

NBSIR-78-134

MCCA

MANUFACTURERS COUNCIL ON COLOR AND APPEARANCE

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COLLABORATIVE REFERENCE PROGRAM  
COLOR AND APPEARANCE

COLOR AND COLOR DIFFERENCE

REPORT NO. 23



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

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Mullen burst of linerboard  
Concora test of medium

MCCA Color and Appearance (4 times per year)

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Color and color difference  
Retroreflectivity

Rubber (4 times per year)

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

ASTM Textiles (3 times per year)

Flammability (FF3-71 and FF5-74)

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)



Collaborative Reference Programs  
B360 Polymer Building  
National Bureau of Standards  
Washington, D.C. 20234

MANUFACTURERS COUNCIL ON  
COLOR AND APPEARANCE

COLLABORATIVE REFERENCE PROGRAM  
FOR  
COLOR AND APPEARANCE

COLOR AND COLOR DIFFERENCE

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U. S. DEPARTMENT OF COMMERCE  
National Bureau of Standards



## INTRODUCTION

This Collaborative Reference Program is sponsored by the Manufacturers Council on Color and Appearance and the National Bureau of Standards. Four times per year, color chip samples are distributed to each participating laboratory. After the data has been returned to and analyzed by NBS, a report (as illustrated by this report) showing the data from all participants is prepared.

Reflectance values for 40 wavelengths and colorimetric data for both 45/0 and 6°/hemispherical reflectance factors have been provided by NBS. For further explanation, see page vi. A plot of the spectrophotometric curves of the samples was provided by Hemmendinger Color Laboratory, Belvedere, New Jersey. The NBS Reflectance values have succeeded the tentative values which were given in previous reports.

If there are any questions on the notes, the analyses, or the report in general, contact J. Stevenson or J. Horlick on 301-921-2946.

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## EXPLANATION OF DATA FOR WHITE SAMPLE

Specimens of a white sample were distributed to the participants along with the usual two pairs of colored specimens, and each participant was asked to return measurement data for the white specimen, reporting results in the same manner as for the colored specimens.

As a first step, three laboratories were selected to serve as "reference" laboratories for the purposes of this analysis and the average of their X, Y, Z values for the white sample were computed. Next, the ratios of the participants data to the combined reference laboratory values were calculated for each participant (transformed to X, Y, Z space if necessary). These ratios are shown in the White Sample Analysis tables.

Two observations can be made about the data in the White Sample Analysis tables. First, the participants as a whole tend to be high compared with the combined average values obtained by the selected reference laboratories. Second, a few participants had noticeably extreme values for one or more of the components and these participants especially should look to the cause.

Next, the ratios in the White Sample Analysis tables were used to "adjust" the data of the normal data tables to obtain the adjusted data table values. The adjustment consisted of dividing the X, Y, Z values of the normal data tables by the respective ratios in the White Sample Analysis tables.

The significant change in the adjusted data tables is in the SD OF MEANS. Comparison of these among-laboratory standard deviations with those in the normal data tables, shows considerable reduction for X, Y, Z. Thus part, at least, of the disagreement among participants is due to errors in standardization that could be corrected through use of an agreed-upon white standard. There is no similar significant change for  $\Delta X$ ,  $\Delta Y$ , and  $\Delta Z$ .

### ΔE Calculation

ΔE is calculated in the Color and Color Difference Collaborative Reference Program by the FMC2\* equations as follows:

The yellow-blue chromatic difference is

$$\Delta C_1 = K_1 S(P\Delta P + Q\Delta Q)/bD^2 - K_1 \Delta S/b;$$

the lightness difference is

$$\Delta L = 0.279K_2(P\Delta P + Q\Delta Q)/aD;$$

and the red-green chromatic difference is

$$\Delta C_3 = K_1(Q\Delta P - P\Delta Q)/aD.$$

The quantity, D, is an abbreviation,

$$D = (P^2 + Q^2)^{\frac{1}{2}}.$$

$$K_1 = 0.55669 + 0.049434 Y - 0.82575 \cdot 10^{-3} Y^2 + \\ 0.79172 \cdot 10^{-5} Y^3 - 0.30087 \cdot 10^{-7} Y^4,$$

$$K_2 = 0.17548 + 0.027556 Y - 0.57262 \cdot 10^{-3} Y^2 + \\ 0.63893 \cdot 10^{-5} Y^3 - 0.26731 \cdot 10^{-7} Y^4,$$

$$a^2 = 17.3 \cdot 10^{-6} (P^2 + Q^2) / [1 + 2.73 P^2 Q^2 / (P^4 + Q^4)],$$

$$b^2 = 3.098 \cdot 10^{-4} (S^2 + 0.2015 Y^2)$$

$$P = 0.724 X + 0.382 Y - 0.098 Z,$$

$$Q = -0.48 X + 1.37 Y + 0.1276 Z,$$

$$S = 0.686 Z,$$

$$\Delta E = [(\Delta C_1)^2 + (\Delta L)^2 + (\Delta C_3)^2]^{\frac{1}{2}}$$

\*Friele-MacAdam-Chickering metric



## Notes on Specific Laboratory Results

- C241 - No values reported for samples C85 and C86.
- C262 - Apparent measurement or reporting error on all samples, L-value.
- C285 - Apparent measurement or reporting error on samples C85-C86, Z-value.
- C534 - Apparent measurement or reporting error on samples C85-C86.
- C615 - Apparent measurement or reporting error on samples C84, C85, and C86.
- C232, C262, C285, C454, C495, C498, C519, C524, C615 - All have some problem regarding measurement of the white sample, and should check their measurement process regarding this.

## Notes on NBS Reflectance Values

The tables on pages 13 and 14 of this report contain absolute reflectance values measured at 40 wavelengths (480-770 nm) and tristimulus values for each of the five samples covered by this report. The measurements were performed by the Radiometric Physics Division of the National Bureau of Standards.

These values represent state-of-the-art color measurements on a single specimen of each sample. Thus the results give an accurate picture of the values for single specimens and are not an accurate measure of the whole sample population. Participants should be aware of this concept when comparing their measurements to these NBS values.

## KEY TO TABLES

MEAN	The average of individual test determinations.
GRAND MEAN - (GR. MEAN)	The average of the individual laboratory MEANS, excluding laboratories flagged (see column F) with an X, #, or +.
SD OF MEANS -	The standard deviation of the laboratory MEANS about the GRAND MEAN: an index of the among-laboratory precision.
INST CODE -	Code for instrument type and color space used to report measurements, see first table.
F -	Flag, is based on $\Delta E$ Column with following meaning:
# -	Excluded because data were not understood; because of a non-coded variation reported by the laboratory or data received late.
M -	Excluded because data for one sample are missing
X -	Excluded from all calculations because $\Delta E$ is beyond (3) standard deviation units.
* -	Included in grand means but results are between two and three standard deviation units. The participant should take this as a warning to reexamine his testing procedure.
0 -	Included in grand mean analysis.

Note: In addition to flag (F) based on delta E column it is also possible to have either a X or an \* on individual MEANS as follows:

X - following a MEAN signifies that the mean is greater than 3 SD of MEANS from the GRAND MEAN. The values for this laboratory have been omitted in the calculations involving the MEAN for the column.

\* - following any of the MEANS signifies that that quantity is greater than 2 but less than 3 of the appropriate standard deviations from the corresponding average. The participant should take this as a warning to reexamine his testing procedures.

$\Delta E$  - Total color difference between two samples. In X, Y, Z analysis it is calculated in MacAdams (FMC II) units. For L, a, b analysis it is calculated in Hunter units.

ANALYSIS C70-1 TABLE 1  
 COLOR & COLOR DIFFERENCE

INSTRUMENT IDENTIFICATION

INST CODE	INSTRUMENT	COLOR SPACE	DATA CODE
----	-----	-----	----
C70BA	BECKMAN AUTO-PR0 54	X Y Z	9014
C70BB	BECKMAN DE-C	X Y Z	9014
C70BL	E-L 505 SPECTROPHOTOMETER	X Y Z	9014
C70CA	CARY 14	X Y Z	9014
C70CD	COLOR EYE SMALL SPHERE	X Y Z	9014
C70CE	COLOR EYE SMALL SPHERE	XX <sup>1</sup> YZ,4V	9016
C70CF	COLOR EYE SMALL SPHERE	XYZ,BaS04	9017
C70CG	COLOR EYE SMALL SPHERE	XX <sup>1</sup> YZ,Ba	9016
C70CH	COLOR EYE SMALL SPHERE	XYZ,3V	9011
C70CL	COLOR EYE LARGE SPHERE	XX <sup>1</sup> YZ,4V	9016
C70CM	COLOR EYE LARGE SPHERE	XX <sup>1</sup> YZ,Ba	9018
C70CN	COLOR EYE LARGE SPHERE	XYZ,BaS04	9017
C70DC	DIANE CBR0WASCAN	X Y Z	9014
C70DX	DIANE/LSCC AUTOMATE	XYZ,BaS04	9017
C70DL	DIANE/LSCC AUTOMATE	XYZ,3V,4F	9019
C70DM	DIANE/LSCC AUTOMATE	XX <sup>1</sup> YZ,4V	9016
C70DT	DIANE/SSCC AUTOMATE	XYZ,BaS04	9017
C70GA	GARDNER AUTO. COLOR DIFF. METER. AC-2A	L a b	9013
C70GB	GARDNER AUTO. COLOR DIFF. METER. AC-2A	X Y Z	9014
C70GC	GARDNER XL-23	X Y Z	9014
C70GD	GARDNER XL-23	L a b	9013
C70GE	DIANE/HARDY/GE SPECTROPHOTOMETER	X Y Z	9014
C70GG	GARDNER XL-30	X Y Z	9014
C70GK	GARDNER XL-70	X Y Z	9014
C70GL	GARDNER XL-70	L a b	9013
C70GM	GARDNER MULTIPURPOSE REFLECTOMETER	X Y Z	9014
C70GP	GARDNER XL-200	L a b	9013
C70GX	GARDNER XL-10	L a b	9013
C70GY	GARDNER XL-10	X Y Z	9014
C70EA	HUNTER D25A (DA, D1A, D2A)	L a b	9013
C70EB	HUNTER D25A (DA, D1A, D2A)	X Y Z	9014
C70EM	HUNTER D25M (DM, D1M, D2M)	L a b	9013
C70EN	HUNTER D25M (DM, D1M, D2M)	X Y Z	9014
C70EP	HUNTER D25P (DP, D1P, D2P)	X Y Z	9014
C70EQ	HUNTER D25P (DP, D1P, D2P)	L a b	9013
C70ER	HUNTER D25A (DA, D1A, D2A)	Rd a b	9012
C70KC	KCS-16	XX <sup>1</sup> YZ,4V	9016
C70KD	KCS-18	XX <sup>1</sup> YZ,Ba	9018
C70KS	KCS-18	X Y Z	9014
C70KT	KCS-40	X Y Z	9014
C70LS	LERES TRILAC	X Y Z	9014
C70LT	LERES TRILAC	XYZ,3V	9011
C70MC	MECCO COLORMASTER V	R G B	9015
C70MS	MARTIN SWEETS	X Y Z	9014
C70MT	MARTIN SWEETS	XX <sup>1</sup> YZ,Ba	9018
C70ND	NEOTEC 220 DU COLOR	R G B	9015
C70NE	NEOTEC 220 DU COLOR	X Y Z	9014
C70FM	FIRSTEVOLT MODEL 501A	R G B	9015
C70PV	FIRSTEVOLT MODEL 610	X Y Z	9014
C70SA	SPECIAL INSTRUMENT	X Y Z	9014
C70SB	SPECIAL INSTRUMENT	Rd a b	9012
C70SC	SPECIAL INSTRUMENT	L a b	9013
C70SL	SPECIAL INSTRUMENT	R G B	9015
C70ZD	ZEISS DMC25	X Y Z	9014
C70ZE	ZEISS ELREPR0	X Y Z	9014
C70ZF	ZEISS ELREPR0	R G B	9015
C70XX	GIVE INSTRUMENT MAKE+MODEL.	NOT SPECIFIED	9020

