BS 4800:2011

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Schedule of paint colours for building purposes

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Contents

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 24, an inside back cover and a back cover.

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Foreword

Publishing information

This British Standard is published by BSI on 30 April 2011. It was prepared by Technical Committee STI/14, *Colour measurement and schedules*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

The Technical Committee recognizes that suppliers of products within the scope of this standard might require time to comply. For this reason, the provisions of this standard become effective 12 months after the publication date.

This British Standard supersedes BS 4800:1989, which will be withdrawn on 31 May 2012.

Relationship with other publications

The colours in this British Standard have been selected from BS 5252, which was designed as the means of implementing the aims of colour co-ordination in the building industry, namely:

a) to bring colours of building materials and finishes into a systematic relationship;

b) to combine economy in the total number of colours used, with sufficient flexibility for meeting design and technical requirements.

Information about this document

The original edition, which replaced BS 2660, *Colours for building and decorative paints*, was published in 1972 and included 88 colours selected from the precursor of BS 5252, namely DD 17:1972, *Basic range for the co-ordination of colours for building purposes*. The 1981 edition revised and extended the range to 100 colours (including black and white) selected from BS 5252. The 1989 edition included the same 100 colours, but the "paint finish availability" was revised.

This edition retains the same selection of colours, adds 22 more and embodies the following major changes:

a) The selection of colours has been revised to reflect market demands. More colours have been included, from the full range specified in BS 5252, that are expected to be popular. Some colours have been marked as obsolescent, but will not be removed until the next edition of this standard. This partly reflects a perceived trend in the decoration of public buildings (such as hospitals and schools) to use brighter colours in place of some of the traditional browns, greens and greys.

b) Some definitions such as "full gloss finish", "eggshell finish", etc. have been removed along with the associated "availability" information and the "basic selection" of colours.

c) Colorimetric data has been included in the format used in BS 381C.

d) Spectral reflectance data for each individual colour have been included (see Tables 2 to 6).

NOTE 1 Attention is drawn to BS 8493. Reflectance values in this British Standard and BS 8493 are not identical nor are they directly comparable.

Users of these British Standard colours should be aware of the other derived standards in which ranges or selections of colours from BS 5252 have been standardized for various purposes. These are:

BS 4900, *Specification for vitreous enamel colours for building purposes*;

BS 4901, *Specification for plastics colours for building purposes*;

BS 4904, *Specification for external cladding colours for building purposes*.

BS 6770, *Guide for exterior colours for park homes (mobile homes), holiday caravans and transportable accommodation units*

NOTE 2 BS 4903 was a part of the series but was replaced by BS 5502-20.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Requirements in this standard are drafted in accordance with *The BSI guide to standardization – Section 2: Rules for the structure, drafting and presentation of British Standards*, subclause **11.3.1**, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall …'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This British Standard specifies, in the form of a schedule, 122 colours for paints for building purposes. The colours (see Table 1) have been selected from the framework of 237 colours established in BS 5252, which aims to ensure co-ordination with the selections for other materials and applications (see Foreword).

NOTE 1 Because of technical or commercial limitations, the inclusion of a colour in this standard does not necessarily mean that it will be available in all types of paint or from all manufacturers.

NOTE 2 Clause 3, Clause 4 and Clause 5 give general information.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 950-1, *Specification for artificial daylight for the assessment of colour – Part 1: Illumination for colour matching and colour appraisal*

BS 4800F, *Schedule of paint colours for building purposes – Colour-matching fan*

BS 5252:1976, *Framework for colour co-ordination for building purposes*

3 Categories of colours

The 122 colours (including black and white), eight of which are proposed for obsolescence, are specified in Table 1 by reference to Clause **4**, Clause **5** and Clause **6**.

4 Framework provided by BS 5252

NOTE 1 The information given in this Clause is based on BS 5252.

BS 5252 locates and relates 237 colours in terms of selected steps in the visual attributes of *hue, greyness, weight* and *lightness*, although the last attribute is not included in the identification reference (see Clause **6**).

a) *Hue* is the attribute of redness, yellowness, blueness, etc. The framework has 12 horizontal *hue* rows, plus a further row of neutral colours (i.e. without *hue*) numbered and named as follows:

02 red-purple

04 red

06 yellow-red

08 yellow-red

10 yellow

12 green-yellow

14 green

16 blue-green

18 blue

20 purple-blue

22 violet

24 purple

00 neutral

Two yellow-red rows are included, one (06) of reddish-browns to harmonize with reddish woods, stones, bricks, etc., and the other (08) of yellowish-browns to harmonize with yellowish woods etc.

b) *Greyness* is the estimated grey content of colours. The framework divides the colours into five groups, lettered A to E, representing steps of diminishing *greyness* as follows.

