

DESIGN AND FABRICATION OF AIR COOLER AND HEATER USING THERMOELECTRIC EFFECT

PARTH PANDYA, JATIN PATEL, NIKANT PATEL, VISHAL PATEL
KRUNAL PARIKH (PROFESSOR MECHANICAL ENGINEERING DEPARTMENT)
IITE, INDUS UNIVERSITY, RANCHARDA, AHMEDABAD -382115

ABSTRACT: Thermoelectric cooling uses the Peltier effect to create a heat flux between the junctions of two different types of materials. A Peltier cooler, heater, or thermoelectric heat pump is a solid-state active heat pump which transfers heat from one side of the device to the other, with consumption of electrical energy, depending on the direction of the current. Such an instrument is also called a Peltier device, Peltier heat pump, solid state refrigerator, or thermoelectric cooler (TEC). It can be used either for heating or for cooling, although in practice the main application is cooling. It can also be used as a temperature controller that either heats or cools.

This technology is far less commonly applied to refrigeration than vapor-compression refrigeration system. The primary advantages of a Peltier cooler compared to a vapor-compression refrigerator are its lack of moving parts or circulating liquid, very long life, invulnerability to leaks, small size and flexible shape. Its main disadvantage is high cost and poor power efficiency. Many researchers and companies are trying to develop Peltier coolers that are both cheap and efficient.

A Peltier cooler can also be used as a thermoelectric generator. When operated as a cooler, a voltage is applied across the device, and as a result, a difference in temperature will build up between the two sides. When operated as a generator, one side of the device is heated to a temperature greater than the other side, and as a result, a difference in voltage will build up between the two sides (the Seebeck effect). However, a well-designed Peltier cooler will be a mediocre thermoelectric generator and vice versa, due to different design and packaging requirement.

Keywords: Peltier Module, Condenser, Water Block, D.C Converter, Submersible Pump, Conventional Pump

1. INTRODUCTION

INTRODUCTION THERMOELECTRIC COOLING:

General :

Thermoelectric cooling provides an alternative solution to the common compressor and absorber cooler. Thermoelectric coolers are used especially if small cooling power is needed (up to 500 W)

Benefits of thermoelectric coolers:

- small size
- light in weight
- no fluid
- independent from the working position
- high reliability
- exact temperature control
- heating by changing the direction of the current

THE COMPONENTS OF THE SYSTEM HAS BEEN DESCRIBED BELOW

1. Fan :

The fans are the only mobile parts of the cooler. Possibly one would like to leave out the fans. You have to consider that a heat sink works 3 times better with fan than without.

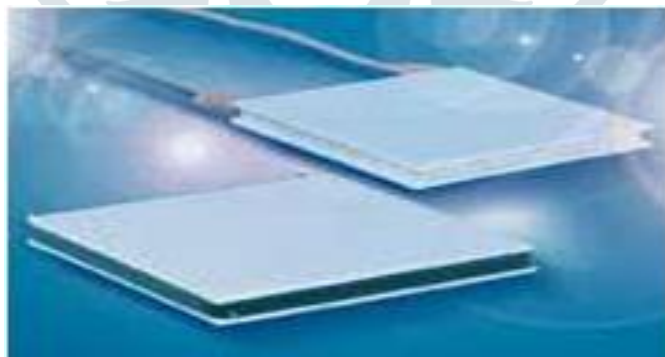
2. Cooling plate :

Normally a heat source delivers the heat to the ambient air. To avoid overheating, the ambient air must often be cooled. You can cool more efficient, by removing the heat directly from the source. If possible one uses a cooling plate (direct-to-air cooling unit) in place of the air-to-air cooling unit.

3. Peltier Module

The core piece of a thermoelectric cooler is the thermoelectric module

A thermoelectric module is an electrical module, which produces a temperature difference with current flow. The emergence of the temperature difference is based on the Peltier effect designated after Jean Peltier. The thermoelectric module is a heat pump and has the same function as a refrigerator. It gets along however with-out mechanically mobile construction units (pump, compressor) and without cooling fluids. The heat flow can be turned by reversal of the direction of current.



4. Water Cooled Condenser

HERE THE CONDENSER IS USE TO COOL THE HOT WATER WHICH IS AT THE PELTIER END & SPRAY THE COOLED WATER ON THE HOT SIDE OF PELTIER,SO THAT TO GET MAXIMUM EFFICIENCY OF PELTIER MODULE.



2. WORKING

Thermoelectric coolers operate by the Peltier effect (which also goes by the more general name thermoelectric effect).

The Peltier module has two sides, and when DC current flows through the device, it brings heat from one side to the other, so that one side gets cooler while the other gets hotter.

The hot side is attached to a heat sink so that it remains at ambient temperature, while the cool side goes below room temperature.

Water Cooled Condenser is attached with this Peltier System, which continuously supply cool water to the hot side of Peltier module.

So Automatically as per the working principle of Peltier module cold side of the module goes to very low Temperature.

Ex. If we take down the temperature of hot side to 50°C with the help of condenser then cold side will go down to -10°C.(Peltier Effect)

There is two Peltier module used in this system to get better cooling effect.

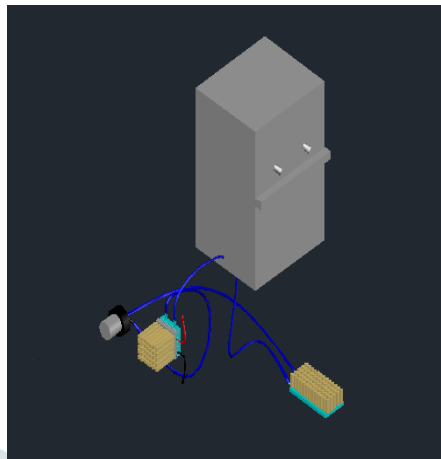
Now water passes through cold side of Peltier module then heat transfer takes place.

This chilled water transferred to tank of conventional cooler & as per the working of conventional cooler take place.

In some applications, multiple coolers can be cascaded together for lower temperature.

Using Peltier elements in combination with our TEC controllers, there are solutions in various application fields.

3-D DESIGN



EXPERIMENTAL SETUP



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