



SCIENTIFIC & RESEARCH PROJECTS

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Project Title:

Pressure Drop Considerations in the Retrofit of Heat Exchanger Networks

Abstract:

Process Integration technology is now widely used in both energy saving retrofits and plant de-bottlenecks. However, in common with much of the developed technology, systematic consideration is only given to the thermal aspects of process design. The effects of any changes in the exchanger arrangement on the network's flow system (pumps, compressors, gravity) are usually considered only after the network arrangement has been determined. Flow considerations do not form part of targeting procedures. The way pressure drop is utilized within the network is not usually considered at all.

An approach in which the flow system is considered only after network topology (and, sometimes after exchanger sizing) can have unfortunate consequences. In one project known to the authors the use of an established retrofit targeting procedure suggested that the annual energy costs of a plant could reduce by around £250,000 through a retrofit involving new exchangers having an installed cost of £500,000. The project appeared very attractive, and a new network was designed. The results confirmed the targeted predictions. Unfortunately, when detailed system design was undertaken it was found that the new scheme would require the replacement of pumps costing around £1,000,000. The economics of the project then proved unviable. This discovery was made quite late and after the expenditure of a lot of engineering effort.

This paper is a response to the above situation. The work started as an attempt to introduce flow considerations into retrofit targeting. It resulted in a general appreciation of how pressure drop should be used in networks. In some retrofit projects it is possible to reduce the amount of additional heat exchange area needed for de-bottlenecking (or, for energy saving) by making changes to the flow arrangement.

In order to introduce the consideration of pressure drop into thermal networking we need to appreciate how heat exchanger area and stream pressure drop are related. However, before considering this let us review the current state-of-the-art network retrofitting.