Abstract

The thermoelectric effect is an exchange in voltage for a change in temperature. Thermoelectric cooling devices are typically used only for cooling, though some can be used for both heating and cooling by reversing the polarity of the current flow. A Peltier Cooling Module is one such component. This application note will breakdown the process of installing and removing a Peltier device as well as going over some important guidelines of the process.

Keywords

Thermoelectric cooling is synonymous with Peltier cooling.

Thermal paste, or thermal grease, is a substance which increases the thermal conductivity of an interface and helps bond two surfaces together.

A Thermocouple is a junction between two different metals that produces a voltage that relates to a temperature difference.
Introduction

There is a calorific effect of an electrical current at the junction of two different metals. This effect is called the Peltier effect. When current flows through a circuit, heat is exuded from the upper junction and absorbed at the lower junction. The heat absorbed can be quantified by

\[ Q = \rho_{ab}I = (\rho_b - \rho_a)I \]

Where \( Q \) is the heat absorbed by the lower junction, \( I \) is the current through the circuit, \( \rho_{ab} \) is the Peltier coefficient of the entire thermocouple, and \( \rho_a \) and \( \rho_b \) are the Peltier coefficients of each material. The thermocouples in Peltier junctions are pressed between two ceramic plates and made up of P-type and N-type semiconductors connected in parallel. Peltier coolers are solid-state active heat pumps that transfer heat from one side of the device to the other.

Installation

Notes

The Peltier module is a thermoelectric device that must be used with a heat sink to work correctly. Most modules also need to be used in conjunction with a fan or liquid coolant. These should be decided on depending on the type of thermoelectric device that will be used.

Non permanent thermal paste would be ideal to allow for component changing in the future. Some non-permanent thermal pastes need to be cleaned off and reapplied yearly.

Steps

Begin by making sure both sides of the thermoelectric module are clean as well as the mounting surface of the heat sink and cold plate.

Spread a thin layer of the thermal paste on the heating side of the module. The heating side can be distinguished by the wires attached to it. In some cases the heating side is also slightly larger.

Use a card or some plastic to spread the paste evenly over the surface. Then place the Peltier device on the heat sink and rub in a circular motion until a resistance is felt. This will make sure the paste is spread evenly and get rid of excess. Too much thermal paste can hinder the thermal conductivity.
Repeat this process for the cold plate side of the device.

Compress the assembly plate around the structure just enough to put the bolts onto the end of each screw.

Tighten each screw just a little and then rotate tightening screws to apply pressure evenly. This will prevent breaking the device and allow for good thermal conduction between all surfaces.

**Afterwards**

Some of the thermal grease will leak out over time, because of this it is important to wait an hour and then tighten the screws again. At this time, the springs in the assembly should be fully compressed.

Some thermal compounds may take time to reach maximum performance.

**Removal**

To remove the device, disconnect the Peltier wires. Remove the screws and take off the assembly plate.

Be careful not to damage the module when removing from the heat sink and cold plate. Do not pull on wires to loosen module.

**Cleaning**

Remove all thermal paste from all surfaces. Be sure not to use oil based cleaners on any surface as it will add an oil layer for the heat to travel through. Isopropyl Alcohol or Acetone would be a good choice for cleaner. Q-tips or an old toothbrush would be good tools in cleaning, avoid linty alternatives such as tissue products.
**Conclusion**

The most important points to remember in the installation process are:
Make sure the orientation of the Peltier is facing the correct direction (heat side to heat sink), make sure thermal grease is completely covering surface but not excessive, and apply uniform pressure by tightening screws a little at a time and then rotating. The thermoelectric device will work most efficiently if these considerations are followed.

**References**

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*Thermal Paste and How to Use It*