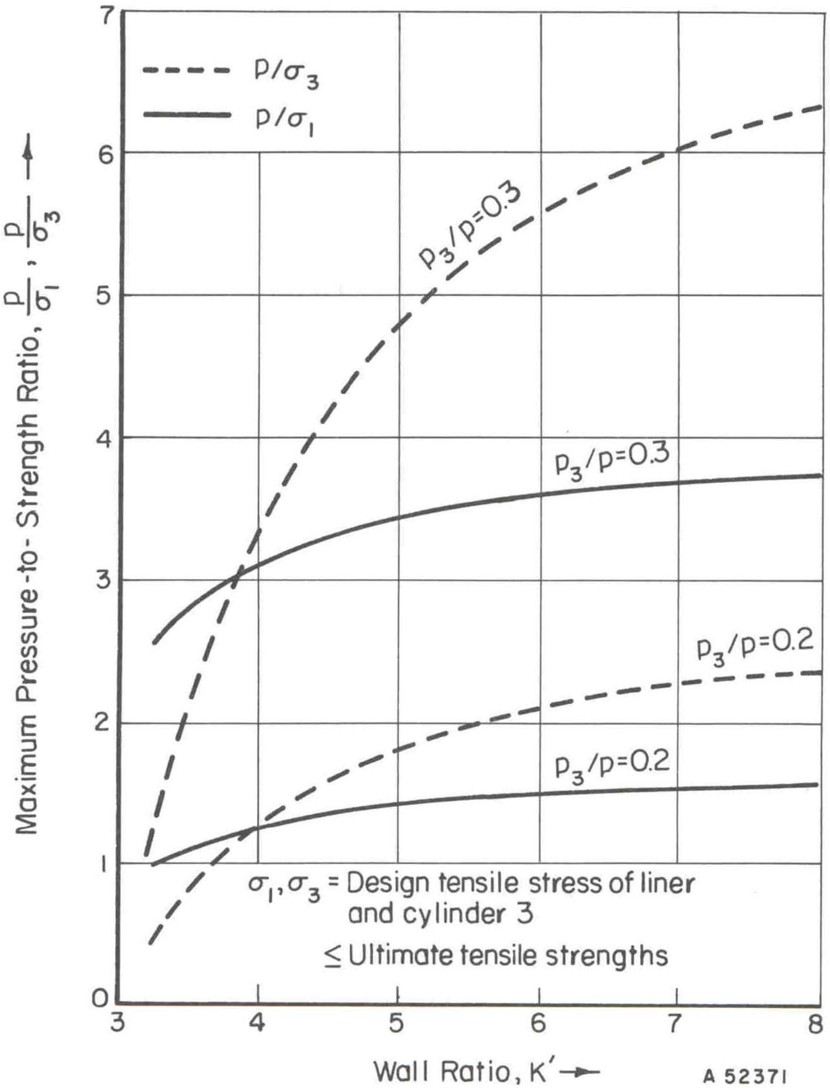

FIGURE 24. EFFECT OF SUPPORT PRESSURE p_3 ON BORE PRESSURE CAPABILITY FOR THE RING-FLUID-SEGMENT CONTAINER

$\alpha_r = 0.5$, $\alpha_m = -0.5$
$k_1 = 1.5$, $k_2 = 2.0$.

Pin-Segment Container

The analysis of the pin-segment container, shown in Figure 7(d), 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:

$$u_1(r_1) + \alpha_1 \Delta T r_1 = u_1(r_1) + \alpha_2 \Delta T r_2 \qquad (67)$$

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 (67), Equations (17a) and (26a) for u_1 and u_2, and solving for p_1, one gets

$$p_1 = \frac{1}{g_2}\left[\frac{2p}{k_1^2-1} + E_1 \Delta T\,(\alpha_1 - k_2\alpha_2)\right] \qquad (68)$$

where

$$g_2 = \frac{E_1}{E_2}\left[\frac{k_2^2+1}{k_2^2-1} + \nu + \frac{M_2 f_3(r_1)}{\beta_1} + E_2\,\frac{G_2}{r_1} + g_{m4}(r_1)\right] + \frac{k_1^2+1}{k_1^2-1} - \nu \quad . \qquad (69)$$

Similarly, q_1 is found if p is taken as zero; i.e.,

$$q_1 = \frac{E_1 \Delta T\,(\alpha_1 - k_2\alpha_2)}{g_2} \quad . \qquad (70)$$

Formulating the range in hoop stress $(\sigma_\theta)_r$ at the bore (Equation (59) and using the definition $\alpha_r \sigma_1 = (\sigma_\theta)_r$, we get the following expression for p/σ_1:

$$\frac{p}{\sigma_1} = \frac{2\alpha_r\,(k_1^2-1)^2\,g_2}{\left[g_2\,(k_1^4-1) - 4k_1^2\right]} \qquad (71)$$

[Equation (71) is identical in form to Equation (61).]