Closed Circuit Cooling Towers

Closed circuit cooling towers provide evaporative cooling for many types of systems, and the specific application will largely determine which BAC Closed Circuit Cooling Tower is best suited for a project. The table on page E5 & E6 is intended as a general guide. Specialized assistance is available through your local BAC Representative.

See page E7 for an article on the advantages of closed circuit cooling towers.

Principle of Operation

Closed circuit cooling towers operate in a manner similar to open cooling towers, except that the heat load to be rejected is transferred from the process fluid (the fluid being cooled) to the ambient air through a heat exchange coil. The coil serves to isolate the process fluid from the outside air, keeping it clean and contaminate free in a closed loop. This creates two separate fluid circuits: (1) an external circuit, in which spray water circulates over the coil and mixes with the outside air, and (2) an internal circuit, in which the process fluid circulates inside the coil. During operation, heat is transferred from the internal circuit, through the coil to the spray water, and then to the atmosphere as a portion of the water evaporates.

Configuration

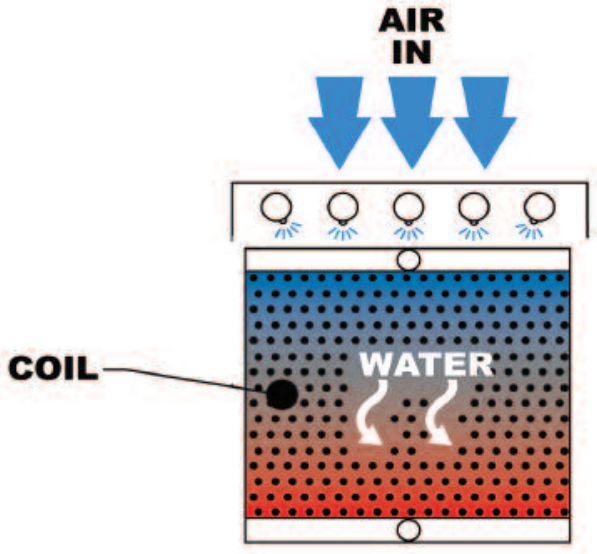
BAC manufactures two types of closed circuit cooling towers: combined flow and counterflow.

Combined Flow

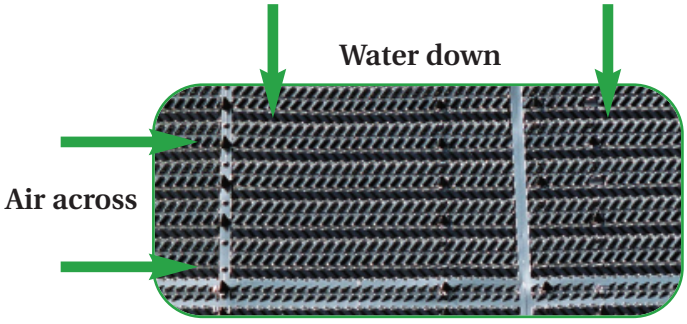
Combined flow is the use of both a heat exchange coil and fill for heat transfer in a closed circuit cooling tower. The addition of fill to the traditional closed circuit cooling tower design reduces evaporation in the coil section, reducing the potential for scaling and fouling. BAC's combined flow closed circuit cooling towers utilize parallel flow of air and spray water over the coil, and crossflow air/water flow through the fill.

In parallel flow, air and water flow over the coil in the same direction. The process fluid travels from the bottom to the top of the coil, increasing efficiency by bringing the coldest spray water and air in contact with the process fluid at its coldest temperature.

In the fill of BAC's combined flow closed circuit cooling towers, air and water interact in a crossflow configuration: water flows vertically down the fill as air flows horizontally across it.



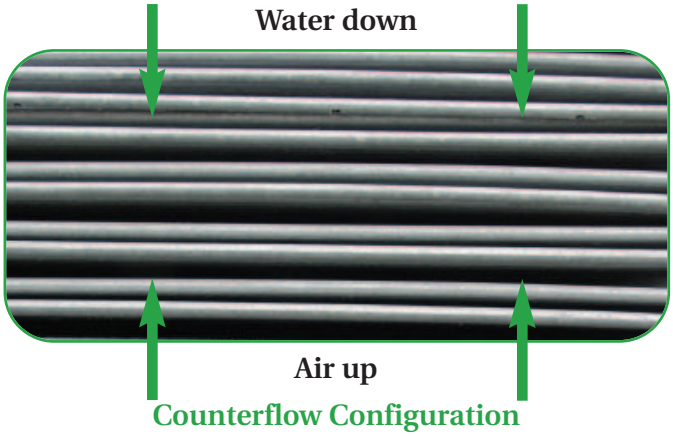
Combined Flow: Parallel Flow of Air and Water Over the coil



Combined Flow: Crossflow Configuration Over the Fill

Counterflow

In a counterflow closed circuit cooling tower design, the flow of the air is in the opposite direction of the spray water. In BAC's counterflow closed circuit cooling towers, air travels vertically up through the unit while the spray water travels vertically down over the coil. The process fluid flows from top to bottom through the coil and is in thermal counterflow to the air.



