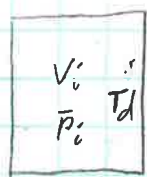
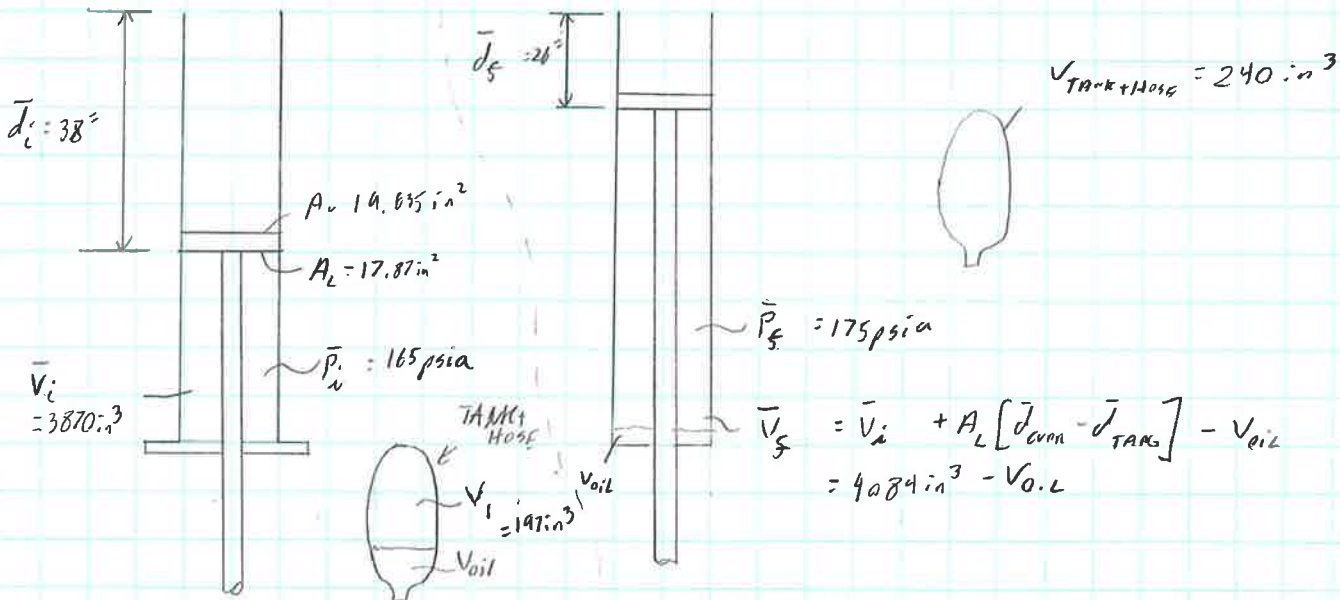


PNEUMATIC SPRING FILL CALCULATIONS

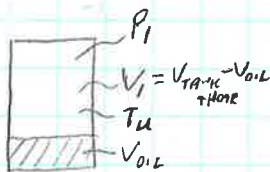
9/2/14 JAH
 $PV = nRT = NT$
 $N = \frac{PV}{T}$

INITIALLY

FINAL



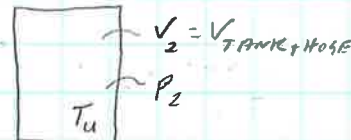
$$N_i = \frac{P_i V_i}{T_d}$$



$$N_1 = \frac{P_1 V_1}{T_u}$$



$$N_f = \frac{P_f V_f}{T_d}$$



$$N_2 = \frac{P_2 V_2}{T_u}$$

$$N_i + N_1 = N_f + N_2$$

$$N_i = N_f + N_2 - N_1$$

$$\frac{P_i V_i}{T_u} = \frac{P_f V_f}{T_d} + \frac{P_2 V_2}{T_u} - \frac{P_1 V_1}{T_d}$$

$$P_i = \frac{T_u}{V_i} \left[\frac{P_f V_f}{T_d} - \frac{P_1 V_1}{T_d} + \frac{P_2 V_2}{T_u} \right]$$

EXAMPLE: $V_i = 3870$ in³

$V_{oil} = 43$ in³

$V_1 = 147$ in³

$T_u = T_d$

$V_2 = 240$ in³

$P_i = 165$ psia

$P_2 = 140$ psia

$P_f = 175$ psia

$V_f = 4041$

$$P_i = \frac{1}{147} \left[\frac{175 \cdot 4041}{1} - \frac{165 \cdot 3870}{1} + \frac{140 \cdot 240}{1} \right] = 519 \text{ psia}$$