

Fabrication of Two Wheeler Driver Cabin With Air Conditioning Using Peltier Effect

Nidhish Maheshwari ¹, Prateek Jain ², Manas Pandey³, Rajat Kumar Singh ⁴ and Ritwik Shukla ⁵, Akbar Ali ⁶

^{1, 3, 5} *B.E (Mechanical Engineering), Medi-caps Institute of Technology & Management, Indore 453331, India*

² *Student (M.Tech-Energy Engineering), National Institute of Technology, Tiruchirappalli 620015, India*

⁴ *Senior Engineer, Adani Total Gas Limited, Halvad 363330, India*

⁶ *Asst Professor, Mechanical Engineering Department, Medi-caps University, Indore 453331, India*

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ABSTRACT

During the major part of the year, various climatic conditions, like heavy rain, extreme hot or cold, make driving a two-wheeler uncomfortable and prone to accidents. In order to prevent such casualties, we made a stiff casing in the form of a cabin with air conditioning within.

Making a covering for the driver and conditioning the air within it will not only protect him/her from difficulty caused while driving due to adverse climate, but it will also help him/her concentrate better.

Use of refrigerants (Freon, ammonia...) can get maximum output, but one of the major disadvantages is harmful gas emission and global warming; this problem is overcome by using the thermoelectric module (Peltier effect). This technique will result in zero emissions.

As the cooling units are of small size, silent contains no liquids or gases and have no moving part hence a long life. It is very simple to control the rate of cooling by adjustment of the current; the response to changes in the supply is very rapid, while reversal of the direction of the current transforms a cooling unit into a heater with COP in excess of unity.

KEYWORDS: *Peltier Module, Heat Sink, Air Fan, Windshield, Fins, Two-wheeler, air conditioning.*

I. INTRODUCTION

A thermoelectric (TE) cooler, sometimes called a thermoelectric module or Peltier cooler, is a semiconductor-based electronic component that functions as a small heat pump. By applying a low voltage DC power source to a TE module, heat will be moved through the module from one side to the other. One module face, therefore, will be cooled while the opposite face simultaneously is heated. It is important to note that this phenomenon may be reversed whereby a change in the polarity (plus and minus) of the applied DC voltage will

cause heat to be moved in the opposite direction. Consequently, a thermoelectric module may be used for both heating and cooling, thereby making it highly suitable for precise temperature control applications. We have fabricated a frame on a two-wheeler of hollow steel pipe and provided covering with polystyrene covers and a windshield to minimize the flow of air in the cabin, and we have also mounted a Peltier cooler on to the frame to provide comfort to passengers while riding.

II. METHODOLOGY

The methodology is adapted to complete the project, Starting from the testing of peltier module assembly to fabrication of peltier cooler, bike frame, and their assembly.

A. Peltier cooler

The Peltier cooler is designed and fabricated as to meet the requirements in various seasons. The fabrication and construction details are as follows:

Peltier cooler consists of: 2 Peltier modules used to cool the driver's cabin and maintain the temperature, 2 Big heat sinks are used to remove the heat generated by Peltier, 3 exhaust fans to create suction so that air entering the cooler strikes the cold fins and then pulled out into the cabin, Peltier modules were sticking to the big heat sinks on one side and with fins on the other side with the help of thermal paste. After adding some epoxy, the whole setup is fixed to the wooden box with the help of 8 bolts; we also attached aluminum sheets inside the cooler so that the cooling inside the box is maintained, exhaust fans are mounted inside the cooler to force out the cool air within into the cabin.

B. Frame

The frame is made up of circular hollow stainless steel pipe because they are best suited in structural efficiency to resist various loading conditions, firstly the pipe is bent into the required geometrical shape by measuring vehicle



dimensions, and drivers comfort from the shape obtained by modeling after bending cross members are attached to the main side members by welding, After the shape is achieved the welding is made permanent, the windproof and waterproof covering is cut in the conjugate shape of a frame and attached to it with the help of nut and bolts, cooler is attached to the frame, and then the whole frame cooler assembly is mounted on the bike with the help of clamps and nut bolts, the windshield is attached at the front portion in the end so as to minimize drag and air leakage.

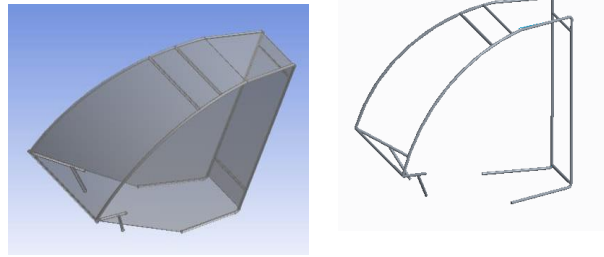


Fig.1- Design in CREO

III. MODELLING AND ANALYSIS

The modeling of a project was done to virtually obtain the prototype of the bike frame that we were going to fabricate and also to check its reliability in real environmental conditions; it was tested on CAE software.

A. Modelling of project

After measuring the vehicle dimensions, handle swing, and leg space of the passengers, modeling was done in CREO parametric software.