Counterflow Configuration

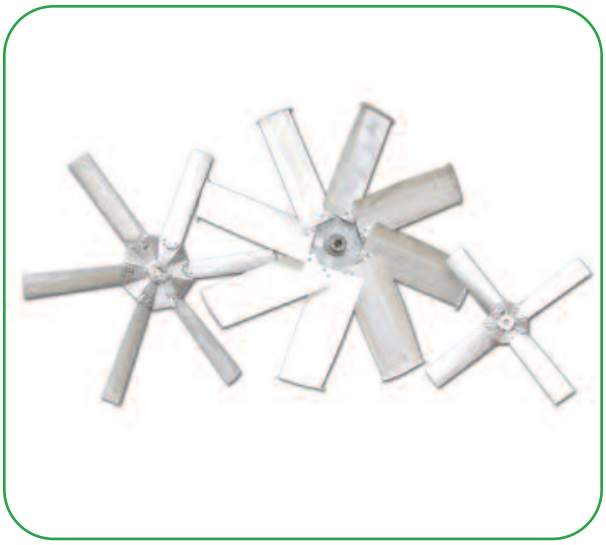
Fan System

The flow of air through most factory assembled closed circuit cooling towers is provided by one or more mechanically driven fans. The fan(s) may be axial or centrifugal, each type having its own distinct advantages.

Axial fan units require approximately half the fan motor horsepower of comparably sized centrifugal fan units, offering significant lifecycle cost savings.

Centrifugal fan units are capable of overcoming reasonable amounts of external static pressure (≤ 0.5") 12.7mm of H_2O, making them suitable for both indoor and outdoor installations. Centrifugal fans are also inherently quieter than axial fans, although the difference is minimal and can often be overcome through the application of optional low sound fans and/or sound attenuation on axial fan units.

Centrifugal Fan



Axial Fan

Induced Draft

Fans can be applied in an induced draft or a forced draft configuration. The rotating air handling components of induced draft equipment are mounted in the top deck of the unit, minimizing the impact of fan noise on near-by neighbors and providing maximum protection from fan icing if units operate in sub-freezing conditions. The use of corrosion resistant materials ensures long life and minimizes maintenance requirements for the air handling components.

Forced Draft

Rotating air handling components are located on the air intake face at the base of forced draft towers, facilitating easy access for routine maintenance and service. Additionally, locating these components in the dry entering air stream extends component life by isolating them from the saturated discharge air.

Capacity Range

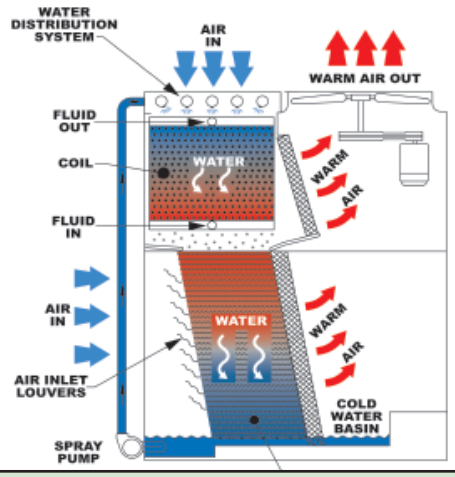
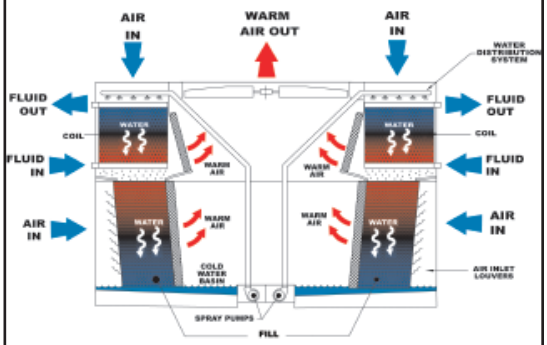
On page E5 and E6, product capacities are called out in terms of a flow rate at 95ºF/85ºF/78ºF. This refers to the flow rate of water that the unit can cool from a 95ºF (35.0ºC) entering water temperature to an 85ºF (29.4ºC) leaving water temperature at a 78ºF (25.6ºC) entering wet-bulb temperature. BAC offers selection software to evaluate the performance of a closed circuit cooling tower at any conditions; see page M17 for details.

