

NBSIR 79-1377

# INTERLABORATORY PROGRAMS FOR RUBBER

ANALYSES NO. 39  
JANUARY - MARCH 1979



U. S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS

NBS COLLABORATIVE REFERENCE PROGRAMS

TAPPI Paper and Board (6 times per year)

Bursting strength	Smoothness
Tearing strength	Surface pick strength
Tensile breaking strength	K & N ink absorption
Elongation to break	pH
Tensile energy absorption	Opacity
Folding endurance	Blue reflectance (brightness)
Stiffness	Specular gloss, 75°
Air resistance	Thickness
Grammage	Concora (flat crush)
	Ring crush

FKBG-API Containerboard (48 times per year)

Mullen burst of linerboard  
Concora test of medium

MCCA Color and Appearance (4 times per year)

Gloss at 60°  
Color and color difference

CTS Rubber (4 times per year)

Tensile strength, ultimate elongation and tensile stress  
Hardness  
Mooney viscosity  
Vulcanization properties

CTS Thermal Insulation Materials (2 times per year)

19 test methods for thermal insulation materials covering:  
thermal properties; strength properties; dimensions, stability,  
and density properties; fire properties; and properties of  
vapor barriers

ASTM Cement (2 times per year)

Chemical (11 chemical components)  
Physical (8 characteristics)

AASHTO Bituminous

Asphalt cement (2 times per year)  
Cutbacks (once a year)

NBS Collaborative Reference Programs  
A05 Technology Building  
National Bureau of Standards  
Washington, DC 20234

**INTERLABORATORY PROGRAMS  
FOR RUBBER**

**Analyses No. 39  
January - March 1979**

**J. Horlick  
Office of Testing Laboratory Evaluation Technology  
Office of Engineering Standards  
National Engineering Laboratory**

**T. L. Cummings, Research Associate,  
Collaborative Testing Services, Inc.**

**G. W. Bullman  
Polymers Science and Standards Division  
Center for Materials Research  
National Measurement Laboratory**

**U. S. DEPARTMENT OF COMMERCE  
National Bureau of Standards**

**NBSIR 79-1377**



## INTRODUCTION

This report summarizes the test results for the first quarter of 1979. The tests cover the four areas in the NBS Collaborative Reference Programs for Rubber: Tensile Properties, Hardness, Mooney Viscosity, and Vulcanization Properties.

For each of the four areas, there is a set of summary tables followed by a table of data and analysis by laboratory and a graphical presentation of the data and analysis. Where applicable, the tables of data have the English and Metric expressions side-by-side. Additional details are given in the section "Key to Tables and Graphs."

If there are questions or comments on the notes, the analyses, or the reports in general, contact Jeffrey Horlick at (301) 921-2946.



Jeffrey Horlick, Administrator  
NBS Collaborative Reference Programs  
Office of Testing Laboratory Evaluation Technology

June 27, 1979



## TABLE OF CONTENTS

	<u>Page</u>
Introduction	
Table of Contents	1
Key to Tables and Graphs	2
Program 1: Tensile strength, ultimate elongation and stress at 300% elongation	5
Program 2: Hardness	13
Program 4: Mooney Viscosity	17
Program 5: Vulcanization characteristics determined with oscillating-disk cure meter	21

## KEY TO TABLES AND GRAPHS

LAB CODE	Confidential laboratory identification number known only to the participant and the Collaborative Reference Program staff.
F	A flag identifying results that are extreme in comparison with the other results.
X	- The plotted point for the indicated laboratory lies outside of the 99% error ellipse (not shown); ie, assuming normal distribution, 99% of laboratories similar to those participating in the program will be represented by points lying within the 99% ellipse.
*	- The plotted point for the indicated laboratory lies outside of the 95% error ellipse shown on graphs, but inside the 99% ellipse.
MEAN	The arithmetic average of the two median values for the two sheets or samples of the same material.
% DEV	The deviation or difference of the laboratory MEAN from the GR. MEAN (see below), expressed as a percent of the GR. MEAN.
REL SDR	The ratio of the SDR (standard deviation of replicate measurements within a laboratory) to the AVER SDR (see below). Extreme values, ie, values that are likely to occur by chance less than one time in a hundred as determined by the chi-square test, are marked with an "X".
VAR CODE	A code number designating a particular test instrument, set of environmental conditions, procedure, unit used, or other variation. The code "01" designates the instrument, conditions and procedure specified at the top of the page either explicitly or in the cited ASTM Standard, and the unit of test shown at the top of the first column of data. A '+' in front of the VAR CODE indicates that the data has been excluded from the grand means due to a non-standard variation of the possibilities mentioned above, or the data is extreme.
GR MEAN	The arithmetic average (grand mean) of all the laboratory MEAN values, excluding those flagged (F) with an "X".
SD MEANS	The standard deviation among the laboratory MEAN values included in the GR. MEAN.



AVER SDR      The arithmetic average of all the standard deviations of within laboratory replication, excluding those excluded from the GR. MEAN and excluding any additional ones for which the REL SDR has been flagged.

#### GRAPH

For each laboratory the MEAN for the second material is plotted against the MEAN for the first material, with each point representing a laboratory. The horizontal and vertical lines are the GR. MEAN values. The dashed line is drawn at 45°. The solid sloping line, which may or may not lie close to the 45° line, is the major axis of the ellipse. The ellipse is drawn so that, on the average, it will include 95% of the points representing the laboratories. The plotted symbols X and \* used to represent results falling outside the ellipse are explained under "F" above. Laboratories inside the ellipse (no flag in the F column) are plotted as an O.

The graph is plotted with an ellipse when there are 20 or more laboratories in the analysis. When there are 10 through 19 laboratories in the analysis, the graph is plotted but the ellipse is omitted. When there are fewer than 10 laboratories retained in the Grand Mean the graph is not plotted.

For development of the theory, see the paper by J. Mandel and T.W. Lashof, Interpretation and Generalization of Youden's Two-Sample Diagram, J. of Quality Technology, Vol. 6, pp 22-36, Jan. 1974.

#### SUMMARY OF ANALYSES

LABS INCL      Number of laboratories included in the GR. MEANS.

LABS OMIT      Number of laboratories reporting data but excluded from the GR. MEANS.

#### STANDARD DEVIATIONS

LABS          Same as the SD MEANS (see above)

SHEETS        Standard deviation between the two sheets or samples of the same material.

REPL          Same as AVER SDR (see above)

#### PRECISION OF METHODS

REPL CRP      The number of replicate measurements per sheet or sample, as specified in the Collaborative Reference Program.

REPL ASTM     The number of replicate measurements specified for a test result in the designated ASTM Standard.

REPEAT      The repeatability, a measure of the within laboratory precision, i.e., of the ability of the test technician to repeat his test result: two test results obtained by the same technician on the same homogeneous sample of material may be expected 95% of the time to agree within the repeatability.

REPROD      The reproducibility, a measure of the between laboratory precision: two test results obtained in different laboratories may be expected 95% of the time to agree within the reproducibility.

ABSOLUTE    Values of REPEAT and REPROD expressed in the units of measurement.

PERCENT     Values of REPEAT and REPROD expressed as a percent of the GR. MEANS.

TENSILE STRENGTH, ULTIMATE ELONGATION, AND STRESS AT 300% ELONGATION

NOTES

Materials A91 and A92 were sheets of the same vulcanized rubber. Similarly, materials A93 and A94 were alike.

V100 results were obtained at NBS using a pendulum tester.

All participants used Die C in ASTM D 412 with the following exceptions:

- V126 used Die 2 in BS903
- V208 did not specify a Die
- V225 used ASTM Die D

INSTRUMENTS

Instrument	Number of Labs	Percent
Electronic Manual	20	33%
Electronic Automatic	19	32%
Pendulum Manual	18	30%
Pendulum Automatic	3	5%
	60	100%

RELATIVE HUMIDITY

Relative Humidity	Number of Labs	Percent
Below 45%	17	28%
Above 55%	12	20%
45% - 55%	22	37%
Not specified	9	15%
	60	100%

SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS			UNITS
					LABS	SHEETS	REPL	
TENSILE STRENGTH	A91-A92 A93-A94	54 54	6 6	2712. 2712.	95. 96.	42. 37.	60. 58.	POUNDS PER SQUARE INCH POUNDS PER SQUARE INCH
TENSILE STRENGTH	A91-A92 A93-A94	54 54	6 6	18.71 18.70	.66 .66	.29 .26	.42 .40	MEGAPASCALS MEGAPASCALS
ULTIMATE ELONGATION	A91-A92 A93-A94	57 57	3 3	624. 619.	22. 23.	7. 6.	15. 14.	PERCENT PERCENT
STRESS AT 300% ELONGATION	A91-A92 A93-A94	56 56	4 4	1163. 1162.	73. 70.	13. 14.	25. 28.	POUNDS PER SQUARE INCH POUNDS PER SQUARE INCH
STRESS AT 300% ELONGATION	A91-A92 A93-A94	56 56	4 4	8.018 8.017	.503 .483	.114 .122	.175 .196	MEGAPASCALS MEGAPASCALS

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

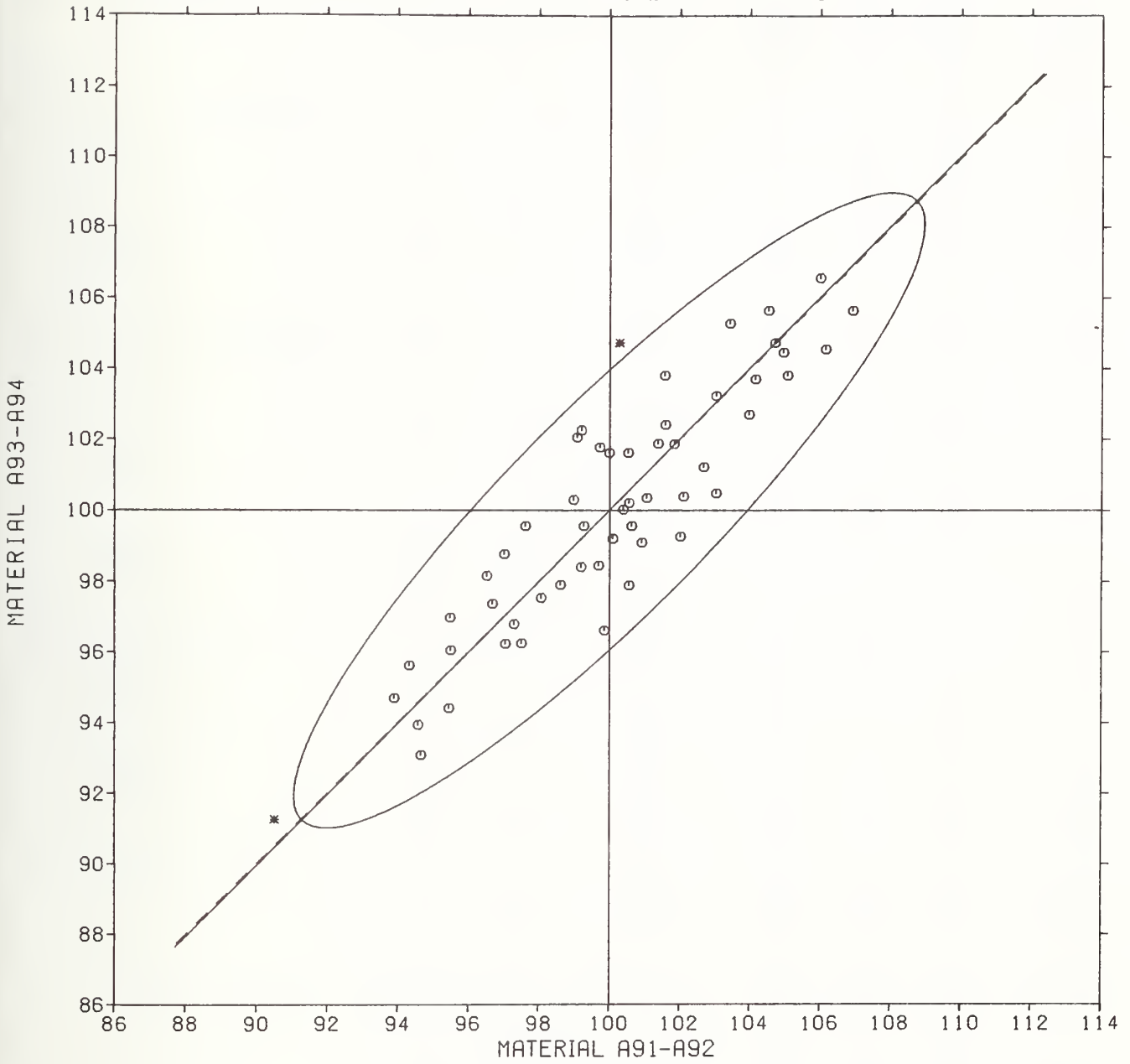
PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE		UNITS	PERCENT	
					REPEAT	REPROD		REPEAT	REPROD
TENSILE STRENGTH	A91-A92 A93-A94	5 5	5 5	2712. 2712.	167. 160.	264. 265.	PSI PSI	6.2 5.9	9.7 9.8
TENSILE STRENGTH	A91-A92 A93-A94	5 5	5 5	18.71 18.70	1.15 1.10	1.82 1.83	MEGAPA MEGAPA	6.2 5.9	9.7 9.8
ULTIMATE ELONGATION	A91-A92 A93-A94	5 5	5 5	624. 619.	41. 38.	60. 64.	% %	6.6 6.2	9.6 10.3
STRESS AT 300% ELONGATION	A91-A92 A93-A94	5 5	5 5	1163. 1162.	70. 79.	202. 194.	PSI PSI	6.0 6.8	17.4 16.7
STRESS AT 300% ELONGATION	A91-A92 A93-A94	5 5	5 5	8.018 8.017	.484 .543	1.393 1.337	MEGAPA MEGAPA	6.0 6.8	17.4 16.7

