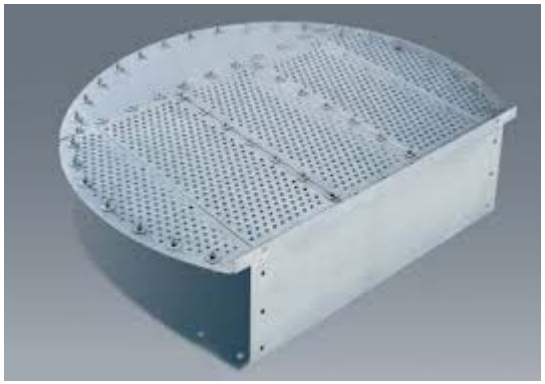
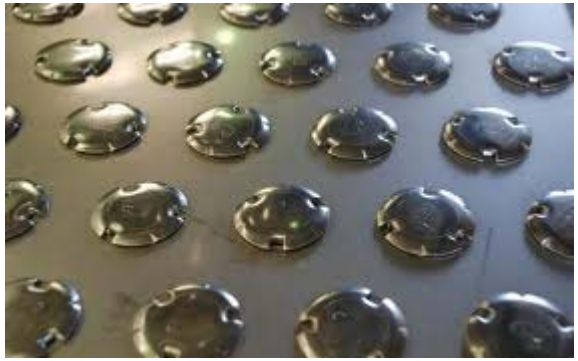
DISTILLATION/ABSORPTION COLUMN TRAY DESIGN

Trays types

Sieve

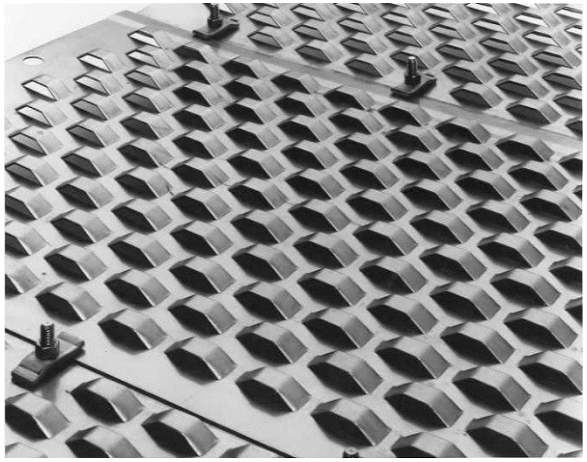


Valve



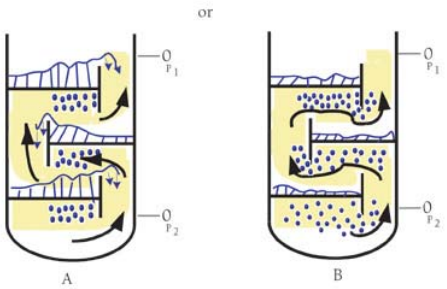
Bubble cap

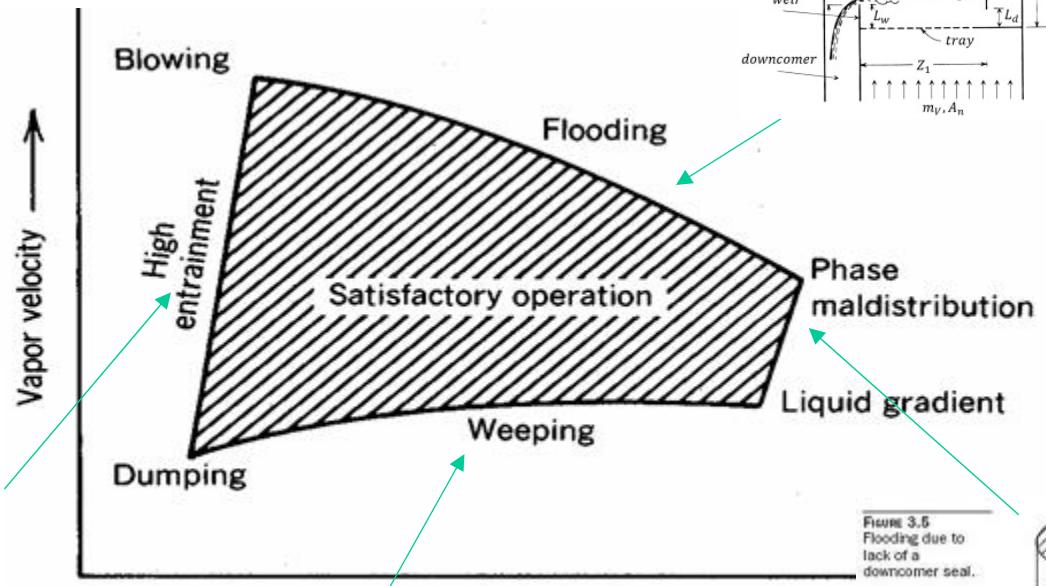
Enhance Deck (Sulzer)



