k_2 for large K' as shown in Figure 55. p/σ_3 continues to increase with k_2 as shown in Figure 56. 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 57. 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 multiring container and the ring-segment container, respectively.

Pin-Segment Container

The analysis of the pin-segment container, shown in Figure 39d, also assumes a high-strength liner. It is also assumed that any manufactured interference is taken up during assembly by slack between pins and holes. Therefore, the residual pressure, q_1, between liner and segments is zero at room temperature and nonzero at temperature only if the coefficient of thermal expansion of the liner, α_1, is greater than that of the segments, α_2. In this analysis, it is assumed that $\alpha_1 \geqq \alpha_2$.

The following radial deformation equation must be satisfied:

$$u_1(r_1) + \alpha_1 \Delta T r_1 = u_2(r_1) + \alpha_2 \Delta T r_2 \tag{64}$$

where

$u_1(r_1)$ = the radial deformation of the liner at r_1 due to p at r_o and p_1 at r_1 when $p \neq 0$, and due to q_1 at r_1 when $p = 0$

$u_2(r_1)$ = the radial deformation of the segments at r_1 due to p_1 or q_1 at r_1 and the pin loading at r_2.

Substituting into Equation (64), Equations (14a) and (23a) for u_1 and u_2, and solving for p_1, one gets

$$p_1 = \frac{1}{g_2}\left[\frac{2p}{k_1^2-1} + E_1 \Delta T\,(\alpha_1 - k_2\alpha_2)\right] \tag{65}$$

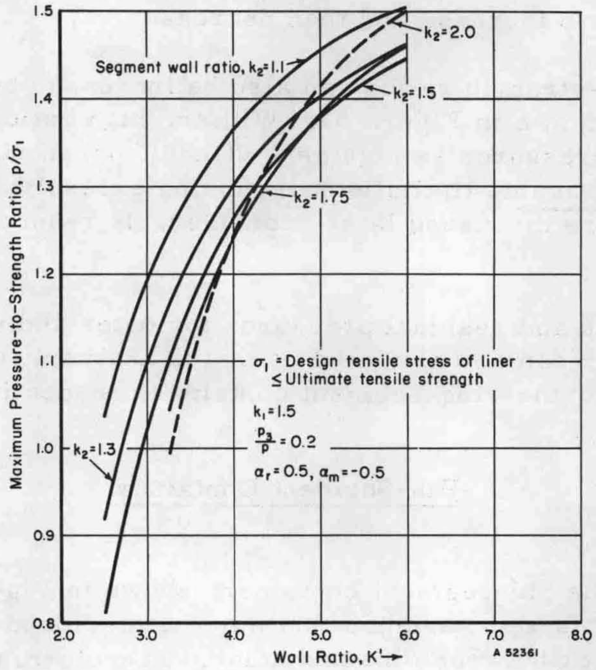

FIGURE 55. EFFECT OF SEGMENT SIZE ON THE PRESSURE-TO-STRENGTH RATIO, p/σ_1, FOR THE RING-FLUID-SEGMENT CONTAINER

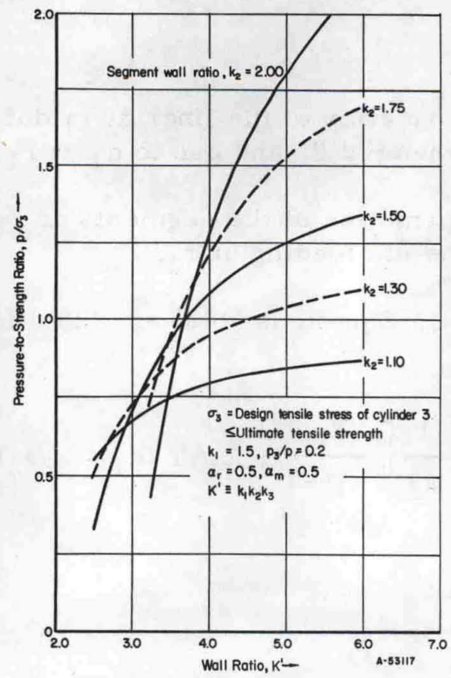

FIGURE 56. EFFECT OF SEGMENT SIZE ON THE PRESSURE-TO-STRENGTH RATIO, p/σ_3, FOR THE RING-FLUID-SEGMENT CONTAINER