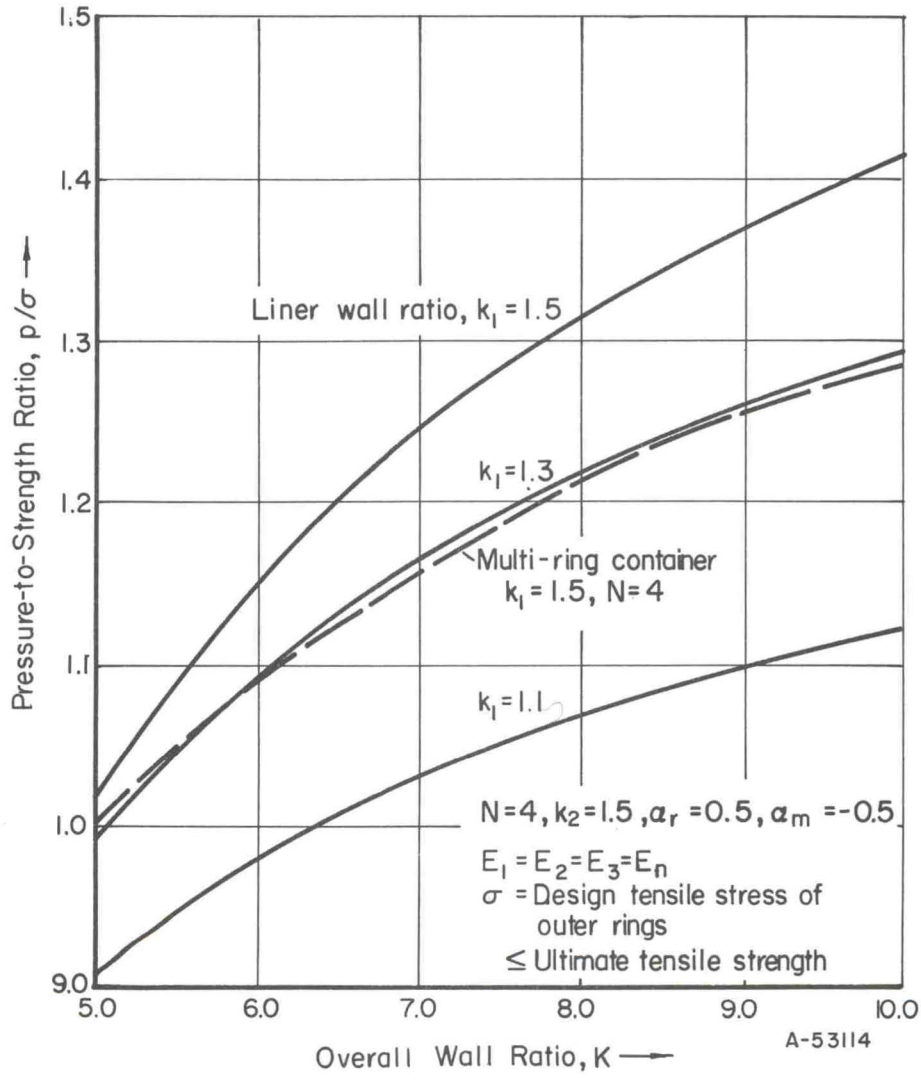

FIGURE 19. EFFECT OF LINER SIZE ON PRESSURE-TO-STRENGTH RATIO, p/σ, FOR RING-SEGMENT CONTAINER

The pressures p_2 and q_2 are related to p_1 and q_1 via Equations (54a, b). p_1 and q_1 are related by Equation (58) with $q_3 \equiv 0$. One other equation involving p_1 and q_1 is needed which is found from the Definition (13b) for the parameter α_m, i.e.,

$$\alpha_m \sigma_1 = \sigma_m = \frac{(\sigma_\theta)_{max} + (\sigma_\theta)_{min}}{2} = \frac{p}{2} \frac{k_1^2 + 1}{k_1^2 - 1} - \frac{(p_1 + q_1)}{k_1^2 - 1} k_1^2$$

at r_o.

Solving for p_1 and q_1, finding p_2 and q_2, substituting into Equation (65), and solving for p/σ_3, one obtains

$$\frac{p}{\sigma_3} = \frac{(k_3^2 - 1)}{k_3^2 \left\{ \frac{2}{k_2} \frac{q_1}{p} + \frac{5}{g(k_1^2 - 1) k_2} + \frac{5}{2} \frac{p_3}{p} \left[\frac{2E_1}{gE_2} \frac{k_3^2}{(k_3^2 - 1)} - 1 \right] \right\}} \qquad (66)$$

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 20 and 21 as a function of segment size k_2 and wall ratio K' for $k_1 = 1.1$, $p_3/p = 0.2$, $\alpha_r = 0.5$, and $\alpha_m = -0.5$. The pressure-to-strength ratios increase with K' or equivalently with k_3, since $K' = k_1 k_2 k_3$. 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 k_2 for large K' as shown in Figure 22. p/σ_3 continues to increase with k_2 as shown in Figure 23. Thus, both p/σ_1 and p/σ_3 increase with large K' for $k_2 = 2.0$ and $k_1 = 1.5$. For values of k_2 between 2.0 and 4.0, however, computer calculations show that p/σ_1 and p/σ_3 first continue to increase and then decrease.

The pressure-to-strength ratios can also be increased by increasing the support pressure p_3. This is shown in Figure 24. With the high ratios shown, it is theoretically possible to have bore pressures as high as 1,000,000 psi in ring-fluid-segment container. However, practicable limitations regarding excessive interference and size requirements, which are discussed later, considerably reduce the pressure capability of this design.

The interferences and residual pressures for outer and inner parts of the ring-fluid-segment container can be calculated using the analysis derived previously for the multi-ring container and the ring-segment container, respectively.