APPENDIX III

Work Hardening Exponent n

IDDRG Cooperative Program - Two Factor Nested Experiment (unbalanced)
Longitudinal Tests by up to 7 Laboratories of 22 Materials

M - Materials
L - Laboratories within materials
R - Residual - Within laboratory and within coil variation

The Analysis of Variance is approximate only and assumes Random Model II

ANOVA					
Code	Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	Expected Mean Squares
M	Between materials	21	0.051432	0.002449	$\sigma^2 + 2.43\ \sigma_L^2 + 15.48\ \sigma_M^2$
L	Between labs within materials	100	0.016882	0.000169	$\sigma^2 + 1.06\ \sigma_L^2$
R	Residual	221	0.006268	0.000028	σ^2
	Total	342	0.074582		

F test $F_L = 5.95 > F(100,221,\ 0.0005) = 1.74$ $\therefore$ Significant difference between labs at the 99.95% confidence level

$F_M = 14.51 > F(21,100,\ 0.0005) = 2.75$ $\therefore$ Significant difference between materials at the 99.95% confidence level

Conclusions:

69.0% of the observed total variation in n is explained by differences between materials at the 99.99% confidence level.

22.6% by differences between laboratories at the 99.95% confidence level.

8.4% by test error and variation within coils.

TABLE OF AVERAGES

Supplier	Material					
	1a	1b	1c	2	3	4
A	0.225			0.211	0.226	0.213
B	0.234			0.200	0.232	0.196
C	0.232	0.223	0.232	0.223	0.210	0.203
D_Y	0.227			0.212	0.225	0.197
D_Z	0.231			0.200	0.228	0.220