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
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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 45/0 reflectance factor have been provided by NBS. For further explanation, see page 20. 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. Horlick on 301-921-2946.

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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 ΔE 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 ΔE 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.

ΔE - 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.

ΔE Calculation

ΔE is calculated in the Color and Color Difference Collaborative Reference Program by the FMC2* equations (X, Y, Z analysis) 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

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

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

ANALYSIS C70-1 TABLE 1
COLOR & COLOR DIFFERENCE

INSTRUMENT IDENTIFICATION

INST CODE	INSTRUMENT	COLOR SPACE	DATA CODE
C70AC	ACS SPECTRA SENSOR	X Y Z	9014
C70BL	B•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'YZ,4V	9016
C70CF	COLOR EYE SMALL SPHERE	XYZ,BaS04	9017
C70CG	COLOR EYE SMALL SPBERE	XX'YZ,Ba	9018
C70CB	COLOR EYE SMALL SPHERE	XYZ,3V	9011
C70CL	COLOR EYE LARGE SPBERE	XX'YZ,4V	9016
C70CM	COLOR EYE LARGE SPHERE	XX'YZ,Ba	9018
C70CN	COLOR EYE LARGE SPBERE	XYZ,BaS04	9017
C70DC	DIANO CHROMASCAN SPECTROPHOTOMETER	X Y Z	9014
C70DH	DIANO MATCH SCAN SPECTROPHOTOMETER	X Y Z	9014
C70DK	DIANO/LSCE AUTOMATE	XYZ,BaS04	9017
C70DL	DIANO/LSCE AUTOMATE	XYZ,3V,4F	9019
C70DM	DIANO/LSCE AUTOMATE	XX'YZ,4V	9016
C70DS	DIANO/SSCE AUTOMATE	XX'YZ,Ba	9018
C70DT	DIANO/SSCE AUTOMATE	XYZ,BaS04	9017
C70GA	GARDNER AUTO AC2/AC3	L a b	9013
C70GB	GARDNER AUTO AC2/AC3	X Y Z	9014
C70GC	GARDNER XL-20/XL-30 SERIES	X Y Z	9014
C70GD	GARDNER XL-20/XL-30 SERIES	L a b	9013
C70GE	GE/DIANO/HARDY SPECTROPHOTOMETER	X Y Z	9014
C70GK	GARDNER XL-70	X Y Z	9014
C70GL	GARDNER XL-70	L a b	9013
C70GM	GARDNER MULTIPURPOSE REPLECTOMETER	X Y Z	9014
C70GP	GARDNER XL-200 SERIES	L a b	9013
C70GX	GARDNER XL-10	L a b	9013
C70GY	GARDNER XL-10	X Y Z	9014
C70HA	HUNTER D25A (DA,D1A,D2A)	L a b	9013
C70HB	HUNTER D25A (DA,D1A,D2A)	X Y Z	9014
C70BF	HUNTER D25AA	L a b	9013
C70HG	HUNTER D25AA	X Y Z	9014
C70HM	HUNTER D25M (DM,D1M,D2M)	L a b	9013
C70HN	HUNTER D25M (DM,D1M,D2M)	X Y Z	9014
C70HP	HUNTER D25P (DP,D1P,D2P)	X Y Z	9014
C70HQ	HUNTER D25P (DP,D1P,D2P)	L a b	9013
C70HR	BUNTER D25A (DA,D1A,D2A)	Rd a b	9012
C70HT	HUNTER D54 SPECTROPHOTOMETER	X Y Z	9014
C70BU	HUNTER D54 SPECTROPHOTOMETER	L a b	9013
C70IB	IBM SPECTROPHOTOMETER	X Y Z	9014
C70KC	KCS-18	XX'YZ,4V	9016
C70KD	KCS-18	XX'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
C70MD	MACBETB MS2000 SPECTROPBOTOMETER	X Y Z	9014
C70ME	MACBETH MS2000 SPECTROPBOTOMETER	L a b	9013
C70MG	MACBETH MC1010	L a b	9013
C70MH	MACBETH MC1010	X Y Z	9014
C70MS	MARTIN SWEETS	X Y Z	9014
C70MT	MARTIN SWEETS	XX'YZ,Ba	9018
C70ND	NEOTEC 220 DU COLOR	R G B	9015
C70NE	NEOTEC 220 DU COLOR	X Y Z	9014
C70SA	SPECIAL INSTRUMENT - INCLUDED	X Y Z	9014
C70SH	SPECIAL INSTRUMENT - INCLUDED	Rd a b	9012
C70SC	SPECIAL INSTRUMENT - INCLUDED	L a b	9013
C70SL	SPECIAL INSTRUMENT - INCLUDED	R G B	9015
C70SP	SPECIAL INSTRUMENT - EXCLUDED	X Y Z	9014
C70SQ	SPECIAL INSTRUMENT - EXCLUDED	Rd a b	9012
C70SR	SPECIAL INSTRUMENT - EXCLUDED	L a b	9013
C70SS	SPECIAL INSTRUMENT - EXCLUDED	R G B	9015
C70ZD	ZEISS DMC25	X Y Z	9014
C70ZE	ZEISS ELREPHO	X Y Z	9014
C70ZP	ZEISS ELREPBO	R G B	9015
C70XX	GIVE INSTRUMENT MAKE•MODEL.	NOT SPECIFIED	9020

FORMAT OF COLORMETRIC (INPUT) DATA

DATA CODE	COLOR SCALE
9011	X,Y,Z 3 FUNCTION VITROLITE CORRECTION
9012	Rd,a,b
9013	L,a,b HUNTER
9014	X,Y,Z
9015	R,G,B
9016	X,X',Y,Z 4 FUNCTION VITROLITE CORRECTION
9017	X,Y,Z, BaSO4 CORRECTION
9018	X,X',Y,Z BaSO4 CORRECTION
9019	X,Y,Z 4 FUNCTION VITROLITE CORRECTION
9020	(NON-STD. INST. SCALE SPECIFIED WITH DATA)

X, Y, Z SPACE ANALYSIS, NORMAL DATA

COLOR * COLOR DIFFERENCE

LAB CODE	F	SAMPLE C95 MEAN X	MEAN Y	MEAN Z	SAMPLE C96 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C96 - C95 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C157	G	28.69	42.47	35.84	27.97	41.46	35.93	-.72	-1.01 *	.09 *	3.02	70GE	C157
C162	G	29.09	41.97	37.39	28.33	41.07	37.41	-.76 *	-.89 *	.02 *	3.24*	70DC	C162
C244	G	29.78	42.52	35.13	29.57	41.87	35.64	-.20	-.65	.50	2.43	70ZE	C244
C250	G	28.60	41.60	37.20	28.20	41.00	37.67	-.39	-.60	.47	2.58	70ZF	C250
C251	G	29.07	42.35	36.26	28.68	41.90	36.73	-.39	-.45	.47	2.71	70ZE	C251
C253	G	29.64	43.03	35.01	29.30	42.57	35.54	-.34	-.47	.52	2.50	70GC	C253
C278	G	31.65X	43.35	41.30X	31.05X	42.65	41.55X	-.60	-.70	.25	2.92	70NE	C278
C372	X	29.88	42.90	36.60	29.10	42.19	36.91	-.78 *	-.70	.31	4.38X	70ZE	C372
C407	G	30.18*	42.75	37.49	29.53	41.95	37.74	-.65	-.80	.24	3.14	70BL	C407
C412	G	29.61	43.00	36.55	28.95	42.17	36.77	-.66	-.82	.22	3.14	70GE	C412
C414	G	29.07	42.01	35.85	28.45	41.25	36.09	-.62	-.76	.24	3.04	70MD	C414
C416A	G	29.42	42.87	36.31	28.86	42.18	36.64	-.56	-.68	.34	2.97	70GE	C416A
C416B	X	30.82X	44.23X	35.72	30.59X	43.97X	35.44	-.23	-.26	-.28 X	.54X	70IB	C416B
C417A	G	29.06	42.32	36.42	28.51	41.65	36.79	-.55	-.67	.38	3.06	70GE	C417A
C418	G	28.22	41.13	35.57	27.82	40.67	36.07	-.39	-.46	.50	2.83	70CE	C418
C422	G	28.59	41.29	34.13	28.14	40.72	34.56	-.45	-.57	.43	2.80	70GC	C422
C424	G	29.34	42.53	36.76	28.98	42.08	37.29	-.36	-.45	.53	2.65	70CA	C424
C428	G	28.74	42.02	34.58	28.35	41.53	35.11	-.39	-.49	.53	2.81	70HB	C428
C437	G	29.89	42.83	39.18*	29.52	42.36	39.68X	-.36	-.47	.50	2.55	70CE	C437
C443	G	29.49	42.25	36.04	29.16	41.78	36.72	-.32	-.47	.68	2.79	70CN	C443
C444	G	29.04	42.27	36.88	28.64	41.75	37.32	-.40	-.52	.44	2.62	70GE	C444
C445	G	29.38	42.53	36.90	29.12	42.20	37.60	-.26	-.32	.70	2.67	70LS	C445
C446A	G	29.13	42.34	36.34	28.70	41.81	36.83	-.43	-.52	.49	2.83	70GE	C446A
C451	G	29.15	42.15	36.23	28.78	41.71	36.75	-.37	-.44	.51	2.71	70AC	C451
C453	G	30.40*	43.52*	35.92	30.02*	43.07*	36.42	-.38	-.45	.50	2.65	70HT	C453
C455	G	29.38	42.70	37.12	28.97	42.18	37.59	-.41	-.52	.47	2.71	70KS	C455
C459	G	28.78	41.83	35.78	28.34	41.27	36.22	-.44	-.57	.44	2.79	70GE	C459
C460	G	29.04	42.32	35.83	28.56	41.72	36.22	-.48	-.60	.39	2.81	70GE	C460
C462B	G	29.05	42.10	34.55	28.80	41.80	35.20	-.25	-.30	.65	2.58	70GE	C462B
C463	G	28.87	42.12	36.22	28.60	41.76	36.87	-.27	-.36	.65	2.60	70ZD	C463
C469	G	29.30	42.81	36.34	28.90	42.30	36.83	-.40	-.51	.49	2.70	70GE	C469
C470	G	28.89	42.03	37.08	28.59	41.64	37.68	-.30	-.39	.60	2.56	70DH	C470
C472	G	29.17	42.05	36.98	28.74	41.50	37.41	-.43	-.55	.43	2.67	70KT	C472
C473	G	29.05	42.28	36.98	28.69	41.84	37.51	-.36	-.43	.52	2.65	70GE	C473
C474	G	28.73	41.82	35.88	28.41	41.41	36.40	-.32	-.41	.52	2.53	70GE	C474
C476	G	28.83	42.18	36.16	28.30	41.50	36.54	-.53	-.68	.37	2.98	70SA	C476
C479A	X	28.35	41.50	35.60	27.75	40.90	34.95	-.60	-.60	-.65 X	1.76X	70GB	C479A
C479B	G	29.85	43.10	38.27*	29.27	42.53	38.33	-.58	-.57	.06 *	2.75	70SA	C479B
C480	G	29.29	42.47	35.00	28.81	41.91	35.48	-.47	-.56	.48	3.04	70HB	C480
C481	G	31.59X	42.95	47.01X	31.43X	42.45	47.68X	-.16	-.50	.67	2.16*	70CF	C481
C483	G	28.99	42.30	35.78	28.67	41.80	36.26	-.31	-.50	.47	2.26*	70ZF	C483
C495	G	29.42	42.54	37.44	29.05	42.08	37.98	-.37	-.46	.55	2.70	70KS	C495
C496A	G	29.12	42.52	36.31	28.66	41.93	36.73	-.46	-.59	.43	2.78	70GE	C496A
C499C	G	31.05X	44.71X	36.07	30.86X	44.17X	36.64	-.19	-.55	.57	2.18*	70BL	C499C
C503	G	28.76	41.91	36.45	28.25	41.28	36.80	-.51	-.63	.36	2.85	70GE	C503
C508	G	29.28	42.69	35.79	29.04	42.39	36.44	-.23	-.31	.64	2.45	70GE	C508
C511	G	29.02	42.15	36.44	28.58	41.59	36.88	-.45	-.56	.44	2.79	70DH	C511
C521A	G	29.27	42.92	36.20	28.95	42.49	36.78	-.33	-.43	.57	2.60	70CA	C521A
C521B	X	28.56	41.50	35.89	29.66	43.15*	38.08	1.10 X	1.64 X	2.19 X	3.48X	70SA	C521B
C522	G	28.77	41.80	35.00	28.55	41.50	35.80	-.23	-.30	.80 *	2.83	70SA	C522
C524	G	29.64	42.93	36.92	29.31	42.50	37.42	-.33	-.43	.51	2.47	70GE	C524
C528	G	28.74	41.62	36.13	28.44	41.26	36.67	-.30	-.37	.54	2.50	70MD	C528
C532	G	27.72*	40.43*	38.60*	27.42	40.00*	39.21*	-.30	-.43	.61	2.59	70GE	C532
C534	G	28.86	41.66	35.69	28.42	41.12	36.09	-.44	-.55	.40	2.70	70MD	C534
C540	G	29.65	42.81	36.69	29.07	42.10	36.99	-.58	-.71	.30	2.97	70GE	C540
C545	G	27.50*	40.28*	34.09	27.33*	40.04*	34.83	-.17	-.24	.74	2.53	70GC	C545
C547	G	27.99	41.47	35.24	27.50	40.84	35.61	-.49	-.63	.37	2.86	70HP	C547
C548	G	28.01	41.20	33.60*	27.39*	40.40	33.82*	-.62	-.80	.22	2.99	70SB	C548
C552	G	28.18	41.10	33.39*	28.14	41.02	34.33	-.04 *	-.08 *	.93 X	2.56	70HN	C552
C612	G	28.88	42.19	36.16	28.56	41.79	36.72	-.32	-.41	.56	2.59	70GE	C612
C613	G	29.14	42.74	36.71	28.71	42.22	37.17	-.43	-.53	.46	2.76	70MD	C613
C619	G	28.00	41.70	35.30	27.60	41.10	35.70	-.40	-.60	.40	2.48	70SA	C619
C627	G	29.67	42.26	36.52	29.01	41.47	36.68	-.66	-.79	.16	3.03	70SA	C627
C629	G	28.61	41.93	34.14	27.91	41.06	34.31	-.69	-.86	.16	3.18	70HN	C629
C630	G	29.37	42.43	36.77	28.65	41.56	36.91	-.72	-.87	.14	3.25*	70KS	C630