FORMAT OF COLORIMETRIC (INPUT) DATA

DATA CODE	COLOR SCALE
----	-----
9011	X,Y,Z 3 FUNCTION VITROHITE CORRECTION
9012	R, a, b
9013	L, a, b HUNTER
9014	X, Y, Z
9015	R, G, B
9016	X, X <sup>1</sup> , Y, Z 4 FUNCTION VITROHITE CORRECTION
9017	X, Y, Z, BaS04 CORRECTION
9018	X, X <sup>1</sup> , Y, Z BaS04 CORRECTION
9019	X, Y, Z 4 FUNCTION VITROHITE CORRECTION
9020	(NON-STD. INST. SCALE SPECIFIED WITH DATA)

LAB CODE	P	SAMPLE C83			SAMPLE C84			DIFFERENCE C84 - C83			INST CODE	LAB
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ		
C121B	0	48.25	40.75	38.65*	47.60	39.90	37.90*	-.65	-.65	-.75	3.15	70HN C121D
C162	0	51.49	44.00	41.62	51.09	43.14	40.83	-.60	-.86	-.79	3.44	70SA C162
C232	0	59.02X	50.50X	47.59X	58.36X	49.60X	46.71X	-.66	-.90	-.89	3.15	70CA C232
C244	0	50.37	42.05	40.18	49.75	41.22	39.50	-.63	-.83	-.69	3.02	70ZB C244
C250	0	51.31	43.40	41.33	50.82	42.60	40.74	-.49	-.80	-.59	3.55	70ZP C250
C251	0	50.33	42.10	40.39	49.82	41.30	39.53	-.51	-.80	-.71	3.69*	70ZB C251
C314	0	47.90*	40.80	39.62	47.33*	40.01	38.97	-.58	-.79	-.64	2.97	70CB C314
C407	0	50.73	43.00	41.33	50.08	42.12	40.48	-.65	-.89	-.85	3.39	70SA C407
C412A	0	50.15	42.57	41.58	49.53	41.71	40.79	-.62	-.85	-.80	3.33	70GB C412A
C412B	0	50.40	42.76	41.85	49.80	41.93	41.01	-.50	-.83	-.81	3.25	70GB C412B
C414	0	51.02	43.36	41.49	50.32	42.44	40.54	-.70	-.92	-.95	3.50	70SA C414
C415A	0	50.85	42.98	41.60	50.08	41.97	40.58	-.78 *	-1.01 *	-1.02 *	3.71*	70GB C415A
C415B	0	51.97	42.68	48.91X	51.42	41.89	48.33X	-.55	-.80	-.57	3.08	70KS C415B
C417B	0	49.92	42.20	41.39	49.25	41.29	40.54	-.67	-.91	-.86	3.45	70GB C417B
C418	0	49.03	41.83	40.68	48.34	40.93	39.92	-.69	-.86	-.76	2.79	70CB C418
C422	0	48.94	41.13	39.77	48.34	40.32	39.02	-.59	-.82	-.75	3.26	70SA C422
C423	0	49.51	42.18	41.63	49.23	41.30	40.74	-.68	-.88	-.89	3.30	70GB C423
C428	0	50.14	42.28	41.41	49.60	41.54	40.72	-.54	-.74	-.69	2.91	75HB C428
C437	0	50.43	43.18	41.73	50.04	42.49	41.05	-.44	-.69	-.71	3.12	70CE C437
C443	0	50.45	42.35	40.65	50.09	41.62	40.62	-.55	-.73	-.63	2.67	70CN C443
C444	0	50.28	42.61	41.45	49.80	41.89	40.50	-.48	-.72	-.65	3.02	70GE C444
C445	0	50.87	43.09	42.50	50.17	42.17	41.61	-.70	-.91	-.89	3.33	70LS C445
C445A	0	48.97	42.17	41.43	48.52	41.51	40.83	-.45	-.66	-.60	2.79	70GE C445A
C451	0	50.55	42.94	41.59	50.12	42.18	40.94	-.54	-.75	-.66	3.03	70HB C451
C455	0	50.52	42.72	41.61	50.09	42.07	40.89	-.43	-.55 *	-.72	3.02	70KS C455
C459	0	49.24	41.61	40.54	48.75	40.92	39.88	-.49	-.69	-.56	2.85	70GB C459
C450	0	49.24	42.19	40.75	49.22	41.38	39.92	-.61	-.82	-.83	3.15	70GB C450
C462	0	49.45	42.00	41.15	49.25	41.35	40.55	-.40 *	-.65 *	-.60	3.09	70HB C462
C453	0	50.45	42.53	41.15	49.99	41.72	40.42	-.56	-.80	-.73	3.32	70ZD C453
C457A	0	49.93	42.26	42.08	49.32	41.43	41.33	-.61	-.83	-.76	3.16	70GB C457A
C457B	0	49.76	41.90	41.04	49.15	41.09	40.30	-.61	-.81	-.74	3.03	70HN C457B
C459	0	51.47	43.79	41.71	50.88	42.98	40.81	-.59	-.81	-.89	3.32	70GE C459
C470	0	50.17	42.81	41.51	49.58	42.03	40.78	-.59	-.78	-.73	2.92	70GB C470
C472	0	50.10	42.50	41.08	49.53	41.69	40.29	-.58	-.80	-.79	3.27	70XT C472
C473	0	50.18	42.45	41.90	49.46	41.53	40.93	-.72	-.91	-.92	3.31	70GE C473
C474	0	50.29	42.54	41.25	49.71	41.75	40.50	-.58	-.79	-.75	3.10	70GE C474
C475	0	50.96	43.13	42.07	50.22	42.18	41.15	-.74	-.95	-.92	3.41	70SA C475
C479A	X	50.48	43.95	41.60	49.80	42.20	40.80	-.65	-1.15 X	-.80	5.33X	70SA C479A
C479B	0	50.57	42.94	41.79	50.03	42.04	41.28	-.64	-.90	-.51 *	3.17	70SA C479B
C480	0	48.39	40.77	38.55*	47.74	39.95	37.82*	-.64	-.82	-.73	2.94	70HB C480
C481	0	50.39	42.44	41.47	49.91	41.75	40.89	-.47	-.69	-.59	2.83	70KB C481
C483	X	49.58	41.30	40.45	49.20	40.70	39.92	-.43	-.60 *	-.53	2.09X	70ZP C483
C495	0	51.65	43.19	41.97	50.32	42.25	41.08	-.74	-.93	-.87	3.25	70KS C495
C495A	0	50.12	42.38	41.30	49.46	41.48	40.43	-.67	-.89	-.87	3.46	70GB C495A
C503	0	49.99	42.30	41.23	49.34	41.45	40.45	-.64	-.85	-.83	3.19	70GE C503
C508	0	50.02	42.29	41.62	49.36	41.43	40.79	-.65	-.87	-.83	3.20	70GE C508
C511	0	50.82	43.17	41.57	50.26	42.39	40.83	-.56	-.78	-.74	3.05	70BA C511
C513	0	50.00	42.33	41.75	49.32	41.45	40.90	-.68	-.88	-.86	3.19	70GB C513
C516	0	51.23	43.85	41.53	50.68	43.10	40.94	-.55	-.75	-.59	2.82	70XT C516
C519	0	48.15*	41.51	37.35X	47.59	40.73	36.65X	-.56	-.78	-.69	3.07	70KS C519
C521A	0	50.95	42.92	41.88	50.34	42.08	41.11	-.62	-.84	-.77	3.20	70CA C521A
C521B	0	50.75	42.89	41.80	49.00	41.19	39.63	-1.76 X	-1.70 X	-1.87 X	3.71*	70SA C521B
C522	0	48.50	41.37	39.62	48.07	40.62	39.05	-.53	-.75	-.57	2.94	70SA C522
C524	0	55.20X	38.11X	36.67*	45.59X	37.35X	37.94*	-.62	-.76	-.73	2.73	70SA C524
C524	0	50.44	42.70	41.01	49.90	41.95	40.31	-.54	-.76	-.71	3.05	70SA C528
C524	0	50.53	42.94	42.70	49.90	42.13	41.92	-.60	-.81	-.78	3.09	70SA C532
C534	0	52.35*	45.69X	44.45X	51.88*	44.95X	43.84X	-.50	-.73	-.62	2.71	70GB C534
C535	0	50.51	42.79	41.17	49.84	41.89	40.62	-.65	-.89	-.84	3.39	70KS C535
C540	0	50.12	42.49	41.55	49.57	41.73	40.84	-.55	-.76	-.71	3.02	70GE C540
C545	0	47.70*	40.29*	39.40	47.17*	39.54*	38.69	-.53	-.76	-.71	3.21	70SA C545
C549	0	48.75*	40.35*	39.55	46.20	39.55*	38.75	-.55	-.30	-.30	3.56	70SA C549
C549	0	47.83*	40.42*	39.79	47.03*	39.42*	38.81	-.79 *	-1.00 *	-.97 *	3.60	70GB C549
C552	0	49.50	41.82	41.11	43.83	40.99	40.32	-.64	-.83	-.79	3.04	70SA C552
C558	0	49.04	41.74	41.04	49.13	40.83	40.18	-.71	-.91	-.85	3.35	70GC C558
C512	0	49.91	42.17	40.92	49.30	41.37	40.17	-.61	-.81	-.75	2.96	70GB C512
C613	0	51.02	43.28	41.55	50.52	42.55	40.84	-.50	-.73	-.70	3.11	70SA C613
C615	X	49.31	41.45	42.00	53.36X	44.20X	43.09*	3.55 X	2.75 X	1.09 X	7.44X	70SA C615
GRAND MEANS												
		50.13	42.37	41.11	49.52	41.53	40.33	-.60	-.82	-.76	3.17	
SD OF MEANS												
		.98	.83	.91	.99	.83	.89	.09	.08	.11	.25	
INCLUDED LABS FOR THIS MEAN												
		62	61	60	62	61	60	63	63	63	64	



