PROJECT PRESENTATION
BY
ABHISHEK SONI

SPONSORSHIP

- This project is an entirely an in-house & self developed project under the able guidance of Prof U.V. Awasarmol

TITLE OF THE PROJECT

Experimental Investigation & Optimization of convective heat transfer through perforated fins.

BACKGROUND

- To present the study on recent experimental research in a succinct and structured manner

- To highlight important and noteworthy results in heat transfer characteristics of pin fin heat sinks under varying conditions and configurations

OBJECTIVES

- To design and fabricate an experimental apparatus to study the heat transfer characteristics of air flowing over inline & staggered perforation in fins
- To test for various values of Reynolds number & optimize the flow using different orientations of fins & also calculating pressure variations for different flow velocities

SIGNIFICANCE

- Relatively unexplored domain
- Pronounced advantages of higher heat transfer rates as well as increased efficiencies
- Reduced weight and economic efficiency
- Widespread application in electronics

NOMENCLATURE

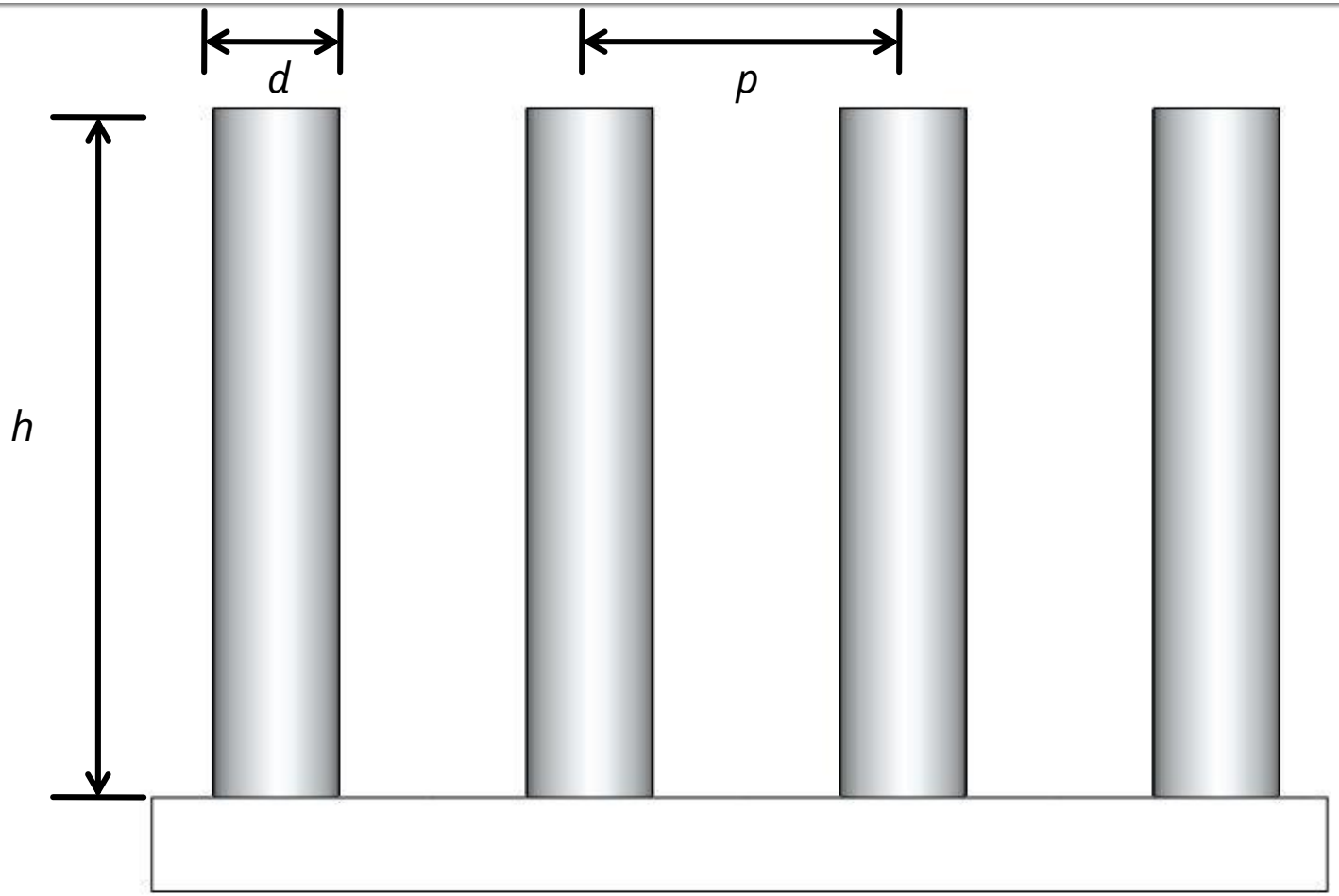
Terms related to individual fin

- Fin height
- Fin shape (cross sectional profile)
- Cross sectional area

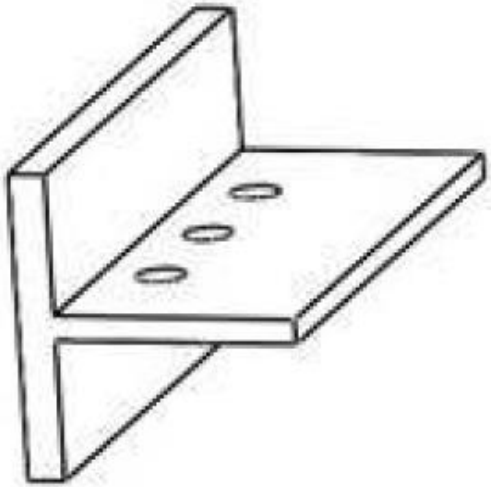
Terms related to heat sink

- Fin population (and population density)
- Fin spacing (Pitch)
- Pitch to diameter ratio
- Pin fin arrangement
- Heat sink orientation

