respect to the ultimate tensile strength, except where otherwise specified.

In the simplest form, the data may be plotted as cyclic pressure versus cycles to failure. Because a summary curve utilizing this parameter will be subsequently shown, it is sufficient to say, that, since the tangential stress is proportional to diameter ratio, the curve will consist of a series of widely separated lines corresponding to each diameter ratio.

Fig. 5 shows normalized maximum tangential stress at the bore which is defined as

$$\frac{\sigma_t}{\text{UTS}} = \frac{P}{\text{UTS}}\,\frac{W^2 + 1}{W^2 - 1} \tag{7}$$

as a function of cycles to failure. As would be expected, a large amount of the diameter-ratio dependence has been removed. It should be noted, however, that the least-squares line for the smaller diameter ratio is at a higher value than the larger diameter ratio. This is opposite to what would be expected. The actual initiation of the fatigue crack can probably be predicted by some cyclic stress or strain parameter independent of diameter ratio. The crack, however, must propagate over a larger area in the larger diameter. Intuitively then, the larger diameter ratio should be at a higher stress and life level. Based on this, fatigue failure is probably some function of a combined stress condition instead of a single principal stress.

Fig. 6 shows the difference in the principal stresses at the bore as defined by

$$\frac{\sigma_t - \sigma_r}{\text{UTS}} = \frac{2PW^2}{\text{UTS}(W^2 - 1)} \tag{8}$$

as a function of the number of cycles to failure. As can be noted, the diameter-ratio dependency is small with the larger diameter ratio logically exhibiting the higher fatigue-strength characteristics.

Fig. 7 shows the data in terms of the normalized octahedral stress as defined by

$$\frac{1}{\text{UTS}}\left\{[(\sigma_t - \sigma_r)^2 + (\sigma_r - \sigma_z)^2 + (\sigma_z - \sigma_t)^2]\,\frac{1}{2}\right\}^{1/2} \tag{9}$$

which, since $\sigma_z = 0$, yields

$$\frac{1}{\text{UTS}}\,[\sigma_t^2 + \sigma_r^2 - \sigma_t\sigma_r]^{1/2} \tag{10}$$