LAB CODE	F	SAMPLE C85			SAMPLE C86			DIFFERENCE C86 - C85			INST CODE	LAB
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ		
C121B	0	6.00	6.10	6.90*	6.20	6.30	7.20*	.20	.20	.30	1.22	70FN C121B
C162	0	6.87	6.99	8.01	7.03	7.16	8.27	.17	.17	.25	1.06	70SA C162
C232	X	7.76X	7.90X	9.45X	8.07X	8.00X	9.86X	.30	.10	.41	4.04X	70CM C232
C244	0	5.94	6.10	7.09	6.21	6.40	7.47	.27	.30	.38	1.78	70ZB C244
C250	0	6.29	6.50	7.68	6.61	6.80	8.15	.31	.30	.47	1.71	70ZF C250
C251	0	6.23	6.30	7.32	6.53	6.60	7.68	.30	.30	.36	1.61	70ZE C251
C314	0	6.28	6.37	7.34	6.56	6.68	7.75	.29	.30	.40	1.75	70CE C314
C407	0	6.55	6.69	7.65	6.78	6.91	7.96	.23	.22	.31	1.19	70SA C407
C412A	0	6.69	6.83	7.98	6.86	6.99	8.22	.17	.17	.25	.89	70GS C412A
C412B	0	6.73	6.85	8.02	6.90	7.03	8.27	.17	.19	.25	1.10	70GB C412B
C414	0	7.22*	7.36X	8.38*	7.48X	7.62X	8.72*	.26	.27	.34	1.33	70SA C414
C416A	0	6.24	6.36	7.47	6.47	6.61	7.80	.24	.26	.33	1.51	70GB C416A
C416B	0	6.39	6.52	7.54	6.61	6.75	7.83	.22	.23	.29	1.24	70ZB C416B
C417B	0	6.20	6.32	7.58	6.37	6.50	7.85	.17	.18	.25	1.04	70GB C417B
C419	0	6.53	6.66	7.75	6.80	6.95	8.12	.27	.29	.38	1.65	70CB C419
C422	0	6.02	6.16	7.08	6.14	6.28	7.27	.12	.13	.19	.78	70SA C422
C423	0	6.41	6.53	7.77	6.71	6.84	8.22	.31	.31	.45	1.74	70GB C423
C428	0	6.33	6.41	7.49	6.53	6.69	7.87	.25	.28	.33	1.60	70CB C428
C437	0	6.19	6.68	7.77	6.79	6.94	8.17	.30	.26	.40	1.71	70ZB C437
C443	0	6.40	6.47	7.65	6.70	6.75	8.05	.30	.28	.40	1.55	70CN C443
C444	0	6.35	6.50	7.65	6.74	6.88	8.17	.35	.38	.51	2.09*	70OR C444
C445	0	6.69	6.51	8.24	6.90	7.03	8.54	.21	.22	.30	1.19	70LS C445
C446	0	6.45	6.55	7.70	6.70	6.82	8.05	.25	.26	.35	1.41	70GE C446
C451	0	6.38	6.52	7.59	6.55	6.79	8.00	.28	.27	.41	1.52	70ES C451
C455	0	6.53	6.67	7.83	6.77	6.92	8.16	.24	.25	.33	1.21	70KS C455
C459	0	6.28	6.40	7.54	6.51	6.64	7.85	.23	.24	.32	1.34	70GE C459
C460	0	6.16	6.29	7.44	6.49	6.64	7.82	.34	.34	.45	1.89	70GB C460
C462	0	6.20	6.30	7.40	6.50	6.60	7.80	.30	.30	.40	1.64	70HB C462
C463	0	6.37	6.46	7.65	6.59	6.72	7.97	.22	.24	.32	1.37	70ZD C463
C464	0	6.35	6.45	7.72	6.64	6.76	8.00	.30	.31	.38	1.72	70GE C464
C467	0	6.19	6.27	7.45	6.49	6.60	7.87	.30	.31	.41	1.71	70ZN C467
C469	0	5.95	6.08	7.27	6.21	6.35	7.63	.25	.27	.37	1.58	70GE C469
C470	0	6.78	6.92	7.97	7.01	7.17	8.29	.24	.25	.32	1.35	70GB C470
C472	0	6.25	6.49	7.60	6.70	6.83	8.05	.34	.34	.45	1.85	70ET C472
C473	0	6.74	6.48	7.65	6.66	6.81	8.09	.32	.33	.44	1.79	70GE C473
C474	X	6.10	6.22	7.25	6.60	6.73	7.91	.49 X	.51 X	.66 X	2.82X	70GE C474
C476	0	6.51	6.64	7.61	6.71	6.84	8.04	.19	.20	.28	1.10	70SA C476
C478	0	7.72X	7.80X	9.00X	7.95X	8.10X	9.40X	.25	.30	.40	2.02	70SA C478
C479	0	6.12	6.75	7.85	6.85	7.01	8.27	.24	.25	.42	1.57	70SA C479
C480	0	6.29	6.44	7.48	6.47	6.62	7.73	.18	.18	.25	1.01	70HB C480
C481	0	6.24	6.52	7.66	6.67	6.80	8.04	.29	.29	.38	1.52	70KS C481
C483	0	6.57	6.60	7.79	6.75	6.85	8.09	.21	.25	.30	1.75	70ZF C483
C485	0	6.72	7.04*	8.37*	7.04	7.18	8.53	.12	.14	.16	.82	70KS C485
C494A	0	6.19	6.52	7.72	6.52	6.65	7.92	.13	.13	.19	.83	70CF C494A
C501	0	6.48	6.51	7.88	6.65	6.80	8.13	.17	.19	.25	1.09	70GE C501
C505	0	6.25	6.34	7.52	6.41	6.53	7.73	.15	.15	.21	.83	70GE C505
C511	0	6.41	6.94	8.25	6.97	7.11	8.47	.16	.17	.22	.90	70SA C511
C514	0	6.84	6.67	7.93	6.72	6.85	8.20	.18	.19	.26	1.07	70GE C514
C515	0	6.54	6.67	7.80	6.66	6.79	7.97	.12	.12	.17	.68	70XT C515
C519	0	6.17	6.49	7.02	6.35	6.68	7.25*	.18	.19	.24	1.04	70KS C519
C521A	0	6.51	6.52	7.70	6.79	6.88	8.12	.28	.26	.42	1.52	70CA C521A
C521B	X	6.11	6.22	7.35	6.97	7.10	8.55	.85 X	.88 X	1.18 X	4.87X	70SA C521B
C522	0	5.74*	6.22	6.94	5.96*	6.41	7.23*	.19	.29	.19	1.13	70SA C522
C524	0	6.62	6.22	7.28	6.35	6.53	7.59	.30	.31	.40	1.71	70SA C524
C528	0	6.41	6.53	7.58	6.67	6.80	8.05	.25	.27	.37	1.49	70SA C528
C532	0	6.28	6.42	7.57	6.59	6.72	7.98	.30	.31	.41	1.65	70SA C532
C534	0	13.75X	13.29X	15.64X	13.20X	13.44X	15.86X	.14	.15	.22	.61*	70GE C534
C536	0	6.43	6.65	7.84	6.80	6.94	8.20	.23	.29	.36	1.55	70KS C536
C540	0	6.40	7.05*	8.27	7.18*	7.34*	8.50	.26	.29	.34	1.45	70GE C540
C545	0	5.77*	5.87*	6.9*	5.95*	6.07*	7.20*	.18	.20	.25	1.19	70SA C545
C548	X	6.00	6.10	7.00	6.15	6.35	7.35	.15	.25	.35	3.51X	70SA C548
C549	0	6.54*	6.55X	6.78*	6.79X	6.91X	7.13*	.26	.26	.35	1.52	70GB C549
C552	0	6.24	6.37	7.44	6.35	6.47	7.63	.09*	.10*	.15*	.62*	70SA C552
C568	0	5.72	6.39	7.98	6.90	7.07	8.22	.18	.18	.24	.94	70GC C568
C612	0	6.27	6.36	7.66	6.44	6.58	7.97	.21	.22	.31	1.20	70GE C612
C613	0	6.52	6.69	7.81	6.69	6.85	8.08	.17	.18	.26	1.14	70SA C613
C615	X	7.14*	7.29*	9.01X	8.50X	8.79X	11.12X	1.46 X	1.50 X	2.11 X	7.61X	70SA C615
GRAND MEANS		6.29	6.52	7.54	6.62	6.76	7.97	.23	.24	.33	1.36	
SD OF MEANS		.30	.25	.35	.25	.24	.35	.06	.06	.08	.36	

INCLUDED LABS FOR THIS MEAN

60 58 60 59 56 60 62 62 62 62

LAB CODE	F	SAMPLE C83			SAMPLE C84			DIFFERENCE C84 - C83			ΔH	INST	
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB		CODE	LAB
C105	0	64.80	23.60	7.90	64.20	24.30	7.80	-.60	.70	-.10	.93	70HM	C105
C121A	0	63.90	23.10	8.60X	63.20	23.90	8.50X	-.70	.80	-.10	1.07	70HM	C121A
C122	0	65.00	23.80	7.80	64.30	24.50	7.70	-.70	.70	-.10	.99	70HA	C122
C148	0	64.95	23.40	7.80	64.35	24.25	7.55	-.60	.85	-.25 X	1.07	70HA	C148
C150	0	64.66	23.52	7.62	64.02	24.29	7.51	-.64	.76	-.11	1.00	70HA	C150
C152	0	65.70	23.20	7.70	65.05	24.05	7.60	-.65	.85	-.10	1.07	70HA	C152
C213	0	64.20	23.50	7.40	63.60	24.25	7.30	-.60	.75	-.10	.97	70HM	C213
C223	0	64.99	23.77	7.66	64.30	24.50	7.57	-.70	.73	-.08 *	1.01	70HA	C223
C241	0	63.80	23.50	8.20	63.25	24.20	7.95	-.55	.70	-.25 X	.92	70HA	C241
C256	0	64.50	24.60	7.95	63.90	25.40	7.80	-.60	.80	-.15 X	1.01	70HM	C256
C259	0	65.05	23.15	7.40	64.45	23.85	7.30	-.60	.70	-.10	.93	70HA	C259
C262	0	41.99X	24.17	7.85	41.22X	25.00	7.74	-.77	.82	-.11	1.14	70HA	C262
C285	0	65.85	22.60	8.30*	65.25*	23.30	8.20*	-.60	.70	-.10	.93	70HA	C285
C288	0	65.45	23.90	7.50	64.85	24.55	7.45	-.60	.65	-.05 X	.89	70HA	C288
C291	0	64.90	23.85	7.70	64.20	24.60	7.60	-.70	.75	-.10	1.03	70HA	C291
C301	0	64.60	23.50	7.70	63.90	24.20	7.60	-.70	.70	-.10	.99	70SC	C301
C317	0	64.40	23.80	7.40	63.80	24.50	7.30	-.60	.70	-.10	.93	70HM	C317
C325	0	65.00	23.76	7.55	64.46	24.39	7.44	-.54	.63	-.11	.84	70HR	C325
C352	0	65.10	23.40	7.50	64.45	24.10	7.40	-.65	.70	-.10	.96	70HA	C352
C355	0	64.60	23.60	7.80	64.10	24.50	7.70	-.70	.70	-.10	.99	70HM	C355
C382	0	65.05	23.30	7.95	64.25	24.10	7.90	-.60 *	.80	-.05 X	1.13	70HA	C382
C420	0	65.20	24.60	7.90	64.70	25.25	7.80	-.50	.65	-.10	.83	70HA	C420
C424	0	65.61	22.12	7.72	64.83	24.00	7.60	-.78 *	.88 *	-.12	1.18*	70CA	C424
C430	0	65.01	24.18	7.62	64.35	24.94	7.50	-.65	.76	-.11	1.01	70HA	C430
C442	0	64.90	23.50	8.10	64.40	24.20	8.10*	-.50	.70	.00 X	.86	70HM	C442
C454	0	64.67	24.58	7.40	64.04	25.28	7.28	-.63	.70	-.12 *	.95	70HA	C454
C455	0	64.99	23.28	7.82	64.30	23.99	7.72	-.69	.71	-.10	1.00	70HA	C455
C458	0	64.85	23.88	7.92	64.35	24.57	7.81	-.50	.68	-.11	.85	70HM	C458
C475	0	64.71	24.92	7.44	64.11	25.64	7.31	-.60	.72	-.12 X	.94	70HA	C475
C477	X	64.76	24.99	8.02	64.18	25.26	7.92	-.58	.27 X	-.10	.65X	70HA	C477
C494	0	65.10	24.40	7.70	64.45	25.00	7.60	-.65	.60 *	-.10	.89	70HA	C494
C495B	0	64.15	22.05*	6.55X	63.40	22.90*	6.40X	-.75	.85	-.15 X	1.14*	70CP	C495B
C498	0	68.70X	25.80X	8.80X	68.00X	27.60X	8.70X	-.70	.80	-.10	1.07	70HO	C498
C499A	0	64.95	23.55	7.90	64.35	24.30	7.80	-.60	.75	-.10	.97	70SC	C499A
C506	0	65.00	23.70	7.80	64.35	24.45	7.70	-.65	.75	-.10	1.00	70HA	C506
C538	0	66.10*	23.70	8.10	65.45*	24.40	8.00	-.65	.70	-.10	.96	70GX	C538
C541	0	64.50	23.40	6.30X	63.90	24.05	6.10X	-.60	.65	-.20 X	.91	70CP	C541
C543	0	65.13	23.54	7.74	64.47	24.29	7.63	-.66	.75	-.11	1.01	70HA	C543
C544	0	64.95	23.65	7.65	64.35	24.35	7.55	-.60	.70	-.10	.93	70HA	C544
C545A	0	64.00	24.60	7.90	63.40	25.50	7.80	-.60	.70	-.10	.93	70HQ	C545A
C545B	0	64.30	23.70	7.50	63.70	24.40	7.40	-.60	.70	-.10	.93	70HM	C545B
C547	0	64.30	25.10*	7.94	63.62	25.91*	7.83	-.67	.81	-.11	1.06	70HQ	C547
C550	0	64.35	23.20	8.85X	63.75	23.95	8.75X	-.60	.75	-.10	.97	70HA	C550
C576	0	63.72*	23.09	8.95X	63.11*	23.82	8.84X	-.61	.73	-.11	.96	70HM	C576
C600	0	64.15	25.35*	7.60	63.50	26.15*	7.50	-.65	.80	-.10	1.04	70SC	C600
C620	0	65.10	22.83	7.83	64.53	23.56	7.73	-.57	.72	-.10	.93	70HA	C620
GRAND MEANS													
		64.80	23.71	7.75	64.17	24.45	7.64	-.64	.73	-.10	.98		
SD OF MEANS													
		.53	.65	.22	.52	.64	.22	.07	.06	.01	.08		
INCLUDED LABS FOR THIS MEAN													
		43	44	39	43	44	39	45	45	36	45		

