ABSTRACT

In the present investigation fluid flow and heat transfer characteristics due to flow separation on square, triangular and rectangular prism are studied experimentally. Experiments have been carried out for the Reynolds number range 2.6×10^4 to 4.9×10^4, blockage ratio 0.1, 0.2, 0.3 and 0.4, different height-ratios and various angles of attack.

The static pressure distribution has been measured on all faces of the square, triangular and rectangular prisms.The results have been presented in the form of pressure coefficient, drag coefficient for various height-ratios and blockage ratios.

The pressure distribution shows positive values on the front face whereas on the rear face negative values of the pressure coefficient have been observed. The positive pressure coefficient for different height-ratios does not vary too much but the negative values of pressure coefficient are higher for all points on the surface as the bluff body approaches towards the upper wall of the wind tunnel. The variation of pressure distribution have been obtained for different Reynolds numbers, angle of attack and blockage ratio. The drag coefficient decreases with the increase in angle of attack as the height-ratio decreases for all bluff bodies. The maximum value of drag coefficient has been observed at an angle of attack nearly 50° and minimum value of drag coefficient has been observed nearly at 60° for square prism and triangular prism respectively at all height-ratios.The drag coefficient for rectangular prism of different blockage ratio varies along the angle of attack but there is no definite angle of attack for rectangular prisms at which the value of drag coefficient is either maximum or minimum.

The heat transfer experiments have been carried out under constant heat flux condition. Heat transfer coefficient are determined from the measured wall temperature and ambient temperature and presented in the form of Nusselt

number. Both local Nusselt numbers have been presented for various height-ratios. The variation of local and average Nusselt number have been shown with non-dimensional distance for different Reynolds numbers, angles of attack and blockage ratio. The variation of average Nusselt number have also been shown with different angles of attack for different Reynolds number, blockage ratios.

The local as well as average Nusselt number decreases as the height-ratio decreases for all non-dimensional distance and angle of attack respectively for square, triangular and rectanglur prisms. The average Nusselt number for all geometric bodies of different blockage ratio varies with the angle of attack. But there is no definite angle of attack for each bluff body at different blockage ratio at which the value of average Nusselt number is either maximum or minimum. Empirical correlations for average Nusselt number have been presented for square, triangular and rectangular prism as a function of Reynolds number, Prandtl number and relevant non-dimensional parameters.

Keywords : Flow separation, Square prism, Triangular prism, Rectangular prism, Blockage ratio, Height-ratio, Angle of attack, Pressure coefficient, Drag coefficient, Nusselt number.