Example calculation:

for the liner: $$(\sigma_\theta)_{max} = p \frac{(k_1^2 + 1)}{(k_1^2 - 1)} - 2 \frac{p_1 k_1^2}{k_1^2 - 1} \quad \text{at the bore}$$

$$= 450,000 \left(\frac{3.72}{1.72}\right) - 2\,(250,000)\left(\frac{2.72}{1.72}\right)$$

$$= 184,000 \text{ psi}$$

$$(\sigma_\theta)_{min} = 0$$

$$(\sigma_\theta)_r = (\sigma_\theta)_m = 92,000 \text{ psi}$$

$$\alpha_r = \alpha_m = \frac{92,000}{263,000} = 0.35 \text{ for } \sigma_1 = 263,000 \text{ psi.}$$

$\alpha_r = \alpha_m = 0.35$ gives 10^4-10^5 cycles life as shown in Figure 9. If $\sigma_u = 300,000$ psi is the ultimate strength of liner material, then the factor of safety is $\frac{300}{263} = 1.14$ on the liner.

The outer part can be designed with $p/\sigma_1 \rightarrow 1$ for $\alpha_r = 0.5$ as shown in Figure 12. If $\sigma_1 = 250,000$ psi and the ultimate strength of the inner cylinder of the outer part is 300,000 psi then the factor of safety is $\frac{300}{250} = 1.2$ on the outer part. Larger factors of safety are possible with the suggested design if lower support pressures and larger liners are used.

The outside diameter requirements may be reduced by using a multi-ring unit in the inner part rather than just one ring. In this case, it may be that the fluid-support pressure should not be reduced to zero with the bore pressure but reduced to some minimum value in order to provide some prestress in the outer cylinder of the inner part. Controlling the pressure in one annulus does not present as many difficulties as it does in the controlled fluid-fill container design where there are many annuli.

The suggested design can be analyzed using analyses similar to those used in this study. It is suggested that this be done.

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