Group A	grey
Group B	nearly grey
Group C	grey/clear
Group D	nearly clear
Group E	clear

NOTE 2 Greyness diminishes as Munsell chroma increases, but the relationship is not regular.

c) *Weight* is a subjective term for the relative character of colours of differing *hues*, as determined by their *greyness* and *lightness*.

The colours in each individual column in the framework have been selected to have the same *weight,* i.e. to offer colours of the same character in the different *hues* represented. To have the same *weight,* colours are required to have the same *greyness* and be adjusted as necessary in *lightness*. The variations of *lightness* for the same *weight* in any column of colours are indicated by the *value* figures in the approximate Munsell [1] references for all framework colours in BS 5252:1976, Annex A.

Weight is used in the framework solely to regulate the appearance of the colours within a given column. It is not used for relating one column to another for which purpose *lightness* is used, as indicated in item (d).

d) *Lightness* is the attribute by which surface colours appear to reflect a greater or lesser amount of the incident light. White has highest *lightness*, black has lowest *lightness*; all other colour have *lightness* in between these extremes.

The framework provides for up to eight vertical columns in each *greyness* group from, high *lightness* to the left to low *lightness* to the right.

NOTE 3 To meet practical requirements in the middle lightness region of Group E, where hue discrimination is at its peak, column 55 of the overlay serves as an extension of column 53.

NOTE 4 The numbering of the columns within the overlay across the whole framework is not regular because certain numbers were standardized in this British Standard before publication of BS 5252 and have been retained for convenience of reference.

Both black and white are clear colours and therefore belong to Group E [see item b)]. They are at opposite extremes of lightness outside the range of the eight columns of the group and should properly have positions of their own on the right and left hand sides respectively. Owing to limited space in the colour card they are shown at the foot of columns 49 and 58 respectively and coded in accordance with BS 5252.

5 Presentation of colour range overlay

The colour selection in this derived colour standard is indicated by the cut-out apertures in the overlay. This is keyed to register with the five-fold composite colour card included in BS 5252 and identifies each colour by its code reference (see Clause **6**).

6 Identification of colours

Each colour shall be identified by a three-part code taken from the framework provided by BS 5252. The following codes shall be used to identify the colours for purposes of specifying or ordering:

a) The first part of the identification code signifies *hue* and consists of a NUMBER with two numerals. (Neutral colours are designated 00.)

b) The second part signifies *greyness* and consists of a single LETTER.

c) The third part signifies *weight* and consists of a NUMBER with two numerals.

EXAMPLES

08 B 15

12 D 45

00 E 53

Codes with the same first pair of numerals identify colours in the same *hue* row, codes with the same letter indicate colours in the same *greyness* group and codes with the same second pair of numerals identify colours in the same *weight* column.

Colorimetric values for individual colours shall be as given in Table 1.

NOTE 1 Some colour samples might deviate slightly from these values, although the colours remain a satisfactory visual match.

Table 1 gives the CIE [1)] tristimulus values X, Y and Z and the CIELAB L*, a*, b*, C_{ab}*and h_{ab} calculated using CIE Standard Illuminant D65 and the1964 Standard Colorimetric Observer, also known as 10° observer.

NOTE 2 The colorimetric data in Table 1 was determined on a standard set of samples by a spectrophotometer with a geometry of (di:8) at the Paint Research Association under specular and UV component included conditions. The instrument used had measurement repeatability averaging DE^*_{ab} of 0.02. When reproducing the colorimetric values in Table 1 expect a mean DE^*_{ab} of 0.9.

NOTE 3 Approximate Munsell [1] references which classify the colours in terms of hue value (lightness) and chroma (saturation), in that order, are given in Table 1 as a further guide to the visual properties of the colours in this standard. All Munsell [1] references given in this British Standard are approximate and for information only and are not to be used for specifying or ordering the colours. The value figure in these references can be used to give an approximate estimate of the reflectance of each colour, as a percentage, by substituting it for V in the formula V(V-1), e.g. the value figures in Munsell references 5Y 6/2 and N7 are 6 and 7 respectively which, substituted for V in the formula, give approximate reflectances of 30 % and 42 %.

