

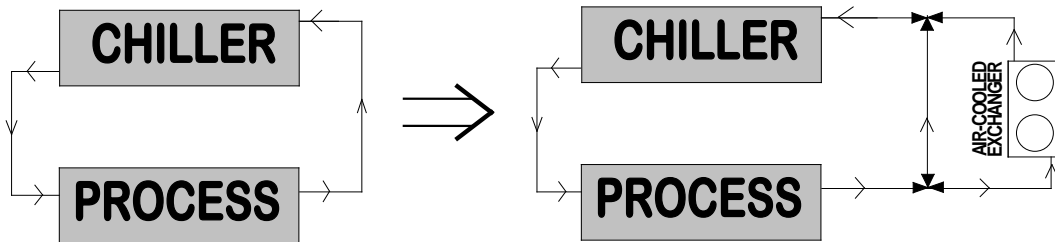
## FREE COOLING

### What Is Free Cooling?

We are taught that nothing is free. This does apply to the concept of “Free Cooling” because there is still an energy input requires (albeit less) as well as costs to modify existing systems. However, it does make sense to utilize existing infrastructure and our cold winters to reduce the energy input for cooling. The term Free Cooling is very broad in scope but might best be defined as; achieving significantly higher cooling efficiencies by adding to, and modifying, an existing chilling system to take advantage of seasonally lower ambient temperatures. Many industrial processes require cooling water below the temperature that a cooling tower can provide. In these cases a chiller is frequently used to provide the cooling. For our purposes we will consider the approach of adding a heat exchanger to an existing cooling system to by-pass or reduce the load on a chiller.

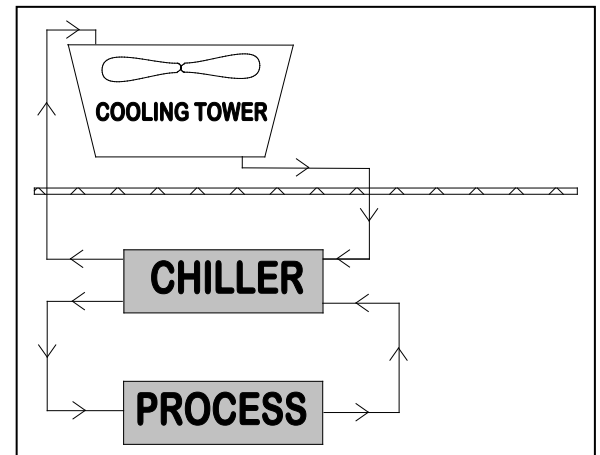
### Helper Cooler

Cooling systems vary in size so for a small load the approach might be to add an air-cooled heat exchanger in the return loop before the chiller. Depending on the temperatures and load pattern, it might be feasible for this air cooled exchanger to operate year round.

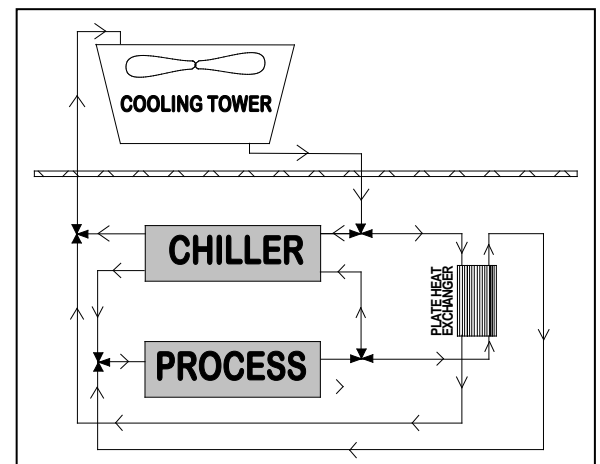


### Indirect Free Cooling

For larger cooling loads, where a cooling tower is used to cool the condenser in the chiller, a great opportunity exists for free cooling. Typical operating conditions for a system of this type might be that the chiller provides water at 57°F to the process and the cooling tower cools the condenser water from 95°F to 85°F. Under this scenario, if the chiller were by-passed and cooling tower cooled the chilled water loop directly, the cooling tower would most probably be able to provide the 57°F water at an ambient around 40°F. Directly cooling the chilled water in a cooling tower is generally not preferred though because the chiller water and cooling tower water would intermix.



Adding a heat exchanger in the loop allows the two fluid streams to remain separate while still taking advantage of the free cooling from the cooling tower. The heat exchanger Although the heat exchanger will introduce some thermal inefficiency to the system, a [plate type heat exchanger](#) can operate at very close approach temperatures therefore reducing the impact of the extra step in the system. Introducing a heat exchanger loop to the system described above; the cooling tower would need to deliver 53°F water to the heat exchanger to produce 57°F chilled water. An ambient temperature below 37°F would be required for the cooling tower in this scenario to produce 53°F water.



### Load Sharing

If the system is properly set up, the heat exchanger can share the load with the chiller. The horsepower draw of the chiller reduces with the load and also; as the load on the chiller reduces, less cooling is required for the condenser. Proper placement of valves and monitoring devices can manage and optimize the cooling tower flow to both the condenser and heat exchanger controlled by the process cooling water temperature. The use of the heat exchanger can start with taking a portion of the load and as the temperature drops and load on the chiller reduces the heat exchanger will assume more of the load until it ultimately provides all the cooling for the system.