X, Y, Z SPACE ANALYSIS, NORMAL DATA

COLOR * COLOR DIFFERENCE

LAB CODE	F	SAMPLE C95 MEAN X	MEAN Y	MEAN Z	SAMPLE C96 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C96 - C95 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C631A	♂	29.38	42.30	36.81	28.65	41.39	36.90	-.73 *	-.91 *	.08 *	3.15	70AC	C631A
C631B	#	29.43	42.45	36.39	28.85	41.75	36.62	-.58	-.70	.24	2.85	70AC	C631B
C632	♂	29.37	42.33	36.52	28.88	41.72	36.92	-.49	-.61	.40	2.87	70AC	C632
C634	♂	28.00	40.80*	34.33	27.58	40.21*	34.70	-.42	-.59	.37	2.52	70CE	C634
C638	♂	28.60	41.60	34.70	28.30	41.20	35.30	-.30	-.40	.60	2.61	70GY	C638
C639	♂	28.38	41.17	36.94	28.03	40.71	37.44	-.35	-.45	.50	2.60	70DH	C639
C644	♂	29.05	42.00	35.95	28.55	41.39	36.32	-.50	-.61	.37	2.83	70MD	C644
C645	♂	29.53	42.47	36.67	28.88	41.68	36.90	-.65	-.78	.23	3.14	70AC	C645
C656	♂	29.37	42.27	35.92	28.91	41.73	36.34	-.46	-.54	.42	2.86	70SA	C656
C657	♂	28.51	42.63	34.00	27.98	41.96	34.30	-.53	-.68	.30	2.83	70AC	C657
C661	♂	27.31*	41.04	36.02	26.90*	40.47	36.46	-.41	-.58	.44	2.68	70GE	C661
C662	♂	28.13	42.09	33.72	27.69	41.52	34.11*	-.44	-.57	.39	2.68	70DH	C662
C664	♂	28.66	41.14	35.33	28.12	40.43	35.63	-.54	-.71	.30	2.84	70KC	C664
C671A	♂	28.53	41.45	35.37	28.11	40.93	35.78	-.42	-.52	.41	2.66	70DH	C671A
C671B	♂	28.21	41.00	36.27	27.90	40.54	36.86	-.31	-.46	.59	2.58	70DH	C671B
C671C	♂	28.68	41.54	34.24	28.29	41.02	34.68	-.39	-.52	.44	2.55	70GC	C671C
C671D	♂	28.97	42.04	34.78	28.49	41.50	35.16	-.48	-.55	.38	2.87	70HB	C671D
C672	♂	28.70	41.20	34.15	28.20	40.50	34.50	-.50	-.70	.35	2.73	70GC	C672
C675	♂	29.22	42.15	36.23	28.76	41.57	36.63	-.46	-.59	.40	2.76	70AC	C675
GRAND MEANS		28.96	42.11	35.97	28.53	41.56	36.36	-.43	-.56	.43	2.75		
SD OF MEANS		.58	.65	1.14	.57	.65	1.06	.15	.16	.16	.23		
INCLUDED LABS FOR THIS MEAN		76	78	77	76	78	76	79	79	78	79		

X, Y, Z SPACE ANALYSIS, NORMAL DATA
COLOR - COLOR DIFFERENCE

LAB CODE	F	SAMPLE C97 MEAN X	MEAN Y	MEAN Z	SAMPLE C98 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C98 - C97 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C157	X	9.28	5.63X	14.08	8.58	5.56X	13.66	-.70 X	-.07	-.42	13.25X	70GE	C157
C162	6	9.97*	7.30*	14.41	9.77*	7.24*	14.09	-.21	-.06	-.32	2.09	70DC	C162
C244	6	8.82	6.35	14.35	8.71	6.35	14.05	-.11	.00	-.30	1.60	70ZE	C244
C250	6	9.81*	7.10*	14.70	9.68*	7.00	14.41	-.13	-.10	-.30	.88	70ZF	C250
C251	6	9.16	6.40	14.05	8.75	6.20	13.46	-.41	-.20	-.59	2.68	70ZE	C251
C253	6	9.02	6.50	14.47	8.59	6.21	13.79	-.43	-.29	-.68	1.62	70GC	C253
C278	6	8.20*	6.50	12.40X	8.15	6.60	12.30*	-.05	.10	-.10 *	3.38	70NE	C278
C372	6	8.53	6.62	14.41	8.17	6.37	13.75	-.36	-.26	-.66	1.44	70ZE	C372
C407	6	9.31	6.86	14.65	8.88	6.58	13.94	-.43	-.27	-.70	1.70	70BL	C407
C412	6	9.32	6.83	14.68	8.90	6.56	13.97	-.42	-.27	-.71	1.55	70GE	C412
C414	6	8.88	6.45	13.91	8.50	6.22	13.26	-.38	-.23	-.65	1.59	70MD	C414
C416A	6	8.56	6.06	13.86	8.40	6.00	13.43	-.16	-.05	-.42	1.23	70GE	C416A
C416B	6	9.02	6.57	14.64	8.73	6.43	14.14	-.29	-.14	-.50	1.64	70IB	C416B
C417A	6	8.78	6.31	13.97	8.57	6.24	13.56	-.21	-.06	-.41	1.88	70GE	C417A
C418	6	9.52	6.78	14.40	9.25	6.66	13.97	-.27	-.12	-.43	1.98	70CE	C418
C422	6	8.53	6.11	13.59	8.39	6.12	13.22	-.13	.00	-.37	2.12	70GC	C422
C424	6	9.36	6.78	14.71	9.17	6.75	14.32	-.19	-.03	-.39	2.37	70CA	C424
C428	6	9.11	6.56	14.65	8.92	6.53	14.27	-.19	-.03	-.38	2.51	70HB	C428
C437	X	9.46	6.68	13.92	9.16	6.64	13.61	-.30	-.04	-.30	4.93X	70CE	C437
C443	6	8.95	6.46	14.29	8.87	6.55	14.02	-.08	.09	-.27	3.27	70CN	C443
C444	6	9.24	6.69	14.33	9.09	6.72	14.01	-.14	.04	-.32	3.13	70GE	C444
C445	6	9.64	7.10*	15.18*	9.42	7.08	14.76*	-.22	-.02	-.42	2.98	70LS	C445
C446A	6	9.04	6.55	14.13	9.00	6.69	13.94	-.04	.14	-.20	3.80	70GE	C446A
C451	6	9.10	6.69	14.09	8.95	6.69	13.69	-.14	.00	-.40	2.09	70AC	C451
C453	6	9.04	6.72	14.96	8.88	6.72	14.54	-.16	.00	-.43	2.44	70HT	C453
C455	6	9.11	6.65	14.10	9.06	6.78	13.91	-.05	.13	-.19	3.64	70KS	C455
C459	6	9.00	6.54	14.07	8.96	6.68	13.89	-.04	.14	-.19	3.72	70GE	C459
C460	6	8.89	6.51	14.27	8.82	6.61	13.99	-.07	.10	-.28	3.06	70GE	C460
C462B	6	8.80	6.40	14.40	8.70	6.40	14.00	-.10	.00	-.40	1.30	70GE	C462B
C463	6	8.95	6.43	14.09	8.90	6.53	13.85	-.05	.10	-.24	3.03	70ZD	C463
C469	6	8.66	6.05	14.01	8.33	5.88*	13.38	-.33	-.17	-.63	1.72	70GE	C469
C470	6	9.30	6.71	14.30	9.21	6.81	14.10	-.09	.10	-.20	3.78	70DH	C470
C472	6	9.24	6.70	14.22	9.21	6.83	14.03	-.03	.13	-.18	3.31	70KT	C472
C473	6	8.74	6.33	13.76	8.70	6.47	13.56	-.04	.15	-.20	4.00*	70GE	C473
C474	6	8.88	6.44	14.19	8.88	6.61	14.04	.00	.17	-.15	3.68	70GE	C474
C476	6	8.85	6.39	14.31	8.55	6.15	13.74	-.31	-.24	-.57	1.46	70SA	C476
C479A	X	7.95X	6.25	12.80*	7.75*	6.45	12.35*	-.20	.20	-.45	8.47X	70GB	C479A
C479B	6	9.87*	7.37X	14.73	9.52*	7.19*	14.69	-.35	-.18	-.04 *	4.24*	70SA	C479B
C480	6	9.12	6.61	14.73	9.02	6.67	14.40	-.10	.06	-.33	2.72	70HB	C480
C481	6	11.29X	7.61X	18.38X	11.06X	7.56X	18.00X	-.23	-.05	-.38	2.49	70CF	C481
C483	6	8.96	6.60	14.29	8.92	6.60	14.05	-.04	.00	-.24	.73	70ZF	C483
C495	6	9.11	6.68	13.96	8.77	6.49	13.36	-.35	-.19	-.60	1.60	70KS	C495
C496A	6	8.96	6.45	14.17	8.75	6.39	13.81	-.21	-.06	-.36	2.26	70GE	C496A
C499C	6	9.54	7.10*	16.24X	9.37	7.07	15.88X	-.17	-.03	-.37	1.98	70BL	C499C
C503	6	9.19	6.64	14.37	9.01	6.62	13.98	-.18	-.01	-.39	2.49	70GE	C503
C508	6	9.15	6.56	14.75	8.92	6.48	14.31	-.23	-.08	-.44	1.94	70GE	C508
C511	6	9.09	6.59	14.17	8.85	6.51	13.76	-.24	-.07	-.41	2.29	70DH	C511
C521A	6	9.10	6.60	14.49	8.85	6.48	14.06	-.25	-.11	-.43	1.66	70CA	C521A
C521B	6	9.17	6.62	14.41	9.38	6.88	14.58	.22 X	.26 *	.16 X	2.49	70SA	C521B
C522	6	8.62	6.77	13.70	8.30	6.60	13.15	-.32	-.17	-.55	2.04	70SA	C522
C524	6	9.40	6.94	14.86	9.21	6.91	14.39	-.20	-.03	-.48	2.21	70GE	C524
C528	6	9.17	6.69	14.23	9.03	6.72	13.88	-.14	.03	-.35	2.68	70MD	C528
C532	6	9.40	6.66	13.21*	9.26	6.71	12.97	-.14	.05	-.25	3.51	70GE	C532
C534	6	8.88	6.09	13.83	8.73	6.12	13.49	-.15	.03	-.35	3.14	70MD	C534
C540	6	9.58	7.12*	14.84	9.31	7.01	14.42	-.27	-.10	-.41	2.48	70GE	C540
C545	6	8.46	6.11	13.58	8.05*	5.84*	12.93	-.41	-.27	-.65	1.77	70GC	C545
C547	6	8.81	6.38	13.75	8.60	6.34	13.33	-.21	-.05	-.41	2.33	70HP	C547
C548	6	8.21*	5.85*	13.26*	8.14	5.95	13.02	-.07	.10	-.24	3.49	70SB	C548
C552	6	8.78	6.32	14.41	8.75	6.46	14.19	-.03	.13	-.22	3.42	70HN	C552
C612	6	8.88	6.44	14.07	8.66	6.37	13.64	-.22	-.06	-.43	2.15	70GE	C612
C613	6	8.74	6.54	13.28	8.44	6.39	12.77	-.30	-.15	-.51	1.88	70MD	C613
C619	6	8.70	6.20	13.60	8.50	6.10	13.20	-.20	-.10	-.40	1.02	70SA	C619
C627	6	9.28	6.74	14.42	9.04	6.66	14.02	-.23	-.08	-.40	2.18	70SA	C627
C629	6	8.91	6.39	14.46	8.74	6.38	14.07	-.18	-.01	-.39	2.41	70HN	C629
C630	6	9.03	6.56	14.33	8.71	6.39	13.71	-.32	-.17	-.62	1.46	70KS	C630