Tables 2 to 6 list the spectral reflectance data for each individual colour. Each data is presented ranged from 400 nm to 700 nm at 10 nm

1) Commission Internationale de l'Eclairage.

intervals. Some samples might deviate slightly from these values , although the colours remain a satisfactory visual match.

7 Colour-matching

BS 4800F [2)] shall be used for visual colour-matching purposes.

NOTE 1 BS 4800F does not include black and white because the purity of colour achievable in different finishes is influenced very strongly by the type of pigmentation used and particularly by the nature of the medium.

NOTE 2 Colour comparisons should be made in good diffuse daylight or under an illuminant complying with BS 950-1. Matching colours in a way other than described might not produce acceptable or consistent results.

NOTE 3 When using BS 4800F for colour-matching, the relative appearance of the surface colours can be affected by differences in gloss and, more particularly, by the character of the light under which they are compared. Thus, close matching under one illuminant might not be close under others, a phenomenon resulting from dye or pigment difference and known as metamerism.

Certain colours in some paint finishes have limited opacity, it therefore might be necessary to apply extra coats of these paints and in such cases the manufacturer's instructions on the choice of appropriate undercoats shall be followed.

Table 1 **Colour range for paints**

Group	Colour code	Colorimetric values under the CIE Standard Illuminant D_{65} and the CIE 1964 10° Supplementary Standard Observer with specular and UV components included								Approximate Munsell reference	
		X	Y	Z	L*	a*	b*	C_{ab}*	h_{ab}		
A	00 A 01	62.065	65.596	66.807	84.790	-0.297	2.998	3.013	95.66	N	8.5
	00 A 05	41.098	43.314	45.706	71.768	0.097	0.843	0.848	83.43	N	7
	00 A 09	21.565	22.780	25.143	54.846	-0.159	-1.154	1.164	262.18	N	5
	00 A 13	9.749	10.301	11.261	38.378	-0.140	-0.583	0.600	256.50	N	3
	10 A 03	53.873	57.004	56.813	80.182	-0.444	4.033	4.057	96.28	5Y	8/0.5
	10 A 07	*30.214*	*31.816*	*31.413*	*63.191*	*0.185*	*3.737*	*3.742*	*87.17*	*5Y*	*6/0.5*
	10 A 11	*13.583*	*14.284*	*14.330*	*44.637*	*0.263*	*2.318*	*2.333*	*83.53*	*5Y*	*4/0.5*
B	04 B 15	72.113	74.389	73.252	89.106	3.367	5.116	6.124	56.65	10R	9/1
	04 B 17	57.388	58.041	55.272	80.762	5.877	6.509	8.769	47.92	10R	8/2
	04 B 21	31.504	31.114	28.583	62.604	7.506	6.839	10.154	42.34	10R	6/2
	08 B 15	78.452	82.038	74.927	92.592	1.343	9.793	9.884	82.19	10YR	9.25/1
	08 B 17	57.869	59.702	51.778	81.676	3.114	11.537	11.949	74.90	8.75R	8/2
	08 B 21	30.676	31.180	27.025	62.659	4.209	9.316	10.222	65.69	8.75R	6/2
	08 B 25	14.686	14.733	12.283	45.266	4.446	8.522	9.612	62.45	8.75R	4/2
	08 B 29	6.903	6.998	6.230	31.802	2.737	4.975	5.678	61.18	8.75R	2/2
	10 B 15	77.884	81.935	74.661	92.546	0.403	9.924	9.932	87.67	5Y	9.25/1
	10 B 17	55.260	58.390	46.806	80.955	-0.251	15.485	15.487	90.93	5Y	8/2
	10 B 21	31.231	32.739	26.320	63.949	0.706	12.648	12.668	86.81	5Y	6/2
	10 B 25	14.521	15.191	11.736	45.895	0.729	11.071	11.094	86.23	5Y	4/2
	10 B 29	*6.142*	*6.445*	*5.916*	*30.508*	*0.347*	*4.067*	*4.082*	*85.13*	*5Y*	*2/2*

NOTE Colours introduced in this edition are in bold, obsolescent colours are in italics.

[2)] BS 5252F is not intended for matching paint colours as it is less accurate.