LAB CODE	P	SAMPLE C85			SAMPLE C86			DIFFERENCE C86 - C85			INST CODES LAB	
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB	ΔE	
C105	0	25.20	.20	.20	25.50	.20	.10	.30	-.00	-.10	.32	70HM C105
C121A	0	24.90	.30	.70X	25.20	.20	.60X	.30	-.10	-.10	.33	70HM C121A
C122	0	25.15	.60	.10	25.60	.60	.00	.45	.00	-.10	.46	70HA C122
C148	0	25.60	-.20	.10	25.70	-.20	.10	.10	.00	.00	.10	70HA C148
C150	0	25.62	-.09	.20	25.97	-.13	.11	.35	-.04	-.09	.36	70HA C150
C152	0	25.60	-.50	.20	25.95	-.55	.10	.35	-.05	-.10	.37	70HA C152
C213	0	24.80	.60	.00	25.30	.60	.05	.50	-.00	.05 X	.50	70HM C213
C223	X	25.20	.16	.30	26.03	1.09*	.21	.84 *	.93 X	-.09	1.25X	70HA C223
C241	X	***X	***X	***X	***X	***X	***X	.00 X	.00	.00	.00X	70HA C241
C256	0	24.70	.50	.25	25.40	.40	.10	.70	-.10	-.15	.72	70HM C256
C259	0	25.20	1.20*	-1.00X	25.80	1.20X	-1.10X	.60	.00	-.10	.61	70HA C259
C262	0	6.49X	-.70	.18	6.81X	-.70	.07	.32	.00	-.11	.34	70HA C262
C285	0	27.05X	-.60	2.50X	27.50X	-.60	2.40X	.45	-.00	-.10	.45	70HA C285
C288	0	25.45	.35	.00	25.95	.40	-.10	.50	.05	-.10	.51	70HA C288
C291	0	25.20	-.00	.30	25.90	-.00	.20	.70	.00	-.10	.71	70HA C291
C301	0	24.75	.30	.20	25.30	.30	-.10	.55	-.00	-.30 X	.63	70SC C301
C317	0	24.90	.20	.10	25.40	.20	.00	.50	.00	-.10	.51	70HM C317
C325	0	25.30	.38	.16	25.69	.30	.08	.39	-.08	-.08	.41	70HM C325
C352	0	25.10	-.00	-.10	25.60	-.00	-.20	.50	.00	-.10	.51	70HA C352
C355	0	25.10	.40	.00	25.40	.30	.00	.30	-.10	-.00	.22	70HM C355
C382	0	25.35	.10	.40*	25.80	.10	.30*	.45	.00	-.10	.46	70HA C382
C420	0	26.10*	-.50	-.10	26.50	-.60	-.20	.40	-.10	-.10	.42	70HA C420
C424	0	25.66	.02	.01	26.46	-.00	-.10	.60	-.02	-.11	.61	70CA C424
C440	0	25.40	.23	.03	25.95	.22	.17	.55	-.01	.13 X	.58	70HA C440
C442	0	25.10	-.00	.20	25.70	-.00	.10	.60	.00	-.10	.61	70HM C442
C454	0	24.32*	-.20	.08	24.70*	-.20	.00	.38	-.00	-.08	.39	70EA C454
C456	0	25.90	-.18	.17	26.08	-.20	.06	.57	-.02	-.11	.58	70HA C456
C458	0	25.09	.06	.17	25.54	.02	.06	.56	-.03	-.11	.57	70HM C458
C475	0	25.50	-.00	.00	25.77	-.00	.00	.50	-.00	-.00	.50	70HA C475
C477	0	25.51	-.04	.25	26.12	-.06	.19	.54	-.02	-.06	.54	70HA C477
C494	0	25.60	-.35	.25	26.20	-.35	.10	.60	.00	-.15	.62	70HA C494
C496B	0	24.80	.40	-.20	25.30	-.20	-.10	.50	-.60 X	.10 X	.79*	70GP C496B
C498	0	26.80X	1.10*	-.20	27.20X	1.00*	-.30*	.40	-.10	-.10	.42	70EQ C498
C499A	0	25.55	-.20	-.10	25.90	-.20	-.20	.35	-.00	-.10	.36	70SC C499A
C506	0	25.15	-.00	.20	25.60	-.00	.10	.45	.00	-.10	.46	70EA C506
C538	0	26.10*	.40	-.20*	26.60*	.45	-.45X	.50	.05	-.15	.52	70OX C538
C541	X	24.30*	.60	-.50X	24.90	-.20	-.50X	.60	-.80 X	.10 X	1.00X	70GP C541
C543	0	25.53	-.18	.20	25.87	-.20	.11	.24	-.02	-.09	.25	70HA C543
C544	0	25.40	-.20	.10	25.90	-.20	.00	.50	-.00	-.10	.51	70HA C544
C545A	0	24.80	.20	.00	25.20	.20	.00	.40	-.00	-.00	.40	70HQ C545A
C543B	0	24.90	.40	.00	25.30	.40	.00	.40	-.00	-.00	.40	70HW C543B
C547	0	25.55	.13	-.05	25.64	.09	-.14	.09	-.04	-.09	.13*	70RQ C547
C550	0	25.40	.10	.10	25.75	.10	.00	.35	-.00	-.10	.36	70HA C550
C575	0	25.09	.10	.03	25.42	.07	.00	.33	-.03	-.08	.35	70HM C575
C600	0	25.85	-.50	.20	26.20	-.50	.20	.35	-.00	.00	.35	70SC C600
C620	0	25.73	-.57	.16	26.30	-.49	.07	.58	.09	-.09	.59	70HA C620
GRAND MEANS												
		25.29	.08	.09	25.74	.02	.02	.44	-.02	-.09	.46	
SD OF MEANS												
		.39	.41	.15	.40	.36	.13	.14	.04	.04	.14	
INCLUDED LABS FOR THIS MEAN												
		40	43	40	40	42	39	43	42	39	43	

LAB CODE	RATIO--(LAB/COMBINED)			INST CODE	PERCENT FROM COMBINED		
	X	Y	Z		X	Y	Z
C121B	1.0021	.9989	1.0025	70HN	.21	-.11	.25
C162	1.0134	1.0113	1.0147	70SA	1.34	1.13	1.47
C232	1.0787	1.0646	1.0319	70CM	7.87	6.46	3.19
C244	.9964	.9943	1.0035	70ZB	-.36	-.57	.35
C250	.9984	.9973	1.0001	70ZP	-.16	-.27	.01
C251	1.0039	1.0016	1.0018	70ZB	.39	.16	.18
C314	.9684	.9657	.9673	70CE	-3.16	-3.43	-3.27
C407	1.0142	1.0123	1.0110	70SA	1.42	1.23	1.10
C412A	1.0029	1.0038	1.0018	700B	.29	.38	.18
C412B	1.0079	1.0044	1.0078	70GZ	.79	.84	.78
C414	1.0044	1.0036	1.0088	70SA	.44	.36	.88
C416A	1.0193	1.0195	1.0189	700Z	1.98	1.95	1.89
C416B	1.0127	1.0094	1.0194	70XS	1.27	.84	1.94
C417B	1.0076	1.0078	1.0131	70GB	.76	.78	1.31
C418	.9814	.9783	.9916	70CB	-1.86	-2.17	-.84
C422	.9865	.9853	.9824	70SA	-1.35	-1.47	-1.76
C423	1.0098	1.0106	1.0127	700E	.98	1.06	1.27
C423	1.0056	1.0035	1.0082	70EB	.56	.35	.82
C437	1.0089	1.0051	1.0220	70CZ	.89	.51	2.20
C443	1.0092	.9970	1.0046	70CN	.92	-.30	.46
C444	1.0056	1.0057	1.0125	70GB	.56	.57	1.25
C445	1.0247	1.0243	1.0305	70LS	2.47	2.43	3.05
C446A	1.0647	1.0040	1.0067	70GB	.47	.40	.67
C451	1.0157	1.0167	1.0140	70BB	1.57	1.67	1.40
C455	1.0127	1.0146	1.0137	70KS	1.27	1.46	1.37
C459	.9929	.9933	.9916	70GE	-.71	-.67	-.84
C460	1.0063	1.0074	1.0065	70GB	.63	.74	.65
C462	1.0038	1.0027	1.0101	70BB	.38	.27	1.01
C463	1.0083	1.0067	1.0099	70ZD	.83	.67	.99
C467A	1.0076	1.0092	1.0109	70GB	.76	.92	1.09
C467B	1.0016	1.0002	1.0061	70RN	.16	.02	.61
C469	1.0224	1.0206	1.0394	70GE	2.24	2.06	3.84
C470	1.0055	1.0089	1.0094	70GE	.85	.89	.94
C472	.9989	.9962	.9982	70KT	-.12	-.18	-.18
C473	1.0107	1.0115	1.0151	70GE	1.07	1.15	1.51
C474	1.0141	1.0143	1.0151	70GE	1.41	1.43	1.51
C476	.9964	.9955	.9996	70SA	-.36	-.35	-.04
C479A	.9971	.9978	.9870	70SA	-.29	-.22	-1.30
C479B	1.0119	1.0122	1.0159	70SA	1.19	1.22	1.59
C490	.9952	.9942	.9889	70EB	-.48	-.58	-1.11
C481	1.0174	1.0147	1.0274	70XS	1.74	1.47	2.74
C483	.9967	.9957	.9979	70ZP	-.33	-.43	-.21
C495	1.0938	1.0858	1.0942	70XS	9.38	8.88	9.43
C496A	1.0149	1.0162	1.0127	70GB	1.49	1.62	1.27
C503	1.0109	1.0105	1.0148	70GB	1.09	1.05	1.48
C508	1.0055	1.0093	1.0083	70GE	.85	.93	.83
C511	1.0048	1.0046	1.0033	70SA	.48	.46	.33
C513	1.0075	1.0094	1.0050	70GS	.75	.94	.50
C516	1.0073	1.0073	1.0072	70KT	.73	.73	.72
C519	.9644	.9647	.9147	70KS	-3.56	-.53	-8.53
C521A	1.0145	1.0159	1.0154	70CA	1.45	1.59	1.54
C521B	.9927	.9919	.9936	70SA	-.73	-.81	-.64
C522	.9910	.9916	.9858	70SA	-.90	-.84	-1.42
C524	.9365	.9425	.9344	70SA	-6.35	-5.74	-6.56
C528	1.0056	1.0051	1.0000	70SA	.56	.51	-.00
C532	1.0105	1.0113	1.0116	70SA	1.05	1.13	1.16
C534	1.0040	1.0041	1.0051	70CE	.40	.41	.51
C535	1.0077	1.0072	1.0082	70XS	.77	.72	.82
C540	1.0052	1.0056	1.0050	70GE	.52	.56	.50
C545	.9655	.9677	.9677	70SA	-3.42	-3.23	-3.23
C548	.9710	.9707	.9667	70SA	-2.90	-2.93	-3.33
C549	.9625	.9629	.9754	70GS	-3.75	-3.71	-2.41
C552	.9952	.9936	.9984	70SA	-.48	-.64	-.16
C568	.9953	.9936	.9902	70GC	-.47	-.64	-.98
C612	1.0092	1.0108	1.0071	70GB	.92	1.08	.71
C613	1.0120	1.0136	1.0123	70SA	1.20	1.36	1.23
C615	.9360	.9350	.9481	70SA	-6.32	-6.50	-5.19