LAB CODE	P	MATERIAL A91-A92 COMMERCIAL TIRE TREAD				MATERIAL A93-A94 COMMERCIAL TIRE TREAD				VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
		MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	MEAN PSI	MEAN MEGAPA	% DEV	REL SDR		
V0062	*	2455.	16.93	-9.5	.66	2475.	17.07	-8.7	.48	01	
V0067		2590.	17.86	-4.5	2.47X	2630.	18.14	-3.0	.72	01	
V0069		2691.	18.56	-.8	1.38	2773.	19.12	2.3	2.12X	01	
V0070		2840.	19.59	4.7	1.06	2840.	19.59	4.7	.56	01	
V0071		2631.	18.15	-3.0	3.40X	2678.	18.47	-1.2	1.38	01	
V0072		2765.	19.07	1.9	.76	2735.	18.86	.9	1.29	+70	DATA RECEIVED LATE
V0073		2762.	19.05	1.8	1.14	2762.	19.05	1.9	1.68	01	
V0076		2820.	19.45	4.0	1.24	2785.	19.21	2.7	1.66	01	
V0078		2547.	17.57	-6.1	1.10	2568.	17.71	-5.3	1.03	01	
V0083		2632.	18.16	-2.9	.41	2610.	18.00	-3.8	.58	01	
V0084		2705.	18.66	-.3	1.97X	2760.	19.03	1.8	2.07X	01	
V0085		2741.	18.90	1.1	.96	2722.	18.77	.4	1.49	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0087		2715.	18.72	.1	1.23	2690.	18.55	-.8	1.06	01	
V0088	X	2246.	15.49	-17.2	1.61	2240.	15.45	-17.4	.80	01	
V0092		2685.	18.52	-1.0	1.43	2720.	18.76	.3	1.06	01	
V0095		2825.	19.48	4.2	1.21	2813.	19.40	3.7	1.17	01	
V0100	*	2720.	18.76	.3	1.39	2840.	19.59	4.7	.76	01	
V0102		2590.	17.86	-4.5	1.24	2605.	17.97	-3.9	.78	01	
V0111		2795.	19.28	3.0	1.07	2810.	19.38	3.6	.82	+70	DATA RECEIVED LATE
V0117		2675.	18.45	-1.4	.72	2655.	18.31	-2.1	1.20	01	
V0123		2785.	19.21	2.7	.83	2745.	18.93	1.2	.89	01	
V0126		2879.	19.86	6.1	1.01	2835.	19.56	4.6	1.01	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0128		2805.	19.34	3.4	.74	2855.	19.69	5.3	1.36	01	
V0141		2769.	19.10	2.1	1.05	2722.	18.78	.4	1.00	01	
V0144		2875.	19.83	6.0	1.00	2890.	19.93	6.6	1.10	01	
V0144B		2835.	19.55	4.5	.66	2865.	19.76	5.6	.67	01	
V0146		2708.	18.68	-.1	.46	2620.	18.07	-3.4	1.47	01	
V0149		2618.	18.06	-3.5	1.52	2662.	18.36	-1.8	.89	01	
V0150		2687.	18.53	-.9	.76	2767.	19.09	2.1	.81	01	
V0152		2900.	20.00	6.9	1.08	2865.	19.76	5.6	1.41	01	
V0153		2622.	18.09	-3.3	1.85	2640.	18.21	-2.6	.85	01	
V0154		2950.	19.66	5.1	.40	2815.	19.41	3.8	.47	01	
V0156		2755.	19.00	1.6	1.20	2815.	19.41	3.8	.88	01	
V0158		2756.	19.00	1.6	1.15	2777.	19.15	2.4	.68	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0160		2558.	17.64	-5.7	1.69	2593.	17.68	-4.4	.99	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0164		2729.	18.82	.6	.95	2700.	18.62	-.4	.80	01	
V0166		2723.	18.78	.4	1.22	2712.	18.71	.0	.92	01	
V0168		2846.	19.63	4.9	.46	2832.	19.53	4.4	1.08	01	
V0169		2712.	18.70	-.0	1.07	2756.	19.00	1.6	1.78	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0176		2645.	18.24	-2.5	.56	2610.	18.00	-3.8	.58	01	
V0184		2639.	18.20	-2.7	.72	2625.	18.10	-3.2	.82	01	
V0190		2750.	18.97	1.4	1.41	2763.	19.06	1.9	1.40	01	
V0199		2647.	18.26	-2.4	1.33	2700.	18.62	-.4	.73	01	
V0208		2690.	18.55	-.8	.91	2669.	18.40	-1.6	1.25	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0213		2704.	18.65	-.3	.75	2670.	18.41	-1.5	1.13	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0214		2727.	18.80	.5	1.20	2756.	19.00	1.6	.67	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0219	X	3149.	21.72	16.1	1.53	3036.	20.94	12.0	1.81	01	
V0223		2660.	18.34	-1.9	.77	2645.	18.24	-2.5	1.00	01	
V0224		2795.	19.28	3.0	2.95X	2725.	18.79	.5	1.42	01	
V0225		2565.	17.65	-5.4	2.01X	2547.	17.57	-6.1	1.30	01	
V0232		2692.	18.57	-.7	.85	2700.	18.62	-.4	.92	01	
V0233		2767.	19.08	2.0	.93	2692.	18.57	-.7	2.04X	01	
V0235		2727.	18.81	.6	1.03	2654.	18.31	-2.1	1.29	01	
V0238	X	3110.	21.45	14.7	2.27X	3007.	20.74	10.9	1.61	01	
V0243		2727.	18.81	.6	.75	2717.	18.74	.2	.67	01	
V0244		2795.	19.28	3.0	.64	2799.	19.31	3.2	.62	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0245A		2567.	17.71	-5.3	1.04	2524.	17.41	-6.9	.44	01	
V0245B		2589.	17.86	-4.5	.64	2560.	17.66	-5.6	1.57	01	
V0249		2635.	18.17	-2.9	.99	2640.	18.21	-2.7	1.14	+70	DATA RECEIVED LATE
V0250		2737.	18.88	.9	1.18	2687.	18.53	-.9	.52	01	
		2712.	18.71	.0	GR. MEAN =	2712.	18.70				5 TEST DETERMINATIONS
		.95.	.66	.0	SD MEANS =	.96.	.66				54 LABORATORIES IN GRAND MEANS
		.60.	.42	.0	AVER SDR =	.58.	.40				60 LABORATORIES REPORTING
		PSI	MEGAPA		UNIT =	PSI	MEGAPA				

# TENSILE STRENGTH

MATERIAL A91-A92    2712.    PSI    MATERIAL A93-A94    2712.    PSI



INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER  
ULTIMATE ELONGATION - PERCENT

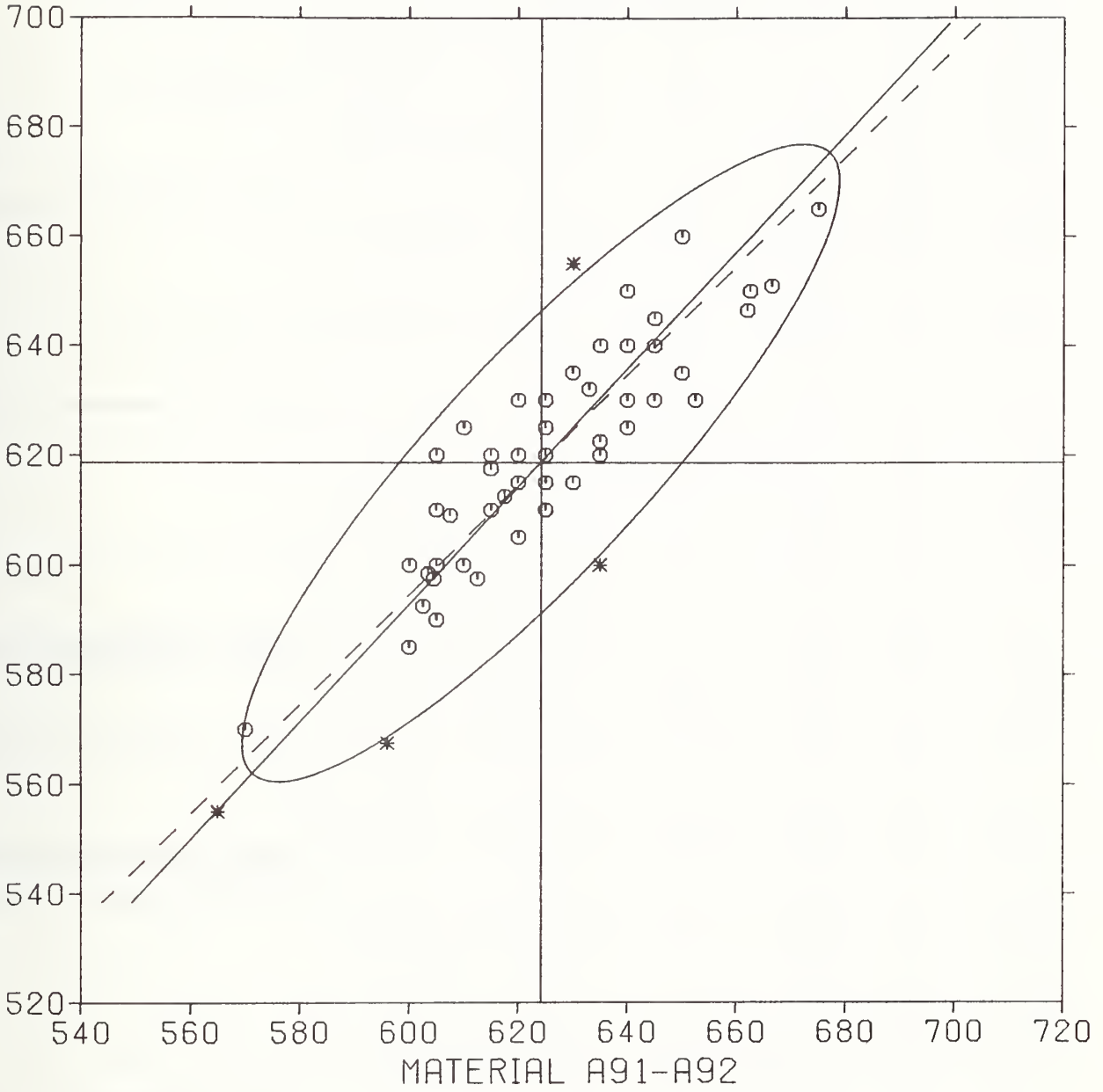
LAB CODE	F	MATERIAL A91-A92 COMMERCIAL TIRE TREAD			MATERIAL A93-A94 COMMERCIAL TIRE TREAD			VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
		MEAN %	% DEV	REL SDR	MEAN %	% DEV	REL SDR		
V0062		603.	-3.3	.47	598.	-3.3	.59	01	
V0067		605.	-3.1	2.34X	610.	-1.4	.64	01	
V0069	*	630.	.9	1.40	655.	5.9	2.47X	01	
V0070		615.	-1.5	.57	617.	-.2	.64	01	
V0071		604.	-3.1	3.13X	597.	-3.4	1.46	01	
V0072		605.	-3.1	.93	595.	-3.8	.95	*70	DATA RECEIVED LATE
V0073		645.	3.3	1.22	640.	3.4	1.55	01	
V0076		605.	-3.1	1.14	590.	-4.6	1.51	01	
V0078		620.	-.7	1.17	615.	-.6	1.14	01	
V0083		635.	1.7	.75	622.	.6	.54	01	
V0084		600.	-3.9	1.38	600.	-3.0	1.16	01	
V0085		662.	6.1	.57	650.	5.1	1.40	01	
V0087		607.	-2.7	1.51	609.	-1.6	.99	01	
V0088	*	596.	-4.5	2.73X	567.	-8.3	1.02	01	
V0092		630.	.9	1.09	635.	2.6	.89	01	
V0095		630.	.9	1.36	615.	-.6	1.32	01	
V0100		640.	2.5	1.32	640.	3.4	.92	01	
V0102		625.	.1	.79	625.	1.0	.61	01	
V0111		632.	1.3	1.08	631.	2.1	.73	*70	DATA RECEIVED LATE
V0117		625.	.1	1.05	620.	.2	1.66	01	
V0123		640.	2.5	.75	625.	1.0	.84	01	
V0126		662.	6.1	1.16	646.	4.5	1.17	01	
V0128		625.	.1	.88	630.	1.8	.71	01	
V0141		625.	.1	.62	610.	-1.4	.42	01	
V0144		650.	4.1	.66	635.	2.6	1.05	01	
V0144B		640.	2.5	.81	630.	1.8	.73	01	
V0146		612.	-1.9	1.01	597.	-3.4	1.34	01	
V0149		617.	-1.1	1.38	612.	-1.0	.67	01	
V0150		620.	-.7	.48	630.	1.8	.60	01	
V0152		615.	-1.5	1.10	610.	-1.4	1.30	01	
V0153		610.	-2.3	.95	625.	1.0	.47	01	
V0154		605.	-3.1	.46	590.	-4.6	.67	01	
V0156		605.	-3.1	1.24	600.	-3.0	1.55	01	
V0158		675.	8.2	1.38	665.	7.5	.58	01	
V0160		605.	-3.1	1.24	620.	.2	.91	01	
V0164		602.	-3.5	.97	592.	-4.2	.20	01	
V0166		605.	-3.1	.83	610.	-1.4	.56	01	
V0168		645.	3.3	.55	630.	1.8	.87	01	
V0169		635.	1.7	1.28	640.	3.4	1.49	01	
V0176		625.	.1	.83	615.	-.6	.84	01	
V0184		620.	-.7	.66	620.	.2	.88	01	
V0190		640.	2.5	1.00	640.	3.4	1.49	01	
V0199		625.	.1	1.32	610.	-1.4	1.08	01	
V0208		600.	-3.9	.84	585.	-5.4	.77	01	
V0213		633.	1.4	.90	632.	2.2	1.17	01	
V0214		640.	2.5	1.64	650.	5.1	.70	01	
V0219		615.	-1.5	1.49	610.	-1.4	1.00	01	
V0223		615.	-1.5	1.12	620.	.2	1.10	01	
V0224		652.	4.5	1.72	630.	1.8	1.27	01	
V0225	*	565.	-9.5	1.32	555.	-10.3	1.22	01	
V0232		650.	4.1	.99	660.	6.7	1.16	01	
V0233		620.	-.7	.94	605.	-2.2	2.24X	01	
V0235		666.	6.8	.95	651.	5.2	1.57	01	
V0238	*	635.	1.7	1.37	600.	-3.0	1.09	01	
V0243		645.	3.3	.45	645.	4.3	.67	01	
V0244		640.	2.5	.39	640.	3.4	.00	01	
V0245A		570.	-8.7	.68	570.	-7.9	.87	01	
V0245B		610.	-2.3	.93	600.	-3.0	1.74	01	
V0249		650.	4.1	.88	655.	5.9	.50	*70	DATA RECEIVED LATE
V0250		635.	1.7	.91	620.	.2	.39	01	
624.			* GR. MEAN *		619.				5 TEST DETERMINATIONS
22.			* SD MEANS *		23.				57 LABORATORIES IN GRAND MEANS
15.			* AVER SDR *		14.				60 LABORATORIES REPORTING
%			* UNIT *		%				



