Restriction on water consumption is becoming an increasing problem for the power generation industry. As an alternative both to once-through cooling and to surface condenser/wet-cooling tower combination, utility companies and equipment manufacturers are considering, and even implementing, air-cooled condenser (ACC). However, the industry is quite reluctant to switch over to ACC for three important reasons: (a) lower power output, (b) higher capital cost, and (c) larger physical footprint, all because of the same reason, the overall thermal resistance from condensing steam to the ambient air is significantly higher than to cooling water.

Detailed mathematical equations were derived to model the heat transfer process through the finned-tubes of the ACC. To identify the design components with highest effect in the process, the total thermal resistance model was analyzed and investigated theoretically in this study.

This study proposed a viable cooling system based on novel heat pipe technology, which addresses the problems addressed in using the air-cooled condensers in steam power plants condensers. The analysis covered the design and manufacturing considerations, in addition to the thermal performance and limitations of the proposed annular disc-shaped heat pipe. The proposed annular disc-shaped heat pipe was investigated using three analysis techniques. A parametric and limitation lumped theoretical analysis of the proposed annular disc-shaped heat pipe to predict the thermal limitations of the heat pipe design. Secondly, an annular disc-shaped heat pipe was designed and built for the experimental investigation. The results obtained by the parametric analysis used as the input for the experimental design. A detailed mathematical set of equations was derived to model the heat pipe thermal resistance. The governing equations of the heat pipe regions were derived to model the flow and heat transfer in the vapor, wick, and solid regions.

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The public is welcome to attend.