LAB CODE	RATIO--(LAB/COMBINED)			INST CODE	PERCENT FROM COMBINED		
	X	Y	Z		X	Y	Z
C105	.9893	.9859	.9956	70HM	-1.07	-1.31	-0.04
C121A	.9915	.9879	.9976	70HM	-.85	-1.21	-.24
C122	.9919	.9899	1.0017	70HA	-.81	-1.10	.17
C148	.9931	.9910	.9993	70HA	-.69	-.90	-.07
C150	.9925	.9918	1.0021	70HA	-.75	-.82	.21
C152	1.0136	1.0118	1.0243	70HA	1.35	1.18	2.43
C213	.9785	.9755	.9851	70HM	-2.15	-2.44	-1.49
C223	1.0025	.9931	1.0112	70HA	.26	-.19	1.12
C241	.9976	.9952	1.0073	70HA	-.24	-.48	.73
C256	.9852	.9828	.9939	70HM	-1.48	-1.72	-.61
C259	.9893	.9859	.9939	70HA	-1.07	-1.31	-.11
C262	.9282	.9261	.9384	70HA	-7.18	-7.39	-6.16
C285	.9883	.9542	.9384	70HA	-4.12	-4.58	-6.38
C288	1.0063	1.0045	1.0243	70HA	.63	.45	2.45
C291	.9897	.9879	.9976	70HA	-1.03	-1.21	-.24
C301	.9894	.9859	1.0001	70SC	-1.06	-1.41	.01
C317	.9927	.9777	.9923	70HM	-1.73	-2.03	-.77
C325	.9953	.9947	1.0005	70HR	-.45	-.53	.06
C312	.9974	.9952	1.0011	70HA	-.27	-.48	.81
C335	.9977	.9859	.9986	70HM	-1.23	-1.41	-.14
C382	.9915	.9890	.9979	70HA	-.84	-1.10	-.21
C400	1.0021	1.0024	1.0078	70HA	.31	.24	.78
C421	.9982	.9979	1.0030	70CA	-.18	-.21	.80
C410	.9993	.9957	1.0057	70HA	-.02	-.43	.57
C412	.9856	.9838	.9950	70HM	-1.44	-1.52	-.50
C431	.9777	.9257	.9213	70HA	-6.53	-7.33	-7.87
C455	.9954	.9935	1.0019	70HA	-.46	-.64	.19
C458	.9872	.9847	.9975	70HM	-1.28	-1.53	-.25
C475	.9963	.9924	1.0059	70HA	-.37	-.75	.58
C477	1.0014	.9984	1.0038	70HA	.14	-.16	.38
C495	1.0059	1.0035	1.0181	70HA	.59	.35	1.81
C496A	.9966	.9941	1.0177	70GP	-.14	-.59	1.77
C498	1.1423	1.1330	1.1376	70HQ	14.23	13.30	13.76
C199A	.9934	.9921	1.0003	70SC	-.61	-.79	.03
C505	.9911	.9890	.9955	70HA	-.89	-1.10	-.05
C538	.9686	.9715	.9711	70GX	-3.14	-2.85	-2.89
C541	1.0054	1.0003	1.0317	70GP	.54	.03	3.17
C543	.9962	.9955	1.0034	70HA	-.32	-.42	.34
C544	.9928	.9910	1.0023	70HA	-.72	-.90	.23
C545A	.9959	.9941	.9979	70HQ	-.41	-.59	-.21
C545B	.9841	.9814	.9929	70HM	-1.59	-1.82	-.71
C547	.9997	.9970	1.0026	70HQ	-.03	-.24	.26
C550	.9976	.9952	1.0073	70HA	-.24	-.48	.73
C576	.9871	.9884	.9947	70HM	-1.29	-1.96	-.53
C600	.9883	.9859	1.0001	70SC	-1.12	-1.41	.01
C620	.9959	.9932	.9980	70HA	-.41	-.58	-.20



LAB CODE	P	SAMPLE C83			SAMPLE C84			DIFFERENCE C84 - C83			INST CODE	LAB
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ		
C121B	0	48.15*	40.79*	38.55X	47.50X	39.94*	37.80X	-.65	-.85	-.75	3.15	70IN C121B
C162	0	51.01	43.51*	41.02	50.42*	42.66*	40.24	-.59	-.85	-.73	3.43	70SA C162
C232	0	54.71X	47.43X	46.12X	54.11X	46.59X	45.26X	-.61	-.85	-.85	3.09	70CX C232
C244	0	50.56	42.29	40.04*	49.93	41.46	39.37*	-.63	-.83	-.67	3.02	70ZE C244
C250	0	51.39*	43.52*	41.33	50.90X	42.72*	40.74	-.49	-.80	-.59	3.55	70ZF C250
C251	0	50.13	42.03	40.32	49.63	41.23	39.61	-.51	-.80	-.71	3.68*	70ZR C251
C314	0	49.47	42.25	40.96	49.87	41.43	40.29	-.60	-.81	-.67	3.00	70CA C314
C407	0	50.02	42.48	40.99	49.33	41.61	40.04	-.65	-.87	-.84	3.37	70SA C407
C412A	0	50.01	42.41	41.51	49.39	41.56	40.72	-.62	-.85	-.79	3.32	70GB C412A
C412B	0	50.01	42.40	41.52	49.41	41.58	40.72	-.60	-.82	-.80	3.24	70GE C412B
C414	0	50.80	43.21	41.13	50.10	42.29	40.19	-.70	-.92	-.95	3.50	70SA C414
C416A	0	49.87	42.16	40.83	49.11	41.17	39.83	-.76	-.59 *	-1.00 *	3.69*	70GB C416A
C416B	0	51.32*	42.33	47.93X	50.73X	41.54	47.41X	-.54	-.79	-.53	3.07	70KS C416B
C417B	0	49.55	41.87	40.86	48.83	40.98	40.02	-.67	-.90	-.84	3.44	70GB C417B
C418	0	49.96	42.76	41.03	49.26	41.89	40.26	-.71	-.88	-.77	2.80	70CB C418
C422	0	49.51	41.73	40.49	49.00	40.92	39.72	-.60	-.83	-.76	3.28	70SA C422
C423	0	49.43	41.74	41.11	48.76	40.86	40.23	-.67	-.88	-.88	3.29	70GE C423
C428	0	49.86	42.13	41.08	49.33	41.40	40.39	-.54	-.74	-.69	2.90	70BB C428
C437	0	50.04	42.96	40.85	49.60	42.27	40.16	-.44	-.68	-.69	3.11	70CE C437
C443	0	50.19	42.48	40.46	49.64	41.75	39.84	-.55	-.73	-.62	2.67	70CN C443
C444	0	50.01	42.37	40.95	49.52	41.66	40.30	-.48	-.71	-.65	3.01	70GE C444
C445	0	49.64	42.07	41.25	48.96	41.17	40.38	-.68	-.89	-.86	3.30	70LS C445
C445A	0	49.74	42.01	41.16	49.29	41.35	40.56	-.45	-.66	-.60	2.79	70GE C445A
C451	0	49.87	42.24	41.02	49.35	41.49	40.38	-.53	-.75	-.55	3.02	70BB C451
C455	0	49.88	42.11	41.05	49.46	41.47	40.34	-.42 *	-.64 *	-.71	3.01	70KS C455
C459	0	49.60	41.89	40.88	49.10	41.20	40.22	-.49	-.69	-.67	2.85	70GB C459
C460	0	49.53	41.89	40.49	48.92	41.08	39.67	-.61	-.81	-.82	3.14	70GE C460
C462	0	49.46	41.89	40.74	49.06	41.24	40.14	-.40 *	-.65 *	-.59	3.08	70BB C462
C463	0	50.04	42.25	40.75	49.48	41.45	40.03	-.56	-.80	-.72	3.31	70ZD C463
C467A	0	47.55	41.88	41.63	48.95	41.05	40.89	-.61	-.82	-.75	3.15	70GE C467A
C467B	0	49.59	41.90	40.79	49.08	41.09	40.06	-.61	-.81	-.73	3.03	70BN C467B
C469	0	50.34	42.90	40.17	49.77	42.11	39.32*	-.57	-.79	-.85	3.29	70GE C469
C470	0	45.75	42.44	41.13	49.17	41.66	40.40	-.58	-.73	-.73	2.91	70GE C470
C472	0	50.16	42.56	41.16	49.59	41.77	40.37	-.58	-.81	-.79	3.28	70KT C472
C473	0	49.65	41.97	41.28	48.94	42.06	40.37	-.71	-.90	-.91	3.29	70GE C473
C474	0	49.60	41.94	40.63	49.02	41.16	39.90	-.57	-.78	-.73	3.09	70GB C474
C476	0	51.15	43.29	42.09*	50.41*	42.33	41.17*	-.74	-.96	-.92	3.41	70SA C476
C479A	X	50.60	42.44*	42.15*	49.94	42.29	41.34*	-.65	-1.15 X	-.81	5.34X	70SA C479A
C479B	0	50.07	42.42	41.13	49.44	41.53	40.63	-.63	-.89	-.50 *	3.16	70SA C479B
C480	0	49.62*	41.01*	38.99X	47.97*	40.18*	38.24X	-.65	-.82	-.74	2.95	70BB C480
C481	0	49.53	41.82	40.37	47.06	41.14	39.60	-.47	-.68	-.57	2.81	70KS C481
C483	X	49.84	41.48	40.53	49.36	40.88	40.00	-.48	-.60 *	-.53	2.10X	70ZF C483
C495	0	46.68X	39.67X	38.36X	46.01X	38.61X	37.54X	-.67	-.86	-.61	3.16	70KS C495
C495A	0	49.39	41.70	40.79	48.74	40.82	39.93	-.66	-.88	-.85	3.44	70GE C495A
C503	0	49.45	41.86	40.68	48.82	41.02	39.85	-.64	-.84	-.82	3.18	70GE C503
C508	0	49.61	41.91	41.28	48.95	41.05	40.46	-.65	-.86	-.82	3.19	70GE C508
C511	0	50.58	42.97	41.44	50.02	42.20	40.70	-.56	-.77	-.74	3.04	70DA C511
C513	0	49.63	41.94	41.85	48.95	41.07	40.70	-.67	-.87	-.85	3.19	70GE C513
C516	0	50.86	43.54*	41.33	50.31*	42.79*	40.65	-.55	-.75	-.68	2.82	70KT C516
C519	0	49.93	41.74	40.84	49.35	40.95	40.09	-.58	-.78	-.75	3.11	70KS C519
C521A	0	50.24	42.25	41.25	49.52	41.42	40.49	-.62	-.83	-.76	3.18	70CA C521A
C521B	0	51.14	43.25	41.77	49.36	41.53	39.88	-1.77 X	-1.72 X	-1.83 X	3.72*	70SA C521B
C522	0	49.04	41.73	40.20	48.51	40.97	39.61	-.53	-.76	-.58	2.95	70SA C522
C524	0	48.27*	40.43X	41.38	47.61X	39.62X	40.60	-.65	-.81	-.78	2.79	70SA C524
C528	0	50.16	42.49	41.02	49.63	41.74	40.31	-.53	-.75	-.71	3.05	70SA C528
C532	0	49.97	42.47	42.21*	49.38	41.66	41.44X	-.59	-.81	-.77	3.08	70SA C532
C534	0	52.18X	45.50X	44.23X	51.68X	44.78X	43.62X	-.50	-.75	-.61	2.71	70GE C534
C536	0	50.13	42.48	41.13	49.47	41.59	40.29	-.66	-.89	-.84	3.38	70KS C536
C540	0	49.86	42.25	41.25	49.32	41.50	40.64	-.54	-.76	-.71	3.01	70GE C540
C545	0	49.39	41.64	40.72	48.84	40.86	39.98	-.55	-.78	-.73	3.25	70SA C545
C548	0	50.21	41.57	40.91	49.64	40.75	40.09	-.57	-.82	-.83	3.70*	70SA C548
C549	0	49.69	41.98	40.77	48.87	40.94	39.77	-.83 *	-1.04 *	-1.00 *	3.64	70GB C549
C552	0	49.74	42.09	41.18	49.09	41.25	40.39	-.64	-.84	-.79	3.04	70SA C552
C508	0	50.08	42.01	41.44	49.35	41.09	40.58	-.71	-.92	-.87	3.36	70GC C508
C612	0	49.46	41.73	40.54	48.85	40.93	39.89	-.61	-.80	-.74	2.95	70GB C612
C613	0	50.42	42.70	41.05	49.93	41.98	40.35	-.49	-.72	-.70	3.10	70SA C613
C615	X	53.17X	44.33X	44.30X	56.96X	47.27X	45.45X	3.79 X	2.94 X	1.15 X	7.57X	70SA C615
GRAND MEANS												
		49.91	42.24	41.02	49.30	41.41	40.22	-.59	-.81	-.75	3.16	
SD OF MEANS												
		.62	.56	.43	.46	.55	.38	.08	.08	.11	.25	
INCLUDED LABS FOR THIS MEAN												
		61	60	58	57	60	57	63	63	63	64	

