Optimized copper alloy tubing configuration for a multi-stage flash distiller

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\textbf{ABSTRACT}

Copper alloys have successfully served as heat exchanger tubing material in multi-stage flash (MSF) desalination plants over decades. They showed, in general, good performance and are still designers’ first choice. The big drawback of these high-alloyed stainless steel materials, however, is the lack of experience that has been made with as a tubing material in thermal desalination so far. The present work describes the experiences and observations made for cupronickel and aluminum brass tubes in three different MSF evaporators located at the Persian Gulf during an operational period of more than three decades. Results of eddy current tests accomplished in the course of refurbishment works are used to determine losses in tube wall thickness after the operation period. Based on the findings obtained an economically optimized tube configuration both in terms of material selection and wall thickness requirements is determined for an exemplary MSF desalination plant with a planned lifetime of thirty years. ASME VIII, Division 1, 2001 is drawn on for calculating the minimum required wall thickness of the different distiller stages. The corrosion allowance necessary for a tubing configuration not sustaining significant damages during this lifetime was calculated using corrosion rates got from eddy current test results and taking into account a tube failure rate of not more than 6% per stage. Detailed results are presented for the most significant stages. Stages were deemed to be most significant whenever a change in wall thickness or material selection became necessary to allow for the most economically efficient tubing configuration. The economical evaluation given is based on current material prices.

\textit{Keywords:} Multistage flash (MSF); Material; Tubing; Copper; Economy; Optimization; Corrosion

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