for the outer part. For the inner part, Equations (51a, b), (52), (53), (54), and (55) apply. The latter equation applies with $q_3 = 0$. Equation (56) is valid and can be used to find p/σ_1 for the liner. [Equation (56) is not needed since p_3 is given.] Solving for p/σ_1 , one finds

$$\frac{p}{\sigma_1} = \frac{\alpha_r (k_1^2 - 1)}{\left[\frac{k_1^2 + 1}{2} - \frac{2}{g} \frac{k_1^2}{(k_1^2 - 1)} - 2 \frac{E_1}{E_3} \frac{p_3}{p} \frac{k_1^2 k_2 k_3^2}{g(k_3^2 - 1)}\right]}$$
(61)

This equation shows that an increase in p_3/p gives an increase in p/σ_1 .

Let σ_3 be the ultimate tensile strength of component 3, the outer cylinder of the inner part of the ring-fluid-segment container. If fatigue relation, Equation (9) is used for this cylinder, then there results

$$\sigma_3 = \frac{k_3^2}{k_3^2 - 1} \left[\frac{5}{2} (p_2 - p_3) - \frac{1}{2} q_2 \right]$$
 (62)

The pressures p_2 and q_2 are related to p_1 and q_1 via Equations (51a, b). p_1 and q_1 are related by Equation (55) with $q_3 \equiv 0$. One other equation involving p_1 and q_1 is needed which is found from the Definition (10b) for the parameter α_m , i.e.,

$$\alpha_{\text{m}} \sigma_{1} = \sigma_{\text{m}} = \frac{(\sigma_{\theta})_{\text{max}} + (\sigma_{\theta})_{\text{min}}}{2} = \frac{p}{2} \frac{k_{1}^{2} + 1}{k_{1}^{2} - 1} - \frac{(p_{1} + q_{1})}{k_{1}^{2} - 1} k_{1}^{2}$$

at ro.

Solving for p_1 and q_1 , finding p_2 and q_2 , substituting into Equation (62), and solving for p/σ_3 , one obtains

$$\frac{p}{\sigma_3} = \frac{(k_3^2 - 1)}{k_3^2 \left\{ \frac{2}{k_2} \frac{q_1}{p} + \frac{5}{g(k_1^2 - 1) k_2} + \frac{5}{2} \frac{p_3}{p} \left[\frac{2E_1}{gE_2} \frac{k_3^2}{(k_3^2 - 1)} - 1 \right] \right\}}$$
(63)

where

$$\frac{q_1}{p} = \frac{(\alpha_r - \alpha_m)}{2} - \frac{(k_1^2 - 1)}{k_1^2} \frac{\sigma_1}{p}$$
.

The pressure-to-strength ratios p/σ_1 and p/σ_3 are plotted in Figures 53 and 54 as a function of segment size k_2 and wall ratio K' for k_1 = 1.1, p_3/p = 0.2, α_r = 0.5, and α_m = -0.5. The pressure-to-strength ratios increase with K' or equivalently with k_3 , since K' = $k_1k_2k_3$. The behavior shown for k_1 = 1.1 is the same as that found previously for the ring-segment container; i.e., p/σ_3 increases with increasing k_2 , but p/σ_1 decreases. However, if k_1 is increased to 1.5 from 1.1, then p/σ_1 also increases with

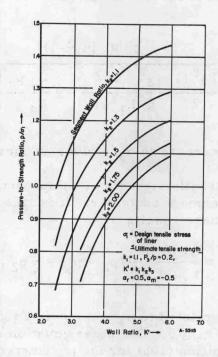


FIGURE 53. EFFECT OF SEGMENT SIZE ON THE PRESSURE-TO-STRENGTH RATIO, p/ σ_1 , FOR THE RING-FLUID-SEGMENT CONTAINER

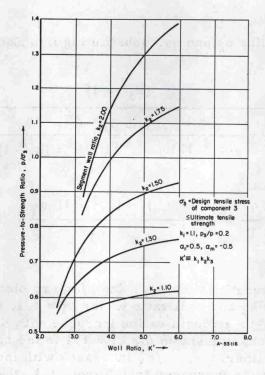


FIGURE 54. EFFECT OF SEGMENT SIZE ON THE PRESSURE-TO-STRENGTH RATIO, p/σ_3 , FOR THE RING-FLUID-SEGMENT CONTAINER