The pressure-to-strength ratio p/σ_1 is plotted in Figure 25. Comparing this figure with Figure 12 for the multi-ring container with $\alpha_r = 0.5$, it is evident that both containers have the same limit $p/\sigma_1 \rightarrow 1$ for large wall ratios. However, $\alpha_r = 0.5$ is possible only if $\alpha_m \leqq 0$ as shown in Figure 9. Actually, $\alpha_m = +0.5$ is likely in the pin-segment container if $\alpha_r = 0.5$ because any interference is expected to be lost in taking up slack between pins and holes. In this case, then, $\alpha_r = 0.5$ would mean only one cycle life whereas $\alpha_r = 0.5$ means 10^4 to 10^5 cycles life in the multi-ring container. If this assembly problem could be eliminated by careful machining and selective fitting of pins, then theoretically with sufficient compressive prestress, the p/σ_1 ratio of the pin-segment container could be made to approach that of the multi-ring container.

Since no prestress has been assumed for the pin-segment container, $\alpha_r = \alpha_m = 0.35$ for 10^4 to 10^5 cycles as shown by Figure 9. For $\alpha_r = 0.35$, it is found that p/σ_1 is limited to 0.7 at best. Therefore, the maximum pressure in the pin-segment container is $p = 0.7\ (300,000) = 210,000$ psi for 10^4 to 10^5 cycles life.

The stresses in the segments have not yet been considered. High stresses develop around the pin holes. These too limit the pressure in the pin-segment container. Analysis of the stresses in the segments is described in Appendix A. For the purpose of estimating stresses in the segments the interface pressure p_1 is needed. Therefore, plots of p_1/p are provided in Figure 26. It is evident that the interface pressure p_1 is appreciably less than the bore pressure p_1 especially for large k_1 and small k_2.

The pins are analyzed in Appendix B. In order to carry the pressure loading p_1, it is found that the pin-to-segment-diameter ratio must be

$$\frac{d}{2r_1} = \frac{8}{3}\frac{t}{d}\frac{p_1}{\tau} \qquad (72)$$

where

d = pin diameter

t = segment thickness

$2r_1$ = inside segment diameter

τ = maximum shear stress in pin.

Strip-Wound Container

An analysis was not conducted for the strip-wound container, because it is possible to estimate its relative strength based upon the results of the analysis of the multi-ring container. The strip-wound (wire-wrapped) cylinder uses basically the same principle as the multi-ring container. It has a cylindrical inner cylinder, the liner, under prestress, but the prestress in the liner is provided by wrapping strips or wire under tension onto the liner.

In order to estimate the pressure-to-strength ratio of the strip-wound vessel it is assumed that it behaves overall as a thick cylinder under internal pressure after the

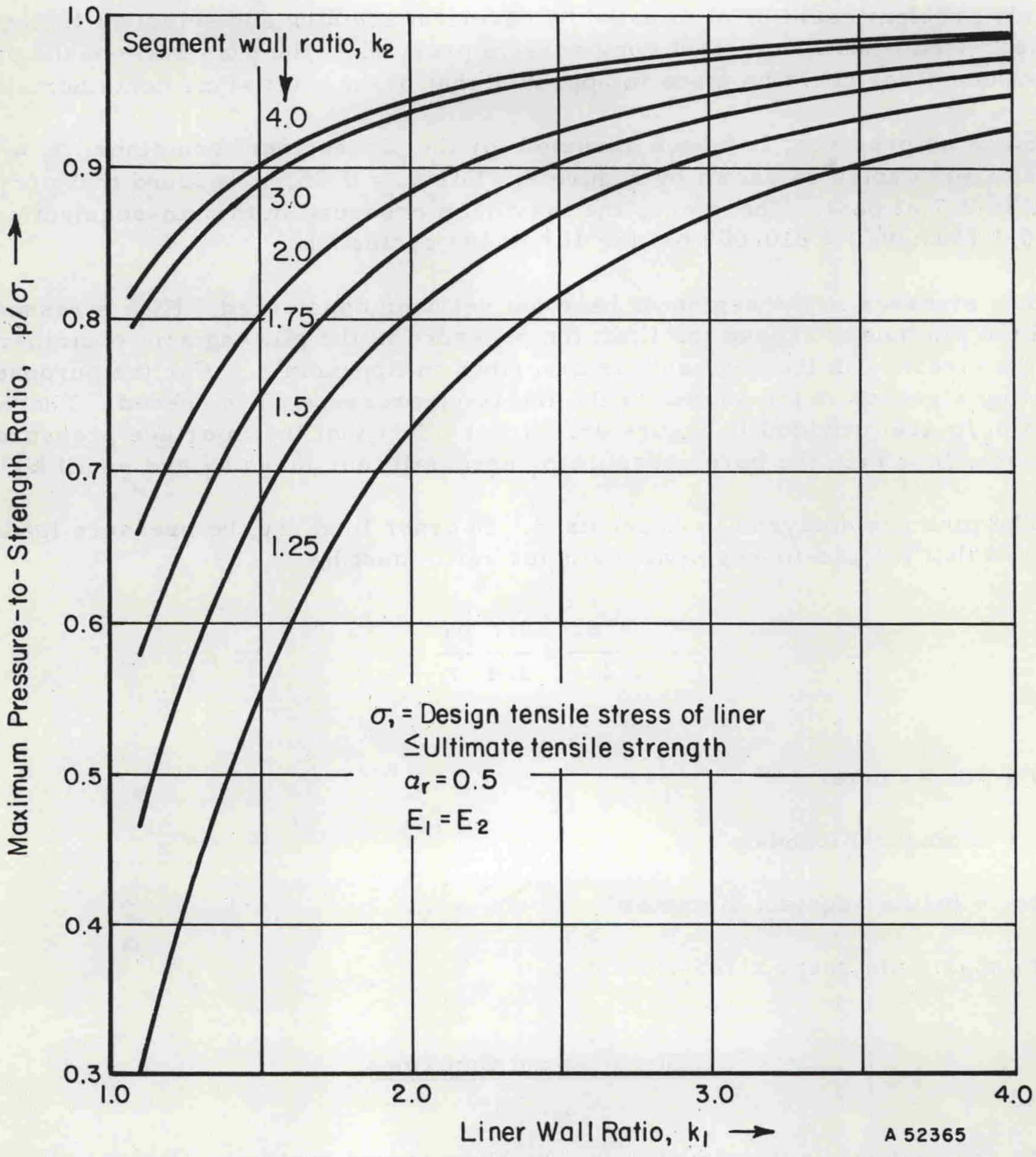

FIGURE 25. MAXIMUM PRESSURE-TO-STRENGTH RATIO, p/σ_1, FOR THE PIN-SEGMENT CONTAINER