side holes to keep the pressurized length about $^3/_4\,(r_o - r_i)$. The cylinders were then tested by applying up to 50 pounds per square inch internal pressure in 10 pounds per square inch increments by means of a tank of commercial nitrogen. Strains were measured by a Baldwin strain indicator.

Pressurizing the cylinders to 50 pounds per square inch resulted in linear elastic behavior for all gages. The strains measured were averaged for the two halves of the cylinder and these average results were used to calculate the stress-concentration factors (K factors).

Results

The results of the strain gage tests are given in Figure 8 as plots of the stress concentration factor in the hoop direction *vs.* distance along the longitudinal axis of the cylinder from the side hole. For the geometry tested the stress concentration was maximum in the hoop direction of the cylinder at the edge of the side hole and decreased as the distance from the side hole increased. The curve for the cylinder having a wall ratio, $R = 2$, and a side hole ratio, $R_s = 1.0$, was calculated by using the following formula and the strain values listed in Table II.

$$K = \frac{\sigma_h}{(\sigma_h)_n} = \frac{E(\epsilon_h + \mu\epsilon_z) - \mu p(1 + \mu)}{(1 - \mu^2)\,p\left(\dfrac{R^2 + 1}{R^2 - 1}\right)} \tag{21}$$

where

E = modulus of elasticity
ϵ_h, ϵ_z = hoop and longitudinal strains, respectively
μ = Poisson's ratio
p = internal pressure
σ_h = hoop stress in cylinder with stress concentration effect
$(\sigma_h)_n$ = normal hoop stress in cylinder

The remainder of the curves on Figure 8 for cylinders having side hole ratios $R_s = 2$, were calculated by using the following formula and the stress and strain values listed in Table III.

$$K = \frac{\sigma_h}{(\sigma_h)_n} = \frac{E\epsilon_h + \mu(\sigma_r + \sigma_z)}{p\left(\dfrac{R^2 + 1}{R^2 - 1}\right)} \tag{22}$$

where

σ_r = radial stress = $-p$
σ_z = longitudinal stress

For this group of cylinders ($R_s = 2$), the longitudinal strains were not measured close to the side hole interface; consequently, to calculate K values, the longitudinal stress, σ_z, had to be approximated so that Equation 22 could be used. This was done by superposing two stresses; one stress, σ_z', was the usual longitudinal stress given by the equation

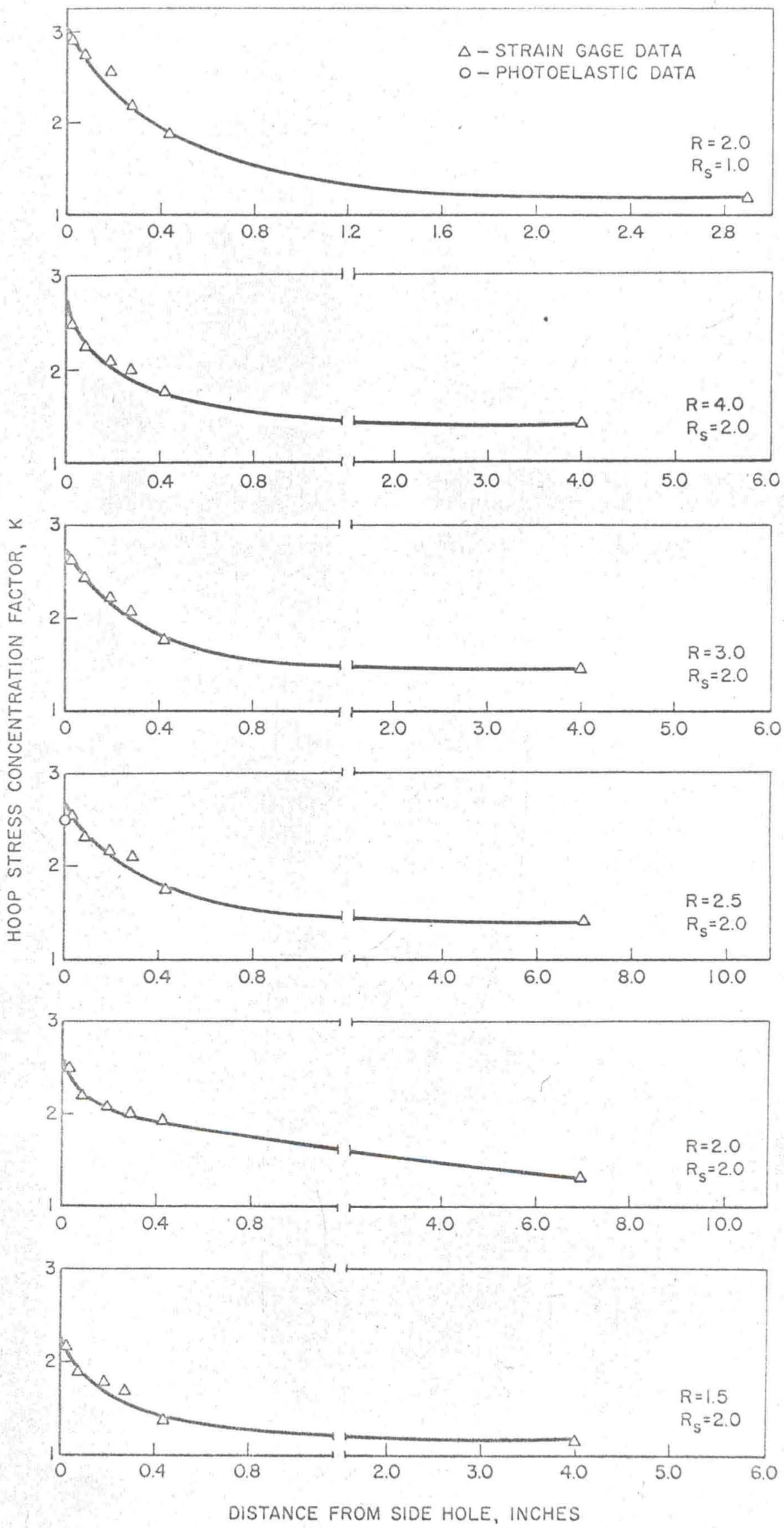

Figure 8. K curves for various cylinders