# ULTIMATE ELONGATION

MATERIAL A91-A92 624. % MATERIAL A93-A94 619. %

MATERIAL A93-A94



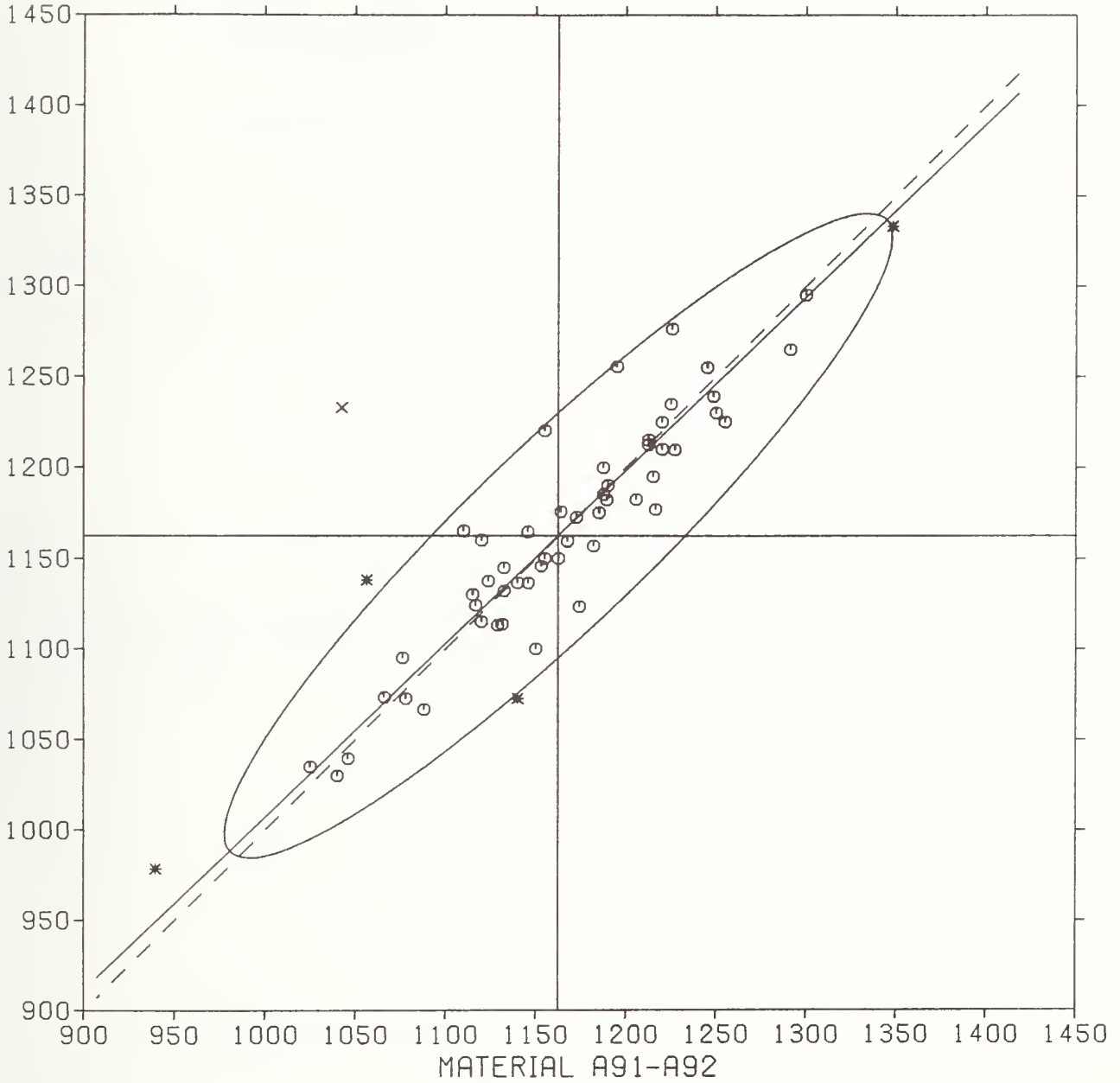
LAB CODE	F	MATERIAL A91-A92 COMMERCIAL TIRE TREAD				MATERIAL A93-A94 COMMERCIAL TIRE TREAD				VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
		MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	MEAN PSI	MEAN MEGAPA	% DEV	REL SDR		
V0062		1120.	7.724	-3.7	1.03	1115.	7.690	-4.1	.74	01	
V0067		1187.	8.190	2.1	.52	1185.	8.172	1.9	.58	01	
V0069		1129.	7.786	-2.9	2.16X	1113.	7.676	-4.2	.84	01	
V0070		1190.	8.207	2.4	.69	1190.	8.207	2.4	1.03	01	
V0071		1195.	8.241	2.8	1.78	1255.	8.659	8.0	1.42	01	
V0072		1140.	7.862	-1.9	1.08	1150.	7.931	-1.1	1.09	*70	DATA RECEIVED LATE
V0073		1162.	8.017	-0.0	2.65X	1150.	7.931	-1.1	1.83	01	
V0076		1300.	8.966	11.8	1.11	1295.	8.931	11.4	.80	01	
V0078		1078.	7.434	-7.3	1.09	1072.	7.397	-7.7	.83	01	
V0083		1132.	7.810	-2.6	.71	1145.	7.897	-1.5	.60	01	
V0084		1185.	8.172	1.9	1.52	1175.	8.103	1.1	.79	01	
V0085		1076.	7.422	-7.4	1.05	1095.	7.552	-5.8	.62	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0087		1255.	8.655	7.9	1.11	1225.	8.448	5.4	.75	01	
V0088	*	939.	6.475	-19.2	2.01X	978.	6.748	-15.8	1.32	01	
V0092		1025.	7.069	-11.8	.63	1035.	7.138	-11.0	.92	01	
V0095		1212.	8.362	4.3	1.24	1212.	8.362	4.3	1.02	01	
V0100		1120.	7.724	-3.7	1.27	1160.	8.000	-2.2	.84	01	
V0102		1040.	7.172	-10.5	.74	1030.	7.103	-11.4	.71	01	
V0111		1165.	8.034	.2	.84	1170.	8.069	.7	.51	*70	DATA RECEIVED LATE
V0117		1155.	7.966	-.7	.83	1150.	7.931	-1.1	.60	01	
V0123		1215.	8.379	4.5	.66	1195.	8.241	2.8	.58	01	
V0126		1146.	7.902	-1.4	.41	1136.	7.837	-2.2	1.10	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0128		1220.	8.414	4.9	1.17	1225.	8.448	5.4	.67	01	
V0141		1248.	8.610	7.4	.88	1239.	8.545	6.6	.43	01	
V0144		1110.	7.655	-4.5	1.03	1165.	8.034	.2	1.26	01	
V0144B		1155.	7.966	-.7	.92	1220.	8.414	5.0	1.84	01	
V0146		1216.	8.390	4.6	1.47	1177.	8.117	1.3	1.06	01	
V0149	*	1056.	7.286	-9.1	1.21	1138.	7.848	-2.1	.94	01	
V0150		1187.	8.190	2.1	.96	1200.	8.276	3.2	1.07	01	
V0152		1225.	8.448	5.4	.41	1235.	8.517	6.2	.53	01	
V0153		1145.	7.900	-1.5	1.17	1164.	8.031	.2	1.31	01	
V0154		1250.	8.621	7.5	.71	1230.	8.483	5.8	.58	01	
V0156		1245.	8.586	7.1	1.45	1255.	8.655	8.0	1.21	01	
V0158		1066.	7.352	-8.3	.97	1073.	7.402	-7.7	.72	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0160		1189.	8.202	2.3	1.18	1182.	8.152	1.7	.95	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0164		1132.	7.810	-2.6	2.36X	1132.	7.807	-2.6	1.39	01	
V0166		1131.	7.803	-2.7	1.03	1113.	7.679	-4.2	1.25	01	
V0168		1164.	8.028	.1	.62	1175.	8.107	1.1	.46	01	
V0169		1153.	7.952	-.8	1.56	1146.	7.902	-1.4	1.12	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0176		1220.	8.414	4.9	1.07	1210.	8.345	4.1	1.37	01	
V0184		1140.	7.862	-1.9	.96	1136.	7.838	-2.2	1.09	01	
V0190		1182.	8.152	1.7	1.71	1157.	7.979	-2.5	.89	01	
V0199		1172.	8.086	.9	.96	1172.	8.086	.9	.94	01	
V0208		1226.	8.452	5.4	2.17X	1276.	8.802	9.8	1.52	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0213		1174.	8.097	1.0	1.39	1123.	7.747	-3.4	.80	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0214		1117.	7.702	-3.9	.38	1124.	7.752	-3.3	.41	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0219	*	1348.	9.297	15.9	1.66	1333.	9.193	14.7	1.53	01	
V0223		1115.	7.690	-4.1	1.14	1130.	7.793	-2.8	1.40	01	
V0224		1212.	8.362	4.3	1.44	1215.	8.379	4.5	1.73	01	
V0225		1291.	8.903	11.0	.98	1265.	8.724	8.8	1.34	01	
V0232	*	1140.	7.862	-1.9	.26	1072.	7.357	-7.7	.16	01	
V0233		1205.	8.314	3.7	.96	1182.	8.155	1.7	1.02	01	
V0235		1088.	7.503	-6.4	.75	1066.	7.355	-8.3	.77	01	
V0238	X	1042.	7.190	-10.3	.88	1232.	8.500	6.0	1.30	01	
V0243		1046.	7.214	-10.0	.69	1039.	7.169	-10.6	1.04	01	
V0244		1227.	8.462	5.5	.75	1210.	8.342	4.1	1.11	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0245A		1167.	8.052	.4	2.05X	1159.	7.997	-.2	1.31	01	
V0245B		1123.	7.748	-3.4	1.01	1137.	7.845	-2.1	.96	01	
V0249		1040.	7.172	-10.5	.65	1010.	6.966	-13.1	.72	*70	DATA RECEIVED LATE
V0250		1150.	7.931	-1.1	.76	1100.	7.586	-5.4	1.06	01	
		1163.	8.018	= GR. MEAN =		1162.	8.017				5 TEST DETERMINATIONS
		73.	.503	= SD MEANS =		70.	.483				56 LABORATORIES IN GRAND MEANS
		25.	.175	= AVER SDR =		28.	.196				60 LABORATORIES REPORTING
		PSI	MEGAPA	= UNIT =		PSI	MEGAPA				



# STRESS AT 300% ELONGATION

MATERIAL A91-A92 1163. PSI MATERIAL A93-A94 1162. PSI

MATERIAL A93-A94





HARDNESS

NOTES

Materials A91 and A92 were sheets of the same vulcanized rubber. Similarly, materials A93 and A94 were alike.

