# EQUATIONS AND CONVERSIONS HANDOUT SHEET

## EQUATIONS

$\dot{Q} = \dot{m} c_p \Delta T$

$\dot{Q} = \dot{m} \Delta h$

$\dot{Q} = UA\Delta T$

$\dot{Q} \propto \dot{m}^2_{\text{Nat Circ}}$

$\Delta T \propto \dot{m}^2_{\text{Nat Circ}}$

$K_{eff} = 1(1 - \rho)$

$\rho = (K_{eff} - 1)/K_{eff}$

$SUR = 26.06/\tau$

$\tau = \dfrac{\bar{\beta} - \rho}{\lambda_{eff}\rho}$

$\rho = \dfrac{\ell^*}{\tau} + \dfrac{\bar{\beta}}{1 + \lambda_{eff}\tau}$

$\ell^* = 1 \times 10^{-4}$ seconds

$\lambda_{eff} = 0.1$ seconds$^{-1}$

$DRW \propto \varphi^2_{tip} / \varphi^2_{avg}$

$Leakage \propto \sqrt{\Delta P}$

$P = P_o 10^{SUR(t)}$

$P = P_o e^{(t/\tau)}$

$A = A_o e^{-\lambda t}$

$CR_{S/D} = S/(1 - K_{eff})$

$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$

$1/M = CR_1/CR_X$

$A = \pi r^2$

$F = PA$

$\dot{m} = \rho A \vec{\upsilon}$

$\dot{W}_{Pump} = \dot{m}\Delta P \upsilon$

$E = IR$

Eff. = Net Work Out/Energy In

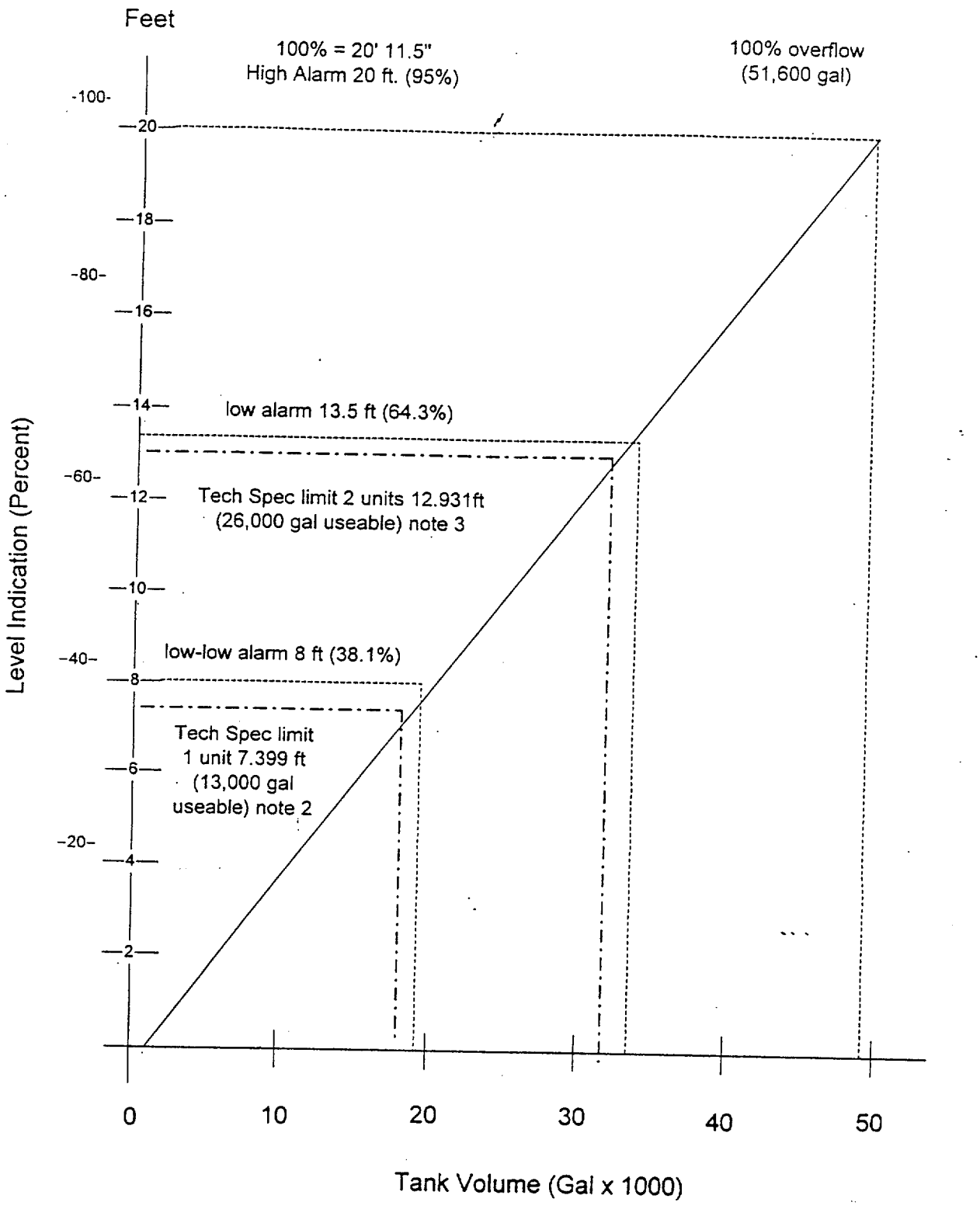
$$\upsilon(P_2 - P_1) + \frac{(\vec{v}_2^{\,2} - \vec{v}_1^{\,2})}{2g_c} + \frac{g(z_2 - z_1)}{g_c} = 0$$