X, Y, Z SPACE ANALYSIS, NORMAL DATA

COLOR • COLOR DIFFERENCE

LAB CODE	F	SAMPLE C97 MEAN X	MEAN Y	MEAN Z	SAMPLE C98 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C98 - C97 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C631A	6	9.11	6.62	13.95	8.76	6.42	13.32	-.35	-.20	-.63	1.45	70AC	C631A
C631B	#	9.13	6.63	14.08	8.85	6.48	13.54	-.28	-.15	-.54	1.38	70AC	C631B
C632	6	9.00	6.54	14.04	8.80	6.46	13.55	-.21	-.08	-.49	1.36	70AC	C632
C634	6	9.22	6.80	14.22	8.85	6.57	13.56	-.37	-.24	-.66	1.42	70CE	C634
C638	6	8.50	6.10	13.60	8.20	5.90*	13.00	-.30	-.20	-.60	1.22	70GY	C638
C639	6	9.19	6.62	13.88	8.88	6.46	13.36	-.30	-.16	-.52	1.57	70DH	C639
C644	6	8.95	6.53	13.94	8.72	6.44	13.43	-.24	-.09	-.50	1.59	70MD	C644
C645	6	9.01	6.56	14.03	8.82	6.51	13.57	-.19	-.05	-.46	1.74	70AC	C645
C656	6	9.03	6.59	14.35	8.65	6.29	13.67	-.38	-.30	-.68	1.78	70SA	C656
C657	6	8.83	6.67	12.88*	8.46	6.45	12.34*	-.37	-.22	-.53	1.92	70AC	C657
C661	6	9.13	6.76	12.28X	8.73	6.51	11.72X	-.39	-.25	-.56	1.62	70GE	C661
C662	6	8.71	6.53	13.02*	8.41	6.34	12.45*	-.30	-.19	-.57	1.25	70DH	C662
C664	6	8.52	6.18	13.30	8.29	6.07	12.78	-.23	-.10	-.53	1.36	70KC	C664
C671A	6	9.16	6.68	14.25	8.95	6.63	13.80	-.21	-.06	-.45	2.16	70DH	C671A
C671B	6	9.20	6.71	13.89	8.83	6.50	13.35	-.36	-.21	-.54	1.83	70DH	C671B
C671C	6	8.95	6.41	14.19	8.64	6.24	13.67	-.31	-.17	-.52	1.55	70GC	C671C
C671D	6	8.93	6.55	14.56	8.52	6.24	13.88	-.41	-.31	-.68	1.67	70HB	C671D
C672	6	8.80	6.30	13.95	8.40	6.10	13.40	-.40	-.20	-.55	2.87	70GC	C672
C675	6	9.11	6.60	14.04	8.79	6.46	13.55	-.33	-.14	-.49	2.59	70AC	C675
GRAND MEANS		9.02	6.56	14.16	8.81	6.50	13.72	-.22	-.07	-.43	2.23		
SD OF MEANS		.33	.26	.45	.35	.29	.52	.12	.13	.16	.81		
INCLUDED LABS FOR THIS MEAN		79	78	76	79	79	77	79	80	79	80		

L, a, b SPACE ANALYSIS, NORMAL DATA

COLOR * COLOR DIFFERENCE

LAB CODE	F	SAMPLE C95 MEAN L	MEAN A	MEAN B	SAMPLE C96 MEAN L	MEAN A	MEAN B	DIFFERENCE C96 - C95 ΔL	ΔA	ΔB	ΔE	INST CODE	LAB
C121	X	64.20	-35.90X	12.70	63.80	-35.00	11.80	-.40	.90 X	-.90	1.33X	70HM	C121
C122	G	64.50	-33.50	13.30	64.20	-33.50	12.30	-.30	.00	-1.00	1.04	70HM	C122
C148	G	64.95	-34.40	14.20	64.50	-34.40	13.25	-.45	-.00	-.95	1.05	70HA	C148
C150	G	64.94	-33.99	13.83	64.39	-34.03	12.90	-.55	-.04	-.93	1.09	70HA	C150
C152	G	65.05	-33.00	13.80	64.50	-33.00	12.80	-.55	-.00	-1.00	1.14	70HA	C152
C166	G	64.55	-33.65	13.30	64.25	-33.65	12.40	-.30	-.00	-.90	.95	70HA	C166
C183	#	64.85	35.05X	13.80	64.55	35.20X	12.90	-.30	.15 *	-.90	.96	70HA	C183
C213	G	64.40	-33.20	13.60	64.10	-33.20	12.70	-.30	-.00	-.90	.95	70HM	C213
C223	G	65.95	-33.60	13.40	65.55	-33.60	12.45	-.40	-.00	-.95	1.03	70HA	C223
C230	G	65.02	-34.11	13.79	64.49	-34.04	12.85	-.53	.07	-.95	1.09	70HA	C230
C241	X	64.75	-33.50	12.90	64.45	-33.50	12.40	-.30	-.00	-.50 X	.58X	70HA	C241
C255	G	65.40	-33.90	13.75	64.95	-33.85	12.80	-.45	.05	-.95	1.05	70HA	C255
C256	G	64.44	-34.04	13.73	64.05	-34.02	12.80	-.39	.02	-.93	1.01	70HM	C256
C259	G	64.85	-33.75	14.05	64.35	-33.70	13.10	-.50	.05	-.95	1.07	70HA	C259
C262	G	65.59	-33.55	12.81	65.23	-33.50	11.86	-.36	.05	-.95	1.02	70HR	C262
C285	G	64.95	-34.35	13.40	64.75	-34.35	12.50	-.20	.00	-.90	.92	70HA	C285
C288	G	64.95	-34.25	13.50	64.80	-34.15	12.55	-.15 *	.10	-.95	.97	70HA	C288
C291	G	64.95	-33.75	13.90	64.65	-33.70	13.00	-.30	.05	-.90	.95	70HA	C291
C317	G	64.50	-34.30	13.70	64.00	-34.30	12.80	-.50	.00	-.90	1.03	70SC	C317
C320	G	65.74	-33.34	13.14	65.34	-33.34	12.10	-.40	.00	-1.04 *	1.11	70HA	C320
C325	G	65.42	-34.35	13.04	65.08	-34.31	12.10	-.34	.04	-.93	1.00	70HR	C325
C340	G	65.52	-32.86	12.13	64.96	-32.82	11.17	-.56	.04	-.96	1.11	70HA	C340
C352	G	65.25	-34.15	13.80	64.65	-34.15	12.85	-.60	.00	-.95	1.12	70HA	C352
C356	G	64.60	-33.90	13.30	64.10	-33.90	12.30	-.50	-.00	-1.00	1.12	70HM	C356
C380	G	65.05	-33.60	13.90	64.60	-33.50	13.00	-.45	.10	-.90	1.01	70HA	C380
C382	G	64.85	-34.30	13.40	64.40	-34.25	12.40	-.45	.05	-1.00	1.10	70HA	C382
C402	G	65.02	-33.65	13.77	64.48	-33.58	12.79	-.54	.07	-.99	1.13	70HA	C402
C427	G	64.90	-33.30	13.50	64.45	-33.25	12.50	-.45	.05	-1.00	1.10	70HA	C427
C440	G	65.15	-34.04	13.81	64.89	-33.99	12.90	-.26	.05	-.91	.94	70HA	C440
C442	G	64.30	-33.30	12.60	64.00	-33.30	11.70	-.30	.00	-.90	.95	70HM	C442
C454	G	66.05*	-32.90	13.60	65.65	-32.92	12.67	-.40	-.02	-.93	1.01	70HA	C454
C456	G	65.08	-33.88	13.80	64.70	-33.88	12.88	-.38	.00	-.92	.99	70HA	C456
C458	G	64.51	-34.04	12.67	64.19	-34.01	11.74	-.33	.03	-.94	1.00	70HM	C458
C475	G	65.44	-33.81	12.35	65.07	-33.75	11.42	-.37	.06	-.93	1.00	70HA	C475
C477	G	65.98	-34.34	12.61	65.49	-34.24	11.65	-.49	.09	-.95	1.08	70HA	C477
C494	G	65.25	-34.50	11.60*	64.95	-34.45	10.60*	-.30	.05	-1.00	1.05	70HA	C494
C496B	G	63.40X	-32.40*	12.50	63.20*	-32.30*	11.50	-.20	.10	-1.00	1.02	70GP	C496B
C499A	G	64.75	-34.20	13.85	64.35	-34.20	12.90	-.40	.00	-.95	1.03	70HA	C499A
C499B	G	64.95	-33.75	13.90	64.35	-33.75	12.90	-.60	.00	-1.00	1.17*	70HA	C499B
C506	G	64.90	-33.50	14.10	64.65	-33.50	13.20	-.25	.00	-.90	.93	70HA	C506
C517	G	65.00	-32.30*	11.70*	64.60	-32.20*	10.80*	-.40	.10	-.90	.99	70SC	C517
C538	G	65.70	-26.80X	8.70X	65.20	-26.70X	7.60X	-.50	.10	-1.10 X	1.21*	70GX	C538
C541	G	64.90	-34.15	13.35	64.50	-34.00	12.40	-.40	.15 *	-.95	1.04	70GP	C541
C542	G	64.11	-33.88	13.07	63.88	-33.65	12.10	-.23	.23 X	-.97	1.02	70GD	C542
C543	G	64.73	-33.93	13.69	64.52	-33.87	12.78	-.22	.05	-.91	.94	70HA	C543
C574	G	65.40	-34.25	12.00	65.05	-34.15	11.10	-.35	.10	-.90	.97	70HQ	C574
C576	#	42.35X	33.22X	14.23	42.13X	33.21X	13.34	-.21	-.01	-.89	.91	70HM	C576
C585	G	64.87	-33.39	13.37	64.41	-33.37	12.44	-.47	.02	-.94	1.04	70HA	C585
C600	G	65.20	-33.70	13.40	64.70	-33.70	12.45	-.50	.00	-.95	1.07	70GD	C600
C619	G	64.60	-35.50*	12.70	64.20	-35.40*	11.80	-.40	.10	-.90	.99	70HQ	C619
C620	G	65.55	-32.65	12.29	65.30	-32.69	11.40	-.26	-.04	-.89	.93	70HA	C620
C628	X	71.67X	-41.41X	14.59*	71.10X	-41.56X	13.79	-.57	-.15 X	-1.20 X	1.34X	70ME	C628
C633	G	64.61	-35.25*	14.37	64.31	-35.22*	13.42	-.49	.04	-.95	1.07	70HA	C633
C640	G	65.82	-33.80	11.87	65.50	-33.74	10.96	-.32	.06	-.91	.97	70ME	C640
C646	X	62.53X	-28.31X	6.34X	62.05X	-28.53X	5.75X	-.48	-.22 X	-.58 X	.79X	70CG	C646
C648	G	66.37*	-32.48	13.97	65.93*	-32.44	13.04	-.43	.04	-.94	1.03	70SC	C648
C655	G	64.84	-33.38	11.91	64.32	-33.30	10.96	-.52	.08	-.95	1.08	70HU	C655
C674	G	65.05	-33.85	13.50	64.65	-33.85	12.60	-.40	.00	-.90	.98	70HA	C674
C677	G	65.31	-32.27*	12.38	64.83	-32.29*	11.43	-.48	-.02	-.95	1.06	70SC	C677
C690	G	64.20	-33.30	14.05	63.75	-33.40	13.20	-.45	-.10 *	-.85 *	.97	70HM	C690
GRAND MEANS		65.06	-33.73	13.27	64.63	-33.69	12.32	-.40	.03	-.94	1.03		
SD OF MEANS		.49	.65	.71	.52	.64	.71	.11	.05	.04	.07		
INCLUDED LABS FOR THIS MEAN		53	53	53	54	53	53	54	53	53	54		