V100 results were obtained at NBS using ASTM D2240. V200 results were obtained at NBS using ASTM D1415.

Four of the 31 participants reporting used ASTM D1415 (Wallace) for the hardness determination. All others used ASTM D2240 (Type A Durometer).

SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS			UNITS
					LABS	SHEETS	REPL	
HARDNESS	A91-A92	29	2	58.16	1.42	.20	.54	IRHD
	A93-A94	29	2	58.16	1.74	.28	.47	IRHD

PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE		UNITS	PERCENT	
					REPEAT	REPRD		REPEAT	REPRD
HARDNESS	A91-A92	5	5	58.16	1.50	3.94	IRHD	2.6	6.8
	A93-A94	5	5	58.16	1.32	4.81	IRHD	2.3	8.3

LAB CODE	F	MATERIAL A91-A92 COMMERCIAL TIRE TREAD			MATERIAL A93-A94 COMMERCIAL TIRE TREAD			VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
		MEAN IRHD	% DEV	REL SDR	MEAN IRHD	% DEV	REL SDR		
V0062		60.00	3.2	.00	61.50	5.7	.58	01	
V0069		58.00	-.3	1.43	58.00	-.3	1.15	01	
V0070		56.50	-2.8	3.72X	57.50	-1.1	2.35X	01	
V0071		57.00	-2.0	1.07	57.50	-1.1	1.46	01	
V0072		56.50	-2.8	1.28	57.00	-2.0	.00	*70	DATA RECEIVED LATE
V0078		57.50	-1.1	1.28	58.00	-.3	1.41	01	
V0084		59.00	1.4	.41	58.00	-.3	1.05	01	
V0085		59.35	2.1	1.19	58.55	.7	.72	01	
V0087		61.00	4.9	.00	61.50	5.7	.00	01	
V0088		58.00	-.3	1.28	58.00	-.3	1.46	01	
V0092		58.50	.6	1.24	60.00	3.2	2.23X	01	
V0095		57.50	-1.1	.51	57.50	-1.1	.47	01	
V0100		55.25	-5.0	.58	54.25	-6.7	.61	01	
V0102		59.50	2.3	1.33	59.50	2.3	2.03X	01	
V0111		59.00	1.4	.92	59.00	1.4	.58	*70	DATA RECEIVED LATE
V0128		57.00	-2.0	1.01	56.50	-2.8	.58	01	
V0141		57.00	-2.0	.83	56.50	-2.8	1.05	01	
V0144		58.50	.6	1.34	58.00	-.3	1.20	01	
V0144B		58.50	.6	1.62	58.50	.6	1.05	01	
V0168		59.75	2.7	.41	60.25	3.6	.61	01	
V0169		57.00	-2.0	.41	57.00	-2.0	1.05	01	
V0176		57.75	-.7	1.26	57.50	-1.1	.81	01	
V0190		60.00	3.2	.41	60.50	4.0	1.15	01	
V0200		55.65	-4.3	.62	54.50	-6.3	.50	01	
V0208		57.30	-1.5	1.28	56.90	-2.2	1.73	01	
V0214		60.00	3.2	1.73	59.35	2.1	2.51X	01	
V0224		60.00	3.2	1.07	60.00	3.2	1.69	01	
V0233		58.50	.6	1.33	59.00	1.4	1.35	01	
V0235		56.50	-2.8	.33	56.75	-2.4	.91	01	
V0243		57.50	-1.1	.00	57.50	-1.1	.47	01	
V0244		58.50	.6	1.01	58.00	-.3	.94	01	
		58.16		GR. MEAN	58.16				5 TEST DETERMINATIONS
		1.42		SD MEANS	1.74				29 LABORATORIES IN GRAND MEANS
		.54		AVER SDR	.47				31 LABORATORIES REPORTING
		IRHD		UNIT	IRHD				

# HARDNESS

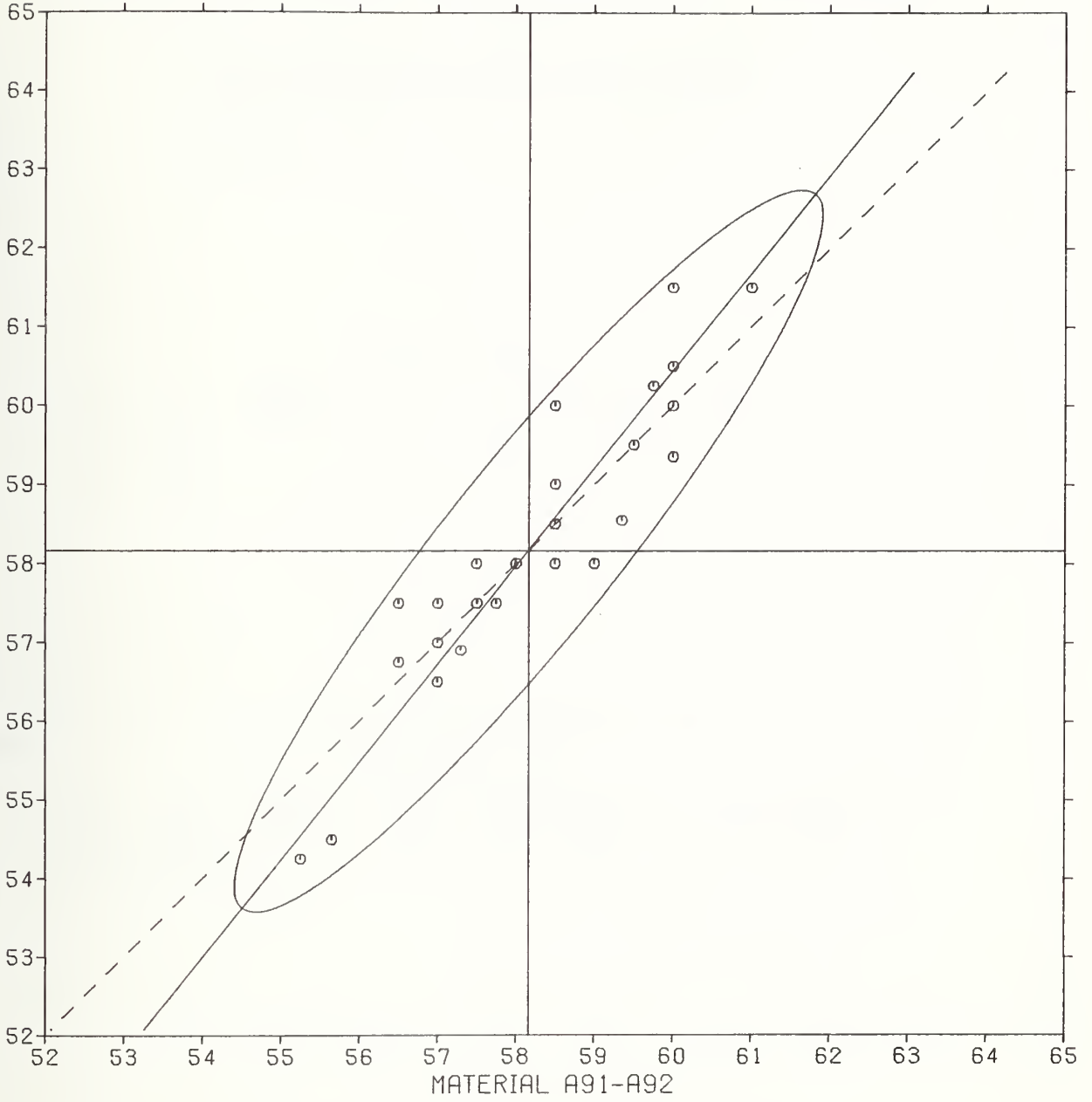
MATERIAL A91-A92

58.16 IRHD

MATERIAL A93-A94

58.16 IRHD

MATERIAL A93-A94





MOONEY VISCOSITY

NOTES

Materials R91 and R92 were the same rubber. Similarly, materials R93 and R94 were the same rubber. No sample preparation was required for materials R91 and R92 whereas, mill massing was required for materials R93 and R94.

V100 results were obtained at NBS on the manually closed viscometer used for determining the Mooney viscosities of the standard rubbers.

SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS			UNITS
					LABS	SHEETS	REPL	
MOONEY	R91-R92	40	2	67.58	2.54	.15	.30	ML
VISCOSITY	R93-R94	40	2	63.97	3.89	.53	.48	ML

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE		UNITS	PERCENT	
					REPEAT	REPROD		REPEAT	REPROD
MOONEY	R91-R92	3	3	67.58	.83	7.02	ML	1.2	10.4
VISCOSITY	R93-R94	3	3	63.97	1.34	10.77	ML	2.1	16.8

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER  
MOONEY VISCOSITY - ML

LAB CODE	F	MATERIAL R91-R92 BUTYL RUBBER			MATERIAL R93-R94 SBR			VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
		MEAN ML	% DEV	REL SDR	MEAN ML	% DEV	REL SDR		
V0061		66.60	-1.5	1.52	65.20	1.9	1.55	01	
V0068		72.00	6.5	5.92X	73.00	14.1	2.78X	01	
V0071		66.95	-9	.62	65.50	2.4	.63	01	
V0072	*	67.00	-9	4.24X	54.00	-15.6	1.63	01	
V0077		66.30	-1.9	.48	56.40	-11.8	5.10X	01	
V0078	*	60.00	-11.2	2.62X	60.05	-6.1	.60	01	
V0083		69.50	2.8	.98	67.15	5.0	2.47X	01	
V0085	*	73.75	9.1	.97	66.50	4.0	1.31	*70	DATA RECEIVED LATE
V0090		69.75	3.2	.97	63.50	-7	.90	01	
V0092		67.00	-8.9	1.94	61.50	-3.9	1.20	01	
V0095		68.25	1.0	.97	63.50	-7	.90	01	
V0100		69.10	2.2	.54	63.70	-4	.34	01	
V0111	*	60.50	-10.5	1.74	60.65	-5.2	.85	01	
V0117		67.25	-5	1.81	64.00	.0	2.18	01	
V0128		70.75	4.7	1.32	68.50	7.1	.60	01	
V0144		69.50	2.8	.60	65.00	1.6	1.04	01	
V0146		69.00	2.1	.48	66.25	3.6	.52	01	
V0149		68.10	.8	.62	67.05	4.8	1.96	01	
V0150		68.00	.6	.97	62.00	-3.1	5.77X	01	
V0156		65.50	-3.1	.97	63.50	-7	1.20	01	
V0166		68.75	1.7	1.68	68.25	6.7	.90	01	
V0169		70.75	4.7	.48	69.50	8.6	.82	01	
V0177		64.45	-4.6	.54	62.30	-2.6	1.07	01	
V0182		69.00	2.1	.48	65.50	2.4	.00	01	
V0190		68.10	.8	.76	61.25	-4.3	.83	01	
V0207		71.20	5.3	.19	68.30	6.8	1.08	01	
V0208		67.50	-1	.97	66.00	3.2	1.20	01	
V0211		69.00	2.1	.00	66.50	4.0	.60	01	
V0213		66.25	-2.0	1.45	66.00	3.2	.60	01	
V0214		65.00	-3.8	1.32	65.00	1.6	.90	01	
V0217		66.50	-1.6	.97	63.50	-7	.30	01	
V0218		69.55	2.9	1.01	67.35	5.3	.56	01	
V0220		66.95	-9	1.51	59.60	-6.8	.45	01	
V0221		67.55	-1	.36	64.20	.4	.83	01	
V0223		66.50	-1.6	.84	65.50	2.4	1.63	01	
V0230	*	69.00	2.1	.86	56.30	-12.0	.73	01	
V0236		71.00	5.1	.57	66.00	3.2	2.39	01	
V0238		64.00	-5.3	.00	56.00	-12.5	.60	01	
V0244		65.00	-3.8	2.91X	61.50	-3.9	1.20	01	
V0249		64.00	-5.3	1.77	67.50	5.5	1.04	*70	DATA RECEIVED LATE
V0250		68.75	1.7	.76	65.30	2.1	.73	01	
V0251		67.55	-1	1.91	64.45	.8	1.53	01	
67.58			GR. MEAN	-	63.97				3 TEST DETERMINATIONS
2.54			SD MEANS	-	3.89				40 LABORATORIES IN GRAND MEANS
.30			AVER SDR	-	.48				42 LABORATORIES REPORTING
ML			UNIT	-	ML				



