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Comprehensive analysis of the thermohydraulic performance of cooling networks subject to fouling and undergoing retrofit projects

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Abstract

The aim of this paper is to develop guidelines for the placing of new coolers in cooling systems subject to retrofit. The effects of the accumulation of scale on the flow system are considered. A methodology to assess the interconnected effect of local fluid velocity and fouling deposition is developed. The local average fluid velocity depends on the water flow rate distribution across the piping network. The methodology has four main calculation components: a) the determination of the flow rate distribution across the piping network, b) the prediction of fouling deposition, c) determination of the hydraulic changes and the effect on fouling brought about by the placing of new exchangers into an existing structure, and d) the calculation of the total cooling load and pressure drop of the system. The set of disturbances introduced to the system through fouling and the incorporation of new coolers, create network responses that eventually influence the cooling capacity and the pressure drop. In this work, these interactions are analysed using two case studies. The results indicate that, from the thermal point of view, the incorporation of new heat exchangers is recommended in series. The limit is the point where the increase of the total pressure drop causes a reduction in the overall volumetric flow rate. New coolers added in parallel create a reduction of pressure drop and an increase in the overall water flow rate;

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