L, a, b SPACE ANALYSIS, NORMAL DATA
COLOR • COLOR DIFFERENCE

LAB		SAMPLE C97			SAMPLE C98			DIFFERENCE C98 - C97				INST	
CODE	F	MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	ΔA	ΔB	ΔE	CODE	LAB
C121	6	25.00	14.40X	-29.20X	25.20	13.30X	-28.20X	.20	-1.10	1.00	1.50	70HM	C121
C122	6	25.40	18.30	-15.60	25.40	17.20	-14.80	.00	-1.10	.80	1.36	70HM	C122
C148	6	25.70	18.05	-15.80	25.40	17.15	-15.15	-.30	-.90	.65	1.15	70HA	C148
C150	6	25.88	17.87	-15.54	25.57	16.82	-14.89	-.31	-1.04	.66	1.27	70HA	C150
C152	6	25.80	17.90	-16.10	25.30	17.10	-15.40	-.50	-.80	.70	1.17	70HA	C152
C166	6	25.50	17.85	-15.40	25.50	16.70	-14.70	.00	-1.15	.70	1.35	70HA	C166
C183	#	25.35	18.65	-16.00	25.40	17.45	-15.25	.05	-1.20	.75	1.42	70HA	C183
C213	6	25.20	18.00	-15.80	24.90	17.00	-15.20	-.30	-1.00	.60	1.20	70HM	C213
C223	6	25.60	17.00	-15.20	25.45	15.95	-14.50	-.15	-1.05	.70	1.27	70HA	C223
C230	6	25.75	18.44	-15.60	25.07	17.61	-15.22	-.68	-.83	.38	1.14	70HA	C230
C241	X	25.70	23.55X	-15.40	25.25	16.70	-14.70	-.45	-6.85 X	.70	6.90X	70HA	C241
C255	6	25.70	18.70	-15.70	25.20	17.95	-15.20	-.50	-.75	.50	1.03	70HA	C255
C256	6	25.37	18.24	-15.91	24.74	17.60	-15.51	-.62	-.64	.40	.97	70HM	C256
C259	6	25.60	18.40	-16.00	25.20	17.65	-15.50	-.40	-.75	.50	.99	70HA	C259
C262	6	25.30	17.35	-15.41	25.04	16.43	-14.84	-.26	-.92	.57	1.12	70HR	C262
C285	6	25.45	18.15	-15.00	25.10	17.35	-14.40	-.35	-.80	.60	1.06	70HA	C285
C288	6	25.45	18.45	-15.80	25.40	17.40	-15.00	-.05	-1.05	.80	1.32	70HA	C288
C291	6	25.20	18.00	-16.40	25.40	16.80	-15.40	.20	-1.20	1.00	1.57	70HA	C291
C317	6	25.10	19.10	-15.80	25.20	17.90	-14.90	.10	-1.20	.90	1.50	70SC	C317
C320	6	25.21	17.28	-14.74	25.05	16.00	-14.00	-.16	-1.28	.74	1.49	70HA	C320
C325	6	25.00	18.73	-15.66	25.00	17.34	-14.79	.00	-1.39	.87	1.64	70HR	C325
C340	6	25.47	16.71	-13.87*	25.02	15.94	-13.45*	-.45	-.78	.42	.99	70HA	C340
C352	6	25.60	18.50	-16.00	25.30	17.80	-15.30	-.30	-.70	.70	1.03	70HA	C352
C356	6	25.30	18.50	-15.80	24.90	18.00	-15.20	-.40	-.50	.60	.88	70HM	C356
C380	6	25.50	18.40	-16.00	25.10	17.60	-15.30	-.40	-.80	.70	1.14	70HA	C380
C382	6	25.60	19.10	-15.40	25.10	18.40	-14.70	-.50	-.70	.70	1.11	70HA	C382
C402	6	25.65	17.68	-15.80	25.17	16.85	-15.17	-.48	-.83	.63	1.14	70HA	C402
C427	6	25.00	18.40	-16.25	25.05	17.30	-15.35	.05	-1.10	.90	1.42	70HA	C427
C440	6	25.78	18.58	-15.52	25.81	17.22	-14.65	.03	-1.37	.88	1.62	70HA	C440
C442	6	25.40	17.40	-15.00	25.50	16.10	-14.10	.10	-1.30	.90	1.58	70HM	C442
C454	6	25.11	17.07	-15.82	25.30	15.62	-14.79	.19	-1.45	1.03	1.79*	70HA	C454
C456	6	25.48	18.14	-15.85	25.60	16.76	-14.85	.12	-1.39	1.00	1.71	70HA	C456
C458	6	25.39	18.27	-14.86	25.61	16.94	-13.90	.22	-1.33	.96	1.65	70HM	C458
C475	6	25.42	17.26	-14.75	25.06	16.30	-14.18	-.35	-.96	.57	1.17	70HA	C475
C477	6	25.42	17.87	-14.04*	25.25	16.90	-13.42*	-.17	-.97	.62	1.16	70HA	C477
C494	6	26.60*	15.80*	-13.05X	26.00*	15.40	-12.90X	-.60	-.40 *	.15 *	.74*	70HA	C494
C496B	6	24.50*	16.50	-14.60	24.60	15.60	-13.80	.10	-.90	.80	1.21	70GP	C496B
C499A	6	25.50	18.15	-16.10	25.50	17.00	-15.30	.00	-1.15	.80	1.40	70HA	C499A
C499B	6	25.60	17.90	-15.80	25.30	17.10	-15.20	-.30	-.80	.60	1.04	70HA	C499B
C506	6	25.40	18.25	-16.20	25.70	17.00	-15.20	.30	-1.25	1.00	1.63	70HA	C506
C517	6	25.10	18.10	-15.20	25.10	17.00	-14.50	.00	-1.10	.70	1.30	70SC	C517
C538	6	25.90	19.20	-14.30	25.45	18.40	-13.90	-.45	-.80	.40	1.00	70GX	C538
C541	6	24.40*	18.50	-15.70	24.50*	17.25	-14.90	.10	-1.25	.80	1.49	70GP	C541
C542	6	24.29*	19.22	-15.77	24.25*	18.25	-15.04	-.03	-.97	.73	1.22	70GD	C542
C543	6	25.67	17.79	-16.20	25.70	16.61	-15.22	.03	-1.18	.98	1.54	70HA	C543
C574	6	25.40	17.60	-14.80	25.30	16.55	-14.10	-.10	-1.05	.70	1.27	70HQ	C574
C576	#	8.06X	22.35X	14.38X	8.00X	21.23X	13.61X	-.06	-1.12	-.77 X	1.36	70HM	C576
C585	6	25.58	17.54	-16.06	24.97	16.85	-15.64	-.61	-.69	.43	1.01	70HA	C585
C600	6	25.90	17.10	-14.40	25.60	16.20	-13.80	-.30	-.90	.60	1.12	70GD	C600
C619	6	25.00	18.70	-14.70	24.55	17.70	-14.20	-.45	-1.00	.50	1.21	70HQ	C619
C620	6	25.28	16.38*	-14.63	25.11	15.20*	-13.98	-.17	-1.18	.65	1.35	70HA	C620
C628	6	30.72X	24.90X	-18.23X	30.34X	23.97X	-17.47X	-.38	-.92	.76	1.26	70ME	C628
C633	6	24.40*	17.86	-15.48	24.06X	16.98	-14.71	-.34	-.88	.77	1.22	70HA	C633
C640	6	25.89	18.71	-15.39	25.71	17.86	-14.61	-.19	-.85	.78	1.17	70ME	C640
C646	6	29.12X	18.76	-10.19X	28.54X	18.77*	-10.04X	-.58	.01 X	.15 *	.60*	70CG	C646
C648	6	25.13	19.66*	-15.21	24.73	19.04*	-14.53	-.40	-.62	.69	1.00	70SC	C648
C655	6	25.66	18.32	-14.39	25.26	17.60	-13.71	-.41	-.72	.68	1.07	70HU	C655
C674	6	25.75	18.45	-15.65	25.05	17.55	-15.25	-.70	-.90	.40	1.21	70HA	C674
C677	6	26.50*	16.34*	-14.73	25.60	15.66	-14.54	-.91 *	-.68	.19 *	1.14	70SC	C677
C690	6	24.90	18.40	-16.40	25.10	17.10	-15.45	.20	-1.30	.95	1.62	70HM	C690
GRAND MEANS		25.41	18.02	-15.44	25.22	17.06	-14.74	-.22	-.97	.68	1.25		
SD OF MEANS		.44	.78	.62	.34	.83	.58	.28	.24	.21	.25		
INCLUDED LABS FOR THIS MEAN		55	55	53	54	55	53	57	56	57	57		

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 ΔX, ΔY, and ΔZ.

WHITE SAMPLE ANALYSIS
X, Y, Z LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C157	1.0086	.9960	1.0064	70GE	.86	-.40	.64
C162	1.0118	1.0103	1.0104	70DC	1.18	1.03	1.04
C244	.9942	.9938	.9956	70ZE	-.58	-.62	-.44
C250	.9996	.9982	.9992	70ZF	-.04	-.18	-.08
C251	1.0040	1.0021	1.0015	70ZE	.40	.21	.15
C253	1.0163	1.0148	1.0118	70GC	1.63	1.48	1.18
C278	1.0261	1.0296	1.0229	70NE	2.61	2.96	2.29
C372	1.0053	.9998	1.0041	70ZE	.53	-.02	.41
C407	1.0106	1.0096	1.0133	70BL	1.06	.96	1.33
C412	1.0113	1.0120	1.0112	70GE	1.13	1.20	1.12
C414	.9825	.9844	.9769	70MD	-1.75	-1.56	-2.31
C416A	1.0185	1.0194	1.0156	70GE	1.85	1.94	1.56
C416B	1.0531	1.0539	1.0209	70IB	5.31	5.39	2.09
C417A	1.0097	1.0104	1.0134	70GE	.97	1.04	1.34
C418	.9825	.9799	.9948	70CE	-1.75	-2.01	-.52
C422	.9909	.9897	.9836	70GC	-.91	-1.03	-1.64
C424	1.0064	1.0067	1.0069	70CA	.64	.67	.69
C428	1.0067	1.0049	1.0078	70HB	.67	.49	.78
C437	1.0135	1.0124	1.0302	70CE	1.35	1.24	3.02
C443	1.0113	1.0001	1.0066	70CN	1.13	.01	.66
C444	1.0096	1.0105	1.0121	70GE	.96	1.05	1.21
C445	1.0152	1.0147	1.0194	70LS	1.52	1.47	1.94
C446A	.9983	.9982	.9985	70GE	-.17	-.18	-.15
C451	1.0054	1.0069	.9971	70AC	.54	.69	-.29
C453	1.0069	1.0080	1.0000	70BT	.69	.80	.00
C455	1.0085	1.0111	1.0103	70KS	.85	1.11	1.03
C459	.9958	.9967	.9909	70GE	-.42	-.33	-.91
C460	1.0052	1.0065	1.0029	70GE	.52	.65	.29
C462B	1.0013	1.0015	1.0053	70GE	.13	.15	.53
C463	1.0024	1.0017	1.0009	70ZD	.24	.17	.09
C469	.9553	.9566	.9091	70GE	-4.47	-4.34	-9.09
C470	1.0147	1.0156	1.0194	70DH	1.47	1.56	1.94
C472	.9999	.9998	.9973	70KT	-.01	-.02	-.27
C473	1.0122	1.0129	1.0141	70GE	1.22	1.29	1.41
C474	1.0002	1.0011	1.0005	70GE	.02	.11	.05
C476	1.0102	1.0099	1.0081	70SA	1.02	.99	.81
C479A	.9911	.9910	.9873	70GB	-.89	-.90	-1.27
C479B	1.0184	1.0185	1.0242	70SA	1.84	1.85	2.42
C480	1.0057	1.0037	1.0085	70HB	.57	.37	.85
C481	1.0390	1.0169	1.2120	70CF	3.90	1.69	21.20
C483	.9921	.9927	.9925	70ZF	-.79	-.73	-.75
C495	1.0089	1.0103	1.0042	70KS	.89	1.03	.42
C496A	1.0163	1.0176	1.0139	70GE	1.63	1.76	1.39
C499C	1.0298	1.0310	.1031	70BL	2.98	3.10	-89.69
C503	1.0158	1.0162	1.0205	70GE	1.58	1.62	2.05
C508	1.0175	1.0173	1.0172	70GE	1.75	1.73	1.72
C511	.9995	1.0002	.9965	70DH	-.05	.02	-.35
C521A	1.0104	1.0123	1.0145	70CA	1.04	1.23	1.45
C521B	1.0253	1.0242	1.0241	70SA	2.53	2.42	2.41
C522	.9965	.9979	.9889	70SA	-.35	-.21	-1.11
C524	1.0146	1.0154	1.0121	70GE	1.46	1.54	1.21
C528	.9870	.9883	.9796	70ND	-1.30	-1.17	-2.04
C532	1.0106	1.0115	1.0160	70GE	1.06	1.15	1.60
C534	.9875	.9889	.9775	70ND	-1.25	-1.11	-2.25
C540	1.0072	1.0076	1.0044	70GE	.72	.76	.44
C545	.9658	.9671	.9670	70GC	-3.42	-3.29	-3.30
C547	1.0165	.9926	1.0039	70HP	1.65	-.74	.39
C548	.9745	.9756	.9693	70SB	-2.55	-2.44	-3.07
C552	.9961	.9949	.9994	70HN	-.39	-.51	-.06
C612	1.0138	1.0155	1.0078	70GE	1.38	1.55	.78
C613	1.0201	1.0224	1.0215	70ND	2.01	2.24	2.15
C619	1.0092	1.0087	1.0067	70SA	.92	.87	.67
C627	.9909	.9914	.9870	70SA	-.91	-.86	-1.30
C629	.9965	.9955	.9974	70HN	-.35	-.45	-.26
C630	.9993	.9988	1.0018	70KS	-.07	-.12	.18
C631A	1.0109	1.0113	1.0029	70AC	1.09	1.13	.29
C631B	1.0093	1.0146	.9904	70AC	.93	1.46	-.96
C632	1.0059	1.0060	.9986	70AC	.59	.60	-.14
C634	.9828	.9799	.9758	70CE	-1.72	-2.01	-2.42
C638	.9967	.9944	.9925	70GY	-.33	-.56	-.75
C639	.9938	.9934	.9937	70DH	-.62	-.66	-.63
C644	.9922	.9940	.9823	70MD	-.78	-.60	-1.77
C645	.9559	.9522	.9107	70AC	-4.41	-4.78	-8.93
C656	.9904	.9910	.9828	70SA	-.96	-.90	-1.72
C657	.9746	1.0066	.9186	70AC	-2.54	.66	-8.14
C661	.9748	1.0043	.9304	70GE	-2.52	.43	-6.96
C662	.9659	.9907	.9160	70DH	-3.41	-.93	-8.40
C664	.9615	.9554	.9574	70KC	-3.85	-4.46	-4.26
C671A	.9882	.9890	.9817	70DH	-1.18	-1.10	-1.83
C671B	.9909	.9912	.9863	70DH	-.91	-.88	-1.37
C671C	.9920	.9918	.9855	70GC	-.80	-.82	-1.45
C671D	1.0033	1.0021	1.0070	70HB	.33	.21	.70
C672	.9928	.9938	.9877	70GC	-.72	-.62	-1.23
C675	1.0059	1.0063	.9992	70AC	.59	.63	-.08

