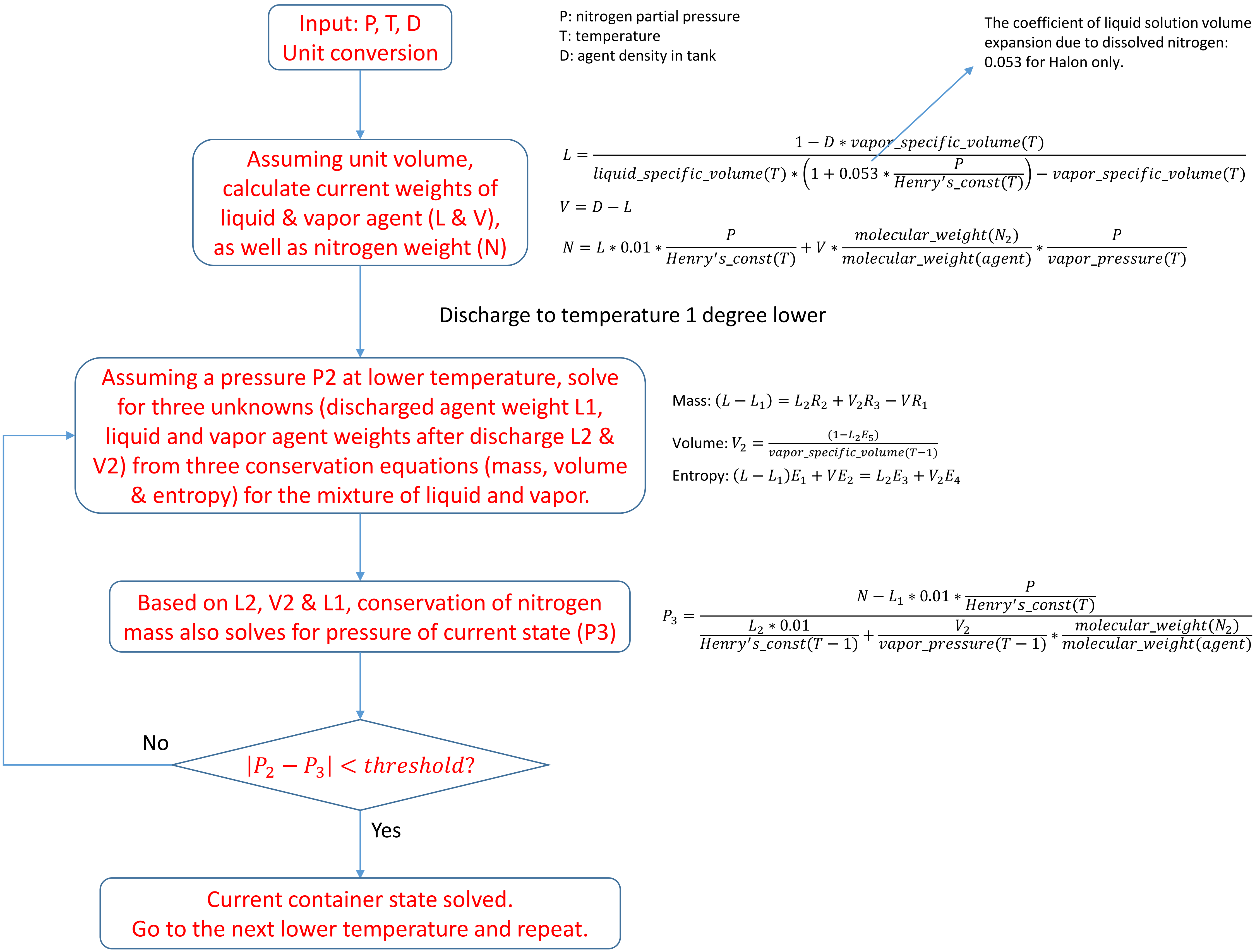
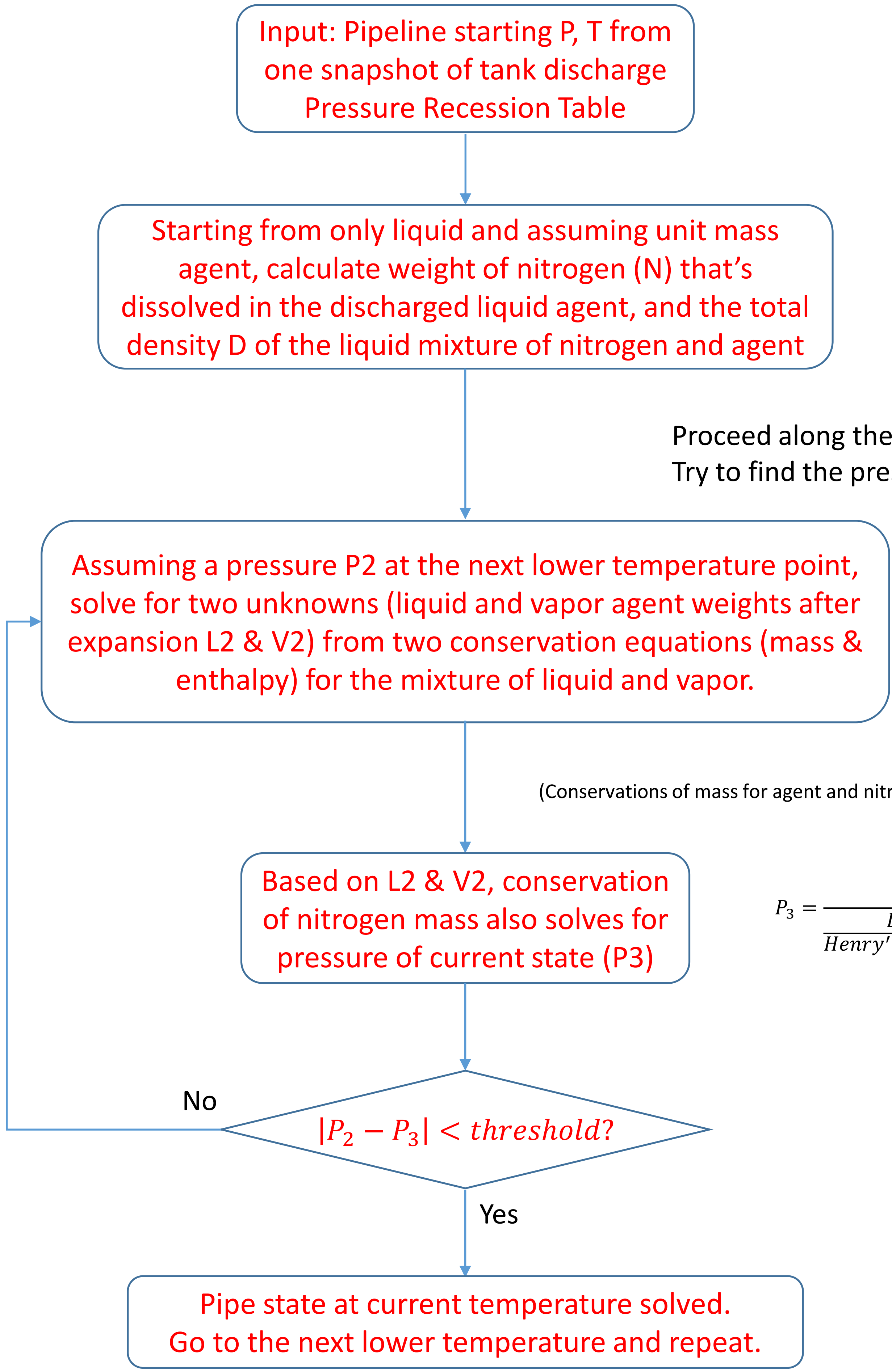
Williamson Method for Tank State during Discharge



Williamson Method for Pipeline Expansion due to Pressure Drop



P: nitrogen partial pressure
T: temperature

$$L = 1 \qquad V = 0$$

$$N = L * 0.01 * \frac{P}{Henry's\_const(T)}$$

$$D = \frac{1 + N}{liquid\_specific\_volume(T) * \left(1 + 0.053 * \frac{P}{Henry's\_const(T)}\right)}$$

Proceed along the pipe to temperature 1 degree lower.
Try to find the pressure and density drop.

Mass: $LE_6 + VE_7 = L_2E_8 + V_2E_9 \quad (L + V = L_2 + V_2 = 1)$

Enthalpy: $LE_1 + VE_2 = L_2E_3 + V_2E_4$

(Conservations of mass for agent and nitrogen are two independent equations.)

$$P_3 = \frac{N}{\frac{L_2 * 0.01}{Henry's\_const(T-1)} + \frac{V_2}{vapor\_pressure(T-1)} * \frac{molecular\_weight(N_2)}{molecular\_weight(agent)}}$$

$$D = \frac{1 + N}{liquid\_specific\_volume(T) * \left(1 + 0.053 * \frac{P}{Henry's\_const(T)}\right) * L_2 + vapor\_specific\_volume(T) * V_2}$$