

RESEARCH AND DEVELOPMENT

Name of the Researcher	Designation & Department	Research Topic	Year of Completion
Dr. Rajesh E. Thombre	Associate Professor, Department of Mechanical Engineering	Numerical study of buoyancy induced flow and heat transfer inside a pipe	2015

BRIEF SUMMARY OF THE WORK:

This work is carried out as a part of Doctoral work at Priyadarshini College of Engineering, Nagpur. Designing of thermo-siphon system is depends on its working temperature and flow rate required in specific application. In some situation higher flow rate is required, in some applications higher fluid temperatures are required, while in some cases more heat collection is required. Therefore in order to design the natural convection system to the specific application, knowledge of the buoyancy induced flow and the associated heat transfer coefficient is essential. For thermo siphon system, no exact procedure and correlations are available to calculate flow rate, heat transfer coefficient and outlet temperature of fluid, if only diameter, length, inclination of tube and heat supply are known.

This work deals with the establishing the correlations for heat transfer and flow characteristics for the buoyancy induced flow through inclined tubes in terms of dimensionless parameters, involving various system parameters like tube length, tube diameter, tube inclination and heat supplied. The generalized procedure for designing of any thermo-siphon system is established. Relationship is developed between Nusselt Number, Rayleigh Number the Reynolds Number with suitable modifications in their definitions. The procedure adopted here to solve numerically various governing equations (mass, momentum and energy equations) to calculate (1) induced flow rate, (2) the fluid outlet temperature and (3) heat transfer characteristics inside a pipe for wide range of parameters such as pipe length, pipe diameter, and pipe inclinations and heat flux. Wherever required the solution obtained numerically was validated by experimentation also by professional CFD software for some standard situations.

INDUSTRY RELEVANCE : The work is extremely vital in designing any system which works on natural convection such as solar water heater, water tube boiler and heat exchanger. The work provides generalized design procedure for the systems which works on thermo siphon.

RESEARCH OUTCOMES : Four papers in international Journals and Two papers in Proceedings of International/ National Conferences have been published on this work.