Table 1 **Colour range for paints** *(continued)*

Group	Colour code	Colorimetric values under the CIE Standard Illuminant D_{65} and the CIE 1964 10° Supplementary Standard Observer with specular and UV components included								Approximate Munsell reference	
		X	Y	Z	L*	a*	b*	C_{ab}*	h_{ab}		
	12 B 15	71.764	76.934	69.674	90.291	-2.479	10.074	10.374	103.83	5GY	9/1
	12 B 17	53.359	57.884	46.754	80.675	-3.888	15.057	15.551	104.48	2.5GY	8/2
	12 B 21	29.036	31.710	24.809	63.103	-3.933	13.632	14.188	106.09	2.5GY	6/2
	12 B 25	12.990	14.161	11.402	44.463	-2.855	9.517	9.936	106.70	2.5GY	4/2
	12 B 29	*5.931*	*6.416*	*5.727*	*30.438*	*-1.677*	*4.766*	*5.052*	*109.38*	*2.5GY*	*2/2*
	18 B 17	55.688	60.073	64.517	81.878	-3.155	-0.049	3.155	180.89	5B	8/1
	18 B 21	29.929	32.358	35.803	63.638	-2.822	-1.411	3.155	206.56	5B	6/1
	18 B 25	14.562	15.781	18.422	46.686	-2.430	-3.078	3.921	231.71	5B	4/1
	18 B 29	5.819	6.249	7.492	30.032	-1.188	-2.991	3.218	248.33	7.5B	2/1
	22 B 15	72.444	76.812	79.442	90.235	-0.804	2.235	2.375	109.77	10PB	9/1
	22 B 17	53.904	56.435	63.432	79.861	1.021	-2.576	2.770	291.62	10PB	8/2
C	02 C 33	60.920	58.497	59.209	81.015	13.290	3.225	13.676	13.64	7.5RP	8/4
	02 C 37	25.189	21.395	22.375	53.379	22.385	1.021	22.408	2.61	7.5RP	5/6
	02 C 39	11.746	9.511	10.024	36.951	21.020	0.545	21.027	1.48	7.5RP	3/6
	02 C 40	7.231	6.589	7.435	30.852	10.092	-1.367	10.184	352.29	7.5RP	2/4
	04 C 31	**79.287**	**81.632**	**80.625**	**92.412**	**3.776**	**5.095**	**6.341**	**53.46**	**7.5R**	**9.25/2**
	04 C 33	59.671	56.862	50.026	80.102	14.256	10.613	17.772	36.67	7.5R	8/6
	04 C 37	24.294	20.671	15.304	52.588	21.938	13.761	25.896	32.10	7.5R	5/6
	04 C 39	11.795	9.524	6.696	36.974	21.270	12.004	24.423	29.44	7.5R	3/6
	06 C 33	*57.656*	*57.076*	*40.489*	*80.223*	*8.857*	*21.378*	*23.140*	*67.50*	*7.5YR*	*8.4*
	06 C 35	**47.791**	**43.974**	**25.633**	**72.211**	**17.702**	**27.993**	**33.120**	**57.69**	**7.5YR**	**7/6**
	06 C 37	24.594	21.669	11.571	53.675	18.559	24.935	31.083	53.34	5YR	5/6
	06 C 39	10.812	9.700	5.321	37.299	12.731	18.418	22.389	55.35	7.5RP	3/6
	06 C 40	**7.733**	**7.236**	**6.125**	**32.338**	**8.482**	**6.336**	**10.587**	**36.76**	**5YR**	**2/4**
	08 C 31	73.569	76.233	63.200	89.968	2.706	15.055	15.296	79.81	10YR	9/2
	08 C 33	**55.265**	**55.736**	**38.343**	**79.464**	**6.190**	**22.669**	**23.499**	**74.73**	**10YR**	**8/4**
	08 C 35	43.575	42.164	21.222	70.984	10.931	33.447	35.188	71.90	10YR	7/6
	08 C 37	22.147	20.688	8.413	52.607	12.216	32.689	34.896	69.51	10YR	5/6
	08 C 39	*10.171*	*9.654*	*5.527*	*37.214*	*8.211*	*17.335*	*19.181*	*64.65*	*10YR*	*3/6*
	10 C 31	72.729	76.254	60.111	89.977	0.909	17.849	17.872	87.09	5Y	9/2
	10 C 33	62.310	65.578	40.440	84.781	0.314	29.295	29.297	89.39	5Y	8.5/4
	10 C 35	40.246	41.723	19.099	70.680	2.155	36.945	37.008	86.66	5Y	7/6
	10 C 39	9.312	9.509	5.801	36.946	2.480	15.660	15.855	81.00	5Y	3/4
	12 C 31	**70.759**	**76.917**	**59.736**	**90.284**	**-4.584**	**18.721**	**19.274**	**103.76**	**2.5GY**	**9/2**
	12 C 33	51.295	56.936	35.879	80.144	-6.993	26.950	27.842	104.55	2.5GY	8/4
	12 C 37	**17.533**	**20.318**	**8.433**	**52.195**	**-9.081**	**31.909**	**33.175**	**105.88**	**2.5GY**	**5/6**
	12 C 39	*8.101*	*9.176*	*5.656*	*36.321*	*-5.299*	*15.219*	*16.114*	*109.20*	*2.5GY*	*3/4*
	14 C 31	69.169	76.205	74.071	89.955	-6.588	5.925	8.860	138.04	5G	9/1
	14 C 35	37.404	42.690	40.243	71.344	-9.773	6.364	11.662	146.93	5G	7/2
	14 C 39	7.658	9.636	8.826	37.182	-13.100	4.714	13.922	160.21	5G	3/4
	14 C 40	5.716	6.495	6.485	30.630	-4.934	1.908	5.290	158.86	5G	2/2