A strain parameter defined by

$$\frac{\sigma_t - \nu\sigma_r}{E} \tag{11}$$

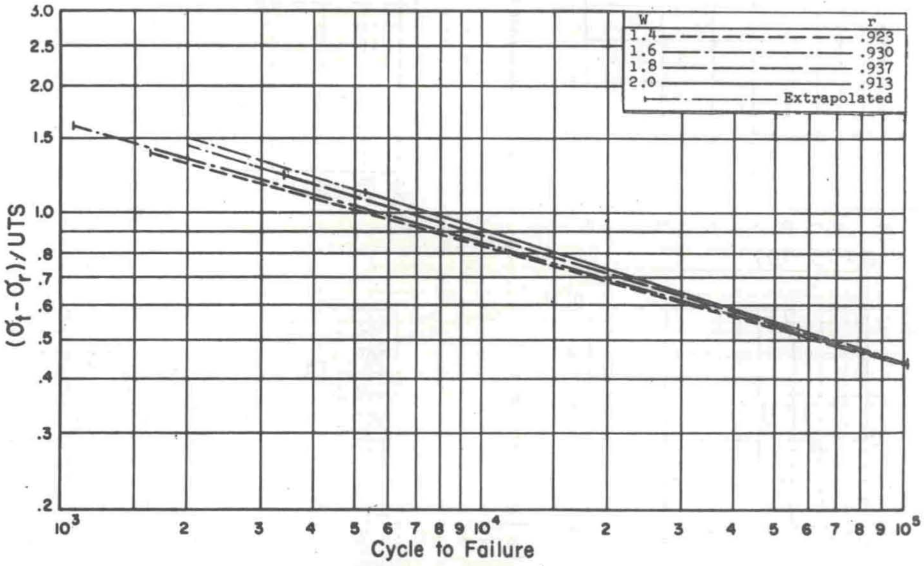


Fig. 7 Octahedral stress parameter versus cycles to failure

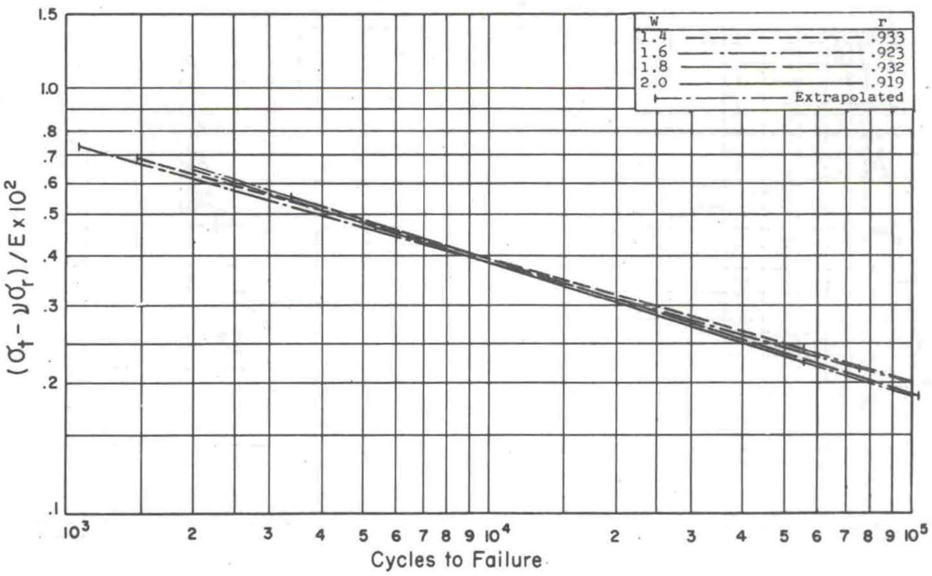
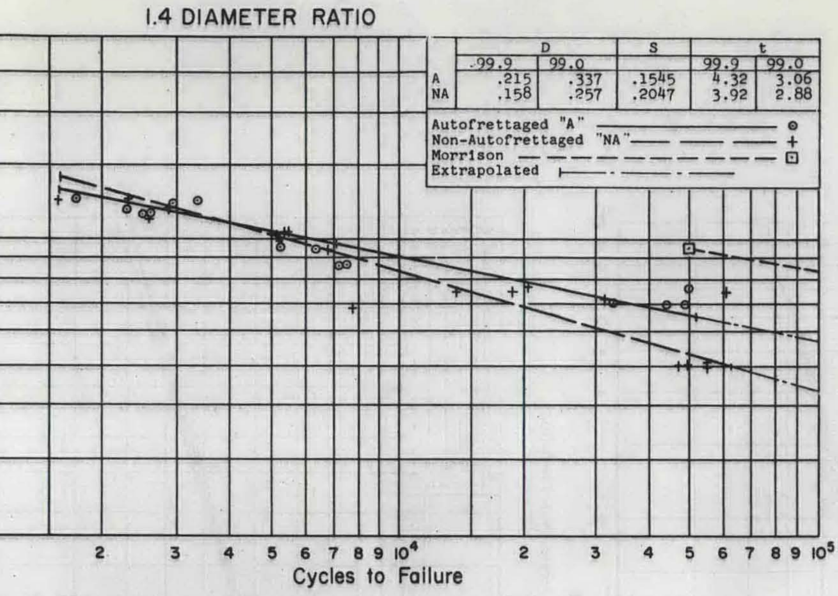
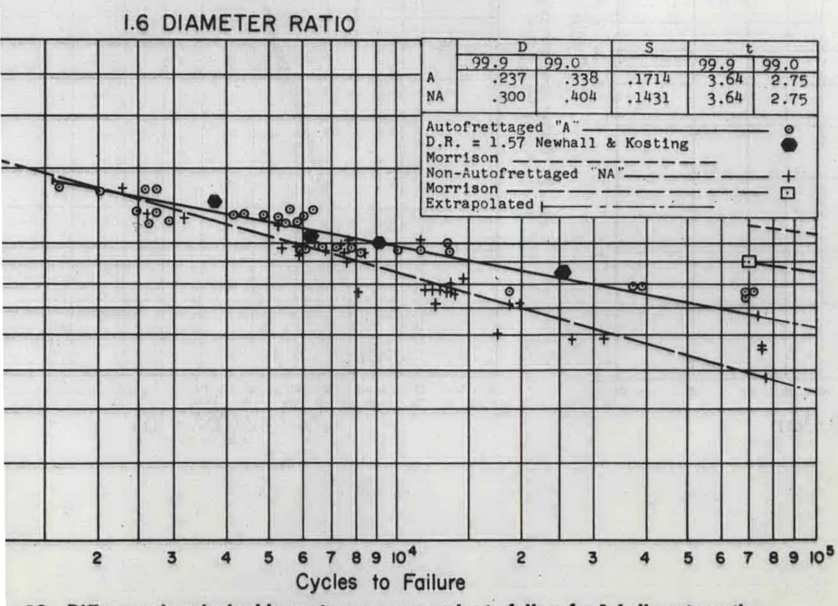