The isometric view of the frame is shown below:

B. Analysis in Ansys Workbench

After proper preparation of model in CREO parametric software, the model is imported into Ansys(16.0) software and different analysis such as static structural, CFD was performed, and maximum stresses, deformation, and pressure were obtained. Bumping load of 3000N was applied at the frame body, and fix support was applied at the frame ends. The values obtained were compared with the theoretical values, and a factor of safety of 1.5 was obtained as the ultimate tensile strength of structural steel is 550MPa

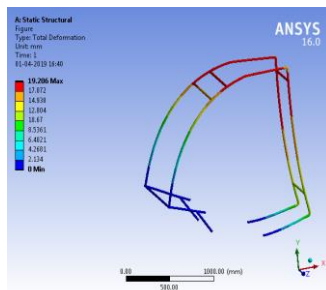


Fig :2- Deformation

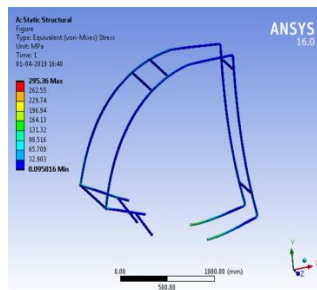


Fig:3- stresses Induced

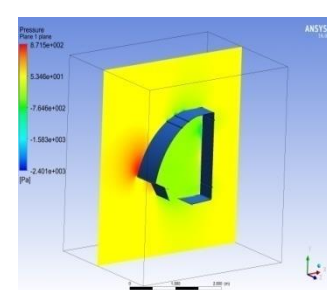


Fig:4-pressure distribution

IV. FABRICATION

The Photographs of the Peltier cooler and fabrication of the frame have been shown below. Also, the picture shows the compatibility of two passenger's comfortability in the two-wheeler.

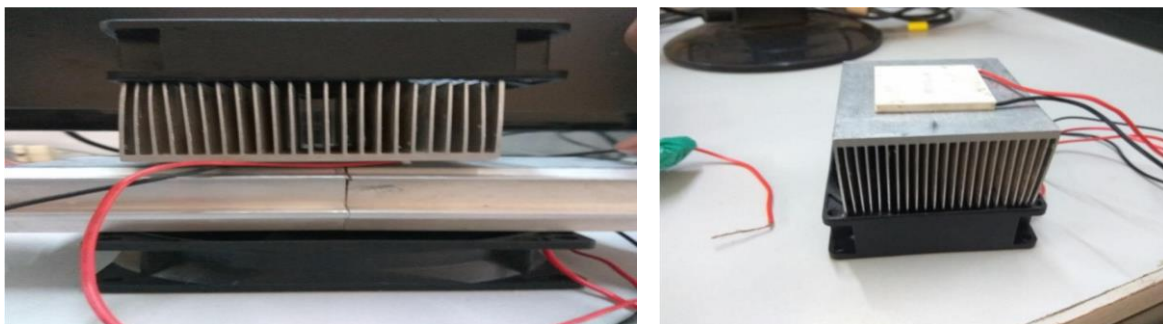


Fig:5 Peltier Assembly with fins and exhaust fan

A. Fabrication of Peltier cooler

Complete assembly of Peltier modules with heat sinks and exhaust fans were made, and the all the devices were connected in parallel with a 12V D.C battery.



Fig:6 Exhaust fans arrangement in Peltier cooler



Fig:7 Peltier Cooler with heat sink

B. Fabrication of Bike Frame:

After the bending and welding of pipes and mounts, a foldable transparent shed and windshield were attached, after which the Peltier cooler was mounted on the upper members.



Fig: 8-Core frame



Fig: 9 - Fully assembled project

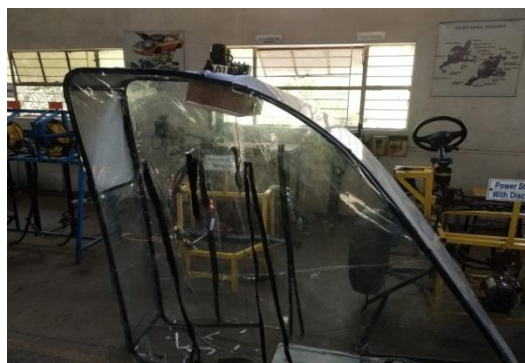


Fig:10- Cooler frame assembly

V. RESULT & CONCLUSION

Table: Result table for Peltier module

S. No.	Initial Temperature(°C)	Final Temperature (°C)	Temperature difference(°C)	Time
1	39	26	13	2 min
2	35	15	20	5 min
3	37	10	27	10 min

Steady-state is reached after 10 minutes of Peltier working.

Advantages of project

- Provide comfort to the driver and passenger in two wheeler during adverse weather conditions.
- Prevention from loo winds, rain, dust, etc.
- High reliability, which does not produce constraints while riding.
- Temperature within the cabin is maintained for a suitable driving atmosphere.
- Comfortable atmosphere during winter as a major problem during cold weather is cold winds.
- Foldable curtains are used so that during a pleasant outer atmosphere, curtains can be folded, and the cooler can be switched off.
- Good headspace and legroom are being provided.
- Battery is charged by the alternator of the battery; hence power consumption by the cooler is not a problem.
- Covering can also be made from fiber sheets for rigid side structures.
- Solar panels can also be installed for battery charging.
- Hot side of the Peltier can be used to provide warm air during cold seasons.
- Wipers can be installed for rain.
- Other means of cooling, such as evaporation cooling, can be used as Peltier is less efficient and power consuming.
- More packed and leak-proof covering can be fabricated for efficient cooling.
- The cabin can also be heated and cooled simultaneously by means of vortex tube

refrigeration by making an arrangement of compressor that runs by bike battery power.

- Use of cooling and heating jackets-such as Peltier jackets and vortex tube air jackets can also be used for providing comfort in adverse weather conditions
- Refrigeration by an expansion of air or throttling of gas can also be used.

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