Cooling Water Systems

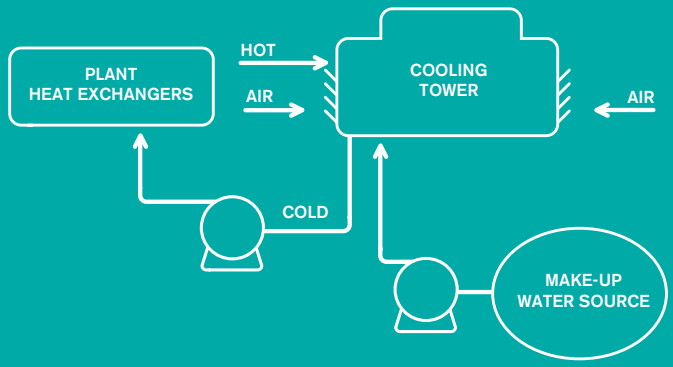
Cooling water systems are a very important part of many industrial plants. They represent a relatively inexpensive and dependable means of removing low grade heat from processes as opposed to the more expensive options available such as artificial cooling using electric or absorption chillers.

Types of Systems

There are generally two types of cooling water systems.
- The once through cooling water system.
- The recirculation cooling water system.

The once through system was popular years ago when water was cheap and a good source of low temperature water was available. Here, town or river water was collected and pumped to cool the process in question before been sent back either to a river or water treatment plant. Today these systems rarely exist except in some power stations and small cooling applications. The recirculation type system is the most popular today as it conserves water even though it uses more energy.

Cooling Water System Process Flow Diagram



The main components of a cooling water system are:

- The pump that pumps the cooling water through the various process heat exchangers so that the product in question can be cooled.
- The various networks of pipework and heat exchangers in the system.
- A cooling tower that uses a fan or fans to draw air in counterflow to the water being cooled.
- A water make up system, that adds water to the system as it losses it through evaporation and leaks.

Types of Cooling Towers

Cooling towers fall into two main sub-divisions: – natural draft and mechanical draft. Natural draft designs use very large concrete chimneys to introduce air through the media. Due to the tremendous size of these towers (500 ft high and 400 ft in diameter at the base) they are generally used for water flow rates above 900,000 litre/min. Usually these types of towers are only used by utility power stations.

Mechanical draft cooling towers are much more widely used. These towers utilise large fans to force air through circulated water. The water falls downward over random surfaces which help increase the contact time between the water and the air. This helps maximise heat transfer between the two streams.

Energy Saving Opportunities

- Ensure that all pumps have sufficient suction pressure to operate efficiently (refer to pump characteristic curves).
- Some cooling water pumps are oversized and could have their impellers trimmed to reduce flow and power requirements.
- Generally, the heat exchanger surface will limit the heat removal rate, especially in older shell and tube heat exchangers where rust and dirt prevail.
- Heat transfer may be reduced in jacketed vessels (such as chemical reactors) due to rust build up before the indirect cooling system was commissioned.
- There may be opportunities to use the heat absorbed by cooling water systems in processes that require low grade heat such as evaporation of nitrogen or for the preheating of old air for combustion.
- Install a restriction orifice or globe valve in the water lines where excessive flow occurs. This will help reduce overall flow rates and pumping costs.
- Consider the installation of variable speed drives on pumps that need to be throttled at present. This could save large amounts of energy.
- The cooling tower fans should have at least two speed control or variable speed drives to allow for reduced air flow when ambient temperatures or reduced process cooling loads allow.
- Cooling water towers should have good water quality and water treatment if required. Cooling tower blow down should be regulated by salt concentration and make-up requirements.
- To save on water it may be possible to use waste water from another part of the process as make-up water for the cooling tower.
- Replacement of refrigeration systems that operate on water cooled condensers with evaporative condensers can remove a heating load from the cooling water system and maybe avoid the cost of new cooling towers. Also the efficiency of the refrigeration system will improve and the refrigeration cooling capacity possible increase.

ESB Independent Energy has considerable expertise in the efficient utilisation of Cooling Water Systems. If you require further information please contact your Customer Relationship Manager or ESBIE Head Office at 00 353 1 8628300.