Fig. 8 Strain parameter versus cycles to failure



ig. 9 Difference in principal bore stress versus cycles to failure for 1.4-diameter ratio



. 10 Difference in principal bore stress versus cycles to failure for 1.6-diameter ratio

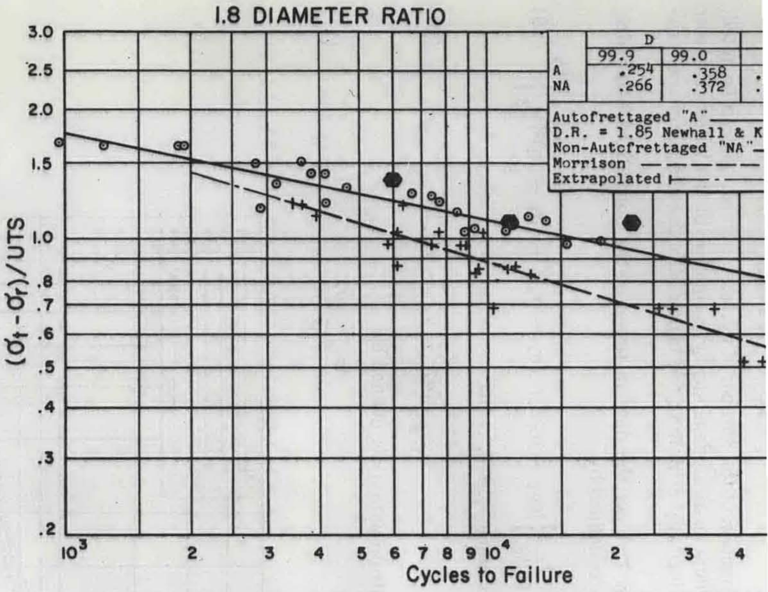


Fig. 11 Difference in principal bore stress versus cycles to failure for 1.8-dia

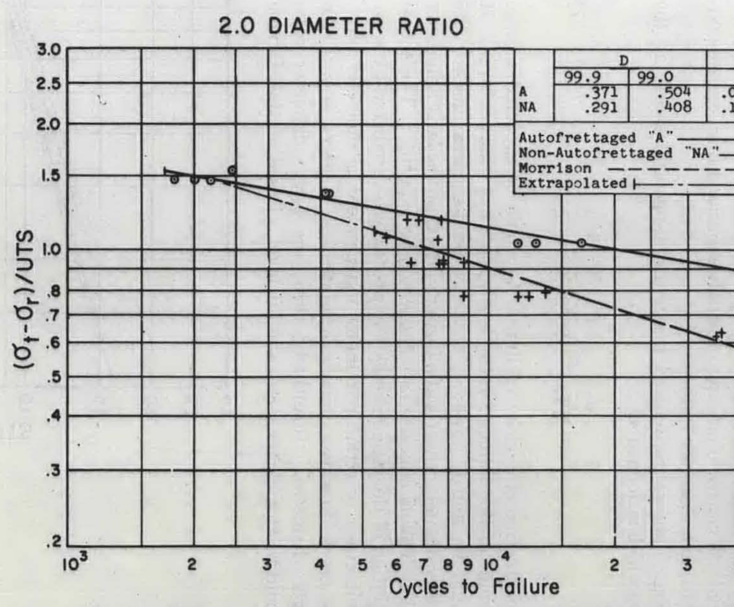


Fig. 12 Difference in principal bore stress versus cycles to failure for 2.0-