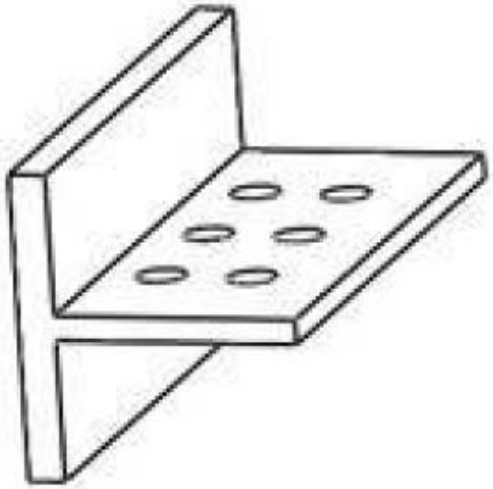
Nomenclature

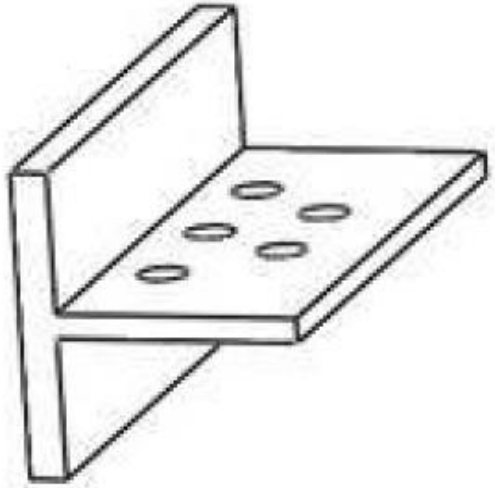


ARRANGEMENT OF FINS



In-line fins

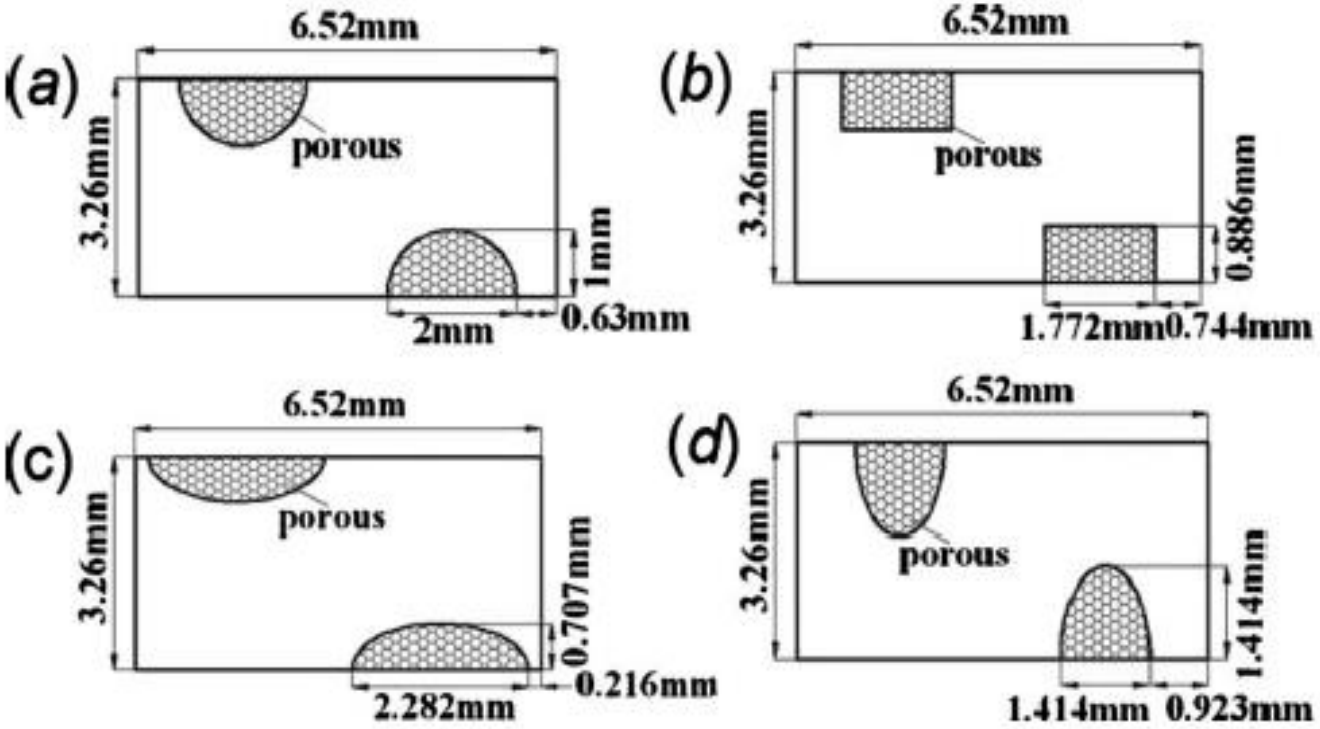




Staggered fins

DIFFERENT PERMEABLE FINS

- The picture displays the different shapes of permeable fins



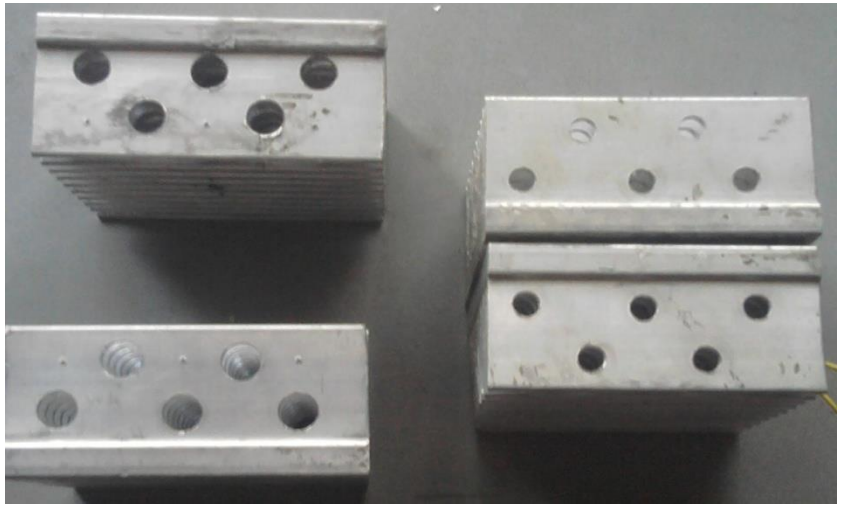