NOTE Colours introduced in this edition are in bold, obsolescent colours are in italics.

Table 1 **Colour range for paints** *(continued)*

Group	Colour code	Colorimetric values under the CIE Standard Illuminant D_{65} and the CIE 1964 10° Supplementary Standard Observer with specular and UV components included								Approximate Munsell reference	
		X	Y	Z	L*	a*	b*	C_{ab}*	h_{ab}		
	16 C 33	51.031	57.642	62.062	80.540	-9.399	-0.188	9.400	181.14	7.5BG	8/2
	16 C 37	17.366	21.699	25.331	53.707	-16.503	-3.423	16.854	191.72	7.5BG	5/4
	18 C 31	74.494	79.744	81.491	91.570	-2.286	2.994	3.767	127.36	5B	9.25/1
	18 C 35	37.243	41.646	51.696	70.627	-7.207	-7.432	10.352	225.88	7.5B	7/3
	18 C 39	7.973	9.470	14.524	36.875	-8.848	-11.524	14.529	232.48	7.5B	3/4
	20 C 33	54.478	59.278	74.615	81.444	-4.338	-9.181	10.154	244.71	5PB	8/4
	20 C 37	20.604	22.796	36.036	54.862	-4.829	-16.843	17.521	254.00	5PB	5/6
	20 C 40	5.339	5.687	9.149	28.610	-0.637	-11.115	11.133	266.72	5PB	2/4
	22 C 37	20.847	20.505	33.464	52.404	6.943	-17.691	19.005	291.43	10PB	5/6
	24 C 33	56.433	56.581	64.830	79.944	7.044	-3.657	7.937	332.57	7.5P	8/3
	24 C 39	11.313	9.728	15.661	37.351	16.194	-13.318	20.967	320.57	7.5P	3/6
D	04 D 44	19.471	14.246	8.521	44.583	33.861	18.489	38.580	28.64	7.5R	4/10
	04 D 45	12.822	9.142	5.421	36.257	31.403	16.164	35.319	27.24	7.5R	3/10
	06 D 43	33.686	29.399	9.624	61.133	21.666	43.463	48.564	63.50	7.5YR	6/10
	06 D 45	16.536	14.016	6.495	44.256	19.633	25.364	32.075	52.26	5YR	4/8
	08 D 41	**58.614**	**57.128**	**29.805**	**80.252**	**11.065**	**35.458**	**37.144**	**72.67**	**10YR**	**8/6**
	10 D 43	37.920	38.649	9.094	68.497	4.181	57.834	57.985	85.87	5Y	7/10
	10 D 45	16.536	14.016	6.495	44.256	19.633	25.364	32.075	52.26	5Y	5/8
	12 D 41	**51.532**	**58.198**	**26.900**	**80.849**	**-9.408**	**40.873**	**41.942**	**102.96**	**2.5GY**	**8/6**
	12 D 43	*24.023*	*27.984*	*8.741*	*59.874*	*-10.650*	*44.118*	*45.385*	*103.57*	*2.5GY*	*6/8*
	12 D 45	12.499	14.232	6.376	44.564	-6.580	26.376	27.184	104.01	2.5GY	4/6
	16 D 45	6.665	9.481	11.941	36.894	-21.638	-5.004	22.208	193.02	7.5BG	3/6
	18 D 43	17.779	22.080	34.321	54.112	-16.019	-15.894	22.566	224.78	7.5B	5/6
	20 D 41	**42.310**	**46.382**	**68.039**	**73.793**	**-4.950**	**-17.006**	**17.712**	**253.77**	**5PB**	**7/6**
	20 D 45	9.660	10.653	22.891	38.989	-3.488	-24.694	24.939	261.96	5PB	3/8
	22 D 41	**44.922**	**45.765**	**67.742**	**73.393**	**4.481**	**-17.445**	**18.011**	**284.40**	**10PB**	**7/6**
	22 D 45	11.095	9.917	23.055	37.693	13.126	-27.214	30.214	295.75	10PB	3/8
E	00 E 53	Black (no data available)								N	1.5
	00 E 55	White (no data available)								N	9.5
	04 E 49	75.072	75.051	71.430	89.417	8.185	7.124	10.850	41.04	7.5R	9/3
	04 E 51	41.072	30.149	15.104	61.783	43.057	30.071	52.518	34.93	7.5R	6/12
	04 E 53	24.821	15.850	5.786	46.777	49.270	32.677	59.121	33.55	7.5R	4.5/16
	04 E 55	**26.922**	**17.410**	**5.352**	**48.773**	**49.449**	**38.056**	**62.397**	**37.58**	**8.75R**	**4.5/16**
	04 E 56	**21.278**	**13.354**	**5.527**	**43.293**	**48.280**	**27.816**	**55.719**	**29.95**	**7.5R**	**4/13**
	04 E 58	**9.182**	**7.614**	**6.923**	**33.165**	**17.694**	**4.552**	**18.270**	**14.43**	**7.5R**	**2/8**
	06 E 50	61.546	56.558	25.086	79.931	19.436	42.190	46.451	65.27	7.5YR	8/8
	06 E 51	49.555	39.790	14.265	69.320	35.003	45.029	57.033	52.14	2.5R	7/11
	06 E 56	25.623	20.401	5.828	52.288	28.922	41.995	50.991	55.44	5YR	5/12
	08 E 51	49.610	44.544	6.430	72.591	21.054	74.479	77.397	74.22	10YR	7.5/12
	08 E 55	**52.830**	**43.845**	**6.354**	**72.125**	**31.597**	**73.984**	**80.449**	**66.87**	**7.5YR**	**7/15**