DISTILLATION/ABSORPTION COLUMN TRAY DESIGN

Operational limits for trays.





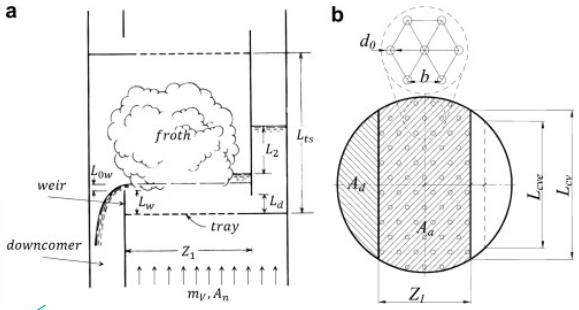
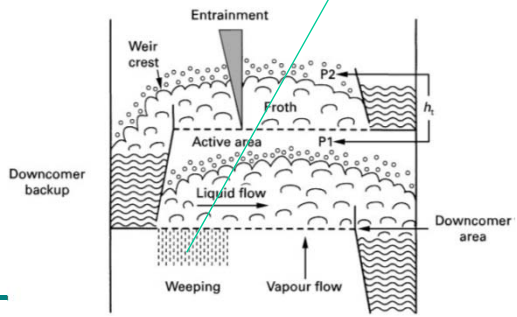
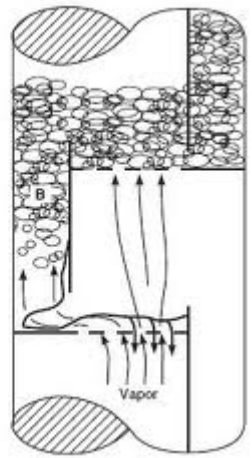