WHITE SAMPLE ANALYSIS
L, a, b LABORATORIES

LAB CODE	RATIO--(LAB/COMBINED) X	Y	Z	INST CODE	PERCENT FROM COMBINED X	Y	Z
C121	.9844	.9807	.9917	70HM	-1.56	-1.93	-.83
C122	.9873	.9859	.9954	70HM	-1.27	-1.41	-.46
C148	.9883	.9869	.9935	70HA	-1.17	-1.31	-.65
C150	.9784	.9783	.9874	70HA	-2.16	-2.17	-1.26
C152	1.0134	1.0119	1.0212	70HA	1.34	1.19	2.12
C166	.9893	.9880	.9998	70HA	-1.07	-1.20	-.02
C183	.9876	.9859	.9939	70HA	-1.24	-1.41	-.61
C213	.9740	.9715	.9808	70HM	-2.60	-2.85	-1.92
C223	.9999	.9973	1.0086	70HA	-.01	-.27	.86
C230	.9883	.9865	.9977	70HA	-1.17	-1.35	-.23
C241	.9901	.9890	.9978	70HA	-.99	-1.10	-.22
C255	.9340	.9328	.8965	70HA	-6.60	-6.72	-10.35
C256	.9834	.9817	.9907	70HM	-1.66	-1.83	-.93
C259	.9873	.9859	.9954	70HA	-1.27	-1.41	-.46
C262	.9981	.9951	1.0093	70HR	-.19	-.49	.93
C285	.9867	.9859	.9954	70HA	-1.33	-1.41	-.46
C288	.9929	.9921	1.0018	70HA	-.71	-.79	.18
C291	.9926	.9901	1.0110	70HA	-.74	-.99	1.10
C317	.9822	.9797	.9891	70SC	-1.78	-2.03	-1.09
C320	.9944	.9925	.9985	70HA	-.56	-.75	-.15
C325	.9931	.9922	1.0002	70HR	-.69	-.78	.02
C340	.9897	.9874	.9995	70HA	-1.03	-1.26	-.05
C352	.9941	.9921	1.0063	70HA	-.59	-.79	.63
C356	.9804	.9797	.9914	70HM	-1.96	-2.03	-.86
C380	.9929	.9921	1.0002	70HA	-.71	-.79	.02
C382	.9858	.9838	.9911	70HA	-1.42	-1.62	-.89
C402	.9867	.9851	.9936	70HA	-1.33	-1.49	-.64
C427	.9904	.9890	1.0031	70HA	-.96	-1.10	.31
C440	.9972	.9946	1.0022	70HA	-.28	-.54	.22
C442	.9852	.9838	.9979	70HM	-1.48	-1.62	-.21
C454	1.0014	.9979	1.0033	70HA	.14	-.21	.33
C456	.9926	.9906	1.0003	70HA	-.74	-.94	.03
C458	.9865	.9849	.9965	70HM	-1.35	-1.51	-.35
C475	.9931	.9904	1.0033	70HA	-.69	-.96	.33
C477	.9998	.9970	1.0019	70HA	-.02	-.30	.19
C494	1.0042	1.0025	1.0185	70HA	.42	.25	1.85
C496B	.9873	.9859	.9909	70GP	-1.27	-1.41	-.91
C499A	.9904	.9890	.9986	70HA	-.96	-1.10	-.14
C499B	.9884	.9859	.9970	70HA	-1.16	-1.41	-.30
C506	.9941	.9921	1.0002	70HA	-.59	-.79	.02
C517	1.0143	1.0119	1.0158	70SC	1.43	1.19	1.58
C538	.9784	.9756	.9849	70GX	-2.16	-2.44	-1.51
C541	1.0018	1.0004	1.0041	70GP	.18	.04	.41
C542	1.0027	.9991	1.0032	70GD	.27	-.09	.32
C543	.9921	.9907	.9998	70HA	-.79	-.93	-.02
C574	1.0210	1.0172	1.0196	70HQ	2.10	1.72	1.96
C576	.8866	.8802	.8911	70HM	-11.34	-11.98	-10.89
C585	.9881	.9866	1.0032	70HA	-1.19	-1.34	.32
C600	.9840	.9818	.9852	70GD	-1.60	-1.82	-1.48
C619	.9956	.9942	.9978	70HQ	-.44	-.58	-.22
C620	.9966	.9934	1.0004	70HA	-.34	-.66	.04
C628	1.0233	1.0222	1.0275	70ME	2.33	2.22	2.75
C633	1.0448	1.0426	1.0528	70HA	4.48	4.26	5.28
C640	1.0042	1.0053	1.0131	70ME	.42	.53	1.31
C646	.9996	.9987	1.0070	70CG	-.04	-.13	.70
C648	.9946	.9923	1.0062	70SC	-.54	-.77	.62
C655	.9932	.9930	.9904	70HU	-.68	-.70	-.96
C674	.9917	.9901	.9997	70HA	-.83	-.99	-.03
C677	1.0139	1.0114	1.0283	70SC	1.39	1.14	2.83
C690	.9753	.9746	.9809	70HM	-2.47	-2.54	-1.91

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA

COLOR + COLOR DIFFERENCE

LAB		SAMPLE C95			SAMPLE C96			DIFFERENCE C96 - C95				INST	
CODE	F	MEAN X	MEAN Y	MEAN Z	MEAN X	MEAN Y	MEAN Z	ΔX	ΔY	ΔZ	ΔE	CODE	LAB
C157	6	28.45	42.64	35.61	27.73	41.63	35.70	-.71	-1.01 *	.09 *	3.00	70GE	C157
C162	6	28.75	41.54	37.01	28.00	40.65*	37.02	-.75 *	-.89	.02 *	3.23	70DC	C162
C244	6	29.95	42.79	35.29	29.75	42.14	35.80	-.21	-.65	.51	2.43	70ZE	C244
C250	6	28.61	41.67	37.23	28.22	41.07	37.70	-.39	-.60	.47	2.58	70ZF	C250
C251	6	28.95	42.26	36.21	28.57	41.81	36.67	-.39	-.45	.47	2.70	70ZE	C251
C253	6	29.16	42.41	34.61	28.83	41.95	35.13	-.33	-.46	.52	2.49	70GC	C253
C278	6	30.84X	42.10	40.38X	30.26*	41.42	40.62X	-.58	-.68	.24	2.91	70NE	C278
C372	X	29.73	42.91	36.45	28.95	42.21	36.76	-.78 *	-.71	.31	4.36X	70ZE	C372
C407	6	29.87	42.34	37.00	29.22	41.55	37.24	-.65	-.79	.24	3.12	70BL	C407
C412	6	29.28	42.49	36.15	28.63	41.68	36.37	-.66	-.82	.22	3.13	70GE	C412
C414	6	29.59	42.68	36.70	28.96	41.90	36.94	-.63	-.77	.24	3.07	70MD	C414
C416A	6	28.88	42.05	35.75	28.34	41.38	36.08	-.54	-.67	.33	2.96	70GE	C416A
C416B	X	29.27	41.97	34.99	29.05	41.72	34.71	-.22	-.25	-.27 X	.52X	70IB	C416B
C417A	6	28.78	41.88	35.94	28.24	41.22	36.31	-.54	-.66	.37	3.05	70GE	C417A
C418	6	28.72	41.98	35.75	28.32	41.51	36.26	-.40	-.47	.51	2.83	70CE	C418
C422	6	28.86	41.72	34.70	28.40	41.14	35.14	-.45	-.58	.44	2.81	70GC	C422
C424	6	29.15	42.25	36.51	28.79	41.80	37.03	-.36	-.45	.53	2.65	70CA	C424
C428	6	28.55	41.82	34.31	28.17	41.33	34.84	-.39	-.49	.53	2.80	70HB	C428
C437	6	29.49	42.31	38.03	29.13	41.84	38.52	-.36	-.47	.49	2.52	70CE	C437
C443	6	29.16	42.25	35.80	28.84	41.77	36.48	-.32	-.47	.67	2.77	70CN	C443
C444	6	28.77	41.84	36.45	28.37	41.32	36.88	-.40	-.51	.43	2.61	70GE	C444
C445	6	28.94	41.91	36.20	28.68	41.59	36.89	-.26	-.32	.68	2.65	70LS	C445
C446A	6	29.18	42.42	36.40	28.75	41.89	36.88	-.43	-.53	.49	2.83	70GE	C446A
C451	6	29.00	41.86	36.34	28.63	41.43	36.86	-.37	-.44	.52	2.72	70AC	C451
C453	6	30.19*	43.18*	35.92	29.81*	42.73X	36.42	-.38	-.45	.50	2.65	70HT	C453
C455	6	29.14	42.23	36.75	28.73	41.72	37.21	-.41	-.51	.46	2.71	70KS	C455
C459	6	28.91	41.97	36.11	28.46	41.41	36.55	-.45	-.57	.44	2.80	70GE	C459
C460	6	28.89	42.05	35.73	28.42	41.45	36.11	-.48	-.60	.39	2.81	70GE	C460
C462B	6	29.01	42.04	34.37	28.76	41.74	35.01	-.25	-.30	.65	2.58	70GE	C462B
C463	6	28.81	42.05	36.19	28.54	41.69	36.84	-.27	-.36	.65	2.60	70ZD	C463
C469	6	30.68X	44.76X	39.98X	30.26*	44.22X	40.51X	-.42	-.53	.54	2.80	70GE	C469
C470	6	28.47	41.39	36.38	28.18	41.00	36.97	-.29	-.38	.59	2.55	70DH	C470
C472	6	29.17	42.06	37.08	28.75	41.51	37.52	-.43	-.55	.44	2.68	70KT	C472
C473	6	28.70	41.74	36.47	28.35	41.31	36.99	-.35	-.43	.52	2.64	70GE	C473
C474	6	28.73	41.78	35.86	28.40	41.37	36.38	-.32	-.41	.52	2.53	70GE	C474
C476	6	28.54	41.77	35.88	28.02	41.10	36.25	-.52	-.67	.37	2.97	70SA	C476
C479A	X	28.60	41.87	36.06	28.00	41.27	35.40	-.61	-.61	-.66 X	1.77X	70GB	C479A
C479B	6	29.31	42.32	37.37	28.75	41.76	37.43	-.56	-.55	.06 *	2.73	70SA	C479B
C480	6	29.12	42.32	34.70	28.65	41.76	35.18	-.47	-.56	.48	3.03	70HB	C480
C481	6	30.40*	42.24	38.79*	30.25*	41.75	39.34*	-.16	-.49	.55	2.08*	70CF	C481
C483	6	29.22	42.61	36.06	28.90	42.11	36.53	-.32	-.50	.48	2.27*	70ZF	C483
C495	6	29.16	42.11	37.28	28.80	41.65	37.83	-.36	-.46	.54	2.70	70KS	C495
C496A	6	28.65	41.79	35.81	28.20	41.20	36.23	-.45	-.58	.42	2.77	70GE	C496A
C499C	X	30.16*	43.37X	350.07X	29.97*	42.84X	355.55X	-.18	-.53	5.48 X	4.23X	70BL	C499C
C503	6	28.31	41.25	35.72	27.81	40.62*	36.06	-.50	-.62	.35	2.83	70GE	C503
C508	6	28.78	41.97	35.19	28.54	41.67	35.82	-.23	-.30	.63	2.44	70GE	C508
C511	6	29.04	42.15	36.57	28.59	41.59	37.02	-.45	-.56	.44	2.80	70DH	C511
C521A	6	28.98	42.40	35.69	28.65	41.97	36.25	-.32	-.42	.57	2.59	70CA	C521A
C521B	6	27.86*	40.52X	35.05	28.93	42.13	37.18	1.07 X	1.61 X	2.14 X	3.45*	70SA	C521B
C522	6	28.88	41.89	35.39	28.65	41.59	36.20	-.23	-.30	.81 *	2.84	70SA	C522
C524	6	29.22	42.28	36.48	28.89	41.86	36.98	-.33	-.42	.50	2.46	70GE	C524
C528	6	29.12	42.12	36.89	28.82	41.75	37.44	-.30	-.37	.55	2.52	70MD	C528
C532	6	27.43*	39.97X	38.00	27.14*	39.55X	38.60*	-.29	-.43	.60	2.58	70GE	C532
C534	6	29.23	42.13	36.51	28.78	41.58	36.92	-.45	-.55	.41	2.73	70MD	C534
C540	6	29.44	42.49	36.53	28.87	41.78	36.83	-.57	-.70	.30	2.97	70GE	C540
C545	6	28.48	41.65	35.25	28.30	41.40	36.02	-.18	-.25	.77 *	2.56	70GC	C545
C547	6	27.54*	41.78	35.10	27.05*	41.15	35.48	-.48	-.63	.37	2.83	70HP	C547
C548	6	28.74	42.23	34.67	28.10	41.41	34.89	-.64	-.82	.22	3.03	70SB	C548
C552	6	28.29	41.31	33.41*	28.25	41.23	34.35*	-.04 *	-.08 *	.94 X	2.55	70HN	C552
C612	6	28.49	41.55	35.88	28.18	41.15	36.44	-.32	-.40	.56	2.59	70GE	C612
C613	6	28.57	41.81	35.94	28.15	41.29	36.39	-.42	-.51	.45	2.75	70MD	C613
C619	6	27.75*	41.34	35.06	27.35*	40.75*	35.46	-.40	-.59	.40	2.47	70SA	C619
C627	6	29.95	42.63	37.01	29.28	41.84	37.16	-.67	-.79	.16	3.04	70SA	C627
C629	6	28.71	42.12	34.23	28.01	41.25	34.40*	-.70	-.87	.17	3.18	70HN	C629
C630	6	29.40	42.48	36.71	28.68	41.61	36.85	-.72	-.87	.14	3.24*	70KS	C630