NOTE Colours introduced in this edition are in bold, obsolescent colours are in italics.

Table 1 **Colour range for paints** *(continued)*

Group	Colour code	Colorimetric values under the CIE Standard Illuminant D_{65} and the CIE 1964 10° Supplementary Standard Observer with specular and UV components included								Approximate Munsell reference	
		X	Y	Z	L*	a*	b*	C_{ab}*	h_{ab}		
	10 E 49	68.272	73.933	46.355	88.891	-3.958	29.656	29.919	97.60	10Y	9/4
	10 E 50	63.233	65.686	22.472	84.836	2.212	55.086	55.130	87.70	5Y	8.5/8
	10 E 53	54.941	56.211	8.038	79.734	4.209	80.748	80.857	87.02	6.25Y	8.5/13
	10 E 55	**60.138**	**60.067**	**9.492**	**81.875**	**7.729**	**79.636**	**80.010**	**84.46**	**5Y**	**8.5/14**
	12 E 51	47.310	54.710	12.876	78.874	-12.357	64.929	66.094	100.78	2.5GY	8/10
	12 E 53	30.851	38.550	10.614	68.424	-19.989	53.063	56.703	110.64	5GY	7/11
	12 E 55	**22.573**	**29.825**	**10.129**	**61.503**	**-24.169**	**42.561**	**48.944**	**119.59**	**7.5GY**	**6/10**
	14 E 49	**67.425**	**76.684**	**73.947**	**90.176**	**-11.357**	**6.405**	**13.039**	**150.58**	**5G**	**9/2**
	14 E 50	**50.899**	**61.123**	**54.509**	**82.445**	**-17.963**	**10.152**	**20.633**	**150.53**	**5G**	**8/4**
	14 E 51	22.991	33.574	21.550	64.623	-35.717	21.882	41.887	148.51	2.5G	6.5/8
	14 E 53	13.935	22.142	16.449	54.178	-38.620	13.957	41.065	160.13	5G	5/10
	16 E 50	**49.163**	**60.032**	**67.545**	**81.856**	**-20.095**	**-2.689**	**20.274**	**187.62**	**7.5BG**	**8/4**
	16 E 53	15.581	23.105	29.140	55.180	-32.935	-6.791	33.628	191.65	7.5BG	5/8
	18 E 49	68.733	75.873	81.873	89.801	-6.873	-0.342	6.881	182.84	5B	9/2
	18 E 50	52.609	60.688	73.885	82.211	-12.451	-7.280	14.423	210.31	7.5B	8/4
	18 E 51	24.894	32.163	52.750	63.478	-22.404	-20.816	30.581	222.90	7.5B	6/8
	18 E 53	12.073	15.936	34.798	46.890	-19.526	-28.977	34.941	236.03	10B	4/10
	20 E 51	29.515	33.727	65.330	64.746	-9.173	-30.294	31.652	253.15	5PB	6/10
	20 E 53	**14.261**	**16.275**	**40.264**	**47.334**	**-7.078**	**-35.060**	**35.767**	**258.59**	**5PB**	**4/12**
	20 E 56	**9.664**	**11.280**	**28.234**	**40.048**	**-8.018**	**-31.525**	**32.529**	**255.73**	**5PB**	**3.5/11**
	24 E 53	**18.982**	**15.414**	**27.470**	**46.196**	**24.417**	**-19.758**	**31.410**	**321.02**	**7.5P**	**4/10**