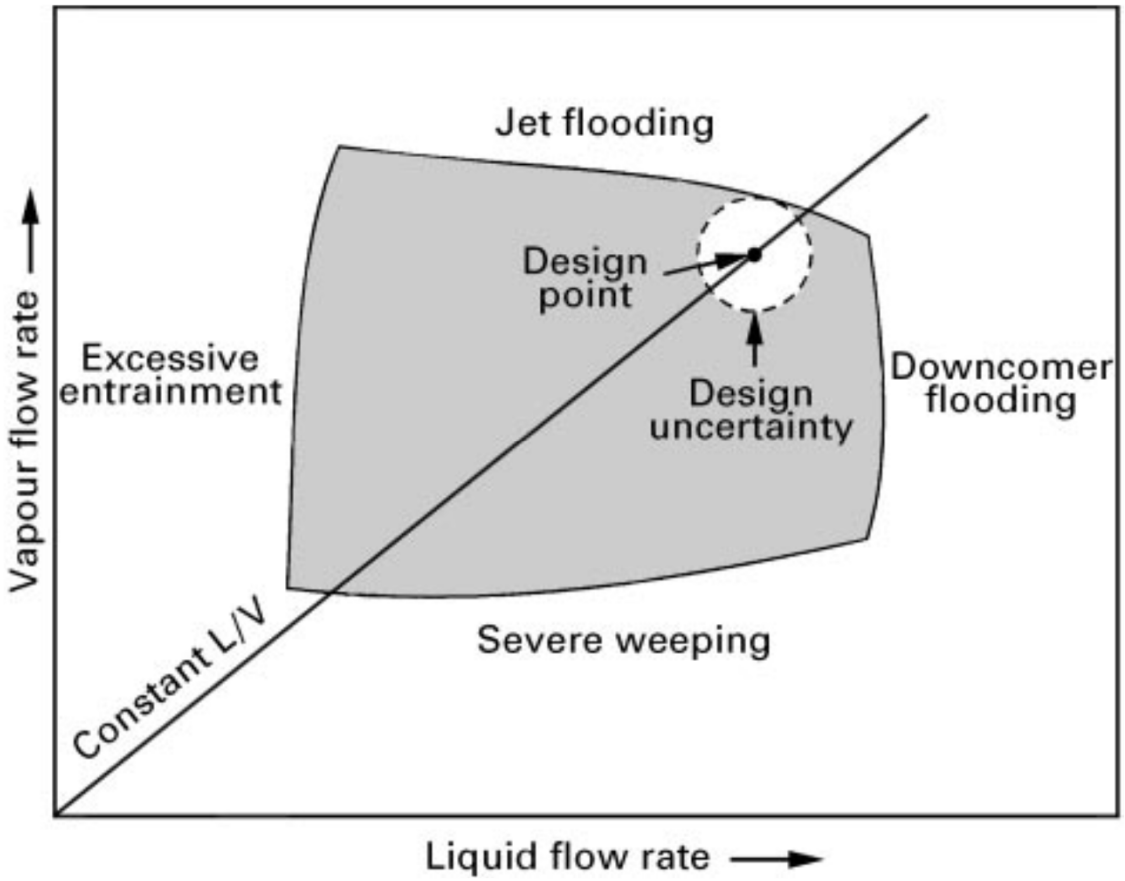
FIGURE 3.5
Flooding due to lack of a downcomer seal.





DISTILLATION/ABSORPTION COLUMN TRAY DESIGN

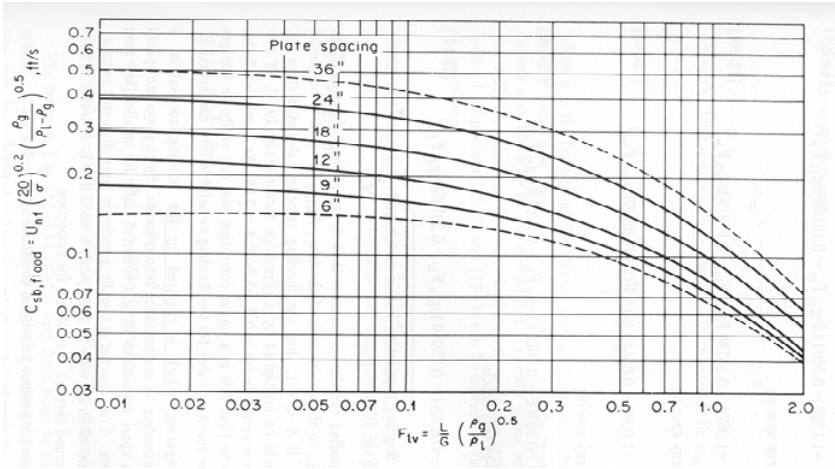
Design Point

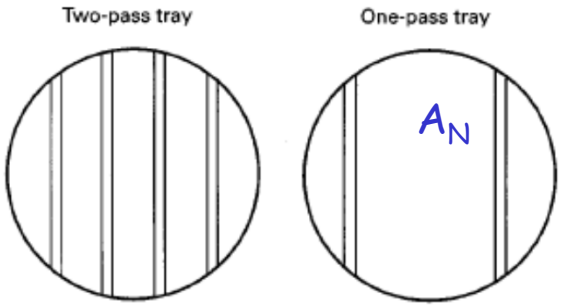


DISTILLATION/ABSORPTION COLUMN TRAY DESIGN

Diameter first. Design for velocity. Flooding velocity given by (are you surprised?)

