

32.9 A counterflow heat exchanger is used to remove heat from steam condensate prior to discharge and for pre-heating cold water. Cold water enters at $50^{\circ}F$ and leaves at $70^{\circ}F$. Condensate enters at $160^{\circ}F$ and leaves at $100^{\circ}F$. What is the log mean temperature difference?

- A. $62^{\circ}F$
- B. $68^{\circ}F$
- C. $76^{\circ}F$
- D. $90^{\circ}F$

For a counterflow heat exchanger, the hot stream enters on the opposite side from the cold stream such that the ΔT along the length is close to the average ΔT . (Contrast this with the temperature profile for a parallel flow heat exchanger which varies dramatically along the length.) Arbitrarily call the hot entering end "Side A" and cold entering end "Side B." Calculate the temperature differences at both ends. It may be useful to draw the temperature profile on a *Temperature vs. Length* diagram.

$$\Delta T_A = 160^{\circ}F - 70^{\circ}F = 90^{\circ}F$$

$$\Delta T_B = 100^{\circ}F - 50^{\circ}F = 50^{\circ}F$$

Look up **Log Mean Temperature Difference** (LMTD) in the Reference Handbook. Consider applying the simplified version of this formula initially introduced earlier in the Heat Transfer section of this book:

$$LMTD = \frac{\Delta T_A - \Delta T_B}{\ln\left(\frac{\Delta T_A}{\Delta T_B}\right)} = \frac{90^{\circ}F - 50^{\circ}F}{\ln\left(\frac{90^{\circ}F}{50^{\circ}F}\right)} = 68^{\circ}F$$

Answer B