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA

COLOR - COLOR DIFFERENCE

LAB CODE	F	SAMPLE C95 MEAN X	MEAN Y	MEAN Z	SAMPLE C96 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C96 - C95 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C631A	0	29.07	41.83	36.71	28.34	40.93	36.79	-.73 *	-.90 *	.08 *	3.15	70AC	C631A
C631B	*	29.16	41.84	36.74	28.59	41.15	36.98	-.57	-.69	.24	2.86	70AC	C631B
C632	0	29.20	42.08	36.57	28.71	41.47	36.97	-.49	-.60	.40	2.88	70AC	C632
C634	0	28.49	41.63	35.18	28.06	41.04	35.56	-.43	-.60	.38	2.54	70CE	C634
C638	0	28.69	41.84	34.96	28.39	41.43	35.57	-.30	-.40	.60	2.62	70GY	C638
C639	0	28.56	41.44	37.17	28.20	40.98	37.68	-.36	-.46	.50	2.61	70DH	C639
C644	0	29.28	42.26	36.60	28.78	41.64	36.97	-.50	-.61	.37	2.85	70MD	C644
C645	0	30.89X	44.60X	40.27X	30.21*	43.78X	40.52X	-.68	-.82	.25	3.24	70AC	C645
C656	0	29.66	42.66	36.55	29.19	42.11	36.98	-.46	-.54	.43	2.87	70SA	C656
C657	0	29.26	42.36	37.01	28.71	41.69	37.34	-.55	-.67	.33	2.96	70AC	C657
C661	0	28.02	40.87*	38.72*	27.60	40.30X	39.19*	-.42	-.57	.47	2.79	70GE	C661
C662	0	29.12	42.49	36.81	28.67	41.91	37.25	-.46	-.58	.43	2.80	70DH	C662
C664	0	29.81	43.06*	36.90	29.24	42.32*	37.22	-.56	-.74	.32	2.87	70KC	C664
C671A	0	28.87	41.92	36.03	28.44	41.39	36.45	-.43	-.53	.42	2.68	70DH	C671A
C671B	0	28.47	41.36	36.78	28.16	40.90	37.37	-.31	-.46	.59	2.59	70DH	C671B
C671C	0	28.91	41.89	34.75	28.52	41.36	35.19	-.39	-.53	.45	2.56	70GC	C671C
C671D	0	28.67	41.96	34.54	28.40	41.41	34.92	-.47	-.54	.38	2.86	70HB	C671D
C672	0	28.91	41.46	34.57	28.40	40.75*	34.93	-.50	-.70	.35	2.74	70GC	C672
C675	0	29.05	41.89	36.26	28.59	41.31	36.66	-.46	-.58	.40	2.77	70AC	C675
GRAND MEANS		28.93	42.05	36.08	28.59	41.50	36.54	-.43	-.56	.43	2.77		
SD OF MEANS		.53	.42	1.02	.61	.37	1.00	.14	.17	.16	.24		
INCLUDED LABS FOR THIS MEAN		76	75	76	79	74	76	78	78	77	79		

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA

COLOR + COLOR DIFFERENCE

LAB CODE	F	SAMPLE C97 MEAN X	MEAN Y	MEAN Z	SAMPLE C98 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C98 - C97 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C157	X	9.20	5.65X	13.99	8.51	5.58X	13.57	-.69 X	-.07	-.42	13.27X	70GE	C157
C162	G	9.86*	7.23*	14.26	9.66*	7.17*	13.94	-.20	-.06	-.32	2.09	70DC	C162
C244	G	8.87	6.39	14.41	8.76	6.39	14.11	-.11	.00	-.30	1.61	70ZE	C244
C250	G	9.81*	7.11*	14.71	9.69*	7.01	14.42	-.13	-.10	-.30	.88	70ZF	C250
C251	G	9.12	6.39	14.03	8.72	6.19	13.64	-.41	-.20	-.59	2.68	70ZE	C251
C253	G	8.88	6.41	14.31	8.45	6.12	13.63	-.42	-.29	-.67	1.62	70GC	C253
C278	G	7.99X	6.31	12.12X	7.94*	6.41	12.02X	-.05	.10	-.10 *	3.36	70NE	C278
C372	G	8.49	6.63	14.35	8.12*	6.37	13.69	-.36	-.26	-.66	1.44	70ZE	C372
C407	G	9.22	6.79	14.46	8.79	6.52	13.76	-.43	-.27	-.70	1.69	70BL	C407
C412	G	9.22	6.75	14.52	8.81	6.48	13.82	-.41	-.27	-.70	1.54	70GE	C412
C414	G	9.04	6.56	14.24	8.65	6.32	13.58	-.39	-.23	-.67	1.60	70MD	C414
C416A	G	8.41*	5.94*	13.65	8.25	5.89*	13.23	-.16	-.05	-.42	1.22	70GE	C416A
C416B	G	8.57	6.24	14.35	8.29	6.10	13.86	-.27	-.14	-.49	1.60	70IB	C416B
C417A	G	8.70	6.25	13.78	8.49	6.18	13.39	-.20	-.06	-.40	1.88	70GE	C417A
C418	G	9.69*	6.92	14.47	9.41	6.79	14.04	-.28	-.12	-.43	2.00	70CE	C418
C422	G	8.61	6.18	13.82	8.47	6.18	13.44	-.14	.01	-.38	2.12	70GC	C422
C424	G	9.30	6.73	14.61	9.11	6.70	14.22	-.19	-.03	-.39	2.37	70CA	C424
C428	G	9.05	6.53	14.54	8.86	6.50	14.16	-.19	-.03	-.38	2.51	70HB	C428
C437	X	9.33	6.60	13.51	9.04	6.56	13.22	-.30	-.04	-.29	4.91X	70CE	C437
C443	G	8.85	6.46	14.20	8.77	6.55	13.93	-.07	.09	-.26	3.26	70CN	C443
C444	G	9.15	6.62	14.16	9.01	6.66	13.85	-.14	.03	-.32	3.13	70GE	C444
C445	G	9.50	7.00	14.90	9.28	6.98	14.48	-.22	-.02	-.42	2.97	70LS	C445
C446A	G	9.06	6.57	14.16	9.02	6.71	13.96	-.04	.14	-.20	3.80	70GE	C446A
C451	G	9.05	6.64	14.13	8.91	6.64	13.73	-.14	.00	-.40	2.07	70AC	C451
C453	G	8.98	6.67	14.96	8.82	6.67	14.54	-.16	.00	-.42	2.43	70HT	C453
C455	G	9.04	6.58	13.96	8.99	6.71	13.77	-.05	.12	-.19	3.63	70KS	C455
C459	G	9.04	6.56	14.20	9.00	6.70	14.02	-.04	.14	-.19	3.72	70GE	C459
C460	G	8.84	6.47	14.23	8.77	6.57	13.95	-.07	.09	-.28	3.05	70GE	C460
C462B	G	8.79	6.39	14.32	8.69	6.39	13.93	-.10	.00	-.40	1.30	70GE	C462B
C463	G	8.93	6.42	14.08	8.88	6.52	13.84	-.05	.10	-.24	3.02	70ZD	C463
C469	G	9.07	6.32	15.41*	8.72	6.15	14.72*	-.35	-.18	-.69	1.71	70GE	C469
C470	G	9.17	6.61	14.03	9.08	6.71	13.84	-.08	.10	-.20	3.76	70DH	C470
C472	G	9.25	6.71	14.26	9.22	6.84	14.07	-.03	.13	-.19	3.31	70KT	C472
C473	G	8.64	6.25	13.57	8.60	6.39	13.38	-.04	.14	-.20	3.99*	70GE	C473
C474	G	8.88	6.43	14.19	8.88	6.60	14.03	.00	.17	-.15	3.68	70GE	C474
C476	G	8.77	6.33	14.20	8.46	6.09	13.63	-.30	-.23	-.57	1.45	70SA	C476
C479A	X	8.02X	6.31	12.97*	7.82*	6.51	12.51*	-.20	.20 *	-.46	8.48X	70GB	C479A
C479B	G	9.70*	7.24*	14.39	9.35	7.06*	14.35	-.34	-.18	-.04 *	4.20*	70SA	C479B
C480	G	9.07	6.59	14.61	8.97	6.65	14.28	-.10	.06	-.32	2.72	70HB	C480
C481	G	10.87X	7.48X	15.17*	10.65X	7.44X	14.85*	-.22	-.04	-.32	2.54	70CF	C481
C483	G	9.03	6.65	14.40	8.99	6.65	14.16	-.04	.00	-.24	.73	70ZF	C483
C495	G	9.03	6.62	13.90	8.69	6.42	13.30	-.34	-.19	-.60	1.59	70KS	C495
C496A	G	8.82	6.34	13.98	8.61	6.28	13.63	-.21	-.06	-.36	2.24	70GE	C496A
C499C	G	9.27	6.89	157.64X	9.10	6.86	154.10X	-.17	-.03	-3.54 X	1.04	70BL	C499C
C503	G	9.05	6.53	14.08	8.87	6.52	13.70	-.18	-.01	-.38	2.48	70GE	C503
C508	G	9.00	6.45	14.50	8.77	6.37	14.07	-.23	-.08	-.43	1.93	70GE	C508
C511	G	9.09	6.59	14.22	8.86	6.51	13.81	-.24	-.07	-.41	2.28	70DH	C511
C521A	G	9.01	6.52	14.29	8.76	6.41	13.86	-.25	-.11	-.43	1.65	70CA	C521A
C521B	G	8.94	6.46	14.08	9.15	6.72	14.24	.21 X	.26 *	.16 X	2.47	70SA	C521B
C522	G	8.66	6.79	13.85	8.33	6.61	13.30	-.33	-.18	-.56	2.03	70SA	C522
C524	G	9.27	6.84	14.69	9.08	6.81	14.22	-.19	-.03	-.47	2.19	70GE	C524
C528	G	9.30	6.77	14.53	9.15	6.80	14.17	-.14	.03	-.36	2.69	70MD	C528
C532	G	9.30	6.59	13.01*	9.16	6.63	12.77*	-.14	.04	-.24	3.51	70GE	C532
C534	G	8.99	6.16	14.15	8.84	6.19	13.80	-.15	.03	-.35	3.14	70MD	C534
C540	G	9.52	7.07	14.77	9.24	6.96	14.36	-.27	-.10	-.41	2.47	70GE	C540
C545	G	8.76	6.32	14.05	8.33	6.04	13.38	-.43	-.27	-.67	1.79	70GC	C545
C547	G	8.67	6.43	13.70	8.47	6.39	13.28	-.20	-.05	-.41	2.31	70HP	C547
C548	G	8.42	6.00*	13.68	8.36	6.10	13.43	-.07	.10	-.24	3.50	70SB	C548
C552	G	8.81	6.36	14.42	8.78	6.49	14.20	-.03	.14	-.22	3.43	70HN	C552
C612	G	8.76	6.34	13.97	8.54	6.28	13.54	-.22	-.06	-.43	2.13	70GE	C612
C613	G	8.57	6.40	13.01*	8.28	6.25	12.51*	-.29	-.15	-.50	1.87	70MD	C613
C619	G	8.62	6.15	13.51	8.42	6.05	13.11	-.20	-.10	-.40	1.02	70SA	C619
C627	G	9.37	6.80	14.61	9.13	6.72	14.21	-.24	-.08	-.41	2.18	70SA	C627
C629	G	8.95	6.42	14.50	8.77	6.41	14.11	-.18	-.02	-.40	2.42	70HN	C629
C630	G	9.04	6.57	14.31	8.72	6.40	13.69	-.32	-.17	-.62	1.46	70KS	C630

