

1.48

$$P = \frac{F}{A}$$

$$P = \frac{18000 \text{ lb}}{A}$$

$$d = 2.5 \text{ in}$$



$$A = \pi (1.25)^2 = 4.90$$

$$P = 3666.92 \text{ lb/in}^2$$

1.58 Compute pressure change required for decrease in volume of mercury by 1%

$$\Delta V / V = -0.01$$

$$\Delta P = -E [\Delta V / V] = [-3590000 \text{ psi}] [-0.01] = 35900 \text{ psi}$$

$$= -24,750 \text{ E}(-0.01) = 247.5 \text{ MPa}$$

1.63

Stiffness of linear actuator system

$$A = \frac{\pi}{4} d^2 = \frac{\pi}{4} (0.5)^2 = 0.1963$$



$$d = 0.5 \text{ in } L = 42 \text{ in}$$

$$E (\text{machine oil}) = 189000 \text{ lb/in}^2$$

$$S = \frac{F}{\Delta L} = \frac{EA}{L} = \frac{189000 \text{ lb/in}^2 \cdot 0.1963 \text{ in}^2}{42 \text{ in}} = 883$$

$$S = 883.35 \text{ lb/in}$$

1.75 = ?

1.76



$$1 \text{ slug} = 32.174 \text{ lb}$$

$$\frac{11 \text{ lb} \cdot 1 \text{ slug}}{32.174 \text{ lb}} = 0.03108 \text{ slug}$$

$$1 \text{ kg} = 2.2046 \text{ lb}$$

$$\frac{1}{2.2046} = 0.454 \text{ kg}$$

$$11 \text{ lb} = 4.9 \text{ N} = 4.45 \text{ N}$$

1.92



$$w_c = 2.25 \text{ N}$$

$$w_c + w_o = 35.4 \text{ N}$$

$$d = 150 \text{ mm} = 0.15 \text{ m}$$

$$h = 200 \text{ mm} = 0.2 \text{ m}$$

$$\gamma_o = \frac{w_o}{V}$$

$$Sg_o = \frac{\gamma_o}{\gamma_w @ 4^\circ \text{C}}$$

$$35.4 \text{ N} - 2.25 = 33.15 \text{ N}$$

$$r = \frac{0.15}{2} = 0.075 \text{ m}$$

$$\gamma_w @ 4^\circ \text{C} = 9.81 \text{ kN/m}^3$$

$$V = \pi r^2 h$$

$$= \pi (0.075 \text{ m})^2 (0.2)$$

$$V = 0.003534 \text{ m}^3$$

$$w_o = 33.15 \text{ N} = 0.03315 \text{ kN}$$

$$\gamma_o = \frac{w_o}{V} = \frac{0.03315 \text{ kN}}{0.003534 \text{ m}^3} = 9.38 \text{ kN/m}^3$$

$$\gamma_o = 9.38 \text{ kN/m}^3$$

$$Sg = \frac{9.38 \text{ kN/m}^3}{9.81 \text{ kN/m}^3} = 0.96$$

1.107

$$Sg_o = 0.79$$

$$Sg = \frac{\rho_s}{\rho_w @ 4^\circ \text{C}}$$

$$\rho_a = (0.79) (0.9 \text{ g/cm}^3) / 0.79 \text{ g/cm}^3$$

$$\rho_a = ? \text{ slugs}$$

$$\rho_w @ 4^\circ \text{C} = 1000 \text{ kg/m}^3 = 1.94 \text{ slugs}$$

$$\frac{1000 \text{ kg}}{\text{m}^3} \left(\frac{1000 \text{ g}}{1 \text{ kg}} \right) \left(\frac{1}{1000} \right)$$

$$= 1 \text{ g/cm}^3$$

$$\rho_a = (0.79) (1.94 \text{ slugs/ft}^3) = 1.53 \text{ slugs/ft}^3$$

$$\rho_a = 0.79 \text{ g/cm}^3 \approx 1.53 \text{ slugs/ft}^3$$