EXPERIMENTAL SETUP

Heat Flow Test Rig

Heat Transfer Setup

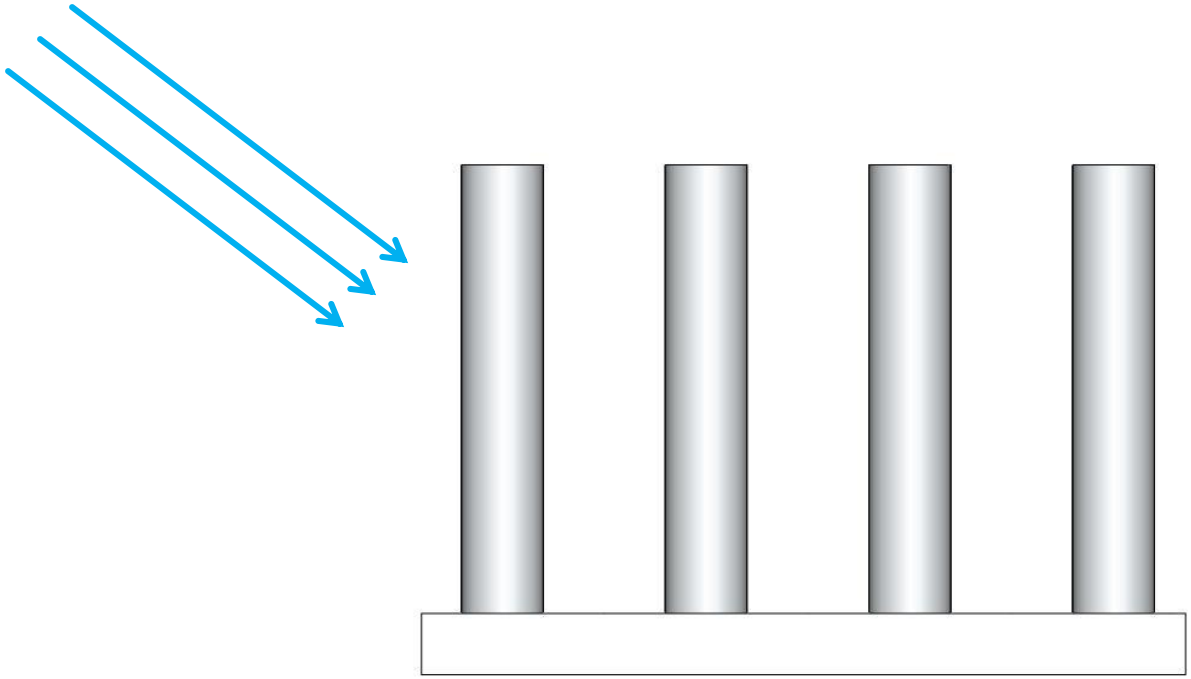
WHY USE PERFORATIONS

- The main purpose of incorporating perforations is to interrupt the hydrodynamic boundary layer periodically, add surface area, generate secondary flows and vortexes at the expense of local pressure drop



