



Free Cooling vs. VSD

MARKETING GUIDE

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Free Cooling vs. VSD

Free Cooling is an application that is thought to be more efficient than running a chiller during cold weather periods. Normally this would be during winter months in Northern states, but can also be achieved in some middle to Southern states.

Normal free cooling can be accomplished when the outdoor wet bulb is low enough so that the chiller tower can be used to cool the chilled water loop in the building. Some type of plate and frame heat exchanger is usually used to keep the tower water and chilled water loops isolated. Since most chilled water loops operate at 44° F and typical plate and frame heat exchangers can have a 4° F approach this would show that the water off of the tower must be 40° F. While most cooling towers have a 7° F approach at design wet bulb the approach falls off as the conditions get colder. In colder temperatures the approach can increase to a typical value of 10° F. This means that the out door wet bulb must be 30° F for free cooling to work.

Reviewing local weather conditions can show how many hours a year a wet bulb of 30° F or lower are available. Average wet bulb data for over 200 cities is available in YorkCalc in the "Weather" tab section. Some Northern states can claim up to 2000 hours a year of free cooling, but a more typical value is 1000 hours a year. If we determine how much energy our chiller would be using under these conditions we can calculate the dollars saved by using free cooling.

The ability to use cold ECWT for York centrifugal chillers reduces the amount of energy the chiller would use if running. Adding a VSD will greatly reduce the amount of energy used. The low kW/ton values of a VSD centrifugal can be achieved at 55° F ECWT. This is much more readily achieved than the 40° F tower water temperature required for free cooling.

The YK chiller at York headquarters in York, PA is a 350 ton P3 chiller. Using rough calculations, there is a 100 ton load on the chiller all winter long to satisfy the core cooling load. During the winter months, 50° F ECWT can be used and the kW displayed on the OptiView panel is 20 kW. Since we pay 5 cents per kWh we know it cost us \$1 per hour to run the chiller. If there are 1000 hours where free cooling would have been possible, then we could have saved \$1000 per year.

However, the cost to go to free cooling is not free. There is the cost of the heat exchanger, the valves for switching over the system, and the installation cost of this system. A typical heat exchanger for this size duty would be roughly \$10,000. The valves and installation cost would typically be another \$10,000 to \$15,000. This "free cooling" system would cost the customer \$20,000 to \$25,000. If they can save \$1000 a year, then they would have a 20 to 25 year payback. Assuming they could run free cooling for 2000 hours a year, this is still a 10 to 12 year payback.

Furthermore, the added space of the heat exchanger, pipes, and valves will also cost the owner some money in additional "real estate" used that is not required with the VSD chiller. The VSD chiller will also save the owner energy and money throughout the year.

In conclusion the VSD equipped York centrifugal chiller is a better solution for the owner than Free Cooling.