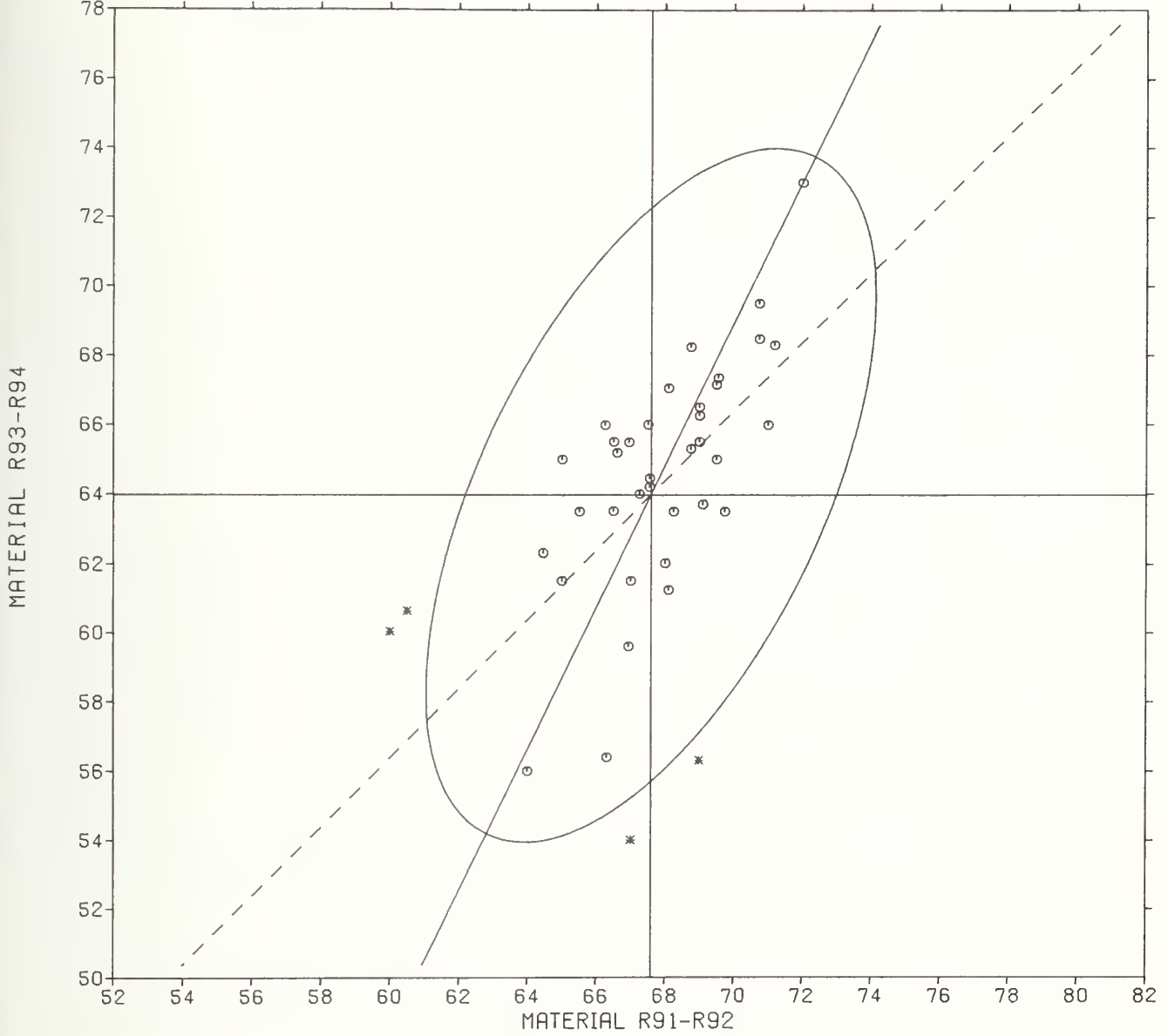
# MOONEY VISCOSITY

MATERIAL R91-R92

67.58 ML

MATERIAL R93-R94

63.97 ML





VULCANIZATION CHARACTERISTICS USING OSCILLATING DISK CURE METER

NOTES

Materials W91 and W92 were the same rubber formulation. Similarly, materials W93 and W94 were alike.

V100 results were obtained at NBS using a Model TM-100 Monsanto Rheometer with a disk oscillating at  $\pm 1^\circ$  amplitude and 1.7 hertz frequency.

All participants used Monsanto Rheometers operated at one degree amplitude and 1.7 hertz frequency.

SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS			UNITS
					LABS	SHEETS	REPL	
SCORCH TIME	W91-W92	35	6	4.633	.267	.023	.077	MINUTES
	W93-W94	35	6	4.642	.286	.021	.050	MINUTES
CURE TIME (50% MH)	W91-W92	35	6	6.73	.32	.03	.07	MINUTES
	W93-W94	35	6	6.68	.31	.02	.06	MINUTES
CURE TIME (90% MH)	W91-W92	35	6	10.32	.53	.06	.11	MINUTES
	W93-W94	35	6	10.26	.55	.03	.09	MINUTES
MINIMUM TORQUE	W91-W92	37	4	5.07	.46	.04	.08	POUND-INCHES
	W93-W94	37	4	5.01	.42	.03	.07	POUND-INCHES
MINIMUM TORQUE	W91-W92	34	7	.5726	.0521	.0058	.0086	NEWTON-METERS
	W93-W94	34	7	.5664	.0472	.0039	.0077	NEWTON-METERS
MAXIMUM TORQUE	W91-W92	38	3	23.52	1.57	.06	.13	POUND-INCHES
	W93-W94	38	3	23.46	1.51	.04	.08	POUND-INCHES
MAXIMUM TORQUE	W91-W92	38	3	2.6577	.1773	.0087	.0142	NEWTON-METERS
	W93-W94	38	3	2.6503	.1710	.0054	.0092	NEWTON-METERS

PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE		UNITS	PERCENT	
					REPEAT	REPROD		REPEAT	REPROD
SCORCH TIME	W91-W92	3	3	4.633	.213	.739	MINUTE	4.6	16.0
	W93-W94	3	3	4.642	.139	.792	MINUTE	3.0	17.1
CURE TIME (50% MH)	W91-W92	3	3	6.73	.20	.89	MINUTE	3.0	13.2
	W93-W94	3	3	6.68	.17	.85	MINUTE	2.6	12.8
CURE TIME (90% MH)	W91-W92	3	3	10.32	.30	1.48	MINUTE	2.9	14.3
	W93-W94	3	3	10.26	.24	1.53	MINUTE	2.3	14.9
MINIMUM TORQUE	W91-W92	3	3	5.07	.21	1.28	LB-IN.	4.2	25.2
	W93-W94	3	3	5.01	.19	1.16	LB-IN.	3.8	23.1
MINIMUM TORQUE	W91-W92	3	3	.5726	.0238	.1443	N-M	4.2	25.2
	W93-W94	3	3	.5664	.0213	.1308	N-M	3.8	23.1
MAXIMUM TORQUE	W91-W92	3	3	23.52	.35	4.35	LB-IN.	1.5	18.5
	W93-W94	3	3	23.46	.23	4.19	LB-IN.	1.0	17.9
MAXIMUM TORQUE	W91-W92	3	3	2.6577	.0393	.4911	N-M	1.5	18.5
	W93-W94	3	3	2.6503	.0254	.4736	N-M	1.0	17.9

LAB CODE	F	MATERIAL W91-W92 COMMERCIAL TIRE TREAD			MATERIAL W93-W94 COMMERCIAL TIRE TREAD			VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
		MEAN MINUTE	% DEV	REL SDR	MEAN MINUTE	% DEV	REL SDR		
V0061		4.000	-13.7	1.93	4.000	-13.8	1.75	01	DATA RECEIVED LATE
V0064		4.725	2.0	.76	4.770	2.9	.67	01	
V0071		4.615	-.4	1.83	4.625	-.4	.90	01	
V0074	X	3.750	-19.1	1.94	3.975	-14.4	1.60	01	
V0077		4.500	-2.9	8.28X	4.400	-5.2	2.52X	01	
V0078		4.250	-8.3	.00	4.225	-9.0	.00	01	
V0079		4.512	-2.6	.75	4.500	-3.1	.00	01	
V0083		4.750	2.5	1.13	4.800	3.4	1.15	01	
V0085		4.650	.4	.00	4.550	-2.0	.00	01	
V0086		4.800	3.6	.38	4.800	3.4	.00	01	
V0090		4.750	2.5	1.84	4.925	6.1	.58	01	
V0092		4.300	-7.2	.76	4.300	-7.4	1.05	01	
V0095		4.550	-1.8	1.02	4.650	.2	.58	01	
V0100	X	4.800	3.6	1.64	4.400	-5.2	3.23X	01	
V0117		4.800	3.6	1.37	4.850	4.5	1.15	01	
V0120		4.750	2.5	1.50	4.870	4.9	.93	01	
V0128		4.800	3.6	.00	4.800	3.4	.00	01	
V0144		4.710	1.7	.19	4.565	-1.7	.40	01	
V0146	*	5.250	13.3	1.88	5.200	12.0	3.15X	01	
V0149		4.750	2.5	.38	4.775	2.9	.58	01	
V0150	X	5.850	26.3	1.77	5.800	24.9	2.51X	01	
V0152		4.800	3.6	.38	4.850	4.5	1.15	01	
V0154	X	7.660	65.3	.46	7.490	61.3	.81	01	
V0156		4.850	4.7	.84	4.875	5.0	1.00	01	
V0158		4.625	-.2	.94	4.500	-3.1	.29	01	
V0161		4.500	-2.9	.75	4.500	-3.1	.58	01	
V0166		4.850	4.7	.75	4.850	4.5	2.57X	01	
V0169		4.300	-7.2	1.13	4.350	-6.3	.58	01	
V0171	X	1.950	-57.9	.38	1.950	-58.0	.79	01	
V0182		4.200	-5.4	1.62	4.150	-10.6	.79	01	
V0190		4.125	-11.0	1.00	4.075	-12.2	.50	01	
V0207		4.600	-.7	1.37	4.550	-2.0	1.57	01	
V0208		4.450	-4.0	1.00	4.505	-3.0	1.61	01	
V0211		4.600	-.7	.38	4.700	1.2	1.15	01	
VC213		4.750	2.5	.00	4.750	2.3	.00	01	
V0214		5.200	12.2	.00	5.250	13.1	2.10	01	
V0217		4.700	1.4	.00	4.750	2.3	.00	01	
V0218		4.700	1.4	.75	4.700	1.2	1.15	01	
V0221		4.500	-2.9	.38	4.500	-3.1	2.30X	01	
V0238		4.935	6.5	1.43	4.935	6.3	1.90	01	
V0243		4.750	2.5	.38	4.850	4.5	.58	01	
		4.633		- GR. MEAN -	4.642				3 TEST DETERMINATIONS 35 LABORATORIES IN GRAND MEANS 41 LABORATORIES REPORTING
		.267		- SD MEANS -	.286				
		.077		- AVER SDR -	.050				
		MINUTE		- UNIT -	MINUTE				