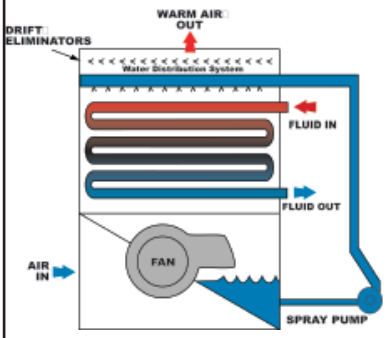
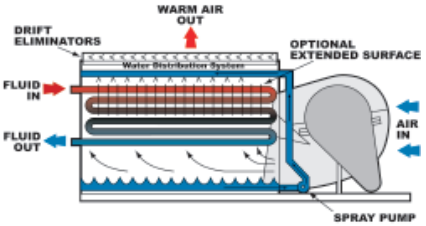
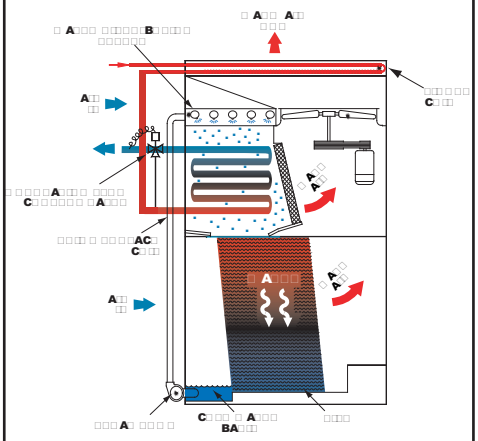
All capacities shown are for a single cell; multiple cell units can be applied to achieve larger capacities.

Maximum Entering Water Temperature

All BAC Closed Circuit Cooling Towers are capable of withstanding entering fluid temperatures as high as 180ºF (82.2ºC), and the HXV is capable of withstanding even higher temperatures due to the added dry coil technology.

Closed Circuit Cooling Tower
Product Lines

	FXV	
	Single Air Inlet Models	**Dual Air inlet Models**
Principle of Operation		
Configuration	Combined Flow	Combined Flow
Fan System	Axial Fan, Induced Draft	Axial Fan, Induced Draft
Capacity Range (Single Cell)	26 - 299 Nominal Tons 78.7 - 896 GPM at 95˚F/85˚F/78˚F	344 - 624 Nominal Tons 1,031 - 1,872 GPM at 95˚F/85˚F/78˚F
Maximum Entering Water Temperature	180˚F (82.2˚C)	180˚F (82.2˚C)
Typical Applications	Small to medium HVAC & industrial applications such as water source heat pump loops and air compressor cooling. Tight enclosures & installations requiring a single air inlet Unit replacements	Medium to large HVAC & industrial applications such as electric arc furnaces and pharmaceutical plants.

Series V		HXV
VF1	VFL (low profile)	
		
Counterflow	Counterflow	Combined Flow
Centrifugal Fan, Forced Draft	Centrifugal Fan, Forced Draft	Axial Fan, Induced Draft
4.1 - 543 Nominal Tons 12.4 - 1,629 GPM 95˚F/85˚F/78˚F	3.9 - 108 Nominal Tons 11.6 - 324.6 GPM at 95˚F/85˚F/78˚F	160 - 305 Nominal tons 480 - 915 GPM at 95˚F/85˚F/78˚F
180˚F (82.2˚C)	180˚F (82.2˚C)	Entering water temperature can exceed 180˚F but is application specific; contact your local BAC Representative for details.
Small to medium HVAC & industrial applications such as water source heat pump loops and air compressor cooling Indoor installations High temperature applications Tight enclosures & installations requiring a single air inlet Extremely sound sensitive applications	Small to medium HVAC & industrial applications Installations with extremely low height requirements Indoor installations High temperature industrial applications Extremely sound sensitive applications	Small to medium HVAC & industrial applications such as water source heat pump loops and air compressor cooling Installations requiring plume abatement Installations requiring water conservation Large range/close approach applications High temperature industrial applications