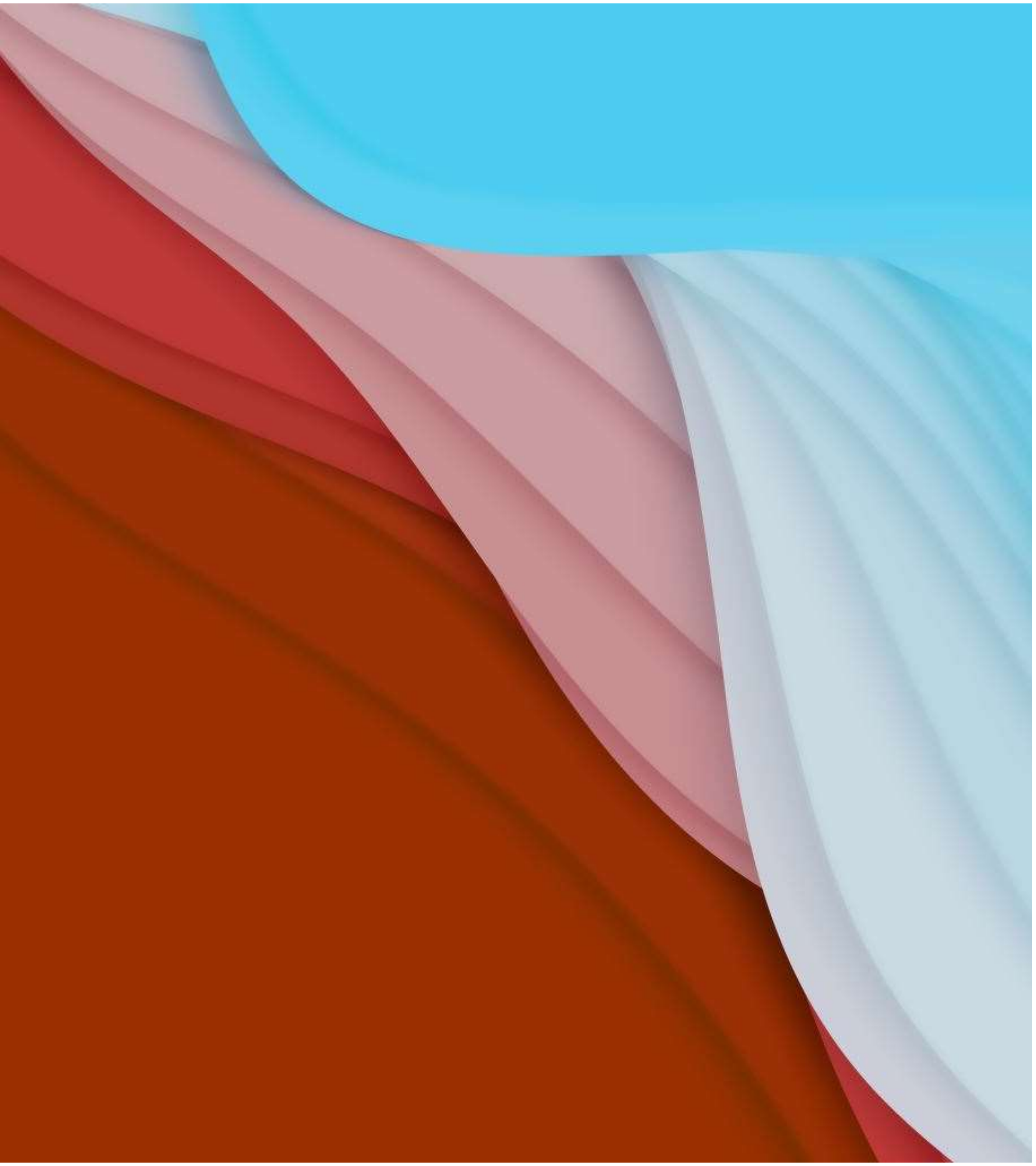


CEN416
PROCESS DESIGN II

Typical packing efficiencies

System	Pressure kPa	Column dia, m	Packing type	Packing size, mm	HTU m	HETP m
Absorption						
Hydrocarbons	6000	0.9	Pall	50		0.85
NH_3-Air-H_2O	101	—	Berl	50	0.50	
Air-water	101	—	Berl	50	0.50	
Acetone-water	101	0.6	Pall	50		0.75
Distillation						
Pentane-propane	101	0.46	Pall	25		0.46
IPA-water	101	0.46	Int.	25	0.75	0.50
Methanol-water	101	0.41	Pall	25	0.52	
	101	0.20	Int.	25		0.46
Acetone-water	101	0.46	Pall	25		0.37
	101	0.36	Int.	25		0.46
Formic acid-water	101	0.91	Pall	50		0.45
Acetone-water	101	0.38	Pall	38	0.55	0.45
	101	0.38	Int.	50	0.50	0.45
	101	1.07	Int.	38		1.22
MEK-toluene	101	0.38	Pall	25	0.29	0.35
	101	0.38	Int.	25	0.27	0.23
	101	0.38	Berl	25	0.31	0.31

Pall = Pall rings, Berl = Berl saddles, Int. = INTALOX® saddles

Cornell Correlation

Equations and figures are given for a range of sizes of Raschig rings and Berl saddles.

$$\mathbf{H}_G = 0.011\psi_h (Sc)_v^{0.5} \left(\frac{D_c}{0.305}\right)^{1.11} \left(\frac{Z}{3.05}\right)^{0.33} \Big/ \left(L_w^* f_1 f_2 f_3\right)^{0.5}$$

$$\mathbf{H}_L = 0.305\phi_h (Sc)_L^{0.5} K_3 \left(\frac{Z}{3.05}\right)^{0.15}$$