LAB CODE	P	SAMPLE C85			SAMPLE C86			DIFFERENCE C86 - C85			INST	
		MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ	ΔR	COOR LAB
C121B	0	5.99	6.11	6.88*	6.19	6.31	7.18*	.20	.20	.30	1.22	70HN C121B
C152	0	6.78	6.91	7.90	6.94	7.08	8.15	.16	.17	.26	1.05	70SA C152
C232	X	7.20X	7.42X	9.16X	7.48X	7.51X	9.55X	.28	.09	.40	3.86X	70CM C232
C244	0	5.95	6.13	7.07	6.24	6.44	7.44	.28	.30	.38	1.78	70ZB C244
C250	0	6.30	6.52	7.68	6.62	6.82	8.15	.31	.30	.47	1.71	70ZF C250
C251	0	6.21	6.29	7.31	6.50	6.59	7.67	.30	.30	.36	1.61	70ZB C251
C314	0	6.43	6.60	7.59	6.78	6.91	8.01	.30	.32	.41	1.77	70CE C314
C407	0	6.47	6.61	7.57	6.69	6.83	7.87	.22	.22	.31	1.18	70SA C407
C412A	0	6.68	6.80	7.97	6.84	6.97	8.21	.17	.16	.24	.89	70GB C412A
C412B	0	6.68	6.79	7.96	6.85	6.98	8.21	.17	.18	.25	1.09	70GB C412B
C414	0	7.19X	7.33X	8.31*	7.45X	7.60X	8.64*	.26	.26	.34	1.33	70SA C414
C416A	0	6.12	6.24	7.33	6.35	6.49	7.65	.23	.25	.33	1.50	70GE C416A
C416B	0	6.31	6.47	7.40	6.53	6.59	7.68	.22	.23	.28	1.23	70KS C416B
C417B	0	6.15	6.28	7.49	6.32	6.45	7.75	.17	.17	.26	1.04	70GE C417B
C419	0	6.65	6.81	7.81	6.93	7.10	8.19	.27	.29	.38	1.66	70CB C419
C422	0	5.11	6.25	7.21	6.23	6.38	7.40	.12	.13	.19	.78	70SA C422
C423	0	6.75	6.46	7.68	5.55	6.77	8.12	.30	.31	.44	1.73	70GB C423
C429	0	6.24	6.39	7.43	6.50	6.67	7.81	.26	.28	.35	1.60	70KB C429
C437	0	5.43	6.65	7.60	6.73	6.90	7.99	.30	.26	.39	1.71	70CE C437
C443	0	6.34	6.49	7.62	6.84	6.77	8.01	.29	.28	.39	1.55	70CN C443
C454	0	6.34	6.47	7.57	6.70	6.84	8.07	.35	.37	.50	2.03	70GE C454
C455	0	6.53	6.65	8.00	6.74	6.86	8.29	.20	.21	.29	1.18	70LS C455
C456A	0	6.42	6.53	7.55	6.67	6.79	8.00	.25	.26	.35	1.40	70GE C456A
C451	0	6.28	6.41	7.49	6.56	6.68	7.89	.28	.27	.40	1.51	70KB C451
C455	0	6.45	6.5	7.72	6.69	6.82	8.05	.24	.24	.33	1.30	70GS C455
C459	0	5.33	6.45	7.61	6.56	6.69	7.93	.23	.24	.32	1.34	70GB C459
C459	0	6.12	6.25	7.39	6.45	6.59	7.84	.33	.34	.45	1.88	70GB C459
C467	0	6.18	6.28	7.33	6.48	6.58	7.72	.30	.30	.40	1.64	70HB C467
C467	0	6.32	6.44	7.58	6.54	6.68	7.90	.32	.23	.32	1.36	70ZD C467
C467	0	6.30	6.39	7.54	6.59	6.70	8.02	.29	.31	.38	1.71	70GE C467A
C467	0	6.19	6.29	7.41	6.48	6.60	7.82	.29	.30	.41	1.71	70HN C467B
C467	0	5.82*	5.96*	7.00*	6.07*	6.23*	7.35	.25	.26	.35	1.57	70GB C467
C470	0	6.72	6.86	7.90	6.96	7.11	8.22	.23	.25	.32	1.36	70GB C470
C472	0	6.37	6.50	7.61	6.71	6.85	8.07	.34	.35	.45	1.86	70KT C472
C473	0	6.23	6.41	7.54	6.59	6.74	7.97	.32	.33	.43	1.78	70GB C473
C474	X	6.01	6.14	7.14	6.51	6.64	7.79	.49 X	.50 X	.65 X	2.81X	70GB C474
C475	0	6.54	6.65	7.82	6.73	6.86	8.10	.20	.20	.28	1.10	70SA C475
C479A	0	7.72X	7.82X	9.12X	7.97X	8.12X	9.52X	.25	.30	.41	2.02	70SA C479A
C479B	0	6.54	6.68	7.73	6.78	6.93	8.14	.2*	.25	.41	1.66	70SA C479B
C480	0	6.33	6.45	7.56	6.50	6.66	7.82	.18	.18	.25	1.01	70KB C480
C481	0	6.28	6.43	7.46	6.56	6.71	7.83	.28	.28	.37	1.51	70KS C481
C481	0	6.57	6.63	7.81	6.77	6.88	8.11	.21	.25	.30	1.75	70ZF C481
C481	0	6.23	6.47	7.65	6.44	6.60	7.79	.11	.13	.15	.79	70KS C481
C481	0	6.30	6.42	7.63	6.42	6.55	7.82	.12	.13	.19	.83	70GB C481A
C481	0	6.41	6.54	7.77	6.59	6.73	8.02	.17	.19	.25	1.08	70GB C481
C481	0	6.21	6.33	7.46	6.36	6.47	7.67	.15	.15	.21	.82	70GB C481
C481	0	6.78	6.91	8.23*	6.94	7.08	8.45	.16	.17	.21	.89	70BA C481
C481	0	6.50	6.61	7.90	6.67	6.80	8.15	.18	.19	.26	1.07	70GE C481
C481	0	6.50	6.63	7.75	6.61	6.75	7.92	.11	.12	.17	.58	70KT C481
C481	0	6.40	6.52	7.68	6.58	6.72	7.94	.19	.19	.26	1.05	70KS C481
C511	0	6.42	6.52	7.58	6.59	6.77	8.00	.27	.26	.42	1.51	70CA C511A
C511	0	6.12	6.23	7.41	7.03	7.16	8.50*	.87 X	.83 X	1.19 X	4.89X	70SA C511B
C511	0	5.82*	6.27	7.05	6.01*	6.47	7.33*	.20	.20	.29	1.13	70SA C511
C511	0	6.48	6.50	7.90	6.80	6.93	8.22	.32	.33	.43	1.75	70SA C511
C511	0	6.38	6.50	7.69	6.53	6.77	8.05	.25	.46	.37	1.48	70SA C511
C511	0	6.25	6.35	7.49	6.53	6.65	7.89	.30	.30	.40	1.64	70SA C511
C514	0	13.81Z	13.24X	15.55X	13.15X	13.39X	15.73X	.14	.15	.22	.61*	70GB C514
C515	0	6.43	6.49	7.78	6.75	6.89	8.13	.27	.29	.36	1.54	70KS C515
C540	0	6.55*	7.01*	8.23*	7.14*	7.30*	8.56*	.28	.29	.33	1.45	70GE C540
C545	0	5.97	6.09	7.15	6.16	6.29	7.44	.19	.20	.26	1.21	70SA C545
C545	X	6.18	6.35	7.24	6.33	6.54	7.60	.15	.25	.36	3.54X	70SA C545
C549	0	5.75*	5.67*	6.75*	6.02*	6.14*	7.31*	.25	.27	.36	1.54	70GE C549
C552	0	6.27	6.41	7.47	6.38	6.51	7.64	.10	.10	.15	.62*	70SA C552
C608	0	6.70	6.93	8.06	6.93	7.12	8.30	.18	.18	.24	.94	70GC C608
C612	0	6.17	6.30	7.51	6.28	6.51	7.91	.21	.21	.30	1.20	70GB C612
C613	0	6.45	6.59	7.72	6.61	6.77	7.98	.16	.18	.26	1.13	70SA C613
C615	X	7.52X	7.90X	9.51X	9.17X	9.40X	11.73X	1.56 X	1.60 X	2.23 X	7.83X	70SA C615
GRAND MEANS												
		6.35	6.49	7.60	6.58	6.72	7.93	.23	.24	.33	1.36	
SD OF MEANS												
		.24	.23	.30	.24	.23	.30	.06	.06	.08	.36	
INCLUDED LABS FOR THIS MEAN												
		59	59	60	59	59	60	62	62	62	62	

