

VVX-5

Motströms plattvärmväxlare

$T_{H,in} = 75^\circ C$

$\dot{m}_H = 10 \text{ kg/s}$

$T_{C,in} = 15^\circ C$ $T_{C,out} = 70^\circ C$ $\dot{m}_C = 5 \text{ kg/s}$



$\dot{m}_C c_{p,C} (T_{C,out} - T_{C,in}) = \dot{m}_H \cdot c_{p,H} (T_{H,in} - T_{H,out})$

$\Rightarrow c_{p,H} (75 - T_{H,out}) = 114840$ Bestäm $T_{H,out}$ mha iteration.

1. $T_{H,out} = 47,5^\circ C \Rightarrow c_p \left(\frac{75+47,5}{2} \right) = 4180,75 \text{ J/kg}\cdot K \Rightarrow T_{H,out} = 47,53^\circ C$

2. $T_{H,out} = 47,53^\circ C \Rightarrow c_p = 4180,76 \text{ J/kg}\cdot K \Rightarrow T_{H,out} = \underline{47,53^\circ C}$

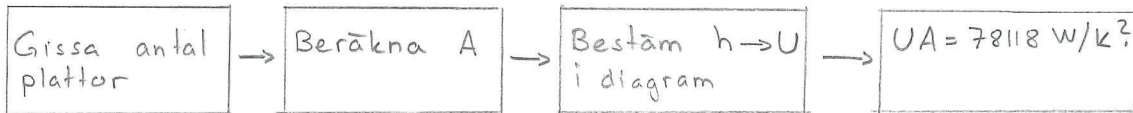
$\Delta T_{lm} = \frac{(75-70) - (47,53-15)}{\ln \frac{75-70}{47,53-15}} = 14,7^\circ C$

<p>Varm ström $\rho = 987,5 \frac{\text{kg}}{\text{m}^3}$ $\mu = 461 \cdot 10^{-6} \text{ Pa}\cdot\text{s}$ $Pr = 2,93$ $\nu = 0,470 \cdot 10^{-6} \text{ m}^2/\text{s}$</p>	<p>$k = 0,66 \frac{\text{W}}{\text{m}\cdot\text{K}}$</p>	<p>Kall ström $\rho = 991,2 \text{ kg/m}^3$, $k = 0,637 \text{ W/m}\cdot\text{K}$ $\mu = 629 \cdot 10^{-6} \text{ Pa}\cdot\text{s}$, $\nu = 0,635 \text{ m}^2/\text{s} \cdot 10^{-6}$ $Pr = 4,15$</p>
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För ren motström: $q = UA \Delta T_{lm} \Rightarrow UA = \frac{q}{\Delta T_{lm}} = 78118 \text{ W/K}$

Betrakta kall sida!

Vill ha antal plattor s.a. $UA = 78118 \text{ W/K}$. Iterera:



Antal gånger \approx Plattor / 2

1. 150 plattor $\Rightarrow A_c = 150 \cdot 0,25 = 37,5 \text{ m}^2$ $A_g = 75 \cdot 0,005 \cdot 0,25 = 0,0938 \text{ m}^2$

Kall $Re = \frac{\dot{m}}{A_g \rho} \cdot \frac{dh}{\nu_b} = \frac{5 \cdot 0,005}{0,0938 \cdot 991,2 \cdot 0,635 \cdot 10^{-6}} = 424$

$\Rightarrow \frac{Nu}{Pr^{0,4} \left(\frac{\nu}{\nu_w} \right)^{0,1}} = 25 \Rightarrow Nu = 25 Pr^{0,4} = 25 \cdot 4,15^{0,4} = 41,5 = \frac{hL}{k}$

$\Rightarrow h_k = 41,5 \frac{k}{L} = \frac{41,5 \cdot 0,637}{2 \cdot 0,005} = 2643,55 \text{ W/m}^2\cdot K$

Varm

$Re = 1149 \dots \Rightarrow Nu = 61,5 \Rightarrow h_v = 61,5 \frac{k}{L} = 4059 \text{ W/m}^2\cdot K$

$U = \frac{1}{A \left(\frac{1}{h_k A_s} + \frac{1}{h_v A_o} \right)} = \frac{1}{\frac{1}{h_k} + \frac{1}{h_v}} = 1600$

$\therefore UA = 1600 \cdot 37,5 = 60000 \text{ W/K}$