X, Y, Z SPACE ANALYSIS, ADJUSTED DATA

COLOR • COLOR DIFFERENCE

LAB CODE	F	SAMPLE C97 MEAN X	MEAN Y	MEAN Z	SAMPLE C98 MEAN X	MEAN Y	MEAN Z	DIFFERENCE C98 - C97 ΔX	ΔY	ΔZ	ΔE	INST CODE	LAB
C631A	0	9.01	6.55	13.91	8.67	6.35	13.28	-.34	-.20	-.63	1.44	70AC	C631A
C631B	#	9.05	6.53	14.22	8.77	6.39	13.67	-.28	-.15	-.55	1.37	70AC	C631B
C632	0	8.95	6.51	14.07	8.75	6.43	13.57	-.20	-.08	-.49	1.35	70AC	C632
C634	0	9.38	6.94	14.57	9.00	6.70	13.90	-.38	-.24	-.67	1.43	70CE	C634
C638	0	8.53	6.13	13.70	8.23	5.93*	13.10	-.30	-.20	-.60	1.22	70GY	C638
C639	0	9.25	6.67	13.97	8.94	6.51	13.44	-.31	-.16	-.52	1.58	70DH	C639
C644	0	9.03	6.57	14.19	8.79	6.48	13.68	-.24	-.10	-.51	1.59	70MD	C644
C645	0	9.43	6.89	15.41*	9.23	6.84	14.91*	-.20	-.05	-.51	1.71	70AC	C645
C656	0	9.12	6.65	14.61	8.73	6.35	13.91	-.38	-.30	-.69	1.79	70SA	C656
C657	0	9.06	6.63	14.02	8.68	6.41	13.44	-.38	-.22	-.58	1.92	70AC	C657
C661	0	9.37	6.74	13.20*	8.96	6.49	12.60*	-.41	-.25	-.61	1.61	70GE	C661
C662	0	9.02	6.59	14.22	8.71	6.40	13.60	-.31	-.19	-.62	1.24	70DH	C662
C664	0	8.86	6.46	13.90	8.62	6.35	13.35	-.24	-.11	-.55	1.37	70KC	C664
C671A	0	9.27	6.76	14.52	9.06	6.70	14.06	-.22	-.06	-.46	2.16	70DH	C671A
C671B	0	9.28	6.77	14.09	8.92	6.56	13.53	-.37	-.21	-.55	1.83	70DH	C671B
C671C	0	9.03	6.47	14.40	8.72	6.30	13.88	-.31	-.17	-.53	1.55	70GC	C671C
C671D	0	8.90	6.54	14.46	8.49	6.23	13.79	-.41	-.31	-.68	1.67	70HB	C671D
C672	0	8.86	6.34	14.12	8.46	6.14	13.57	-.40	-.20	-.56	2.88	70GC	C672
C675	0	9.06	6.56	14.05	8.74	6.42	13.56	-.32	-.14	-.49	2.58	70AC	C675
GRAND MEANS		9.03	6.56	14.22	8.80	6.49	13.79	-.22	-.07	-.43	2.22		
SD OF MEANS		.30	.25	.44	.33	.27	.45	.12	.13	.16	.82		
INCLUDED LABS FOR THIS MEAN		78	79	78	79	79	78	79	80	78	80		

L, a, b SPACE ANALYSIS, ADJUSTED DATA

COLOR + COLOR DIFFERENCE

LAB		SAMPLE C95			SAMPLE C96			DIFFERENCE C96 - C95				INST	
CODE	F	MEAN L	MEAN A	MEAN B	MEAN L	MEAN A	MEAN B	ΔL	Δa	Δb	ΔE	CODE	LAB
C121	X	64.83	-36.54X	13.18	64.42	-35.63*	12.28	-.40	.91 X	-.90	1.34X	70HM	C121
C122	6	64.96	-33.85	13.70	64.66	-33.85	12.70	-.30	.00	-1.00	1.04	70HM	C122
C148	6	65.38	-34.74	14.50	64.93	-34.73	13.55	-.45	.00	-.95	1.05	70HA	C148
C150	6	65.65	-34.38	14.28	65.10	-34.42	13.34	-.56	-.04	-.94	1.09	70HA	C150
C152	6	64.67	-32.92	14.00	64.12	-32.92	13.01	-.55	.00	-.99	1.13	70HA	C152
C166	6	64.94	-33.96	13.76	64.64	-33.96	12.86	-.30	.00	-.90	.95	70HA	C166
C183	#	65.31	35.05X	14.15	65.01	35.20X	13.25	-.30	.15 *	-.90	.96	70HA	C183
C213	6	65.34	-33.89	14.10	65.03	-33.89	13.19	-.30	.00	-.91	.96	70HM	C213
C223	6	66.04	-33.86	13.78	65.64	-33.85	12.84	-.40	.00	-.94	1.03	70HA	C223
C230	6	65.46	-34.49	14.25	64.92	-34.42	13.30	-.53	.07	-.95	1.09	70HA	C230
C241	X	65.11	-33.77	13.26	64.81	-33.77	12.76	-.30	.00	-.50 X	.59X	70HA	C241
C255	6	67.71X	-35.21	12.89	67.25X	-35.15	11.88	-.47	.05	-1.01	1.11	70HA	C255
C256	6	65.04	-34.50	14.15	64.65	-34.48	13.21	-.39	.02	-.93	1.01	70HM	C256
C259	6	65.31	-34.10	14.45	64.81	-34.05	13.50	-.50	.05	-.95	1.08	70HA	C259
C262	6	65.75	-33.88	13.31	65.39	-33.83	12.37	-.36	.05	-.94	1.01	70HR	C262
C285	6	65.41	-34.66	13.80	65.21	-34.66	12.91	-.20	.00	-.90	.92	70HA	C285
C288	6	65.21	-34.45	13.86	65.06	-34.35	12.92	-.15 *	.10	-.95	.96	70HA	C288
C291	6	65.28	-34.13	14.63	64.97	-34.07	13.74	-.30	.05	-.89	.94	70HA	C291
C317	6	65.16	-34.86	14.14	64.66	-34.85	13.24	-.51	.00	-.90	1.04	70SC	C317
C320	6	65.99	-33.62	13.39	65.59	-33.62	12.35	-.40	.00	-1.04 *	1.11	70HA	C320
C325	6	65.68	-34.56	13.35	65.33	-34.52	12.42	-.35	.04	-.93	1.00	70HR	C325
C340	6	65.94	-33.27	12.61	65.37	-33.23	11.66	-.56	.05	-.96	1.11	70HA	C340
C352	6	65.51	-34.44	14.31	64.91	-34.44	13.36	-.60	.00	-.95	1.12	70HA	C352
C356	6	65.27	-34.31	13.82	64.76	-34.31	12.81	-.51	.00	-1.00	1.12	70HM	C356
C380	6	65.31	-33.80	14.21	64.86	-33.69	13.31	-.45	.10	-.90	1.01	70HA	C380
C382	6	65.38	-34.74	13.74	64.93	-34.69	12.74	-.45	.05	-1.00	1.10	70HA	C382
C402	6	65.51	-34.04	14.15	64.97	-33.96	13.16	-.54	.08	-.99	1.13	70HA	C402
C427	6	65.26	-33.59	14.03	64.81	-33.54	13.03	-.45	.05	-1.00	1.10	70HA	C427
C440	6	65.32	-34.35	14.09	65.06	-34.30	13.19	-.26	.05	-.90	.94	70HA	C440
C442	6	64.83	-33.68	13.16	64.52	-33.68	12.26	-.30	.00	-.90	.95	70HM	C442
C454	6	66.12	-33.22	13.79	65.72	-33.23	12.86	-.40	-.02	-.93	1.01	70HA	C454
C456	6	65.38	-34.21	14.18	65.00	-34.20	13.26	-.38	.01	-.91	.99	70HA	C456
C458	6	65.01	-34.43	13.15	64.68	-34.40	12.22	-.33	.03	-.94	1.00	70HM	C458
C475	6	65.75	-34.20	12.84	65.38	-34.14	11.92	-.37	.06	-.92	1.00	70HA	C475
C477	6	66.07	-34.61	12.79	65.58	-34.52	11.83	-.49	.10	-.95	1.08	70HA	C477
C494	6	65.17	-34.59	12.12	64.87	-34.54	11.13	-.30	.05	-.99	1.03	70HA	C494
C496B	6	63.85X	-32.74	12.75	63.65*	-32.64*	11.75	-.20	.10	-1.00	1.03	70GP	C496B
C499A	6	65.11	-34.50	14.23	64.71	-34.50	13.28	-.40	.00	-.95	1.03	70HA	C499A
C499B	6	65.41	-34.20	14.35	64.81	-34.19	13.35	-.60	.00	-1.00	1.17	70HA	C499B
C506	6	65.16	-33.79	14.41	64.91	-33.79	13.51	-.25	.00	-.90	.93	70HA	C506
C517	6	64.62	-32.29*	11.76*	64.22	-32.19*	10.87*	-.40	.10	-.89	.98	70SC	C517
C538	6	66.52*	-27.39X	9.17X	66.01*	-27.28X	8.06X	-.51	.10	-1.11 X	1.22*	70GX	C538
C541	6	64.89	-34.25	13.46	64.49	-34.10	12.52	-.40	.15 *	-.95	1.04	70GP	C541
C542	6	64.14*	-34.18	13.20	63.91*	-33.95	12.24	-.23	.23 X	-.96	1.02	70GD	C542
C543	6	65.03	-34.21	14.05	64.82	-34.15	13.14	-.22	.06	-.91	.93	70HA	C543
C574	6	64.85	-34.26	11.98*	64.50	-34.16	11.09*	-.35	.10	-.89	.96	70HQ	C574
C576	#	45.14X	34.59X	15.36*	44.91X	34.58X	14.43*	-.23	-.01	-.93	.96	70HM	C576
C585	6	65.31	-33.74	14.00	64.84	-33.72	13.07	-.47	.02	-.93	1.04	70HA	C585
C600	6	65.80	-34.19	13.64	65.30	-34.19	12.68	-.50	.00	-.96	1.08	70GD	C600
C619	6	64.79	-35.71*	12.85	64.39	-35.61*	11.95	-.40	.10	-.90	.99	70HQ	C619
C620	6	65.77	-33.03	12.57	65.51	-33.07	11.68	-.26	-.04	-.89	.92	70HA	C620
C628	X	70.89X	-41.04X	15.01	70.33X	-41.19X	13.82	-.56	-.15 X	-1.19 X	1.32X	70ME	C628
C633	6	63.47X	-34.69	14.37	62.99X	-34.65	13.44	-.48	.04	-.92	1.04	70HA	C633
C640	6	65.65	-33.62	12.10	65.33	-33.56	11.20	-.32	.06	-.90	.96	70ME	C640
C646	X	62.57X	-28.40X	6.65X	62.09X	-28.61X	6.07X	-.48	-.22 X	-.58 X	.78X	70CG	C646
C648	6	66.62*	-32.79	14.48	66.18*	-32.76	13.55	-.44	.04	-.93	1.03	70SC	C648
C655	6	65.07	-33.51	11.86*	64.55	-33.43	10.91*	-.52	.08	-.95	1.08	70HU	C655
C674	6	65.38	-34.15	13.88	64.97	-34.15	12.98	-.40	.00	-.90	.98	70HA	C674
C677	6	64.94	-32.29*	12.85	64.46	-32.30*	11.92	-.48	-.02	-.93	1.05	70SC	C677
C690	6	65.03	-33.79	14.43	64.58	-33.89	13.58	-.46	-.10 X	-.86 *	.98	70HM	C690
GRAND MEANS		65.36	-34.03	13.60	64.93	-33.99	12.66	-.40	.04	-.94	1.03		
SD OF MEANS		.47	.67	.77	.48	.67	.77	.11	.04	.04	.07		
INCLUDED LABS FOR THIS MEAN		51	53	53	52	53	53	54	52	53	54		

