - a. The total external static pressure (TESP) and original equipment manufacturer blower table method is probably the quickest. Do an Internet search for "measuring static pressure."
  - b. The mini-vane anemometer is likely the most accurate, but requires drilling several holes in the ductwork.
  - c. The pressure matching method with a true flow plate is likely the easiest, and yet provides a great deal of accuracy.
2. **MEASURE** coil entering and leaving WET BULB (WB) temperatures to the first decimal place with a digital psychrometer.
  - a. Allow the system to operate 10 to 15 minutes to reach stabilized conditions.
  - b. The high limit opening into the heat exchanger area is the best place to measure the entering WB temperatures since it picks up the motor heat as part of the entering load. The return air plenum works as well.
3. **CALCULATE** the total capacity using the "total heat formula."
  - a. Convert WB temperatures to ENTHALPY using a WB to enthalpy conversion chart.
  - b. Use the formula: British thermal units per hour (BTUH) = CFM x 4.5 x  $\Delta$  enthalpy.
    - BTUH is per hour capacity.
    - CFM is measured blower CFM.
    - 4.5 is a constant that converts CFM to pounds (lbs) of air per hour.
    - $\Delta$  enthalpy is coil entering enthalpy minus coil leaving enthalpy. This should be between 6 and 7 for any properly operating system.
4. **EXAMPLE:** CFM—1,200, coil entering WB is 62.9°F and coil leaving WB is 52.8°F.
  - a. 62.9°F WB equals 28.50 BTU/lb enthalpy.
  - b. 52.8°F WB equals 21.91 BTU/lb enthalpy.
  - c.  $\Delta$  enthalpy is 28.50 – 21.91 = 6.59.
  - d. BTUH = 1,200 x 4.5 x 6.59 = 35,586.
5. This is system capacity at the evaporator coil or system total capacity. Whether and where this capacity is actually delivered to the conditioned space depends on duct leakage and transmission gains and losses as well as balancing.