LAB CODE	F	SAMPLE C83			SAMPLE C84			DIFFERENCE C84 - C83			INST CODE	LAB
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB		
C105	θ	65.23	23.43	8.43	64.62	24.13	8.33	-.60	.71	-.10	.93	70HM C105
C121A	θ	64.29	22.75	9.01X	63.58	23.56	8.90*	-.70	.81	-.10	1.08	70HM C121A
C122	θ	65.36	23.52	8.33	64.66	24.22	8.22	-.70	.71	-.11	1.00	70HA C122
C148	θ	65.24	23.22	8.15	64.64	24.07	7.89	-.60	.85	-.25 X	1.08	70HA C148
C150	θ	64.92	23.53	8.04	64.28	24.29	7.92	-.64	.77	-.12	1.01	70HA C150
C152	θ	65.32	22.81	8.12	64.67	23.66	8.02	-.65	.85	-.10	1.07	70HA C152
C213	θ	65.00	23.39	7.85	64.39	24.14	7.75	-.61	.76	-.10	.98	70HM C213
C223	θ	65.05	23.17	8.15	64.36	23.91	8.05	-.70	.73	-.09 *	1.01	70HA C223
C241	θ	63.95*	23.23	8.66	63.40*	23.93	8.41	-.55 X	.70	-.25 X	.93	70HA C241
C256	θ	65.06	24.48	8.44	64.46	25.29	8.28	-.61	.81	-.15 X	1.02	70HM C256
C259	θ	65.48	22.97	7.91	64.88	23.68	7.80	-.60	.71	-.10	.93	70HA C259
C262	θ	43.65X	24.89	8.45	42.83X	25.75*	8.33	-.81 *	.86	-.12	1.18*	70HA C262
C285	θ	67.41X	22.46	7.76	66.80X	23.18	7.65	-.61	.72	-.10	.95	70HA C285
C285	θ	65.30	23.59	8.23	64.70	24.24	8.17	-.60	.65	-.06 X	.83	70HA C285
C291	θ	65.29	23.75	8.12	64.59	24.50	8.01	-.70	.76	-.10	1.04	70HA C291
C301	θ	65.06	23.17	8.29	64.36	23.88	8.19	-.70	.71	-.11	1.00	70SC C301
C317	θ	65.05	23.63	7.95	64.46	24.34	7.85	-.61	.71	-.11	.94	70HM C317
C325	θ	65.17	23.71	7.79	64.63	24.35	7.68	-.54	.64	-.11	.84	70RR C325
C352	θ	65.26	23.17	8.01	64.61	23.87	7.90	-.65	.70	-.10	.96	70RA C352
C355	θ	65.25	23.72	8.34	64.55	24.43	8.23	-.70	.71	-.11	1.00	70RN C355
C382	θ	65.41	23.05	8.33	64.61	23.86	8.28	-.80 *	.81	-.05 X	1.14	70HA C382
C420	θ	65.12	24.48	8.09	64.52	25.13	7.99	-.50	.65	-.10	.83	70HA C420
C424	θ	65.68	23.09	8.11	64.90	23.98	7.99	-.78 *	.89 *	-.12	1.19*	70CA C424
C440	θ	65.15	23.66	8.01	64.49	24.43	7.89	-.65	.76	-.12	1.01	70HA C440
C442	θ	65.43	23.44	8.59	64.93	24.15	8.58	-.50	.71	-.00 X	.87	70HM C442
C454	θ	67.18X	24.47	7.46*	66.52X	25.20	7.34*	-.65	.73	-.12	.99	70HA C454
C455	θ	65.19	23.10	8.16	64.50	23.82	8.05	-.69	.72	-.10	1.00	70HA C455
C458	θ	65.35	23.71	8.46	64.85	24.41	8.35	-.50	.69	-.11	.86	70HM C458
C475	θ	64.96	24.48	7.97	64.36	25.20	7.84	-.60	.72	-.13 *	.95	70HA C475
C477	X	64.82	24.60	8.23	64.23	24.97	8.12	-.59	.27 X	-.11	.65X	70HA C477
C494	θ	64.99	24.02	8.23	64.34	24.63	8.12	-.65	.60 *	-.10	.89	70HA C494
C495B	θ	64.34	21.51*	7.46*	63.59	22.37*	7.30*	-.75	.85	-.16 X	1.15	70GP C495B
C498	θ	64.54	24.06	8.42	63.88	24.82	8.32	-.66	.75	-.10	1.01	70HQ C498
C499A	θ	65.21	23.40	8.24	64.61	24.15	8.14	-.60	.75	-.10	.97	70SC C499A
C505	θ	65.36	23.54	8.24	64.71	24.30	8.14	-.65	.75	-.10	1.00	70HA C505
C538	θ	67.05X	24.48	8.20	66.40X	25.19	8.10	-.66	.71	-.10	.97	70GX C538
C541	θ	64.49	22.71	7.43*	63.89	23.36	7.27*	-.60	.65	-.21 X	.91	70GP C541
C543	θ	65.27	23.45	8.04	64.61	24.20	7.93	-.66	.75	-.11	1.01	70HA C543
C544	θ	65.24	23.51	8.11	64.64	24.21	8.01	-.60	.70	-.10	.93	70HA C544
C545A	θ	64.19	24.63	8.06	63.59	25.33	7.95	-.60	.70	-.10	.92	70HQ C545A
C545B	θ	64.39	23.59	7.99	64.29	24.30	7.89	-.61	.71	-.10	.94	70HM C545B
C547	θ	64.38	24.84	8.13	63.70	25.65	8.02	-.68	.81	-.11	1.05	70MQ C547
C550	θ	64.51	22.93	9.31X	63.90	23.69	9.20X	-.60	.75	-.10	.97	70HA C550
C576	θ	64.35	22.41	9.55X	63.74	23.15	9.44X	-.62	.74	-.12	.97	70HV C576
C600	θ	64.61	25.12*	8.19	63.95	25.92*	8.08	-.65	.81	-.11	1.04	70SC C600
C620	θ	65.32	22.55	8.03	64.75	23.28	7.94	-.57	.73	-.10	.93	70HA C620
GRAND MEANS												
		65.01	23.53	8.12	64.37	24.27	8.03	-.64	.74	-.11	.99	
SD OF MEANS												
		.41	.73	.27	.41	.73	.31	.07	.06	.01	.08	
INCLUDED LABS FOR THIS MEAN												
		41	45	42	41	45	43	45	43	37	45	

LAB CODE	P	SAMPLE C85			SAMPLE C86			DIFFERENCE C85 - C86			INST CODE	LAB
		MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB		
C105	0	25.37	.09	.42	25.67	.09	.33	.30	-.00	-.10	.32	70HM C105
C121A	0	25.05	.14	.87X	25.35	.04	.77X	.30	-.10 *	-.10	.33	70HM C121A
C122	0	25.29	.47	.32	25.74	.47	.23	.45	-.00	-.10	.45	70HA C122
C148	0	25.72	-.29	.25	25.82	-.30	.25	.10 *	-.00	.00 *	.10 *	70HA C148
C150	0	25.72	-.12	.39	26.07	-.16	.30	.35	-.04	-.09	.36	70HA C150
C152	0	25.45	-.58	.41	25.80	-.63	.32	.35	-.05	-.10	.35	70HA C152
C213	0	25.11	.47	.17	25.61	.47	.22	.51	-.00	.05 X	.51	70HM C213
C223	X	25.22	-.04	.53	26.06	.89*	.44	.84 *	.92 X	-.08	1.24X	70HA C223
C241	X	*****X	*****X	*****X	*****X	*****X	*****X	.00 X	.00	.00	.00X	70HA C241
C256	0	24.92	.40	.44	25.62	.30	.30	.71	-.10 *	-.14	.73	70HM C256
C259	0	25.37	1.10*	-.78X	25.47	1.10X	-.88X	.60	-.00	-.09	.61	70HA C259
C262	0	6.74X	-.75	.25	7.08X	-.75	.14	.33	-.00	-.11	.35	70HA C262
C265	0	27.69X	-.84	2.24X	28.15X	-.85*	2.13X	.46	-.09	-.11	.47	70HA C265
C268	0	25.39	.27	.35	25.89	.32	.25	.50	.05	-.09	.51	70HA C268
C291	0	25.35	-.08	.47	26.06	-.08	.35	.70	-.00	-.09	.71	70HA C291
C301	0	24.93	.14	.45	25.49	.14	.15	.55	-.00	-.29 X	.63	70SC C301
C317	0	25.15	.07	.32	25.66	.07	.23	.51	-.00	-.10	.51	70HM C317
C325	0	25.37	.34	.25	25.75	.26	.18	.39	-.08	-.08	.41	70HR C325
C352	0	25.16	-.09	.13	25.66	-.09	.03	.50	-.00	-.09	.51	70HA C352
C356	0	25.29	.32	.22	25.58	.22	.23	.30	-.10 *	.00 *	.32	70HM C356
C382	0	25.49	-.02	.56	25.94	-.02	.46	.45	-.00	-.10	.46	70HA C382
C420	0	26.07*	-.53	-.00	26.47*	-.63	-.10*	.40	-.10 *	-.10	.42	70HA C420
C424	0	25.83	.01	.19	26.49*	-.02	.05	.60	-.02	-.11	.61	70CA C424
C440	0	25.45	.05	.21	26.01	.03	.34	.55	-.02	.13 X	.58	70HA C440
C442	0	25.31	-.08	.40	25.91	-.08	.30	.60	-.00	-.09	.61	70HM C442
C454	0	25.26	-.54	-.02	25.66	-.54	-.10*	.39	-.01	-.09	.40	70HA C454
C456	0	25.59	-.25	.31	26.16	-.28	.21	.57	-.02	-.10	.58	70HA C456
C458	0	25.28	-.06	.40	25.84	-.09	.29	.56	-.03	-.11	.56	70HM C458
C475	0	25.37	-.17	.24	25.87	-.18	.24	.50	-.00	.00 *	.50	70HA C475
C477	0	25.60	-.18	.35	26.14	-.20	.28	.54	-.02	-.05	.54	70HA C477
C494	0	25.55	-.46	.50	26.15	-.45	.36	.60	-.00	-.14	.62	70HA C494
C496B	0	24.57	.20	.21	25.37	-.40	.31	.50	-.60 X	.11 X	.79*	70GP C496B
C498	0	25.13	.67	-.12*	25.55	.57	-.21*	.38	-.10 *	-.09	.40	70HQ C498
C499A	0	25.65	-.28	.05	26.00	-.28	-.05	.35	-.00	-.10	.36	70SC C499A
C506	0	25.29	-.09	.38	25.74	-.09	.29	.45	-.00	-.10	.46	70HA C506
C538	0	26.48X	.55	-.31X	26.99X	.50	-.46X	.51	.05	-.15'	.53	70GX C538
C541	X	24.30X	.38	-.07*	24.90*	-.42	.04	.60	-.60 X	.11 X	1.01X	70GP C541
C543	0	25.68	-.23	.34	25.92	-.24	.25	.24	-.02	-.09	.26	70HA C543
C544	0	25.51	-.28	.30	26.02	-.28	.29	.50	-.00	-.10	.51	70HA C544
C546A	0	24.87	.12	.07	25.27	.12	.07	.40	-.00	.00 *	.40	70HQ C546A
C546B	0	25.12	.30	.20	25.53	.30	.20	.40	-.00	.00 *	.40	70HM C546B
C547	0	25.58	.03	.04	25.67	-.00	-.05	.09 *	-.04	-.09	.13	70HQ C547
C550	0	25.46	-.01	.31	25.81	-.01	.22	.35	-.00	-.10	.36	70HA C550
C576	0	25.33	-.20	.33	25.67	-.23	.28	.34	-.03	-.05	.35	70HM C576
C600	0	25.03*	-.54	.46	26.39	-.64	.46	.35	-.00	.00 *	.35	70SC C600
C620	0	25.81	-.70	.25	26.39	-.61	.16	.58	.08 *	-.09	.59	70HA C620
GRAND MEANS												
		25.40	-.04	.28	25.84	-.10	.21	.45	-.02	-.08	.47	
NO OF LABS												
		40	43	39	40	42	39	43	42	39	43	
INCLUDED LABS FOR THIS MEAN												
		40	43	39	40	42	39	43	42	39	43	



