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# DESIGN, ANALYSIS OF LED LAMP FINS BY USINGDIFFERENT SHAPE FOR INDUSTRIAL USED LED LIGHT

Ms. Snehal Vinayak ZanjadPG Student,
Mechanical (Design) Jaihind College of Engineering,Kuran,Pune,Maharashtra,India
Snehalzanjad58@gmail.com
"Dr.Galhe .D.S"
Dept.of Mechanical Engg. JCOE,Kuran,SPPU Pune IndiaData.dsgl@gmail.com
Guide Prof.Said.K.M
Dept.of Mechanical Engg.
JCOE , Kuran, SPPU Pune ,IndiaSaidkhandu@gmail.com

## Abstract

Industrial and home base applications of LED (light-emitting diode) technology for the streets, terminals, stadiums etc. now a days luminaires are taking more and more important role in lightning industry. Even though LED luminaires are much more energy efficient than traditional lighting however these luminaires are exposed to high temperature influence. In this work the luminaire body cooling is investigated at variable fins shape. Properties of the cooling fins of luminaire body are investigated using FEA models as well as practical testing. FEA procedures of the cooling fins robust shape optimization will be discussed in details.

Kay wards: LED, fins shape, Optimization, thermal analysis.

## Introduction

Employing LED systems for customary down-lighting applications may require shrouded radial fin heat sinks to increase the heat transfer while reducing the space requirement for active cooling. Most lighting is already in some form of housing, and the ability to concurrently optimize these housings for thermal and optical performance could accelerate the widespread implementation of cost- efficient, environmentally-friendly solid-state lighting. In response, this research investigated the use of conical, cylindrical, square, and pyramidal shrouds with pin/radial fin heat sink designs for the thermal management of high-power LED sources. Numerical simulations using FLUENT were order to account for details of the air flow, pressure drop, and pumping power, as well as the heat transfer and temperature distributions throughout the system. The LEDs were modelled as a distributed heat source of 25 – 75 W, on a central portion of the various heat sinks. Combinations of device junction temperature and pumping power were used to assess the performance of shrouded heat sink designs for their use in air-cooled, down lighting LED fixtures.

In general, circular heat sinks with conical/cylindrical shrouds outperformed square heat sinks with pyramidal/square shrouds, despite the circular sinks having only 86.7% of the square sink's surface area. For a pumping power of 5 W and an ambient temperature of 300 K, the transition to pin fin circular sinks reduced the best-shroud-case thermal resistance from 0.40 K/W to 0.35 K/W. The best-case shroud inclination angle went from 71.8º to 65.3º during this transition.

**Scope and Objective of Project**

As this project works on the company's real problem i.e. their street light LED lamp facing a failure problem due to excessive heat generation and the existing thermal system (rectangular finned heat sink) is not efficiently working in this particular case, hence the objective of project are

1. To find out the convective heat transfer coefficient and thermal performance of company's existing rectangular finned heat sink.
2. To find out the convective heat transfer coefficient and thermal performance of newly proposed heat sink.
3. To analyze both the thermal system by using transient thermal ANSYS 14.5.
4. Comparison of thermal performance of both fin geometries and provide the optimum design.

**ANSYS simulation of different fins**

To find out the best suitable fin over the company's existing fin, we carried out many ANSYS simulations by varying fin height, fin spacing, and mainly by changing its geometry. Out of these many simulations below are the ANSYS simulations or analysis for different types of fins, also for finding best suitable meshing for simulation, different types of meshing process run on circular type of fin, and find the best results by using a tetra fine meshing type which is discussed in meshing report.