Onda's Method

- It consists of useful correlations for the film mass-transfer coefficients $\mathbf{k_G}$ and $\mathbf{k_L}$ and the *effective wetted area of the packing* $\boldsymbol{a_w}$, which can be used to calculate $\mathbf{H_G}$ and $\mathbf{H_L}$.
-

$$k_L\left(\frac{\rho_L}{\mu_L g}\right)^{1/3} = 0.0051\left(\frac{L_w^*}{a_w \mu_L}\right)^{2/3}\left(\frac{\mu_L}{\rho_L D_L}\right)^{-1/2}(ad_p)^{0.4}$$

$$\frac{k_G}{a}\frac{RT}{D_v} = K_5\left(\frac{V_w^*}{a\mu_v}\right)^{0.7}\left(\frac{\mu_v}{\rho_v D_v}\right)^{1/3}(ad_p)^{-2.0}$$

$$\mathbf{H}_G = \frac{G_m}{k_G a_w P}$$

$$\mathbf{H}_L = \frac{L_m}{k_L a_w C_t}$$

$$\frac{a_w}{a} = 1 - \exp\left[-1.45\left(\frac{\sigma_c}{\sigma_L}\right)^{0.75}\left(\frac{L_w^*}{a\mu_L}\right)^{0.1}\left(\frac{L_w^{*2} a}{\rho_L^2 g}\right)^{-0.05}\left(\frac{L_w^{*2}}{\rho_L \sigma_L a}\right)^{0.2}\right]$$

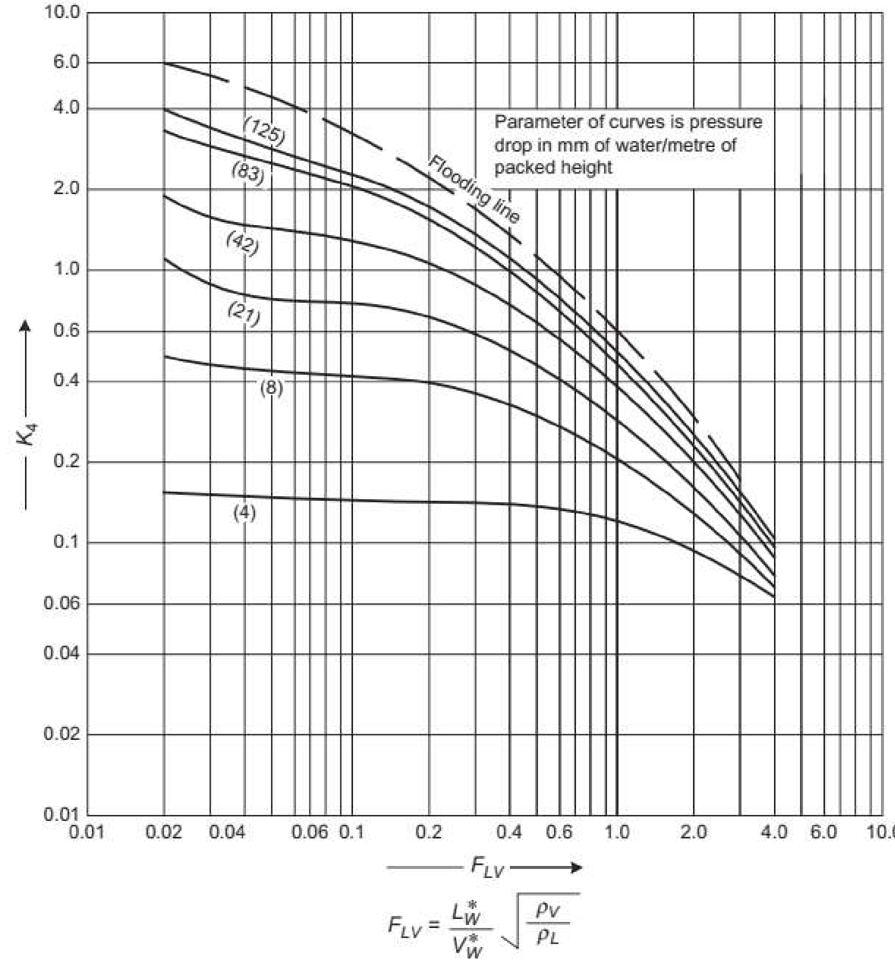
COLUMN DIAMETER (CAPACITY)

The capacity of a packed column is determined by its cross-sectional area.

Normally, the column will be designed to operate at the highest economical pressure drop, to ensure good liquid and gas distribution.

For random packings the pressure drop will not normally exceed 80 mm of water per meter of packing height.

- **Generalized pressure drop correlation**



$$K_4 = \frac{13.1(V_w^*)^2 F_p \left(\frac{\mu_L}{\rho_L}\right)^{0.1}}{\rho_v(\rho_L - \rho_v)}$$

V_w^* = gas mass flow-rate per unit column cross-sectional area, kg/m^2s
F_p = packing factor, characteristic of the size and type of packing.
μ_L = liquid viscosity, Ns/m^2
ρ_L, ρ_v = liquid and vapour densities, kg/m^3

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2. Turton R., Bailie R.C., Whitin W.C., Shaeiwitz J.A. 1998, Analysis, Synthesis and Design of Chemical Processes, Prentice Hall, New Jersey.