L, a, b SPACE ANALYSIS, ADJUSTED DATA

COLOR - COLOR DIFFERENCE

LAB CODE	F	SAMPLE C97 MEAN L	MEAN A	MEAN B	SAMPLE C98 MEAN L	MEAN A	MEAN B	DIFFERENCE C98 - C97 ΔL	Δa	ΔB	ΔE	INST CODE	LAB
C121	0	25.24	14.32X	-28.96X	25.45	13.21X	-27.96X	.20	-1.11	1.00	1.51	70HM	C121
C122	0	25.58	18.34	-15.39	25.58	17.24	-14.59	.00	-1.11	.80	1.36	70HM	C122
C148	0	25.87	18.08	-15.68	25.57	17.18	-15.03	-.30	-.90	.65	1.15	70HA	C148
C150	0	26.16	18.06	-15.40	25.85	17.00	-14.75	-.31	-1.06	.65	1.28	70HA	C150
C152	0	25.65	17.71	-15.70	25.15	16.91	-15.01	-.50	-.79	.69	1.16	70HA	C152
C166	0	25.65	17.87	-15.10	25.65	16.72	-14.40	.00	-1.16	.70	1.35	70HA	C166
C183	#	25.53	18.68	-15.84	25.58	17.47	-15.09	.05	-1.21	.75	1.42	70HA	C183
C213	0	25.57	18.10	-15.71	25.26	17.09	-15.11	-.30	-1.01	.60	1.21	70HM	C213
C223	0	25.63	16.86	-14.85	25.48	15.82	-14.16	-.15	-1.05	.69	1.26	70HA	C223
C230	0	25.92	18.45	-15.33	25.24	17.62	-14.96	-.68	-.83	.37	1.14	70HA	C230
C241	X	25.84	23.61X	-15.19	25.39	16.73	-14.49	-.45	-6.88 X	.69	6.93X	70HA	C241
C255	0	26.61*	19.28	-17.67X	26.09*	18.50	-17.12X	-.52	-.77	.55	1.08	70HA	C255
C256	0	25.60	18.30	-15.75	24.97	17.66	-15.36	-.63	-.64	.39	.98	70HM	C256
C259	0	25.78	18.44	-15.79	25.38	17.69	-15.29	-.40	-.75	.50	.99	70HA	C259
C262	0	25.36	17.21	-14.98	25.10	16.29	-14.42	-.26	-.92	.56	1.11	70HR	C262
C285	0	25.63	18.23	-14.79	25.28	17.43	-14.19	-.35	-.80	.60	1.06	70HA	C285
C288	0	25.55	18.47	-15.54	25.50	17.42	-14.74	-.05	-1.05	.80	1.32	70HA	C288
C291	0	25.33	17.93	-15.77	25.53	16.73	-14.79	.20	-1.20	.99	1.57	70HA	C291
C317	0	25.36	19.13	-15.64	25.46	17.92	-14.74	.10	-1.21	.90	1.51	70SC	C317
C320	0	25.30	17.23	-14.60	25.14	15.95	-13.86	-.16	-1.28	.74	1.49	70HA	C320
C325	0	25.10	18.75	-15.46	25.10	17.35	-14.59	.00	-1.39	.87	1.64	70HR	C325
C340	0	25.63	16.67	-13.57*	25.17	15.90	-13.16*	-.45	-.78	.41	.99	70HA	C340
C352	0	25.70	18.45	-15.58	25.40	17.75	-14.89	-.30	-.70	.69	1.03	70HA	C352
C356	0	25.56	18.64	-15.56	25.16	18.14	-14.97	-.40	-.50	.60	.88	70HM	C356
C380	0	25.60	18.42	-15.79	25.20	17.62	-15.09	-.40	-.80	.69	1.13	70HA	C380
C382	0	25.81	19.13	-15.28	25.31	18.43	-14.58	-.50	-.70	.70	1.11	70HA	C382
C402	0	25.84	17.71	-15.63	25.36	16.88	-15.01	-.48	-.83	.62	1.15	70HA	C402
C427	0	25.14	18.42	-15.86	25.19	17.31	-14.97	.05	-1.10	.89	1.42	70HA	C427
C440	0	25.85	18.47	-15.31	25.88	17.10	-14.44	.03	-1.37	.87	1.62	70HA	C440
C442	0	25.61	17.46	-14.66	25.71	16.15	-13.76	.10	-1.31	.90	1.59	70HM	C442
C454	0	25.14	16.88	-15.66	25.33	15.43	-14.63	.19	-1.45	1.03	1.78*	70HA	C454
C456	0	25.60	18.11	-15.60	25.72	16.72	-14.60	.12	-1.39	1.00	1.71	70HA	C456
C458	0	25.58	18.30	-14.59	25.81	16.96	-13.64	.22	-1.34	.95	1.66	70HM	C458
C475	0	25.54	17.17	-14.40	25.18	16.21	-13.84	-.36	-.96	.56	1.17	70HA	C475
C477	0	25.46	17.72	-13.91*	25.28	16.76	-13.29*	-.18	-.96	.61	1.15	70HA	C477
C494	0	26.57*	15.67*	-12.54X	25.97	15.28	-12.40X	-.60	-.40 *	.14 *	.73*	70HA	C494
C496B	0	24.67*	16.54	-14.54	24.78	15.63	-13.74	.10	-.91	.80	1.21	70GP	C496B
C499A	0	25.64	18.16	-15.86	25.64	17.01	-15.06	.00	-1.15	.80	1.40	70HA	C499A
C499B	0	25.78	17.87	-15.54	25.48	17.06	-14.94	-.30	-.80	.60	1.04	70HA	C499B
C506	0	25.50	18.20	-15.99	25.80	16.94	-14.99	.30	-1.25	1.00	1.63	70HA	C506
C517	0	24.95	17.85	-14.99	24.95	16.76	-14.29	.00	-1.09	.69	1.29	70SC	C517
C538	0	26.22	19.25	-14.17	25.77	18.45	-13.77	-.46	-.81	.40	1.01	70GX	C538
C541	0	24.39*	18.41	-15.58	24.49*	17.16	-14.78	.10	-1.25	.80	1.48	70GP	C541
C542	0	24.30*	19.01	-15.64	24.27X	18.04	-14.92	-.03	-.97	.73	1.21	70GD	C542
C543	0	25.79	17.79	-15.96	25.82	16.60	-14.99	.03	-1.19	.98	1.54	70HA	C543
C574	0	25.18	17.22	-14.60	25.09	16.18	-13.91	-.10	-1.04	.69	1.25	70HQ	C574
C576	#	8.59X	23.55X	15.21X	8.52X	22.36X	14.40X	-.06	-1.18	-.81 X	1.44	70HM	C576
C585	0	25.75	17.56	-15.61	25.13	16.88	-15.19	-.61	-.69	.41	1.01	70HA	C585
C600	0	26.14	17.12	-14.42	25.84	16.21	-13.82	-.30	-.91	.60	1.13	70GD	C600
C619	0	25.07	18.67	-14.63	24.62*	17.67	-14.13	-.45	-1.00	.50	1.21	70HQ	C619
C620	0	25.36	16.23*	-14.45	25.19	15.06*	-13.80	-.17	-1.17	.65	1.35	70HA	C620
C628	0	30.38X	24.55X	-17.83X	30.01X	23.64X	-17.08X	-.38	-.91	.75	1.24	70ME	C628
C633	0	23.89X	17.37	-14.85	23.56X	16.51	-14.11	-.33	-.86	.74	1.18	70HA	C633
C640	0	25.83	18.74	-15.09	25.64	17.89	-14.32	-.19	-.85	.77	1.16	70ME	C640
C646	0	29.14X	18.72	-9.95X	28.56X	18.72	-9.80X	-.58	.01 X	.14 *	.60*	70CG	C646
C648	0	25.23	19.59	-14.82	24.83	18.97*	-14.15	-.40	-.61	.67	1.00	70SC	C648
C655	0	25.76	18.37	-14.53	25.35	17.65	-13.85	-.41	-.72	.68	1.07	70HU	C655
C674	0	25.88	18.44	-15.40	25.18	17.53	-15.01	-.70	-.90	.39	1.21	70HA	C674
C677	0	26.35	16.09*	-14.11	25.46	15.42	-13.93	-.90 *	-.67	.18 *	1.13	70SC	C677
C690	0	25.22	18.59	-16.39	25.43	17.28	-15.43	.20	-1.32	.96	1.64	70HM	C690
GRAND MEANS		25.57	17.99	-15.19	25.38	17.03	-14.50	-.22	-.98	.68	1.25		
SD OF MEANS		.44	.83	.61	.34	.89	.56	.28	.24	.21	.25		
INCLUDED LABS FOR THIS MEAN		54	55	52	53	55	52	57	56	57	57		

NOTES ON NBS REFLECTANCE VALUES

The tables on page 21 of this report contain absolute reflectance values measured at 40 wavelengths (380-770 nm) and tristimulus values for three 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.

NBS VALUES FOR SPECTRAL REFLECTANCE

45/0 REFLECTANCE FACTOR

SAMPLES C95, C97, W15

WAVELENGTH (nm)	C95	C97	W15
380	.0960	.0771	.1275
390	.1389	.1122	.2175
400	.1860	.1515	.4231
410	.2071	.1675	.6920
420	.2157	.1670	.8494
430	.2252	.1573	.8927
440	.2400	.1425	.9014
450	.2622	.1260	.9052
460	.2962	.1094	.9097
470	.3474	.0941	.9111
480	.4131	.0818	.9142
490	.4902	.0715	.9161
500	.5680	.0636	.9178
510	.6233	.0587	.9188
520	.6267	.0555	.9197
530	.5972	.0523	.9209
540	.5495	.0505	.9216
550	.4913	.0509	.9217
560	.4325	.0526	.9216
570	.3766	.0526	.9224
580	.3257	.0515	.9231
590	.2765	.0524	.9233
600	.2353	.0595	.9233
610	.2099	.0782	.9227
620	.1972	.1095	.9225
630	.1905	.1471	.9226
640	.1855	.1792	.9224
650	.1822	.2020	.9227
660	.1836	.2172	.9212
670	.1921	.2273	.9180
680	.2039	.2339	.9188
690	.2158	.2382	.9209
700	.2245	.2414	.9205
710	.2259	.2450	.9207
720	.2184	.2487	.9199
730	.2144	.2522	.9200
740	.2233	.2548	.9199
750	.2430	.2570	.9198
760	.2620	.2596	.9204
770	.2696	.2606	.9209

NBS TRISTIMULUS VALUES

45/0 REFLECTANCE FACTOR

SAMPLES C95, C97, W15

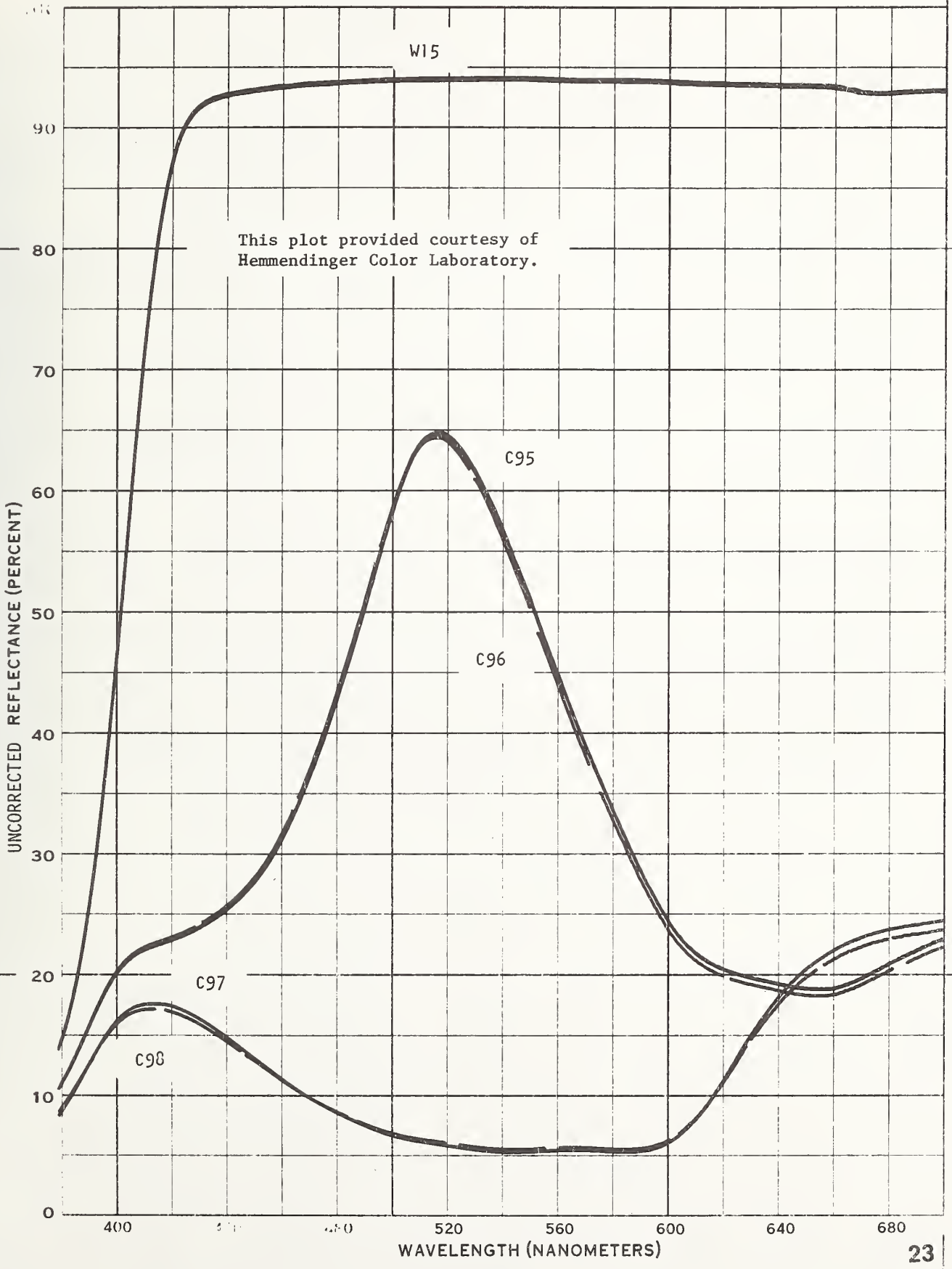
X, Y, Z SPACE

	C95	C97	W15
X	28.93	9.08	89.92
Y	42.22	6.57	92.12
Z	36.06	14.08	106.14

L, a, b SPACE

	C95	C97	W15
L	64.98	25.62	95.98
a	-34.23	18.42	- 0.73
b	12.59	-14.63	1.64

SPECTROPHOTOMETRIC CURVES OF COLOR AND
COLOR DIFFERENCE NO. 26 SAMPLES



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Collaborative Testing Services, Inc., 9241 Wood Glade Drive, Great Falls, VA 22066; and Manufacturers Council on Color and Appearance.

13. Type of Report & Period Covered

Final

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

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; Color; Laboratory evaluation; Precision; Reference samples: Testing calibration

18. AVAILABILITY ☐ Unlimited

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