

Research Article

# Design of Split Water Tank Air Cooler (SWTAC) for Compactness and Portability

Amit Sahay\*

Professor, Department of Mechanical Engineering, Mittal Institute of Technology, Bhopal, M.P., India

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## Abstract

An evaporative cooler is a device that cools air through the evaporation of water. The Evaporative cooling is one of the earliest methods employed by men for conditioning their houses. An air cooler is a device that uses water and air to cool down a room or an area. It works on the principle of evaporation, which is the process of converting liquid water into vapor. When water evaporates, it absorbs heat from the surrounding air and lowers its temperature. This is how an air cooler cools the air. An air cooler has a water tank or a water connection, where water is supplied and stored. A fan or a blower is attached to the air cooler, which draws in the hot and dry air from the surroundings and pushes it through a wet pad or a water tray. The water in the pad or the tray evaporates, and the air becomes cool and moist. The cooled air is then released into the room or the area through a vent or a duct. The main parts of an air cooler are water tank, cooling pad, fan or blower, water pump. Air coolers are provided with a water tank which stores the water. Higher the capacity of the Air Cooler larger is the size of tank. This makes the Air Cooler bulky and heavy when filled with water. In this paper a design is proposed with considerations of compactness and portability.

**Keywords:** Air cooler; Design for Compactness and portability; Split water tank air cooler (SWTAC)

## 1. Introduction

Evaporative Cooling is the process in which air is cooled by using the heat in the air to evaporate the water from an adjacent surface. A temperature reduction of 10 to 20°C (50-68°F) can be achieved by passing the hot fresh air through the wetted pads

An air cooler is a device that uses water and air to cool down a room or an area. It works on the principle of evaporation, which is the process of converting liquid water into vapor. When water evaporates, it absorbs heat from the surrounding air and lowers its temperature. The air cooler uses a fan to blow hot air over a wet evaporative pad. As the air passes over the pad, the water in the pad evaporates which removes heat from the air and cools it. Therefore, an air cooler essentially performs the following functions (<https://www.crompton.co.in/blogs/air-coolers/how-does-an-air-cooler-work>)

- Creates a stream of air
- Creates a stream of water
- Facilitates direct contact of the water particles & the moving air stream

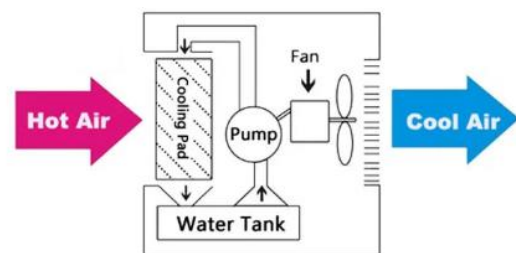


Fig. 1: Schematic design of an air cooler

An air cooler is composed of several components that ensure the smooth functioning of the cooling appliance.

- Water tank: This is where the water is stored for evaporation. The size of the tank varies depending on the capacity of the air cooler.
- Water pump: The water pump is responsible for circulating the water from the tank to the cooling pads.
- Cooling pads: These are the medium through which air passes and is cooled by the water evaporating from them. They are typically made of cellulose or synthetic fibers.
- Fan or blower: The fan pulls the warm air into the air cooler and blows it over the cooling pads, which cools the air. The cool air is then blown out into the room or space.

\*Corresponding author's ORCID ID: 0000-0002-0038-6957  
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- **Motor:** The motor is responsible for powering the fan and the water pump.
- **Control panel:** The control panel allows the user to set the speed of the fan, adjust the water level, and turn the unit on and off.
- **Exhaust vents:** These are the openings through which the cool air is blown out into the room or space.



**Fig. 2:** Parts of a typical air cooler

## 2. What makes air coolers bulky?

Air evaporates the water. While evaporation water absorbs heat from the surrounding air and lowers its temperature. This cooled air is utilized to cool down a room or an area. Therefore, there is loss of water which has to be replenished. Therefore, Air coolers are provided with a water tank which stores the water. The size of the tank varies depending on the capacity of the air cooler. Capacity refers to the cooling capacity and also the duration when the full tank is emptied. Higher the capacity of the Air Cooler larger is the size of tank. This makes the Air Cooler bulky and heavy when filled with water. The disadvantages of a bulky and heavy Air Cooler are the following.

- ❖ It requires a robust structure. Hence the design is demanding and the structure becomes costly owing to the materials cost, manufacturing cost and transportation cost.
- ❖ The cooler requires more space (carpet area) to install
- ❖ The cooler becomes heavy hence difficult to move
- ❖ The makeup water is added at the location of the air cooler. This breaches the privacy and hence causes inconvenience.

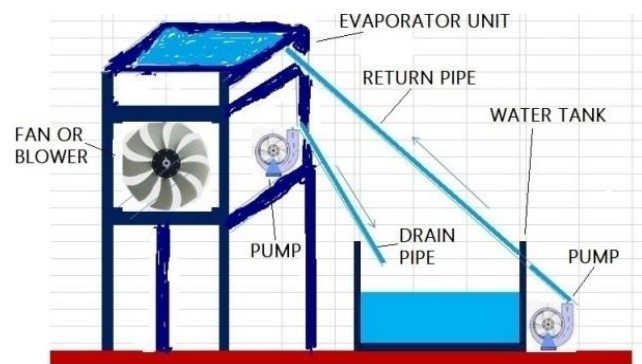
Design considerations are intended as a design guideline and planning tool in respect of universal accessibility or acceptability for a particular need for the targeted customer. Design considerations are the

choices or items that can affect a product or structure's performance, cost, or schedule during the design stage. The air cooler design is done keeping into the design considerations – compactness and portability. (Dorst, K)

## 3. Design for Compactness and Portability

A novel design is proposed which splits the Air Cooler with the water tank. It is termed as Split Water Tank Air Cooler. The acronym for Split Water Tank Air Cooler is (SWTAC). In this design there are two units the Evaporator section and the Water tank. The salient points of SWTAC are the following

- The Evaporator section which facilitates direct contact of the water particles & the moving air stream enables cooling of the air and
- The Water tank which stores the water.
- The water is circulated between the two units namely the Evaporator section and the Water tank using separate water pumps.



**Fig. 3:** Schematic design of proposed Split Water Tank Air Cooler is (SWTAC)

The advantages of Split Water Tank Air Cooler (SWTAC) are the following.

- Design is compact
- Portability while usage
- Cost saving as the design of structure is less demanding
- Ease of shipment
- Considerable size of carpet area is saved
- Makeup water can be added remotely at the water tank.
- This design is very useful for industrial shop floors. Lot of useful space can be saved.
- This design suitable to be adopted as a window unit. The water tank then is placed outside the room to be cooled
- Ease of manufacturing owing to separate manufacturing facilities for the Evaporator section and the water tank

## Conclusions

A futuristic design is proposed. This design is compact, portable and saves considerable size of carpet area. Further this design will have impact in the industrial design and manufacturing processes of air coolers as separate facilities will manufacture the Evaporator section and the water tank owing to the different manufacturing techniques.

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