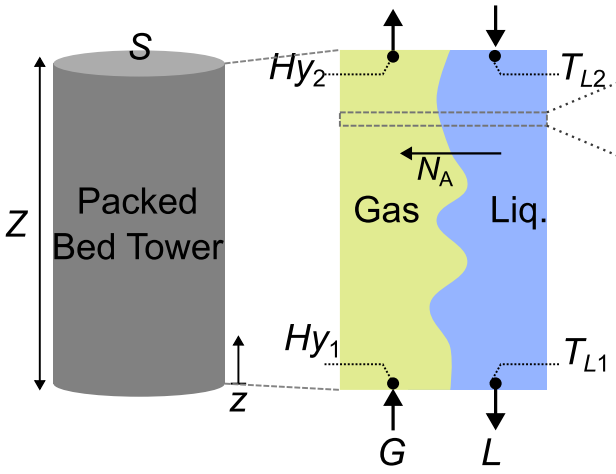
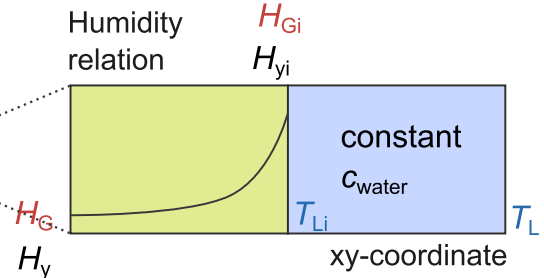
Cheatsheet: Cooling Tower

Online demo

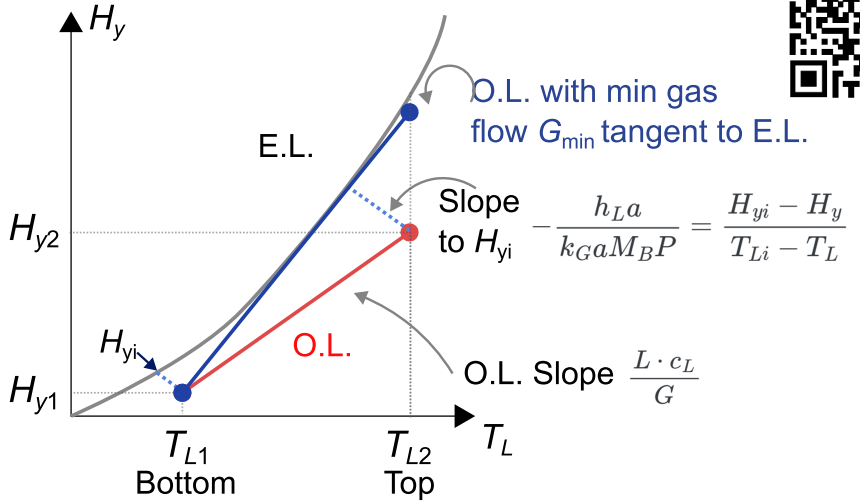
Cooling tower overview





* T_G usually not studied

** Direction of heat transfer see lower right panel



Overall mass balance

$$G(H_{y2} - H_{y1}) = L \cdot c_L(T_{L2} - T_{L1})$$

Operating Line (O.L.)

$$G(H_y - H_{y1}) = L \cdot c_L(T_L - T_{L1})$$

Enthalpy relation

$$H_y = c_s(T - T_0) + H\lambda_0$$
$$= (1.008 + 1.88H)T + 2501.4H$$

T: °C

Bed height

Integration over enthalpy, not T_L!

$$Z = \frac{G}{M_B k_G a P} \int_{H_{y1}}^{H_{y2}} \frac{dH_y}{H_{yi} - H_y}$$

P: Pa

Useful properties for water-air system

H_y unit: kJ / kg dry air

$k_G \cdot a$ unit kg mol/s·m^3·Pa

L & G: unit kg /s·m^2

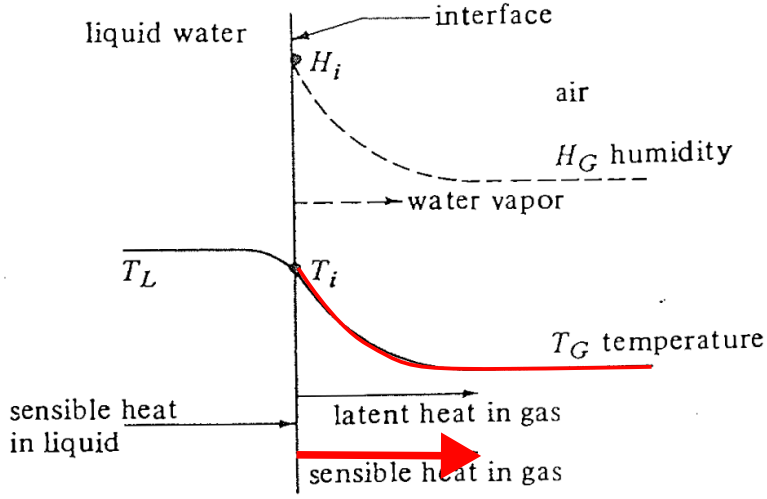
Air M_B = 28.97 kg / kg mol

Liquid heat capacity (298 K)
$c_L \cong 4.182$ kJ / kg·K

Liquid latent heat (273 K)
$\lambda_0 \cong 44020$ kJ / kg mol

Liquid thermal conductivity (273 K)
$h_L \cong 0.628$ W / m · K

Upper part of column



Lower part of column