NOTE Colours introduced in this edition are in bold, obsolescent colours are in italics.

Table 2 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group A**

Wavelength nm	**00 A 01**	**00 A 05**	**00 A 09**	**00 A 13**	**10 A 03**	**10 A 07**	**10 A 11**
400	41.2	33.4	21.8	10.7	37.5	24.2	12.0
410	55.5	40.9	23.9	11.1	47.9	27.3	12.6
420	60.1	42.6	24.0	11.0	50.9	28.1	12.8
430	61.1	42.7	23.8	10.8	51.6	28.4	12.9
440	61.8	42.6	23.6	10.6	52.2	28.8	13.1
450	62.5	42.7	23.4	10.4	52.9	29.3	13.4
460	63.2	42.7	23.3	10.3	53.7	29.7	13.6
470	63.7	42.7	23.2	10.3	54.3	30.0	13.7
480	64.1	42.8	23.2	10.3	54.9	30.2	13.8
490	64.5	42.9	23.2	10.3	55.5	30.4	13.9
500	64.8	43.1	23.0	10.3	56.0	30.6	13.9
510	65.0	43.0	22.8	10.4	56.3	30.7	14.0
520	65.1	43.0	22.9	10.4	56.4	30.9	14.0
530	65.2	43.2	22.9	10.4	56.6	31.1	14.0
540	65.4	43.5	22.6	10.3	56.8	31.5	14.1
550	65.7	43.2	22.6	10.3	57.2	32.0	14.3
560	66.0	42.8	22.8	10.3	57.6	32.5	14.5
570	66.3	43.4	23.0	10.4	57.9	33.0	14.6
580	66.4	44.1	23.0	10.4	58.1	33.3	14.7
590	66.4	44.3	22.8	10.3	58.1	33.3	14.7
600	66.4	44.1	22.6	10.2	58.1	33.1	14.7
610	66.4	43.7	22.4	10.1	58.0	32.7	14.7
620	66.4	43.4	22.3	10.0	57.9	32.4	14.6
630	66.6	43.1	22.1	10.0	57.9	32.0	14.6
640	66.8	42.9	21.9	10.0	58.0	31.8	14.6
650	67.2	42.7	21.7	10.0	58.1	31.4	14.6
660	67.6	42.6	21.5	10.1	58.2	31.2	14.7
670	68.0	42.5	21.3	10.1	58.4	31.0	14.8
680	68.6	42.5	21.2	10.2	58.6	30.9	14.8
690	69.0	42.5	21.0	10.3	58.7	30.8	14.9
700	69.4	42.5	20.8	10.3	58.9	30.6	14.9

