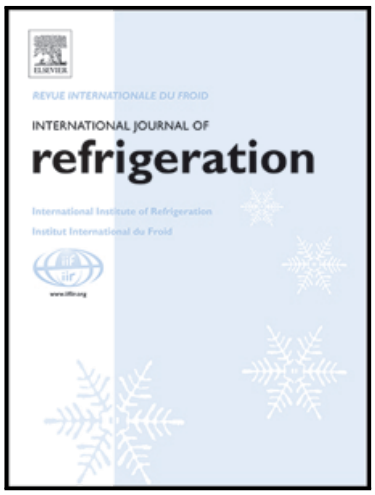

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A Methodology for the Prediction of Back-Pressure Induced Stall in Eductor-jet Pumps

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Abstract

Eductor-jet pumps are used to transfer large quantities of fluids using a high-pressure fluid source without the need for moving parts, such as motors and impellers. The pump operates by creating the Venturi effect inside a convergent-divergent nozzle. These pumps can stall when a back pressure develops at the outlet. In this paper, the critical condition at which the stall occurs is determined by comparing the thrust force from the jets of the pump to the opposing force caused by backpressure at the pump outlet. This methodology predicts the stall conditions for both over-expanded and under-expanded flow conditions. The motive gas pressure and the backpressure ratios at which stall occurs is dependent upon the pump geometry, fluid properties, and the pump operating conditions. Experiments conducted on a 3D printed and a commercially available pump, as well as 3D computational fluid dynamics analyses, enabled verification of the proposed methodology.

Keywords: Eductor-jet pump; Performance; Thrust force; Stall; Ejector refrigeration system; Backflow mode

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