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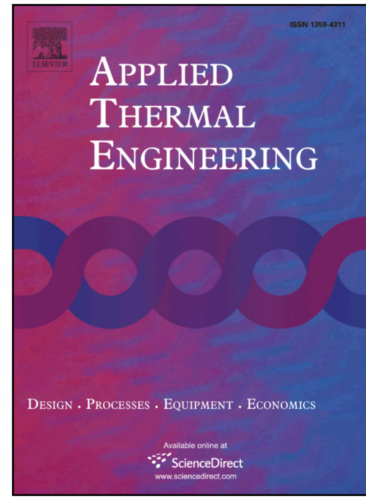

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Abstract

A bayonet tube heat exchanger is typically a pair of concentric tubes, the outer of which has a closed end that creates a clearance pass between the inner and annulus tube. This paper evaluates the impact of key parameters and operating conditions on the performance of a bayonet tube by utilizing computational fluid dynamic approach and Taguchi statistical method. A validated two-dimensional model, that considers conservation of mass, momentum and energy, was employed together with an L_{25} orthogonal array (OA) of Taguchi matrix of five factors and five level designs to determine the optimum combination of parameters as well as their interactions. The result indicates that pipe total length and length of clearance area play an important role in determining the bayonet tube performance in term of pressure drop and heat transfer. The optimum combination of design and operating parameters were obtained with the objective of maximizing the efficiency and performance of the bayonet tube.

Keywords: Bayonet Tube, Heat Transfer, Freezing Pipe, Entropy Generation, Optimization, Taguchi Method

1. Introduction

Bayonet tube heat exchanger consists of two concentric tubes. A working fluid, that could be gas, liquid or phase change material, is pumped either into the inner tube or in the annulus tube, based on the application. Ideally, the fluid is pumped into the inner tube which then flows back in the annulus tube through the closed-ended clearance. Heat transfer in the bayonet tube occurs mainly at two surfaces: (i) the surface between the inner and annular flow streams, and (ii) the surface between the annular flow stream and the surroundings [1, 2].

Bayonet tube has a simple design compared to the other types of heat exchangers. It needs only one penetration point in the working domain to fit in [3]. It can work in a highly corrosive environment and handle ultra-high temperature conditions, by using proper materials

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