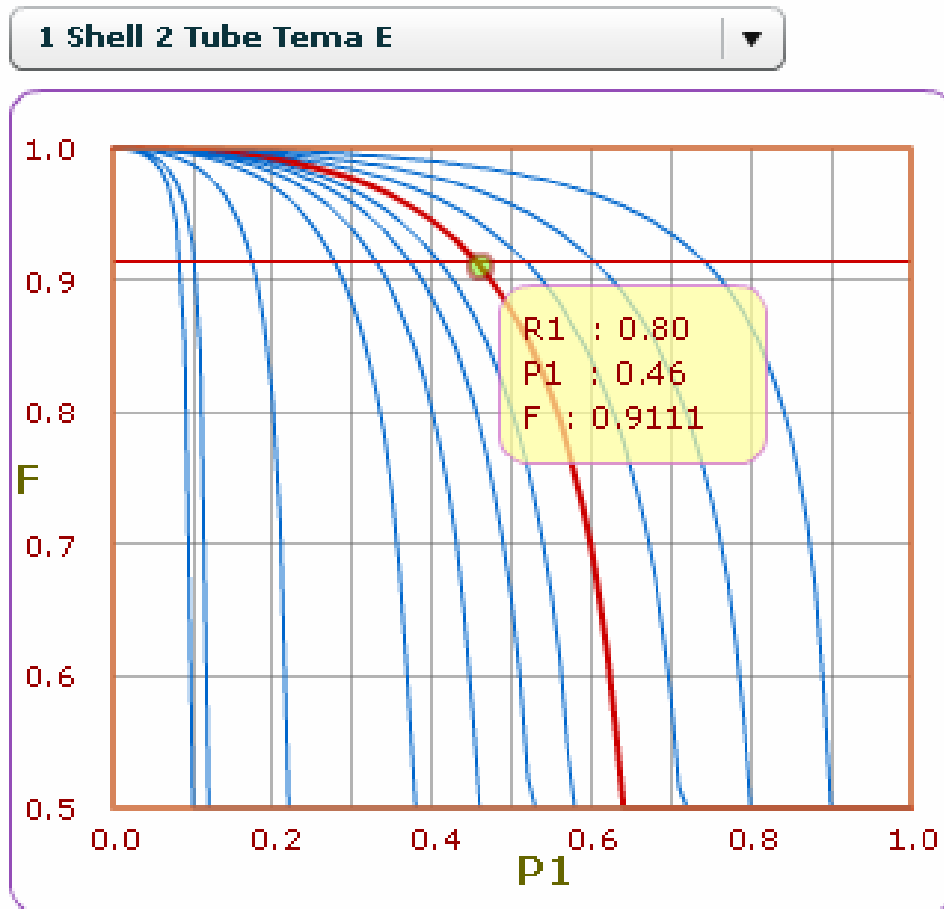


# LOG MEAN TEMPERATURE DIFFERENCE (LMTD) CORRECTION FACTOR (F) CHARTS



## ChemSOF

Online Chemical Engineering Softwares

Visit us at – <http://www.chemsof.com>

Heat Transfer rate in the exchanger is represented by

$$q = U * A * F * \Delta LMTD \quad \text{-----} \quad (1)$$

here  $F(<1)$  is interpreted as a geometric correction factor, that when applied to the LMTD (Log Mean Temperature Difference) of a counter flow heat exchanger, provides the effective temperature difference of the heat exchanger under consideration.

It is a measure of the heat exchanger's departure from the ideal behavior of a counter flow heat exchanger having the same terminal temperatures. The F-LMTD method is widely used in heat exchanger analysis, particularly for heat exchanger selection, (sizing problems) when as a result of the process requirements the temperatures are known and the size of the heat exchanger is required.

Log Mean Temperature Difference is defined as

$$LMTD = \frac{\Delta T_I - \Delta T_{II}}{\ln(\Delta T_I / \Delta T_{II})} \quad \text{-----} \quad (2)$$

Here  $\Delta T_I$  and  $\Delta T_{II}$  are temperature differences between two fluids at each end of a counterflow exchanger.

$$\Delta T_I = T_{h,i} - T_{c,o} \quad , \quad \Delta T_{II} = T_{h,o} - T_{c,i} \quad \text{-----} \quad (3)$$

Log Mean Temperature Difference Correction Factor  $F$  is dependent on temperature effectiveness  $P$  and heat capacity rate ratio  $R$  for a given flow arrangement.

Temperature effectiveness  $P$  is different for each fluid of a two fluid exchanger. For fluid 1, it is defined as the ratio of the temperature range of fluid 1 to the inlet temperature difference.

$$P_1 = \frac{T_{1,o} - T_{1,i}}{T_{2,i} - T_{1,i}} \quad \text{-----} \quad (4)$$

Heat Capacity Ratio R is defined as

$$R_1 = \frac{T_{2,i} - T_{2,o}}{T_{1,o} - T_{1,i}} \text{ ----- (5)}$$

$$F = \Phi_1(P_1, R_1)$$

**Example:** Fluid 1 in 1-2 Tema E Exchanger is to be cooled from 150°F to 100°F by a Fluid 2 on Shell side which gets heated from 40°F to 80°F. Heat transfer Coefficient U is 80 BTU / hr – ft<sup>2</sup> – °F, and Heat Duty for the exchanger is 5x10<sup>6</sup> BTU/ h

**Solution**

LMTD is calculated based on equation (2) and (3)

$$\Delta T_I = 150 - 80 = 70, \Delta T_{II} = 100 - 40 = 60$$

$$\text{LMTD} = (70 - 60) / \ln(70/60) = 64.87^\circ\text{F}$$

$$P_1 = (100 - 150) / (40 - 150) = 0.4545$$

$$R_1 = (40 - 80) / (100 - 150) = 0.8$$

Based on the F-Charts , F value comes out to be 0.9149

$$\begin{aligned} \text{Area} &= Q / (U \times F \times \text{LMTD}) \\ &= 5 \times 10^6 / (80 \times 0.9149 \times 64.87) \\ &= 1053 \text{ ft}^2 \end{aligned}$$