APPENDIX I

TEST METHODS PROPOSED FOR THIS INVESTIGATION

Sample Orientation:

The original supplier measured all properties in three directions; 0, 45, and 90 deg to the rolling direction.

Sample Dimensions:

ASTM standard 2-in. gage length steel specimens or other parallel sided specimens with a gage length at least two times the width were used.

Strain Ratio, r:

A gage length (3/4 in. min) was marked on the specimen and the gage length, Lo, measured accurately to within at least 0.005 in. The total width of specimen was measured at four points within the gage length to within 0.0001 in. and an average width, Wo, recorded.

The specimens were strained approximately 20 per cent (or less, if necessary to avoid necking) and the final gage length, Lf, and gage width, Wf, measured as described above.

The r value was calculated from the equation:

$$r = \frac{\ln \frac{Wo}{Wf}}{\ln \frac{Lf \cdot Wf}{Lo \cdot Wo}}$$

or from the attached nomograph (Fig. 11).

Strain-Hardening Exponent, n:

Although more precise techniques are available, for simplicity and uniformity of procedure the two point Nelson-Winlock method was used. From an autographic curve (or by using dividers) the loads at 10 per cent strain L_{10}, and at maximum load, L_m, were determined. The strain hardening exponent, n, was then determined from the attached graph (Fig. 12).

Since Supplier D tests are believed to be the most precise, the following points in their procedure are noteworthy. Specimens were milled with a 4-in. parallel reduced section. Hand polishing was used to smooth the edges and correct for parallelism, if necessary. A 2-in. extensometer was used for strain indication, and the load was read from the dial of the testing machine, the smallest divisions on the dial being 2 lb. Tests were made at a very slow strain rate which was controlled manually at 0.013 in./in./min. At this slow testing speed simultaneous strain and load readings could be observed and recorded. Readings were made at ten points during uniform deformation of the specimen. From these data both Nelson-Winlock and log-log n values were obtained, and there was good agreement, the average Nelson-Winlock n being greater by about 0.002.