Fair correlation

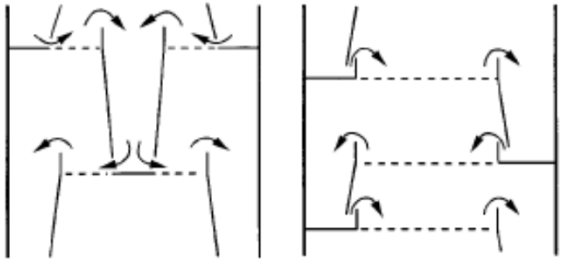




$$U_{N,f} = C_{SB}\left(\frac{\rho_L - \rho_V}{\rho_V}\right)^{0.5}\left(\frac{\sigma_L}{20}\right)^{0.2}$$

$$C_{SB}(\text{ft s}^{-1}) = 0.04232 + 0.1674T_S + (0.0063 - 0.2686T_S)F_{IV} + (0.1448T_S - 0.008)F_{IV}^2$$

$$F_{IV} = (L/V)(\rho_V/\rho_L)^{0.5}$$



Use ~80% of flooding velocity. Diameter is a function of the NET area A_N

DISTILLATION/ABSORPTION COLUMN TRAY DESIGN

Tray Spacing: Large if froth is expected, also allow space for crawling (12" to 24").

Downcomer area: Fluid velocity larger than ascending bubbles (minimum width: 5") Range of velocities= 0.1-0.7 ft/sec. Residence time criteria (3-5 sec) . Downcomer flooding should be avoided.

Hole diameter: 3/16 to $\frac{1}{4}$ in.

Total Hole Area: Such that the velocity through the holes does not form jets)

$$\frac{A_{All-holes}}{A_{holes}} = K\left(\frac{hole-diameter}{hole-pitch}\right)^2 \qquad K = 0.905(equilateral\ triangular\ pitch) \quad K = 0.785(rectangular\ pitch)$$

Number of Holes: Hole area/Total hole area

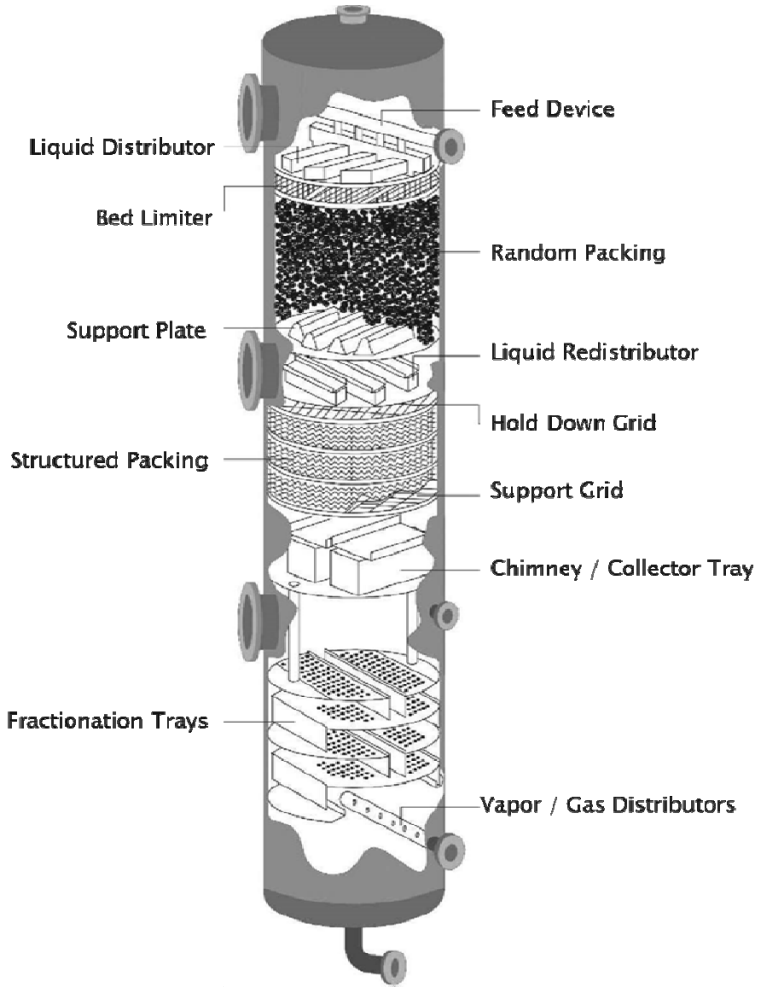
Height of weir: Francis formula $h_{ow} = 0.48\left(\frac{L}{l_{weir}}\right)^{2/3}$

Pressure drop: to be watched. Do not want it to be too large (5-10"). Typical value ~0.1 psi

Efficiency: Murphy & Point Efficiency. There are correlations. In the absence of data look for similar mixtures.