1. **Circular pin finned plate**


Fig. 1 Model of Circular Fins LED Lamp


Fig. 2 Meshing model of Circular LED lamp

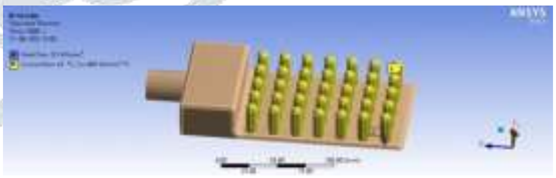


Fig. 3 Boundary Condition applied to Circular LED lamp

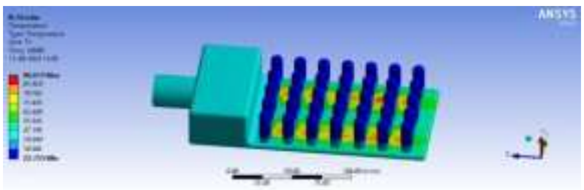


Fig. 4 Temperature result of circular LED lamp

**2. Company's original rectangular finned plate**

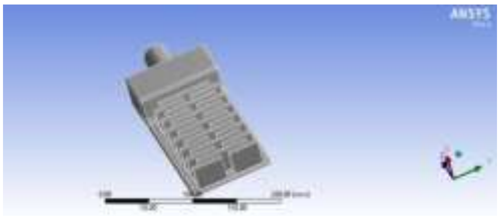


Fig. 5 Model of rectangular Fins LED lamp

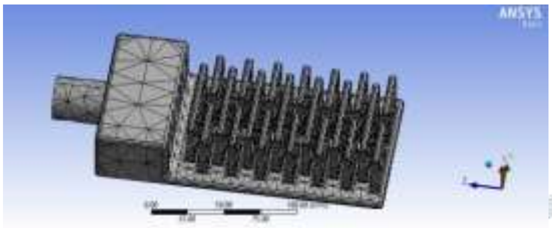


Fig. 6 Meshing of rectangular fins LED lamp

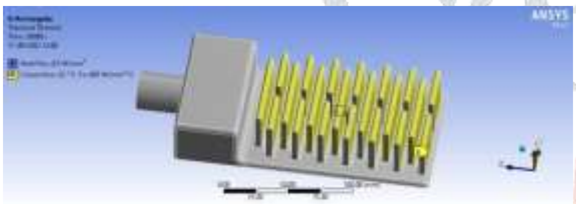


Fig. 7 Boundary condition applied for rectangular fins LED lamp

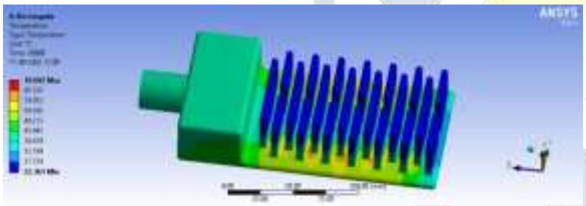


Fig. 8 Temperature results in rectangular fins LED Lamp

**3. 20mm cross finned plate**

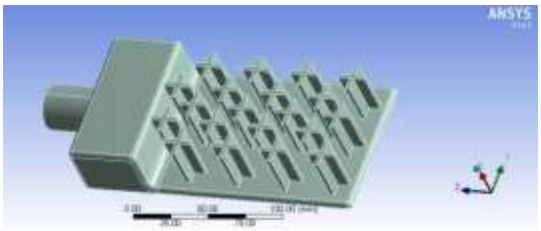


Fig. 9 Model of cross 20mm fins LED Lamp

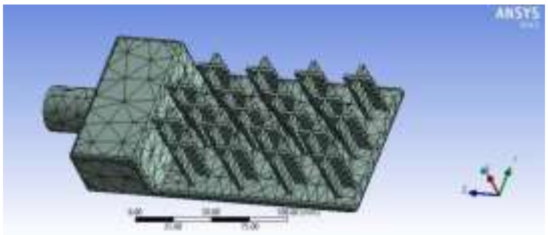


Fig. 10 Meshing in cross 20mm LED lamp

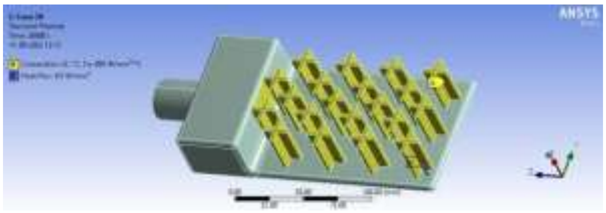


Fig. 11 Boundary condition applied to cross 20mm LED lamp