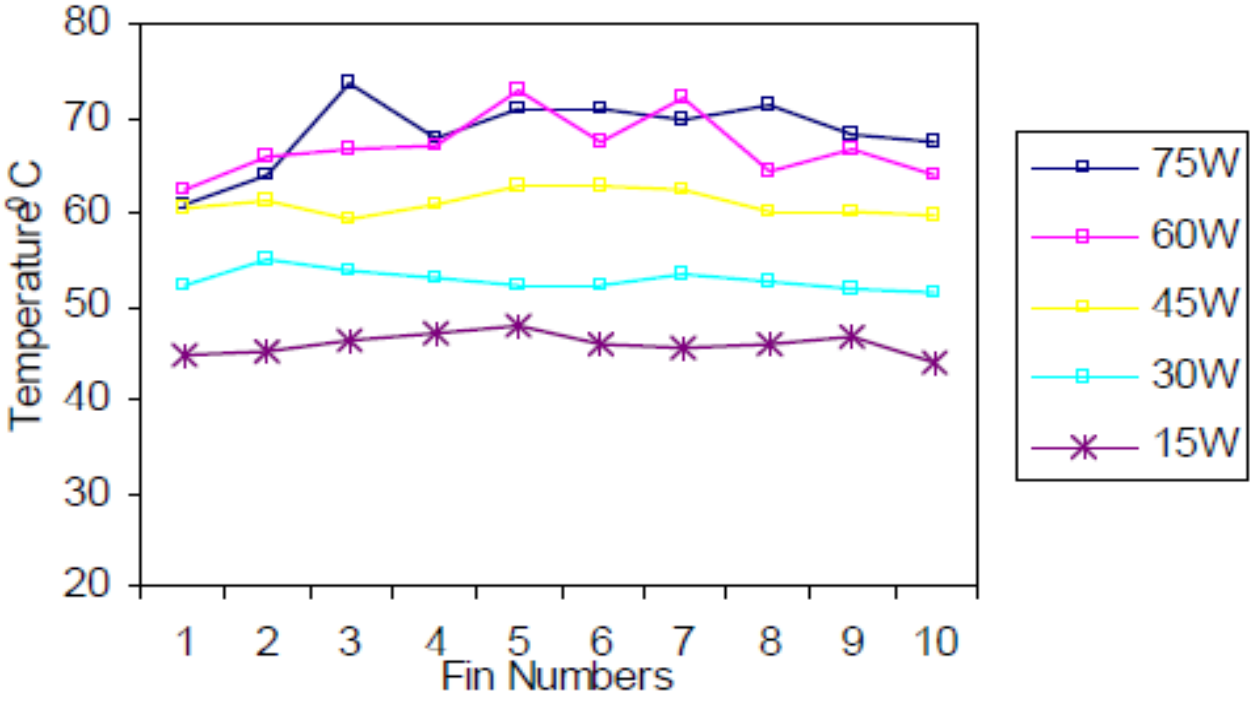
EFFECT OF ORIENTATION

- Testing for the heat transfer rate through 0° to 90°, a maxima is obtained at 45°.



Effect on temperature profile

- For the same fin density, sinks with higher fin height perform better



Flow development and impact on heat transfer characteristics

- The flow velocities are lower in case of permeable fins.
- The flow tortuosities are much higher in case of solid fins.
- Combined effects of accelerated flow and wakes formed by preceding fins affects heat transfer rate.

APPLICATIONS

- Some prominent applications include gas turbine cooling passages, compact heat exchangers, paper pulp industry and in fabricated PCBs.
- Conventional evaporators for water desalination typically comprise multiple effect evaporators having a plurality of heat transfer tubes.

Conclusion

- On reviewing the results and findings of the various research experiments undertaken on natural as well as forced convection heat transfer enhancement included in this paper, it can be said that permeable fins improve the heat transfer capability significantly.