$g_c = 32.2$ lbm-ft/lbf-sec$^2$

## CONVERSIONS

| | | | | | |
|---|---|---|---|---|---|
| 1 Mw | = | $3.41 \times 10^6$ Btu/hr | 1 Curie | = | $3.7 \times 10^{10}$ dps |
| 1 hp | = | $2.54 \times 10^3$ Btu/hr | 1 kg | = | 2.21 lbm |
| 1 Btu | = | 778 ft-lbf | 1 $gal_{water}$ | = | 8.35 lbm |
| °C | = | (5/9)(°F – 32) | 1 $ft^3_{water}$ | = | 7.48 gal |
| °F | = | (9/5)(°C) + 32 | | | |

## CONDENSATE STORAGE TANK



ID GRAVER M21-014 (L23944)(W-3827)
T-24 A/B

1. Approximately 2,350 gal/ft

2. Reference Calculation - N97-155, PBNP-IC-42

**NOTE 1:** Volume discontinuity due to transmitter tap at approximately 1 foot height of tank.

**NOTE 2:** Technical Specification requirement is 13,000 gallons of useable water for one unit. This is represented as the lowest CST indicated level which maintains 13,000 gallons above the CST level where the AFW pump could trip on low suction pressure (including all uncertainties).

CST Technical Specification Level = 13,000 gal / 2350 gal/ft + CST trip level
= 5.532 ft + 1.867 ft = 7.399 ft

**NOTE 3:** Technical Specification requirement is 26,000 gallons of useable water for two units. This is represented as a CST indicated level which maintains 26,000 gallons above the CST level where the AFW pump could trip on low suction pressure (including all uncertainties).

