

## **ABSTRACT**

*Sea water passing through the tube with CuNi 70-30's material in the long term could make a tube leak caused by corrosion at shell and tube 211-E-9, based of this reason, CuNi 70-30's tube would be replaced by duplex stainless steel material.*

*The heat transfer rate occurred in each tube and standard of Birmingham Wire Gage (B.W.G) were used as reference to decide the value of final thickness that correct and commercially available. The comparison of conduction's thermal resistance and tube thickness of each material were used as reference to decide the material that had a better thermal effectiveness.*

*The result of calculation showed rate of heat transfer of each tube was 784,186 W. Based from it was obtained the value of tube thickness for duplex stainless steel 1,067 mm (B.W.G 19), it could accomodate an average temperature in the tube that was equal to 34 °C. Duplex stainless steel had better thermal effectiveness than CuNi 70-30, because the tube thickness and conduction's thermal resistance of duplex stainless were smaller than CuNi 70-30. The thickness tube and conduction's thermal resistance of duplex stainless steel were 1,067 mm and  $1,53 \times 10^{-4}$  °C/W. The tube thickness and conduction's thermal resistance of CuNi 70-30 were 2,108 mm and  $1,61 \times 10^{-4}$  °C/W.*

*Keywords: Rate of heat transfer, tube thickness, thermal effectiveness*

## INTISARI

Air laut yang melewati material *tube* 70-30 CuNi dalam jangka waktu yang lama, menyebabkan *tube* pada *shell and tube heat exchanger* 211-E-9 mengalami korosi. Atas dasar itu maka diambil kebijakan untuk melakukan penggantian material 70-30 CuNi menjadi *duplex stainless steel*.

Standar *Birmingham Wire Gage* (B.W.G) dan laju perpindahan kalor pada *heat exchanger* dijadikan acuan dalam menentukan nilai ketebalan *tube duplex stainless steel* yang tepat. Perbandingan nilai tahanan *thermal* konduksi dan ketebalan *tube* dari masing-masing material dijadikan acuan untuk menentukan material mana yang memiliki efektivitas *thermal* lebih baik.

Hasil perhitungan menunjukkan laju perpindahan kalor pada setiap *tube* sebesar 784,186 W, dengan laju perpindahan kalor tersebut diperoleh nilai ketebalan *tube* untuk material *duplex stainless steel* sebesar B.W.G 19 atau 1,067 mm. Nilai ketebalan tersebut mampu mengakomodir temperatur operasi rata-rata yang terjadi pada *tube*, yaitu sebesar 34 °C. Dari segi efektivitas *thermal*, material *duplex stainless steel* jauh lebih baik dibandingkan dengan 70-30 CuNi, karena memiliki nilai ketebalan *tube* dan tahanan *thermal* konduksi yang lebih kecil daripada 70-30 CuNi. Nilai ketebalan *tube* dan tahanan *thermal* konduksi material *duplex stainless steel* secara berturut-turut sebesar 1,067 mm dan  $1,53 \times 10^{-4} \text{ }^\circ\text{C/W}$ , sedangkan pada material 70-30 CuNi masing-masing sebesar 2,108 mm dan  $1,61 \times 10^{-4} \text{ }^\circ\text{C/W}$ .

Kata kunci: Laju perpindahan kalor, ketebalan *tube*, efektivitas *thermal*