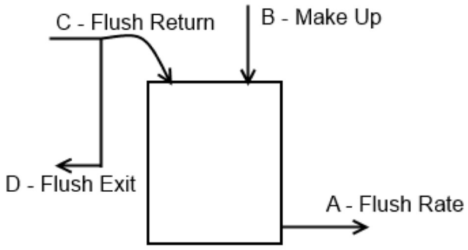
Hot Purging of Flush Seal Water & Temperature Control via Make Up

$Tank_h := 188\ \text{cm}$

$Tank_{Dia} := 1.8\ \text{m}$

$Tank_{Vol} := \pi \cdot \frac{Tank_{Dia}^2}{4} \cdot Tank_h = 4.784\ \text{m}^3$



$Pumps := 20$

$Flush_{rate} := 7\ \frac{\text{L}}{\text{min}}$

$Flow_A := Pumps \cdot Flush_{rate} = 8.4\ \frac{\text{m}^3}{\text{hr}}$

Don't use units here it creates problem with secant method ...

$Flow_B := x$

Level is held constant in tank so volume of tank is irrelevant

$Flow_D := Flow_B$

$Flow_C := Flow_A - Flow_D$

$\rho := 1000\ \frac{\text{kg}}{\text{m}^3}$

~3barg or 4 barA

$P := 4\ \text{bar}$

$T_A := 25\ °\text{C}$

Make up demi water has lower temperature

$T_B := T_A - [2..6]\ \Delta°\text{C} = \begin{bmatrix} 23 \\ 22 \\ 21 \\ 20 \\ 19 \end{bmatrix}\ °\text{C}$

Recommended temperature rise

$T_C := T_A + [5..7]\ \Delta°\text{C} = \begin{bmatrix} 30 \\ 31 \\ 32 \end{bmatrix}\ °\text{C}$

$T_D := T_C$

Liquid enthalpy [H] at different temperatures. In liquid phase pressure changes to enthalpy are negligible & density remains constant as well

$Enthalpy_A := \text{CoolProp\_Props}\left(\text{"H"}; \text{"T"}; T_A; \text{"P"}; P; \text{"Water"}\right) = 105.1967\ \frac{\text{kJ}}{\text{kg}}$

$Enthalpy_B := \overrightarrow{\text{CoolProp\_Props}\left(\text{"H"}; \text{"T"}; T_B; \text{"P"}; P; \text{"Water"}\right)} = \begin{bmatrix} 96.8349 \\ 92.6533 \\ 88.4711 \\ 84.2883 \\ 80.1049 \end{bmatrix}\ \frac{\text{kJ}}{\text{kg}}$

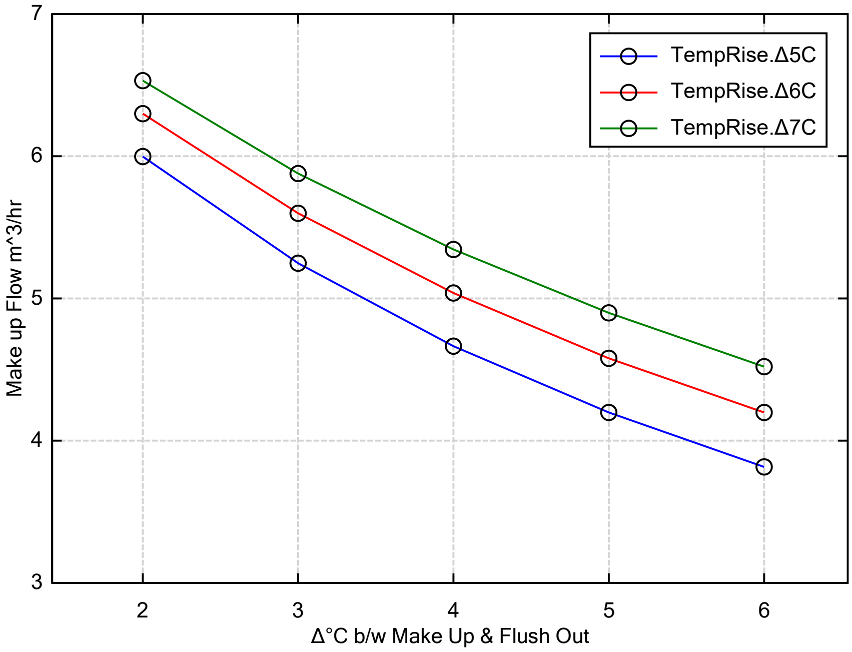
$Enthalpy_C := \overrightarrow{\text{CoolProp\_Props}\left(\text{"H"}; \text{"T"}; T_C; \text{"P"}; P; \text{"Water"}\right)} = \begin{bmatrix} 126.0949 \\ 130.2738 \\ 134.4526 \end{bmatrix}\ \frac{\text{kJ}}{\text{kg}}$

$Enthalpy_D := Enthalpy_C$

Make up water requirement using Enthalpy Balance around flush water tank. ρ is constant so cancels out

$$
\begin{aligned}
& tmp := \text{matrix}(0;\ 0) \\
& \text{for } i \in [1..\text{length}(Enthalpy_C)] \\
& \quad \text{for } j \in [1..\text{length}(Enthalpy_B)] \\
& \quad\quad tmp_{j\ i} := \text{Secant}\left(Flow_A \cdot Enthalpy_A = Flow_B \cdot {Enthalpy_B}_j + Flow_C \cdot {Enthalpy_C}_i;\ 1\ \frac{m^3}{hr};\ 20\ \frac{m^3}{hr}\right)
\end{aligned}
$$

$$
Flow_B := tmp = \begin{bmatrix} 5.9995 & 6.2995 & 6.5328 \\ 5.2493 & 5.5993 & 5.8793 \\ 4.6658 & 5.0391 & 5.3445 \\ 4.199 & 4.5807 & 4.8989 \\ 3.817 & 4.1988 & 4.5218 \end{bmatrix} \frac{m^3}{hr}
$$



$$
\begin{cases}
\text{augment}\left([2..6] \cdot 1\ \Delta°C;\ {Flow_B}_{[1..5]\,1} \cdot 3600\ s\right) \\
\text{augment}\left([2..6] \cdot 1\ \Delta°C;\ {Flow_B}_{[1..5]\,2} \cdot 3600\ s\right) \\
\text{augment}\left([2..6] \cdot 1\ \Delta°C;\ {Flow_B}_{[1..5]\,3} \cdot 3600\ s\right)
\end{cases}
$$