CST Technical Specification Level = 26,000 gal / 2350 gal/ft + CST trip level
= 11.064 ft + 1.867 ft = 12.931 ft

Figure 1
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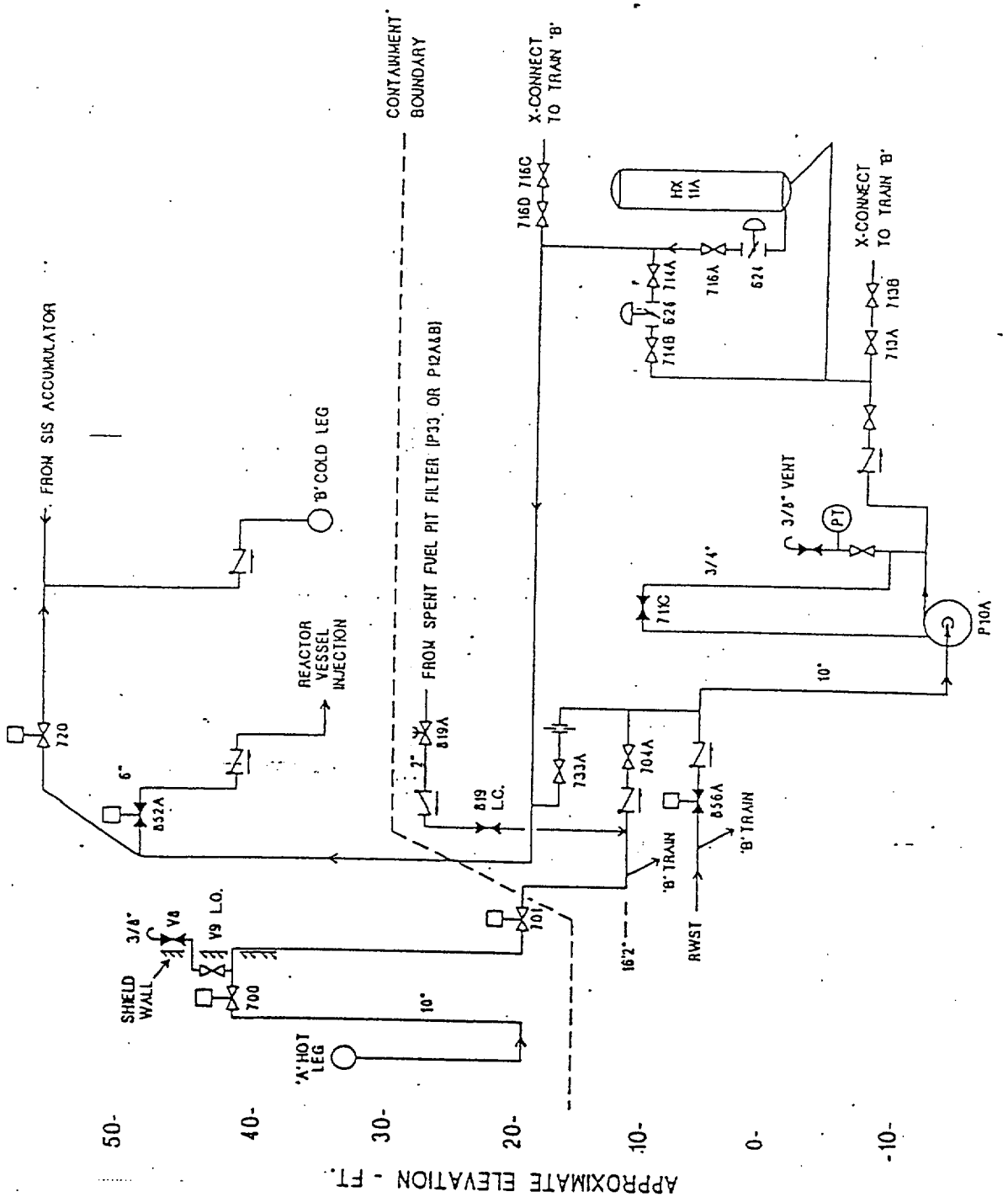
