The detrimental effect of insufficient segment support to the liner can be reduced by using a high modulus material, tungsten carbide, for the segment material. This is shown in Figure 18. However, the reduction is not sufficient enough to increase the pressure capability of the ring-segment container to that of the multi-ring container. This conclusion is based on results for various k_1 and k_2.

The fatigue analysis of the outer ductile cylinders is conducted in the same manner as it was done for the multi-ring container, except now the component numbers are $n = 3, 4, \ldots, N$. The result is

$$\frac{p}{\sigma} = \frac{\alpha_r (k_n^2-1)(N-2)}{k_n^2\left[\frac{(\alpha_r-\alpha_m)}{2}\frac{(k_1^2+1)}{k_2 k_1^2} + \frac{(3\alpha_r + 2\alpha_m)}{k_2(k_1^2-1)(g-h)}\right]} \tag{63}$$

This result is plotted in Figure 19 which shows the effect of increasing k_1 and comparison with the multi-ring container. Although p/σ can be increased by use of segments, the ring-segment container has the limitation of lower p/σ_1 as shown before in Figures 16 and 17.

The effect on p/σ of increasing the segment modulus was also investigated. However, the effects were found to be insignificant.

Ring-Fluid-Segment Container

The ring-fluid-segment container has been illustrated in Figure 7(c). This container is a combination of a ring-segment container for the inner part and a multi-ring container for the outer part. All of the equations derived for the multi-ring container can be used for the outer part. For the inner part, Equations (54a, b), (55), (56), (57), and (58) apply. The latter equation applies with $q_3 = 0$. Equation (59) is valid and can be used to find p/σ_1 for the liner. (Equation (60) is not needed since p_3 is given.) Solving for p/σ_1, one finds

$$\frac{p}{\sigma_1} = \frac{\alpha_r (k_1^2-1)}{\left[\frac{k_1^2+1}{2} - \frac{2}{g}\frac{k_1^2}{(k_1^2-1)} - 2\frac{E_1}{E_3}\frac{p_3}{p}\frac{k_1^2 k_2 k_3^2}{g(k_3^2-1)}\right]} \tag{64}$$

This equation shows that an increase in p_3/p gives and increases 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 (12), is used for this cylinder, then there results

$$\sigma_3 = \frac{k_3^2}{k_3^2-1}\left[\frac{5}{2}(p_2 - p_3) - \frac{1}{2}q_2\right] \tag{65}$$

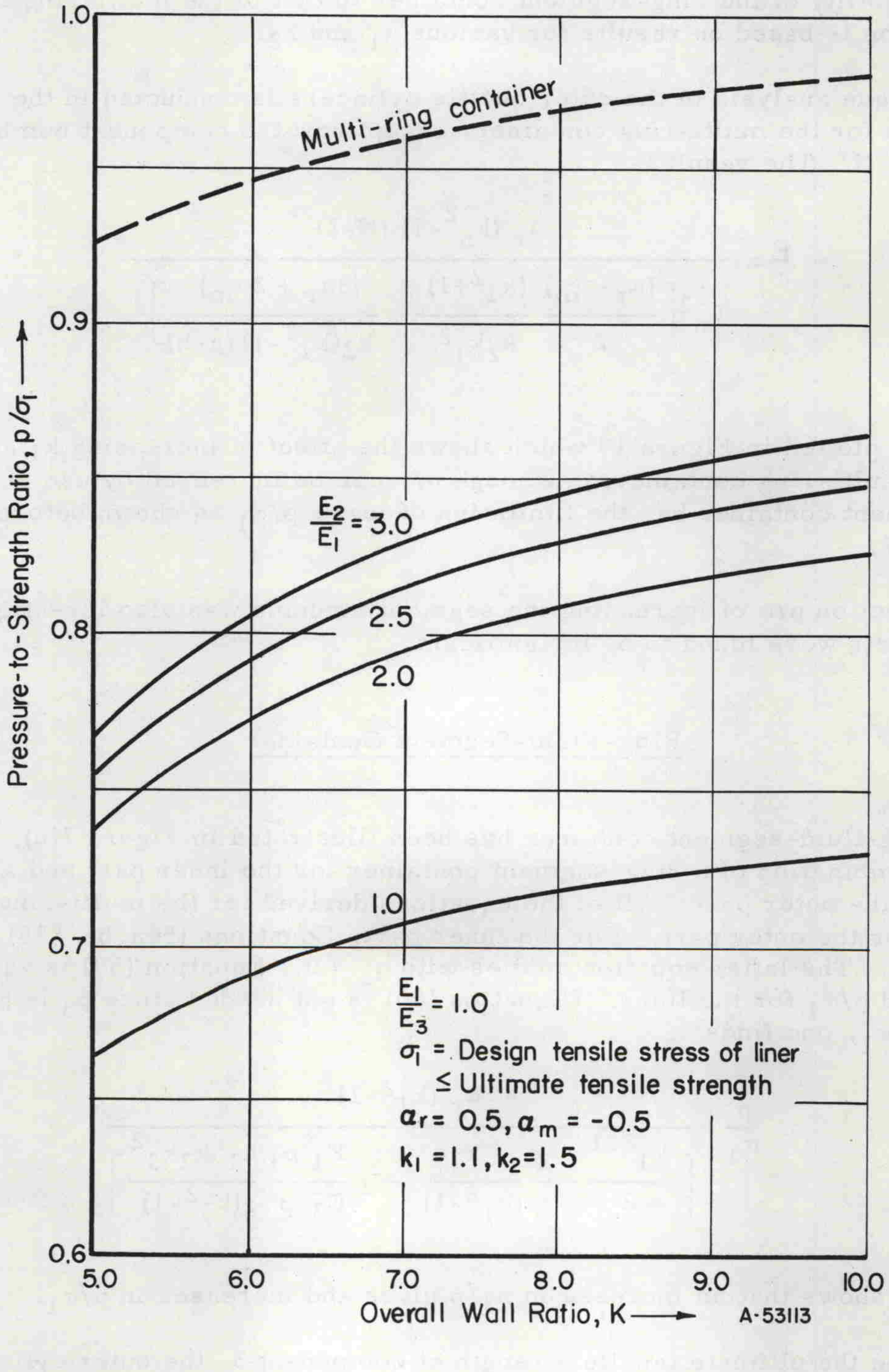

FIGURE 18. EFFECT OF ELASTIC MODULUS OF SEGMENTS ON PRESSURE-TO-STRENGTH RATIO, p/σ_1, FOR THE RING-SEGMENT CONTAINER