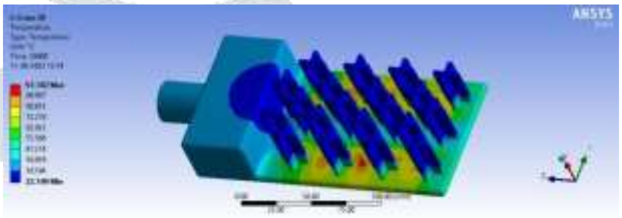


Fig. 12 Temperature results of cross 20mm LED Lamp

**4. Spline finned base plate**

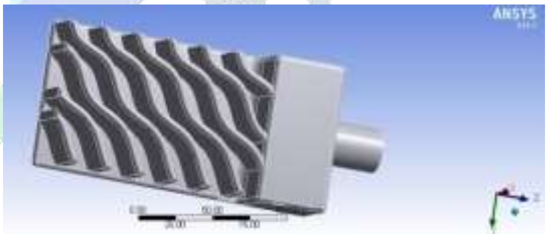


Fig. 13 Model of spline LED lamp

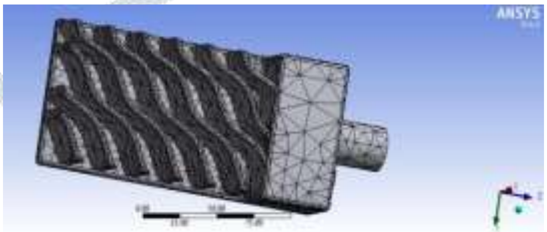


Fig.14 Meshing of spline LED lamp

Fig. 15 Boundary condition applied to spline LED lamp

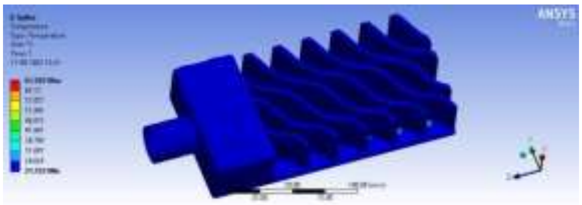

Fig.16 Temperature results of spline LED lamp

### 5. Square 10mm pin finned base plate

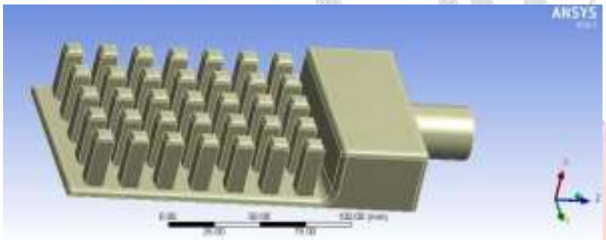

Fig. 17 Model of Square LED lamp

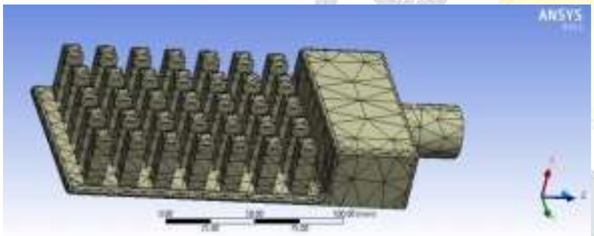

Fig. 18 Meshing of square LED lamp

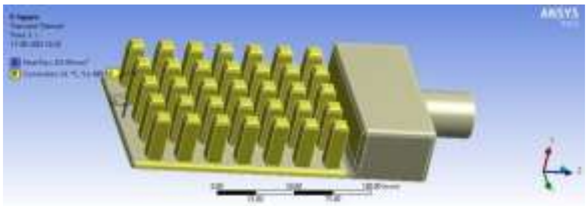

Fig. 19 Boundary condition applied to square LED lamp

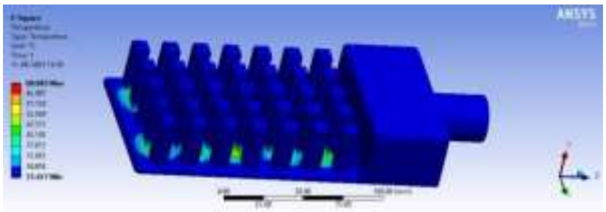

Fig.20 Temperature results of square LED lamp

### 6. Cross 10mm pin finned plate

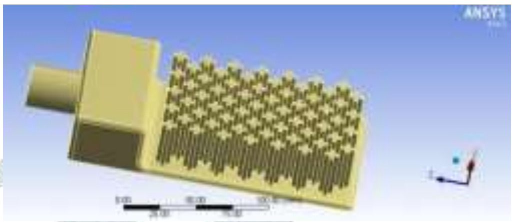

Fig.21 model of cross 10mm LED lamp

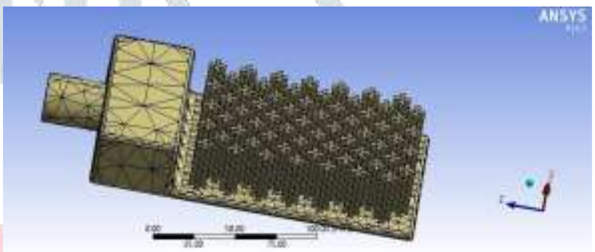

Fig. 22 Meshing of cross 10mm LED lamp