NBS VALUES FOR SPECTRAL REFLECTANCE

45/0 REFLECTANCE FACTOR

SAMPLES C83, C84, C85, C86, W12

WAVELENGTH (nm)	C83	C84	C85	C86	W12
380	.1220	.1211	.0492	.0506	.1313
390	.1996	.1973	.0552	.0576	.2259
400	.3171	.3127	.0596	.0627	.4400
410	.3750	.3694	.0609	.0643	.7095
420	.3711	.3653	.0613	.0645	.8575
430	.3596	.3538	.0619	.0651	.8955
440	.3539	.3479	.0624	.0658	.9243
450	.3473	.3415	.0620	.0659	.9097
460	.3439	.3379	.0623	.0655	.9135
470	.3466	.3401	.0620	.0650	.9179
480	.3382	.3321	.0618	.0648	.9211
490	.3155	.3094	.0618	.0647	.9240
500	.3045	.2979	.0619	.0649	.9272
510	.3055	.2992	.0622	.0652	.9285
520	.2943	.2874	.0625	.0655	.9304
530	.2764	.2699	.0628	.0657	.9321
540	.2820	.2744	.0630	.0659	.9325
550	.3292	.3185	.0631	.0660	.9323
560	.3900	.3758	.0633	.0662	.9319
570	.4376	.4212	.0637	.0665	.9335
580	.5197	.5052	.0640	.0669	.9359
590	.6054	.5975	.0641	.0669	.9364
600	.6464	.6443	.0639	.0657	.9354
610	.6592	.6591	.0605	.0663	.9354
620	.6624	.6629	.0631	.0659	.9355
630	.6526	.6632	.0628	.0655	.9359
640	.6617	.6625	.0624	.0650	.9366
650	.6604	.6613	.0620	.0646	.9366
660	.6591	.6599	.0617	.0642	.9361
670	.6577	.6583	.0615	.0639	.9342
680	.6562	.6572	.0612	.0636	.9349
690	.6549	.6556	.0609	.0633	.9351
700	.6533	.6539	.0606	.0630	.9355
710	.6512	.6522	.0604	.0627	.9355
720	.6497	.6509	.0602	.0624	.9358
730	.6481	.6492	.0600	.0622	.9363
740	.6469	.6474	.0596	.0618	.9351
750	.6454	.6459	.0594	.1616	.9372
760	.6443	.6448	.0592	.0614	.9398
770	.6429	.6441	.0590	.0611	.9401

NBS TRISTIMULUS VALUES

45/0 REFLECTANCE FACTOR

SAMPLES C83, C84, C85, C86, W12

X, Y, Z, SPACE

	C83	C84	C85	C86	W12
X	50.267	49.677	6.185	6.464	90.834
Y	42.520	41.699	6.302	6.593	93.092
Z	40.841	40.125	7.330	7.705	106.595

L, a, b, SPACE

	C83	C84	C85	C86	W12
L	65.207	64.575	25.104	25.677	96.484
a	23.489	24.313	.025	.002	-.800
b	8.523	8.374	.267	.189	2.059



NBS VALUES FOR SPECTRAL REFLECTANCE  
 6°/HEMISPHERICAL REFLECTANCE FACTOR  
 SAMPLES C83, C84, C85, C86, W12

WAVELENGTH (nm)	C83	C84	C85	C86	W12
380	.1336	.1332	.0516	.0536	.1474
390	.2143	.2132	.0580	.0507	.2453
400	.3264	.3229	.0621	.0654	.4560
410	.3790	.3733	.0635	.0568	.7155
420	.3745	.3682	.0638	.0672	.8555
430	.3625	.3562	.0643	.0677	.8904
440	.3563	.3502	.0649	.0683	.8991
450	.3494	.3436	.0649	.0583	.9093
460	.3463	.3403	.0645	.0677	.9071
470	.3483	.3417	.0640	.0673	.9099
480	.3398	.3332	.0638	.0669	.9128
490	.3170	.3106	.0637	.0667	.9147
500	.3058	.2993	.0639	.0670	.9169
510	.3078	.3006	.0641	.0672	.9186
520	.2956	.2883	.0645	.0675	.9197
530	.2779	.2711	.0647	.0577	.9208
540	.2835	.2766	.0649	.0678	.9212
550	.3298	.3203	.0649	.0679	.9205
560	.3892	.3757	.0651	.0681	.9208
570	.4354	.4203	.0655	.0684	.9214
580	.5166	.5041	.0658	.0687	.9230
590	.6002	.5938	.0659	.0687	.9234
600	.6405	.6381	.0657	.0684	.9231
610	.6527	.6522	.0653	.0680	.9225
620	.6555	.6556	.0649	.0676	.9221
630	.6561	.6564	.0645	.0671	.9231
640	.6549	.6555	.0641	.0667	.9231
650	.6534	.6541	.0637	.0662	.9231
660	.6520	.6526	.0634	.0659	.9231
670	.6504	.6507	.0630	.0654	.9201
680	.6489	.6497	.0627	.0651	.9211
690	.6477	.6482	.0625	.0648	.9229
700	.6457	.6462	.0621	.0644	.9226
710	.6441	.6446	.0619	.0641	.9228
720	.6426	.6413	.0616	.0638	.9231
730	.6410	.6413	.0613	.0636	.9230
740	.6393	.6395	.0611	.0633	.9234
750	.6378	.6382	.0608	.0630	.9242
760	.6352	.6363	.0606	.0627	.9243
770	.6343	.6348	.0603	.0624	.9241

NBS TRISTIMULUS VALUES  
 6°/HEMISPHERICAL REFLECTANCE FACTOR  
 SAMPLES C83, C84, C85, C86, W12

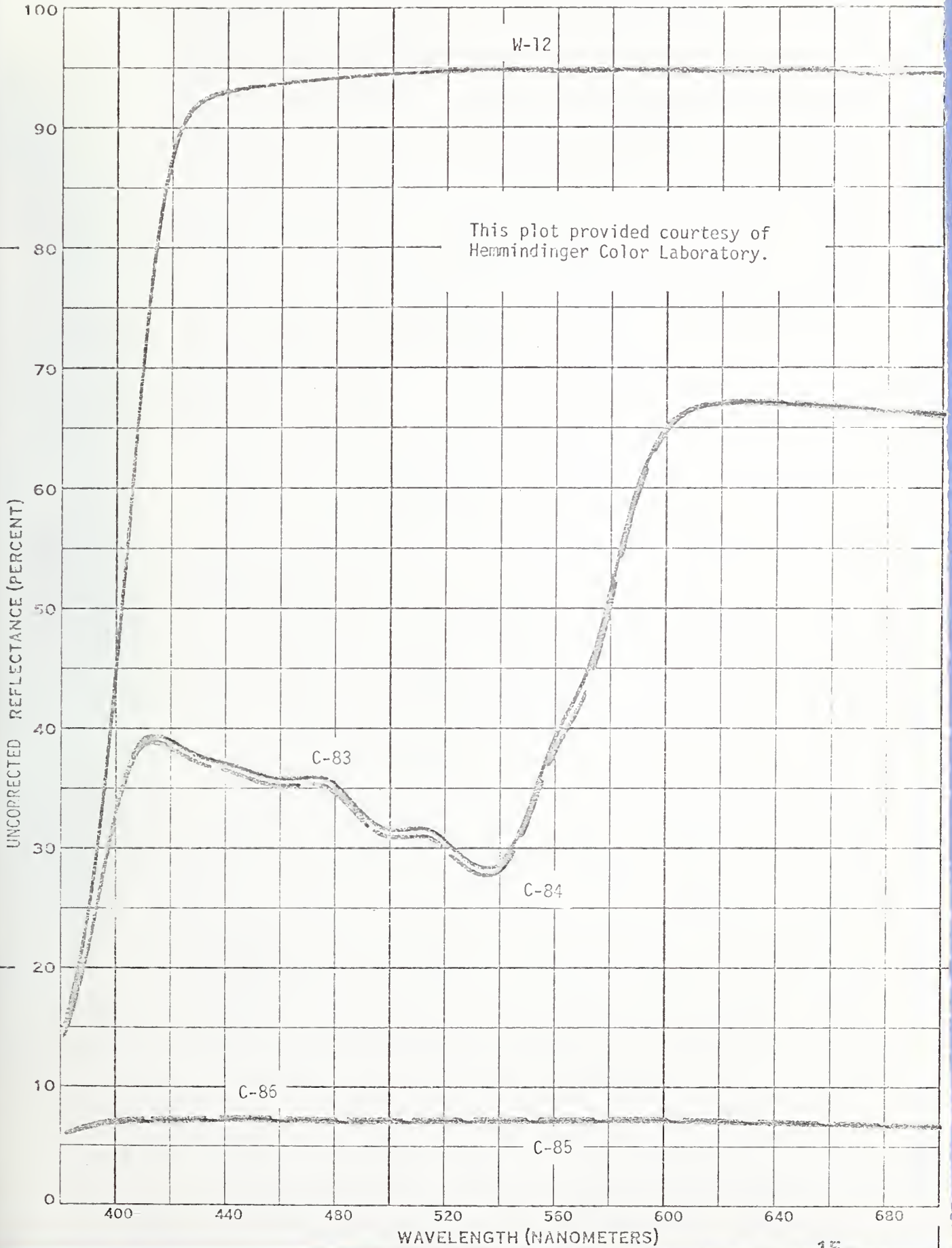
X, Y, Z, SPACE

	C83	C84	C85	C86	W12
X	50.028	49.457	6.373	6.655	89.861
Y	42.431	41.633	6.495	6.785	92.050
Z	41.172	40.465	7.608	7.992	105.975

L, a, b, SPACE

	C83	C84	C85	C86	W12
L	65.139	64.528	25.485	26.048	95.943
a	23.098	23.888	.037	.021	-.715
b	8.136	8.002	.146	.049	1.693

SPECTROPHOTOMETRIC CURVES OF  
COLOR AND COLOR DIFFERENCE NO. 23 SAMPLES



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7. SUPPLEMENTARY NOTES

8. 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.

9. 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; Color; Laboratory evaluation; Precision; Reference samples; Testing calibration.

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