Enthalpie feuchter Luft

$$h_W = \frac{H_W}{m_W} \qquad h_L = \frac{H_L}{m_L}$$

Gemisch

$$h = \frac{H}{m} = \frac{H_L + H_W}{m_L + m_W}$$

bezogen auf trockene Luft

$$h_{1+x} = \frac{H}{m_L} = \frac{H_L + H_W}{m_L}$$

$$= \frac{H_L}{m_L} + \frac{m_W}{m_L}\frac{H_W}{m_W}$$

$$= h_L + x\, h_W$$

Grundannahme

$$dh = c_p\, dT$$

c_p temperaturunabhängig

trockene Luft: $h_L = c_{p,L}\, t$ (t in °C)

($h_L(t = 0°C) \equiv 0$)

Wasser: Bezugspunkt Tripelpunkt $\approx 0°C$, flüssig

$h_{W,fl}(0°C) \equiv 0$

Wasserdampf: $h_D = r_{0°C} + c_{p,D} \cdot t$

Wasser (fl.): $x - x_S$: $h_W = c_{p,W}\, t$

Wasser (fest): $h_E = -\sigma_E + c_{p,E} \cdot t$

Zusammen

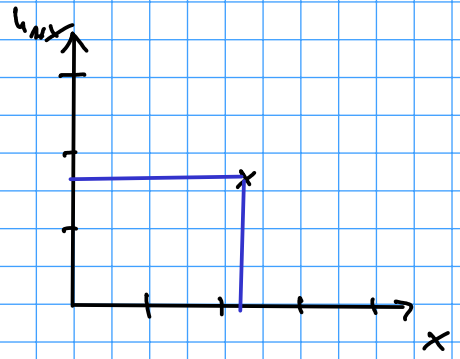
$\varphi < 1$ bzw. $x < x_S$: $h_{1+x} = c_{p,L}\, t + x\,(r_{0°C} + c_{p,D}\, t)$

$x \geq x_S$, $t \geq 0°C$: $h_{1+x} = c_{p,L}\, t + x_S\,(r_{0°C} + c_{p,D}\, t) + (x - x_S)\, c_{p,W}\, t$

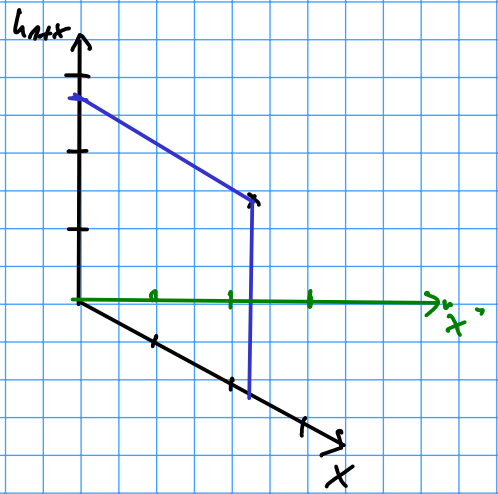
$x \geq x_S$, $t < 0°C$: $h_{1+x} = c_{p,L}\, t + x_S\,(r_{0°C} + c_{p,D}\, t) + (x - x_S)\,(-\sigma_E + c_{p,E}\, t)$

Mollier – Diagramm

rechtwinklig



schiefwinklig



Mischung flüssiger Luftströme

$$\dot{m}_{L3} = \dot{m}_{L1} + \dot{m}_{L2}$$

Massenbilanz für Wasser

$$x_3 \dot{m}_{L3} = x_1 \dot{m}_{L1} + x_2 \dot{m}_{L2}$$

$$\Rightarrow x_3 = \frac{x_1 \dot{m}_{L1} + x_2 \dot{m}_{L2}}{\dot{m}_{L1} + \dot{m}_{L2}} \quad (1)$$

Energiebilanz

$$\dot{m}_{L3} h_{1+x,3} = \dot{m}_{L1} h_{1+x,1} + \dot{m}_{L2} h_{1+x,2}$$

$$\Rightarrow h_{1+x,3} = \frac{\dot{m}_{L1} h_{1+x,1} + \dot{m}_{L2} h_{1+x,2}}{\dot{m}_{L1} + \dot{m}_{L2}} \quad (2)$$

$$(1) \rightarrow \frac{\dot{m}_{L1}}{\dot{m}_{L2}} = \frac{x_3 - x_2}{x_1 - x_3}$$

$$(2) \rightarrow \frac{\dot{m}_{L1}}{\dot{m}_{L2}} = \frac{h_{1+x,3} - h_{1+x,2}}{h_{1+x,1} - h_{1+x,3}}$$

$$\rightarrow \frac{h_{1+x,3} - h_{1+x,2}}{x_3 - x_2} = \frac{h_{1+x,3} - h_{1+x,1}}{x_3 - x_1}$$