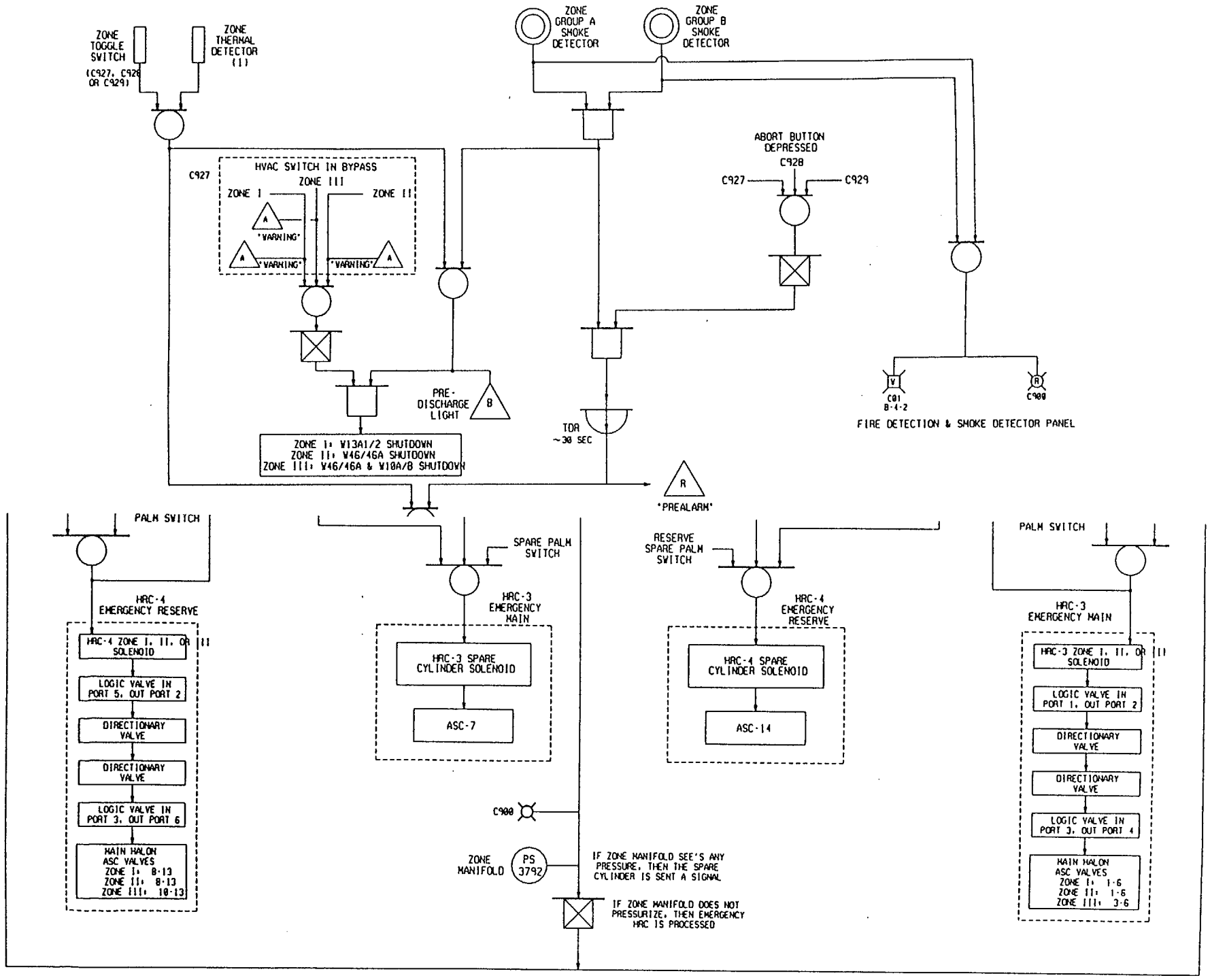
*"RHR System Elevations"*




RHR PUMP, PIPING & INTERCONNECTIONS
RELATIVE ELEVATIONS (APPROXIMATE)

AV 623




HALON LOGIC CIRCUIT
FIGURE 11.14.15