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LAMINAR AIR FLOW FREE CONVECTIVE HEAT TRANSFER INSIDE A VERTICAL CIRCULAR PIPE WITH DIFFERENT INLET CONFIGURATIONS

ABSTRACT

Free convection heat transfer has been experimentally investigated for laminar air flow in a vertical circular pipe by using the boundary condition of constant wall heat flux in the ranges of Ra_L from 1.1 10⁹ to 4.7 10⁹. The experimental setup was designed for determining the effect of different configurations placed at the inlet of a vertical heated pipe, on the surface temperature, the local and average heat transfer coefficients. The apparatus was made with an electrically heated aluminum pipe with length of 900 mm and inside diameter 30 mm. The inlet configurations included two circular pipes having the same diameter as the heated pipe but with lengths of 600 mm, 1200 mm, sharp- edge and bell-mouth. It was found that the surface temperature along the pipe surface for same heat flux would be higher values for inlet condition with length of 1200 mm and would be lower values for bell-mouth inlet condition. The results show that the local Nusselt number Nux and average Nusselt number values would be higher for bell-mouth inlet condition and lower values for 1200 mm inlet condition. For all inlet configurations, the results reveal that the Nusselt number increases as the heat flux increases. Empirical correlations have been proposed in a form of Log versus Log for each case investigated and a general correlation for all cases has been obtained which reveals the effect of inlet conditions existence on the free convection heat transfer process in a vertical circular pipe.

KEYWORDS

[laminar flow](#), [free convective heat transfer](#), [vertical pipe](#), [sharp edge](#), [bell-mouth](#), [different inlet configurations](#)

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