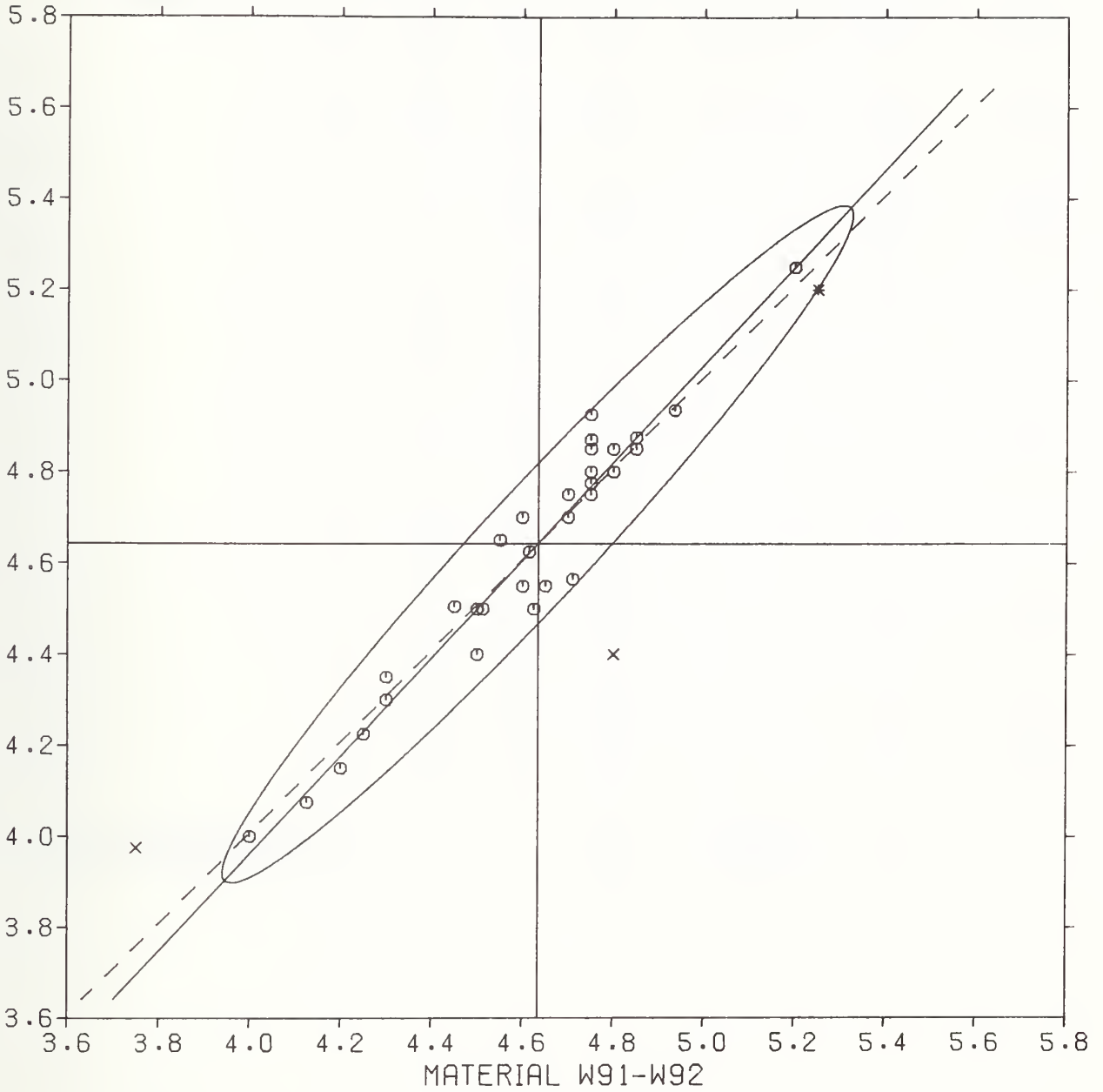
# SCORCH TIME

MATERIAL W91-W92

4.633 MINUTE MATERIAL W93-W94

4.642 MINUTE

MATERIAL W93-W94



LAB CODE	F	MATERIAL W91-W92 COMMERCIAL TIRE TREAD			MATERIAL W93-W94 COMMERCIAL TIRE TREAD			VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
		MEAN MINUTE	% DEV	REL SDR	MEAN MINUTE	% DEV	REL SDR		
V0061		6.00	-10.9	2.27	5.93	-11.2	1.45	01	
V0064		7.18	6.7	.52	7.18	7.5	1.06	070	DATA RECEIVED LATE
V0071		6.75	.2	1.00	6.72	.6	.65	01	
V0074	X	5.44	-19.2	1.80	5.71	-14.5	3.73X	01	
V0077		6.40	-4.9	5.97X	6.35	-5.0	.92	01	
V0078		6.12	-9.0	.40	6.17	-7.6	.00	01	
V0079		6.62	-1.6	.50	6.62	-.9	.00	01	
V0083		7.05	4.7	1.39	7.00	4.7	2.02	01	
V0085		6.87	2.1	.00	6.60	-1.3	2.77X	01	
V0086		7.15	6.2	.80	7.10	6.2	.00	01	
V0090		6.91	2.7	1.77	7.01	4.9	.63	01	
V0092		6.22	-7.5	.62	6.25	-6.5	.40	01	
V0095		7.10	5.4	1.20	7.00	4.7	1.67	01	
V0100		6.70	-.5	1.09	6.75	1.0	1.60	01	
V0117		6.80	1.0	.00	6.75	1.0	1.26	01	
V0120	X	6.78	.7	2.21	7.07	5.8	.68	01	
V0128		6.85	1.7	.00	6.80	1.7	.46	01	
V0144		6.81	1.2	.32	6.65	-.5	.38	01	
V0146		7.35	9.2	1.46	7.10	6.2	2.99X	01	
V0149		6.82	1.4	.75	6.77	1.4	.84	01	
V0150	X	8.05	19.6	.80	8.00	19.7	1.26	01	
V0152		7.00	4.0	.40	7.00	4.7	.92	01	
V0154	X	11.43	65.8	.49	11.10	66.1	.82	01	
V0156		6.95	3.2	1.04	6.97	4.3	.69	01	
V0158		6.52	-3.1	1.12	6.35	-5.0	.69	01	
V0161		6.30	-6.4	.80	6.30	-5.8	1.26	01	
V0166		7.00	4.0	.80	7.05	5.5	.92	01	
V0169		6.40	-4.9	.80	6.40	-4.3	.00	01	
V0171	X	2.67	-60.3	.55	2.70	-59.6	.84	01	
V0182		6.20	-7.9	2.31	6.10	-8.7	.63	01	
V0190		6.55	-2.7	.93	6.51	-2.5	.40	01	
V0207		6.60	-2.0	.40	6.45	-3.5	2.15	01	
V0208		6.66	-1.0	.78	6.76	1.2	.51	01	
V0211		6.85	1.7	.80	6.80	1.7	.46	01	
V0213		7.10	5.4	1.72	7.00	4.7	.92	01	
V0214		7.10	5.4	2.77X	6.90	3.2	3.24X	01	
V0217		6.75	.2	.00	6.70	.2	.00	01	
V0218		6.75	.2	1.09	6.75	1.0	.00	01	
V0221		6.50	-3.5	.80	6.50	-2.8	1.39	01	
V0238		7.12	5.7	.87	7.00	4.7	1.85	01	
V0243		6.75	.2	.80	6.80	1.7	.92	01	
		6.73			6.68				3 TEST DETERMINATIONS
		.32			.31				35 LABORATORIES IN GRAND MEANS
		.07			.06				41 LABORATORIES REPORTING
		MINUTE		UNIT	MINUTE				

CURE TIME (50% MH)

MATERIAL W91-W92

6.73

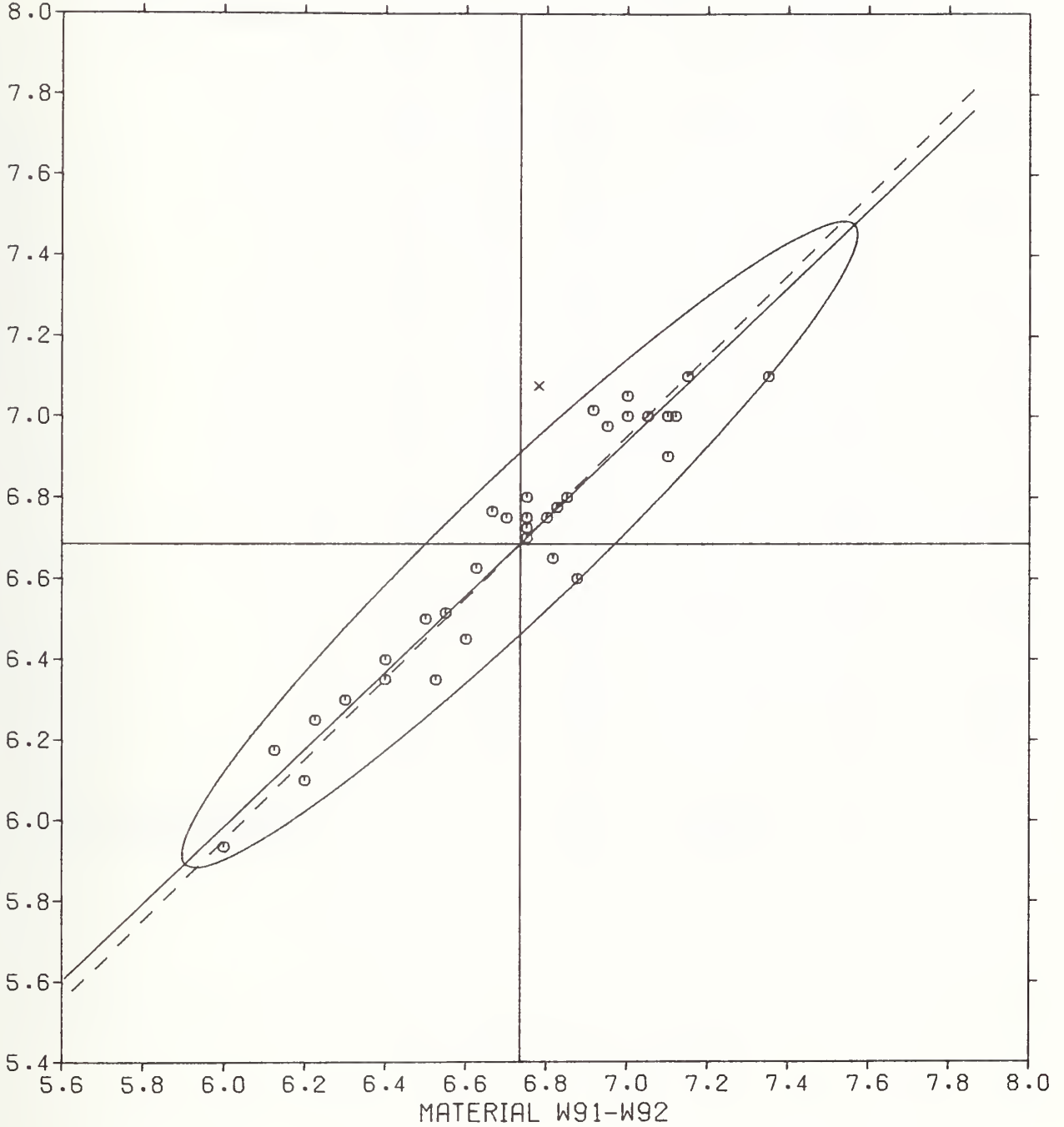
MINUTE

MATERIAL W93-W94

6.68

MINUTE

MATERIAL W93-W94



LAB CODE	F	MATERIAL W91-W92 COMMERCIAL TIRE TREAD			MATERIAL W93-W94 COMMERCIAL TIRE TREAD			VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
		MEAN MINUTE	% DEV	REL SDR	MEAN MINUTE	% DEV	REL SDR		
V0061		9.31	-9.8	2.56X	9.06	-11.7	1.94	01	
V0064		9.50	-7.9	.32	9.50	-7.4	1.12	*70	DATA RECEIVED LATE
V0071		10.44	1.2	.40	10.43	1.7	.98	01	
V0074	X	8.43	-18.2	1.86	8.94	-12.9	1.81	01	
V0077		10.20	-1.1	6.13X	9.90	-3.5	1.00	01	
V0078		9.50	-7.9	.94	9.60	-6.5	1.66	01	
V0079		10.31	-0.0	.00	10.31	.5	.00	01	
V0083		11.00	6.6	1.44	10.85	5.7	1.53	01	
V0085		10.12	-1.9	.00	10.00	-2.6	2.00	01	
V0086		10.80	4.7	.27	10.80	5.2	.00	01	
V0090		10.86	5.3	.90	10.96	6.8	1.30	01	
V0092		9.50	-7.9	.73	9.45	-7.9	.83	01	
V0095	*	10.25	-0.7	.81	10.85	5.7	1.00	01	
V0100		9.80	-5.0	1.18	9.80	-4.5	1.76	01	
V0117		10.60	2.7	1.00	10.30	.4	1.55	01	
V0120	X	10.65	3.2	2.49X	12.18	18.7	3.15X	01	
V0128		10.40	.8	.00	10.40	1.3	.33	01	
V0144		10.12	-1.9	.89	9.79	-4.6	.30	01	
V0146		10.85	5.2	1.74	10.70	4.2	2.40X	01	
V0149		10.35	.3	1.69	10.37	1.1	.45	01	
V0150	X	13.30	28.9	1.34	12.90	25.7	1.15	01	
V0152		10.70	3.7	.00	10.70	4.2	.33	01	
V0154	X	18.06	75.0	.25	17.49	70.4	.37	01	
V0156		10.62	3.0	2.07	10.67	4.0	.95	01	
V0158		9.90	-4.0	.32	9.67	-5.7	1.00	01	
V0161		9.95	-3.6	.73	9.85	-4.0	.67	01	
V0166		10.50	1.8	1.00	10.45	1.8	1.00	01	
V0169		9.80	-5.0	1.47	9.90	-3.5	1.45	01	
V0171	X	3.97	-61.5	.50	3.95	-61.5	.57	01	
V0182		9.47	-8.2	.94	9.32	-9.1	.33	01	
V0190		10.52	2.0	.94	10.52	2.5	.17	01	
V0207		10.05	-2.6	.73	10.15	-1.1	1.33	01	
V0208		10.02	-2.8	3.69X	10.40	1.3	3.69X	01	
V0211		10.60	2.7	.73	10.65	3.8	.67	01	
V0213	*	11.00	6.6	2.13	10.35	.8	.67	01	
V0214	*	11.95	15.8	.54	11.90	15.9	.67	01	
V0217		9.95	-3.6	.00	10.00	-2.6	.00	01	
V0218		10.50	1.8	.27	10.40	1.3	.33	01	
V0221		10.00	-3.1	1.61	9.70	-5.5	1.21	01	
V0238		10.87	5.4	4.16X	10.75	4.7	1.44	01	
V0243		10.25	-0.7	.54	10.25	-0.1	1.15	01	
		10.32		" GR. MEAN "	10.26				3 TEST DETERMINATIONS
		.53		" SD MEANS "	.55				35 LABORATORIES IN GRAND MEANS
		.11		" AVER SDR "	.09				41 LABORATORIES REPORTING
		MINUTE		" UNIT "	MINUTE				



