

NANACoIt

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Pipe radius (ft) Pipe Length (ft) Initial Pressure (lbf/in²) Heat capacity of fluid (lbf-ft/lbm-R)

$r_o := 0.08615$ $L := 5$ $P_1 := 14.7$ $C_v := 412$

Volume of trapped liquid (ft³) fluid density (lbm/ft³) Internal Energy change (lbf-ft/lbm)

$V := \pi \cdot L \cdot (r_o)^2$ $V = 0.117$ $\rho := 59.25$ $dU := 32676$

Heat trace temperature change (R) Thermal expansion coefficient (R⁻¹) Modulus of Elasticity (lbf/ft²)

$dT := 540$ $\beta := .000642$ $E := 8356000$

Mass (lbm) Initial Pressure (lbf/ft²) Thermal Expanded Fluid Volume (ft³)

$m := \rho \cdot V$ $m = 6.907$ $P := 2116.8$ $V_{fluid} := V \cdot (1 + \beta \cdot dT)$
 $V_{fluid} = 0.157$

Pipe expansion due to pressure (ft)

$P := 9300$

$$r_f := \frac{P \cdot 144 \cdot r_o}{E} + r_o$$

$r_f = 0.1$

$V_{new2} := \pi \cdot L \cdot (r_f)^2$ $V_{new2} = 0.157$

Work done on the system (lbf-ft)

$W := P \cdot 144 \cdot (V_{fluid} - V)$

$W = 12319.74$

Heat input to the system (lbf-ft)

$Q := dU \cdot m + W$

$Q = 238028.12$

$C_v := \frac{Q}{m \cdot dT}$ $C_v = 63.814$