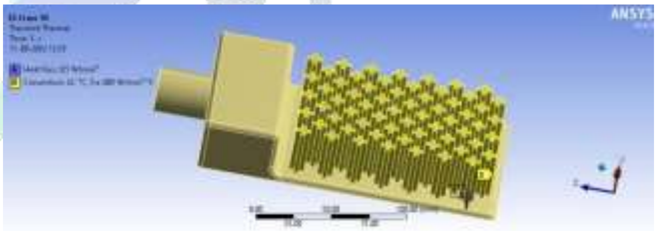

Fig. 23 Boundary Condition applied to cross 10mm LED lamp

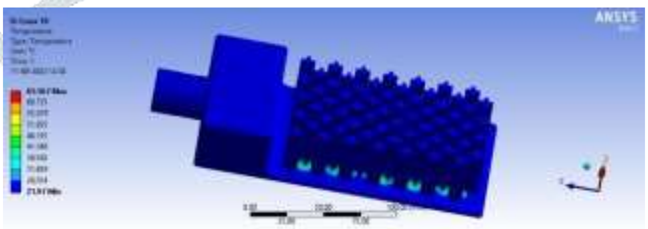

Fig. 24 Temperature results of cross 10mm LED lamp

Result Table

| Sr. No. | Type | Weight (Kg) | Temperature ($^0$C) |
|---|---|---|---|
| 1 | Rectangular | 0.80516 | 70.69 |
| 2 | Circular | 0.64934 | 96.05 |
| 3 | Cross | 0.61476 | 69.118 |
| 4 | Cross 10mm | 0.68069 | 65.56 |
| 5 | Spline | 0.61758 | 67.02 |
| 6 | Square 10mm | 0.71353 | 64.133 |

Table 1. ANSYS simulation result table for different types of finned plate

## Conclusion

On the basis of above simulation, it is observed that cross 10mm pin fin has the best result over the company's original rectangular fin and also other types of fins, hence decided to manufacture this type of finned plate and do experimentation of company's original one and newly manufactured cross 10mm fin for comparison and providing the optimizedsolution to company.

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