CURE TIME (90% MH)

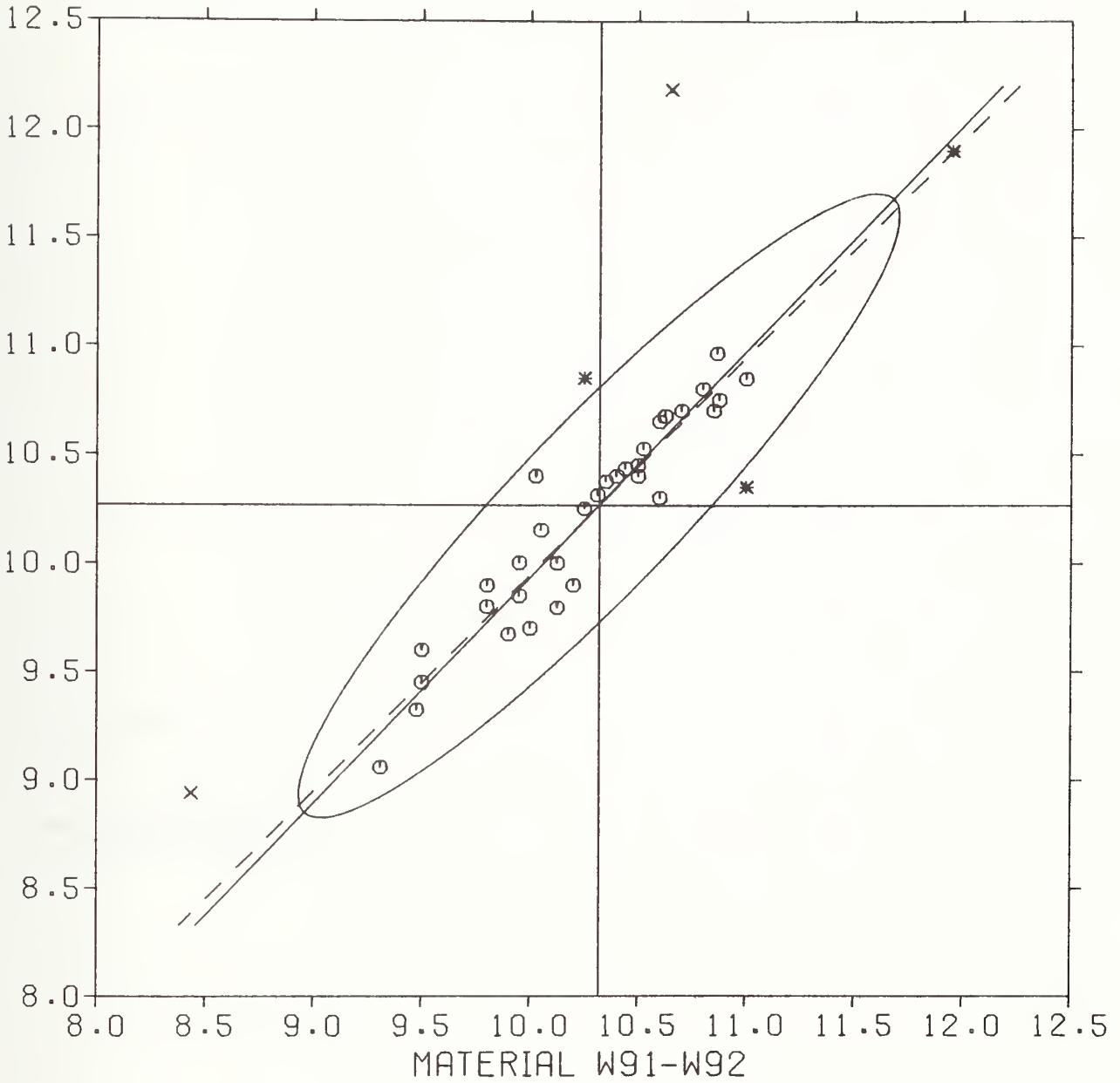
MATERIAL W91-W92

10.32 MINUTE

MATERIAL W93-W94

10.26 MINUTE

MATERIAL W93-W94



LAB CODE	F	MATERIAL W91-W92 COMMERCIAL TIRE TREAD				MATERIAL W93-W94 COMMERCIAL TIRE TREAD					INSTRUMENT, UNIT, OR OTHER VARIATION
		MEAN	MEAN	%	REL	MEAN	MEAN	%	REL	VAR	
		LB-IN.	N-M	DEV	SDR	LB-IN.	N-M	DEV	SDR	CODE	
V0061		5.45	.6158	7.6	.38	5.40	.6101	7.7	.42	01	
V0064		5.52	.6243	9.0	.52	5.50	.6214	9.7	.42	*70	DATA RECEIVED LATE
V0071	*	5.90	.6666	16.4	3.34X	5.35	.6045	6.7	1.16	01	
V0074		4.62	.5226	-8.7	1.82	4.77	.5395	-4.8	1.82	01	
V0077	X	7.25	.8192	43.1	3.04X	6.95	.7853	38.6	1.16	01	
V0078		5.10	.5762	.6	.00	5.15	.5819	2.7	.00	01	
V0079		5.00	.5649	-1.3	.00	5.00	.5647	-.3	.00	01	
V0083		5.20	.5875	2.6	1.38	5.10	.5762	1.7	.73	01	
V0085		4.69	.5300	-7.4	.00	4.74	.5350	-5.5	.00	40	ORIGINAL IN NEWTON-METER
V0086		4.70	.5311	-7.2	.00	4.65	.5254	-7.2	.42	01	
V0090		4.80	.5424	-5.3	1.57	4.85	.5480	-3.3	1.48	01	
V0092		5.40	.6101	6.6	1.14	5.35	.6045	6.7	.00	01	
V0095		5.20	.5875	2.6	.76	5.15	.5819	2.7	.00	01	
V0100	*	4.50	.5085	-11.2	.00	4.90	.5537	-2.3	.00	01	
V0117		4.90	.5537	-3.3	1.14	4.95	.5593	-1.3	.73	01	
V0120		4.65	.5254	-8.2	1.14	4.60	.5198	-8.2	.85	01	
V0128		5.20	.5875	2.6	.00	5.00	.5649	-.3	.00	01	
V0144	*	6.85	.7740	35.2	1.14	6.70	.7570	33.6	1.16	01	
V0146		5.50	.6214	8.5	1.76	5.60	.6327	11.7	1.58	01	
V0149		5.00	.5649	-1.3	1.40	4.92	.5565	-1.8	2.38X	01	
V0150		5.35	.6045	5.6	3.55X	5.10	.5762	1.7	1.85	01	
V0152		4.80	.5424	-5.3	.38	4.80	.5424	-4.3	.42	01	
V0154	X	8.35	.9435	64.8	.76	8.30	.9378	65.6	.42	01	
V0156		5.00	.5649	-1.3	.76	4.85	.5480	-3.3	.42	01	
V0158		4.99	.5638	-1.5	.46	4.99	.5644	-.4	.00	01	
V0161		4.35	.4915	-14.2	.38	4.40	.4972	-12.2	1.16	01	
V0166		4.70	.5311	-7.2	.76	4.65	.5254	-7.2	.42	01	
V0169		4.87	.5500	-3.9	1.80	4.65	.5250	-7.3	1.73	40	ORIGINAL IN NEWTON-METER
V0171	*	4.50	.5085	-11.2	1.14	4.20	.4746	-16.2	.85	01	
V0182		5.50	.6214	8.5	1.04	5.45	.6158	8.7	2.20X	01	
V0190	X	12.00	1.3559	99.9	2.28X	11.75	1.3276	99.9	1.53	01	
V0207		5.25	.5932	3.6	.76	5.10	.5762	1.7	.85	01	
V0208		4.56	.5158	-9.9	1.44	4.47	.5051	-10.8	.81	01	
V0211		5.40	.6101	6.6	.76	5.30	.5988	5.7	1.97X	01	
V0213		5.45	.6158	7.6	.38	5.40	.6101	7.7	.00	01	
V0214		5.25	.5932	3.6	1.00	5.15	.5819	2.7	.85	01	
V0217		4.60	.5198	-9.2	.00	4.80	.5424	-4.3	.00	01	
V0218		5.00	.5649	-1.3	.00	4.90	.5537	-2.3	.42	01	
V0221		5.00	.5650	-1.3	.34	5.04	.5700	.6	1.72	40	ORIGINAL IN NEWTON-METER
V0238		5.00	.5649	-1.3	.95	5.00	.5649	-.3	.55	01	
V0243		5.25	.5932	3.6	1.04	5.05	.5706	.7	1.58	01	
		5.07	.5726	" GR. MEAN "		5.01	.5664				3 TEST DETERMINATIONS
		.46	.0521	" SD MEANS "		.42	.0472				37 LABORATORIES IN GRAND MEANS
		.08	.0086	" AVER SDR "		.07	.0077				41 LABORATORIES REPORTING
		LB-IN.	N-M	" UNIT "		LB-IN.	N-M				

