PROCESS DESIGN PRACTICES EXCHANGERS

3. Temperature Difference

• For true countercurrent exchangers (such as double pipes, Packinox and VCFE):

$$\begin{array}{ll} \Delta T_M &= LMTD\\ F_T &= 1 \end{array}$$

• For typical shell and tube exchangers with multiple tube passes, $F_T < 1$.



1:2 S&T Exchanger Layout (mathematically identical)

• The LMTD correction factor, F_T , is determined from the graphs in TEMA Section 7. Alternatively, for S&T exchangers the equation of Bowman et al. can be used (Trans ASME, 1940):

$$\begin{split} F_T &= \frac{2^{0.5} \times S}{(1-S) \times \ln((2/S-2+2^{0.5})/(2/S-2-2^{0.5})} \text{ if } R = 1 \\ &= \frac{\sqrt{(R^2+1)}/(R-1) \times \ln[(1-S)/(1-SR)]}{\ln[(2/S-1-R+\sqrt{(R^2+1)})/(2/S-1-R-\sqrt{(R^2+1)})]} \text{ if } R <> 1 \\ S &= \frac{P}{P+N-NP} \text{ if } R = 1 \\ &= \frac{1-((1-PR)/(1-P))^{(1/N)}}{R-((1-PR)/(1-P))^{(1/N)}} \text{ if } R <> 1 \\ P &= (T_{co} - T_{ci})/(T_{hi} - T_{ci}) \\ R &= (T_{hi} - T_{ho})/(T_{co} - T_{ci}) \\ N &= \text{ Number of shells in series} \end{split}$$

Copyright ⓒ This data is confidential and shall not be disclosed or reproduced in any manner without written permission