Comparison between Counter Flow Cooling Tower and Cross Flow Cooling Tower:

Sr. No.	Criteria	Counter Flow Cooling Tower	Cross Flow Cooling Tower
1	Principle	The air is vertically upwards, counter current with the hot water falling downwards. The coldest water comes in contact with the coolest and most dry air, optimizing the heat transfer and obtaining the maximum performance	The air flows horizontally and the water falling downwards meets the air at different temperatures. Therefore the heat transfer is not always optimized
2	Area	The tower area required is comparatively much smaller. The air water contact is more due to the efficiency and arrangement of the fill pack. The plenum chamber area for hot air in this tower is smaller	The area required is larger due to its constructional features like larger plenum chamber. Also the arrangement and material of the pack is different and requires a higher area
3	Air Flow	Since the air-water contact time is higher, the quantity of air required is lesser	Since the air-water contact time is lesser, more air is required to effect heat transfer
4	Distribution System	The distribution is done through channel with lateral pipes, fitted with splash cum spray nozzles. Growth of algae is highly restricted as the lateral pipes are a closed unit and not located in direct sunlight	The distribution is done through open trough systems on the fan deck, fitted with nozzles. Distribution may not be as uniform as the counter flow type and is easily attacked by algae, causing problems like scaling and clogging of openings
5	Recirculation	The problem of recirculation is much less in this case as the air intake is at the bottom of the tower and the discharge is at a much higher level. Further the side walls of the tower are closed till the top of the air intake area	Since the air intake area extends from the bottom to the deck level, the flume discharge is very close to the air intake area at the top. This creates the effect of recirculation wherein the discharged air re-enters the tower through the air intake at the top. This creates a significant reduction in performance
6	Fill Pack	The fill pack can be splash type plastic fill for very bad quality of water and film fill for better quality of water	Only splash type fill used in cross flow cooling towers. Usually splash fill will be V bar or timber laths
7	Power Consumption & Pumping Head	The fan Power consumption is low as the required air quantities comparatively lower. The pumping head is also lower as the inlet header is located below the fan deck area	The fan power consumption is higher as the airflow required is higher. The pumping head is also higher since the distribution is located at the fan deck level
8	Maintenance	Maintenance for counter flow towers is much easier than cross flow towers. The simplicity of structure and comfortable sizing allow for quick and exhaustive maintenance	Maintenance for cross flow towers is time consuming and usually requires more skilled technicians on the job as the movement of material is more difficult

Advantages and Disadvantages of Forced Draft Cooling Tower, Induced Draft Counter Flow Cooling Tower and Induced Draft Cross Flow Cooling Tower:

Type of Cooling Tower	Advantages	Disadvantages
Forced Draft Cooling Tower	• Suited for high air resistance due to centrifugal blower fans • Fans are relatively quite	• Recirculation due to high air-entry and low air-exit velocities, which can be solved by locating towers in plant rooms combined with discharge ducts
Induced Draft Counter Flow Cooling Tower	• Less recirculation than forced draft towers because the speed of exit air is 3-4 times higher than entering air	• Fans and the motor drive mechanism require weather-proofing against moisture and corrosion because they are in the path of humid exit air
Induced Draft Cross Flow Cooling Tower	• Less recirculation than forced draft towers because the speed of exit air is 3-4 times higher than entering air	• Fans and the motor drive mechanism require weather-proofing against moisture and corrosion because they are in the path of humid exit air

Forced Draft Cooling Tower Vs. Induced Draft Cooling Tower:

1. Induced Draft Cooling
   Tower have the ability to handle large water flow rate than Forced Draft Cooling Tower
2. Induced Draft Cooling Tower is suitable for large cell sizes and fan sizes as compared with Forced Draft. Larger fan size may result in greater efficiency and consequently lower power and sound level.
3. Forced Draft Cooling Tower can be square or rectangular type only; however, Induced Draft Cooling Towers can be round, square or rectangular type.
4. Induced Draft Cooling Tower uses more compact ground area than Forced Draft Cooling Tower equivalent capacity due to absence of fan on one side.
5. Fan equipment is warm exhaust air is less liable to icing up in winter operation (Cold Countries)
6. Higher velocity in Forced Draft Cooling Tower cause drop in suspension and cause additional static resistance to system.