# MINIMUM TORQUE

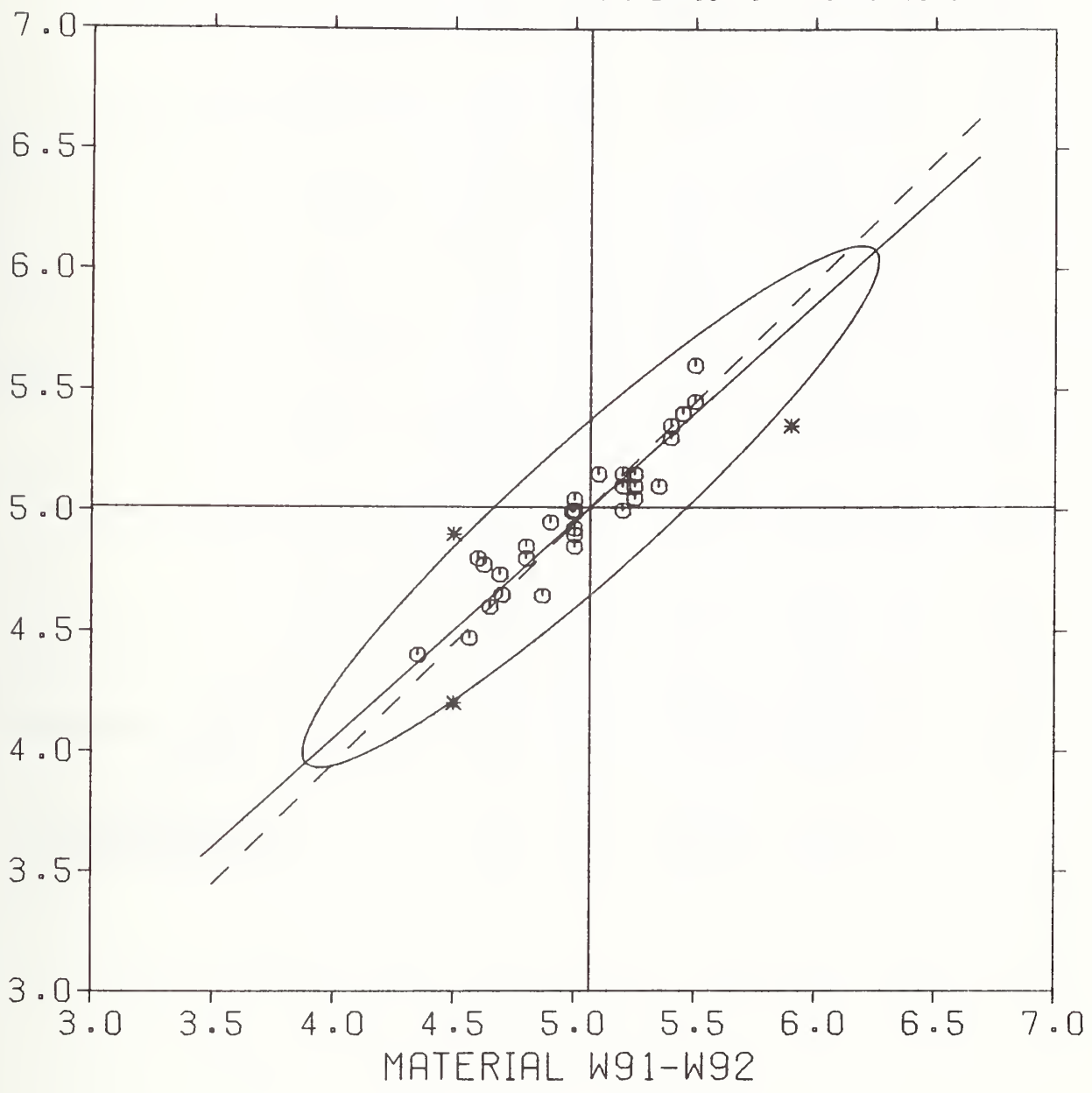
MATERIAL W91-W92

5.07 LB-IN.

MATERIAL W93-W94

5.01 LB-IN.

MATERIAL W93-W94



LAB CODE	MATERIAL W91-W92 COMMERCIAL TIRE TREAD				MATERIAL W93-W94 COMMERCIAL TIRE TREAD				VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION	
	F	MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	MEAN LB-IN.	MEAN N-M	% DEV			REL SDR
V0061		25.10	2.8360	6.7	1.51	25.10	2.8360	7.0	.00	01	DATA RECEIVED LATE
V0064		23.55	2.6605	.1	.53	23.50	2.6553	.2	.53	.70	
V0071	*	24.05	2.7174	2.2	4.72X	23.25	2.6270	-.9	1.98	01	
V0074		23.40	2.6440	-.5	.35	23.55	2.6609	.4	1.42	01	
V0077		25.75	2.9095	9.5	1.06	25.25	2.8530	7.6	1.07	01	
V0078		25.10	2.8360	6.7	.92	25.10	2.8360	7.0	.71	01	ORIGINAL IN NEWTON-METER
V0079		23.70	2.6779	.8	.92	23.67	2.6750	.9	.00	01	
V0083		24.20	2.7344	2.9	1.84	23.95	2.7061	2.1	2.01	01	
V0085		20.75	2.3451	-11.8	.61	20.98	2.3701	-10.6	.00	40	
V0086		22.85	2.5818	-2.9	.69	22.70	2.5649	-3.2	.71	01	
V0090		24.25	2.7400	3.1	1.15	24.02	2.7146	2.4	.49	01	
VC092		25.35	2.8643	7.8	1.32	25.10	2.8360	7.0	.94	01	ORIGINAL IN NEWTON-METER
V0095		23.25	2.6270	-1.2	.46	23.45	2.6496	-.0	.71	01	
V0100		22.30	2.5197	-5.2	.00	22.50	2.5423	-4.1	.00	01	
V0117		22.00	2.4858	-6.5	.63	22.10	2.4971	-5.8	.36	01	
V0120		22.80	2.5762	-3.1	.69	22.90	2.5875	-2.4	.97	01	
V0128		23.75	2.6835	1.0	1.44	23.50	2.6553	.2	.71	01	
V0144		24.95	2.8191	6.1	.46	24.80	2.8022	5.7	.71	01	
V0146		23.50	2.6553	-.1	2.90X	23.45	2.6496	-.0	1.64	01	
V0149		22.25	2.5140	-5.4	.58	22.12	2.4999	-5.7	1.24	01	
V0150		23.50	2.6553	-.1	.00	23.25	2.6270	-.9	1.78	01	
V0152		23.00	2.5988	-2.2	.00	23.00	2.5988	-1.9	.36	01	
V0154	*	27.85	3.1468	18.4	.69	27.80	3.1411	18.5	.97	01	
V0156		23.20	2.6214	-1.4	1.91	22.75	2.5705	-3.0	.71	01	
V0158		24.00	2.7118	2.0	1.38	23.90	2.7005	1.9	.67	01	
V0161		21.10	2.3841	-10.3	1.01	21.30	2.4067	-9.2	1.07	01	ORIGINAL IN NEWTON-METER
V0166		22.35	2.5253	-5.0	1.29	22.10	2.4971	-5.8	.00	01	
V0169		22.57	2.5501	-4.0	2.47X	22.44	2.5351	-4.3	.94	40	
V0171	*	19.00	2.1468	-19.2	.23	19.10	2.1581	-18.6	.71	01	
V0182		24.65	2.7852	4.8	1.90	25.00	2.8248	6.6	1.33	01	
V0190	X	48.25	5.4518	99.9	.63	48.30	5.4574	99.9	.62	01	ORIGINAL IN NEWTON-METER
V0207		23.65	2.6722	.5	1.01	23.70	2.6779	1.0	1.29	01	
V0208		24.30	2.7462	3.3	.83	24.67	2.7880	5.2	4.01X	01	
V0211		24.85	2.8078	5.6	1.63	24.65	2.7852	5.1	.62	01	
V0213		25.00	2.8248	6.3	.46	24.80	2.8022	5.7	3.10X	01	
V0214		24.65	2.7852	4.8	1.03	24.50	2.7683	4.5	.36	01	ORIGINAL IN NEWTON-METER
V0217		21.85	2.4688	-7.1	.00	22.10	2.4971	-5.8	.00	01	
V0218	X	10.45	1.1807	-55.6	.23	10.35	1.1694	-55.9	.36	01	
V0221		23.28	2.6301	-1.0	1.44	23.37	2.6401	-.4	4.40X	40	
VC238		22.00	2.4858	-6.5	.58	21.75	2.4575	-7.3	3.55X	01	
VC243		23.70	2.6779	.8	1.01	23.65	2.6722	.8	1.55	01	3 TEST DETERMINATIONS 38 LABORATORIES IN GRAND MEANS 41 LABORATORIES REPORTING
		23.52	2.6577	= GR. MEAN =		23.46	2.6503				
		1.57	.1773	= SD MEANS =		1.51	.1710				
		.13	.0142	= AVER SDR =		.08	.0092				
		LB-IN.	N-M	= UNIT =		LB-IN.	N-M				

# MAXIMUM TORQUE

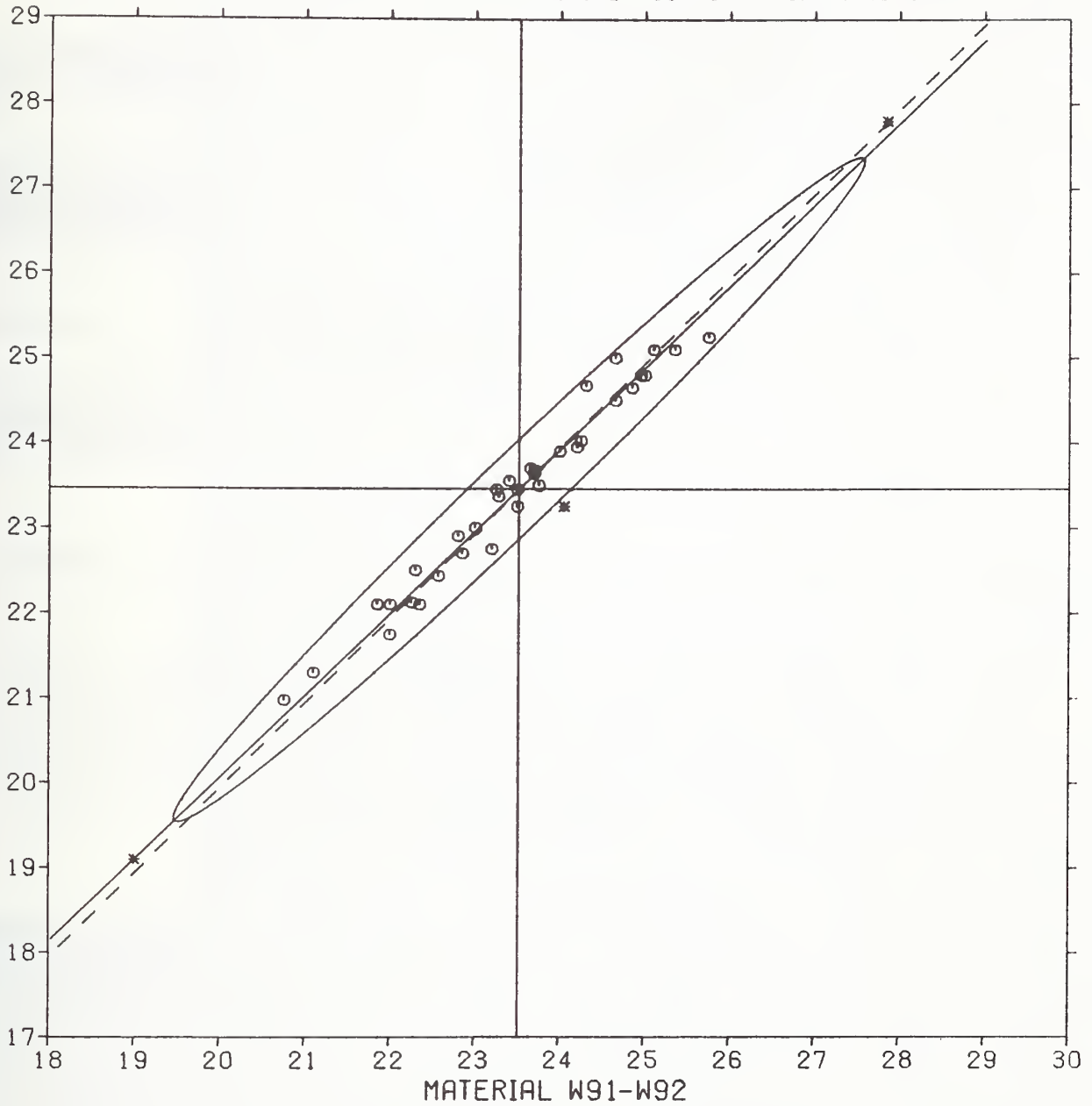
MATERIAL W91-W92

23.52 LB-IN.

MATERIAL W93-W94

23.46 LB-IN.

MATERIAL W93-W94



U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. RUBBER CRP 39	2. Gov't. Accession No.	3. Recipient's Accession No.
4. TITLE AND SUBTITLE INTERLABORATORY PROGRAMS FOR RUBBER Analyses No. 39 January - March 1979		5. Publication Date June 27, 1979	6. Performing Organization Code
7. AUTHOR(S) J. Horlick, G. W. Bullman, T. Cummings		8. Performing Organ. Report No. NBSIR 79-1377	
9. PERFORMING ORGANIZATION NAME AND ADDRESS NATIONAL BUREAU OF STANDARDS DEPARTMENT OF COMMERCE WASHINGTON, DC 20234		10. Project/Task/Work Unit No. 7825578	11. Contract/Grant No.
12. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (Street, City, State, ZIP) Collaborative Testing Services, Inc., 9241 Wood Glade Drive, Great Falls, VA 22066		13. Type of Report & Period Covered FINAL	
15. SUPPLEMENTARY NOTES  <input type="checkbox"/> Document describes a computer program; SF-185, FIPS Software Summary, is attached.		14. Sponsoring Agency Code	
16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)  Collaborative Reference Programs provide participating laboratories with the means for checking periodically the level and uniformity of their testing in comparison with that of other participating laboratories. An important by-product of the programs is the provision of realistic pictures of the state of the testing art. This is one of the periodic reports showing averages for each participant, within and between laboratory variability, and other information for participants and standards committees.			
17. KEY WORDS (six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons) Collaborative reference program; Laboratory evaluation; Precision; Reference samples; Rubber; Testing calibration.			
18. AVAILABILITY <input type="checkbox"/> Unlimited  <input checked="" type="checkbox"/> For Official Distribution. Do Not Release to NTIS  <input type="checkbox"/> Order From Sup. of Doc., U.S. Government Printing Office, Washington, DC 20402, SD Stock No. SN003-003-  <input type="checkbox"/> Order From National Technical Information Service (NTIS), Springfield, VA, 22161		19. SECURITY CLASS (THIS REPORT)  UNCLASSIFIED	21. NO. OF PRINTED PAGES  36
		20. SECURITY CLASS (THIS PAGE)  UNCLASSIFIED	22. Price