DISTILLATION/ABSORPTION PACKED COLUMN DESIGN

Packed Towers



DISTILLATION/ABSORPTION COLUMN TRAY DESIGN

Random Packing

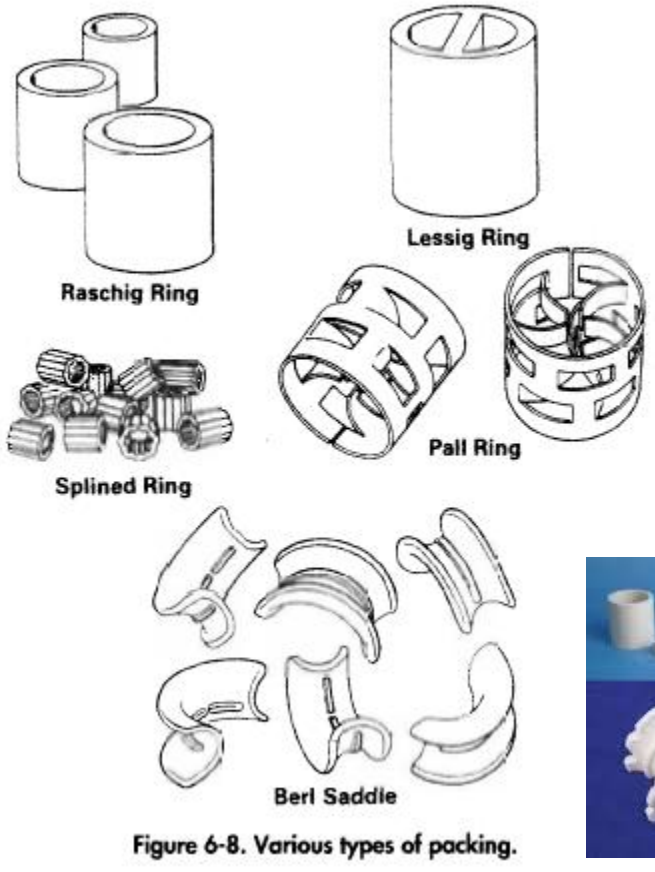
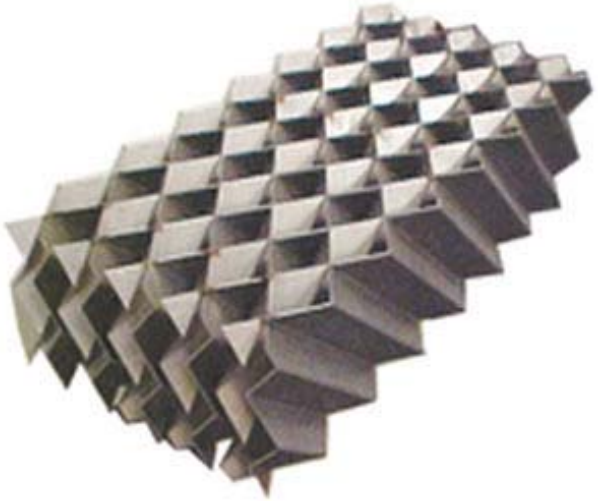


Figure 6-8. Various types of packing.

DISTILLATION/ABSORPTION COLUMN TRAY DESIGN

Structured Packing

Flexipack (Koch)→



Sulzer

Ceramic

DISTILLATION/ABSORPTION COLUMN TRAY DESIGN

Packing Height: Number of equilibrium stages x HETP (Height Equivalent to a Theoretical Plate)

HETP: Typically a function of gas rate (ft/sec) and the packing, as well as the mixture.

Packing Diameter: Similar graph to Fair's graph