35th AIAA Fluid Dynamics Conference and Exhibit
6 - 9 June 2005, Toronto, Ontario Canada

AIAA 2005-4651

Effect of Vortex Generators in Confined Swirl Flow

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Abstract

In this article we examine the effects of two kinds of vortex generators on the pressure drop and the core size in confined swirling flows. The *n*=2 vortex model has been used at the exit planes. The influence of vortex chamber geometry and the Reynolds number on the flow field has been analyzed and compared with the present experimental data. It has been seen that the pressure drop coefficient increases with increasing the Reynolds number and/or the diameter ratio. A stronger vortex will be produced by increasing the diameter ratio and/or Reynolds number, resulting in a higher tangential velocity and hence a higher pressure drop. The actual pressure is less for the double generators than of a single generator. Therefore, more energy can be saved by using two generators than one generator.

Nomenclature

A_o	cross sectional area of the vortex chamber
A_{in}	total inlet area
C_p	pressure coefficient ($2\,\Delta P / \rho q_{in}^2$)
D_e	diameter of the exit port ($2\,R_e$)
d_{in}	diameter of the inlet port
D_o	chamber diameter ($2\,R_o$)
L	chamber length
P	static pressure
P_a	ambient static pressure
P_{in}	static pressure at the inlet
Q_{in}	inlet volumetric flow rate
Q_{out}	outlet volumetric flow rate
q_{in}	total velocity vector at the inlet
r, θ, z	radial, tangential and axial coordinate respectively
R_c	core radius
R_e	radius of exit port

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