Table 3 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group B**

Wavelength nm	**04 B 15**	**04 B 17**	**04 B 21**	**08 B 15**	**08 B 17**	**08 B 21**	**08 B 25**	**08 B 29**
400	42.8	38.7	22.5	43.8	33.1	20.8	9.9	5.6
410	59.7	49.7	25.1	62.0	40.7	23.1	10.3	5.6
420	65.7	52.2	25.8	68.3	43.3	23.7	10.6	5.6
430	66.9	51.9	26.1	69.0	45.1	24.1	10.9	5.6
440	67.6	51.5	26.7	69.0	47.5	24.6	11.4	5.6
450	68.5	51.2	27.0	69.3	49.3	25.2	11.6	5.7
460	69.3	51.0	26.9	70.0	49.9	25.7	11.7	5.8
470	70.1	51.2	26.8	70.9	50.1	26.0	11.7	6.0
480	70.7	51.9	26.8	72.6	50.3	26.4	11.7	6.1
490	71.3	53.2	26.9	75.0	51.1	26.8	11.9	6.3
500	71.6	54.6	27.2	76.4	52.4	27.1	12.2	6.4
510	71.3	55.2	27.6	77.3	54.1	27.6	12.6	6.4
520	71.3	55.2	28.0	79.4	55.8	28.2	13.0	6.3
530	72.0	54.9	28.3	80.9	57.2	28.9	13.4	6.3
540	71.9	54.6	28.6	80.6	58.8	29.6	13.9	6.3
550	71.5	54.9	29.0	81.7	60.5	30.7	14.4	6.4
560	72.5	56.0	29.9	84.0	61.3	32.1	15.1	6.8
570	75.4	58.3	31.7	85.9	62.1	33.5	16.1	7.6
580	78.3	61.2	34.3	86.7	63.9	34.6	16.9	8.4
590	79.6	63.8	36.7	86.8	65.7	35.2	17.3	8.7
600	80.2	65.7	38.0	86.9	66.6	35.6	17.5	8.3
610	80.5	66.7	38.3	87.1	66.8	35.8	17.5	7.9
620	80.9	67.4	38.1	87.4	66.7	35.8	17.4	7.5
630	81.4	68.1	37.9	87.9	66.6	35.7	17.2	7.4
640	82.1	68.9	37.7	88.4	66.5	35.6	17.1	7.3
650	82.9	69.8	37.5	89.0	66.3	35.5	17.0	7.3
660	83.9	71.1	37.6	89.6	66.1	35.3	16.9	7.5
670	85.0	72.6	37.9	90.0	66.0	35.1	16.8	7.8
680	86.3	74.5	38.5	90.5	66.0	35.0	16.7	8.2
690	87.5	76.5	39.2	90.7	65.9	34.8	16.6	8.7
700	88.6	78.6	39.9	91.0	65.9	34.7	16.6	9.0

Table 3 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group B** *(continued)*

Wavelength nm	**10 B 15**	**10 B 17**	**10 B 21**	**10 B 25**	**10 B 29**	**12 B 15**	**12 B 17**	**12 B 21**
400	43.6	34.7	18.5	8.8	5.7	41.2	33.1	19.1
410	61.4	42.1	20.4	9.2	5.7	56.3	39.8	21.0
420	67.6	43.4	21.3	9.5	5.6	61.2	41.2	21.4
430	68.5	43.1	22.4	10.0	5.5	62.1	41.4	21.6
440	68.8	42.7	24.0	10.7	5.5	62.7	41.6	22.0
450	69.1	42.5	25.1	11.2	5.4	63.9	42.3	22.6
460	69.6	42.6	25.5	11.3	5.5	65.7	43.5	23.3
470	70.5	43.2	25.6	11.3	5.5	68.0	45.2	24.2
480	72.2	45.1	25.8	11.5	5.5	70.4	47.5	25.3
490	75.1	48.9	26.4	11.8	5.6	72.5	50.0	26.4
500	78.3	53.4	27.4	12.4	5.7	73.4	52.7	27.6
510	80.2	56.6	28.8	13.1	6.0	74.3	55.8	29.3
520	80.8	58.1	30.4	14.0	6.4	76.8	58.9	31.3
530	81.5	58.6	32.0	14.8	6.7	78.6	60.5	33.2
540	82.1	58.5	33.4	15.5	6.6	78.4	60.9	34.5
550	81.8	58.7	34.4	15.9	6.5	78.7	60.8	35.1
560	81.6	59.4	35.1	16.4	6.4	79.5	60.5	34.6
570	83.1	60.8	35.6	16.9	6.6	79.4	60.2	33.5
580	85.3	62.5	35.9	17.0	6.8	78.7	59.9	32.7
590	86.5	63.8	35.8	16.9	6.9	77.9	59.5	32.3
600	87.0	64.1	35.6	16.7	6.9	77.4	59.2	31.8
610	87.1	63.6	35.4	16.5	6.8	77.5	58.9	31.2
620	87.2	63.0	35.1	16.3	6.7	77.8	58.7	30.8
630	87.3	62.4	34.8	16.1	6.7	78.4	58.4	30.9
640	87.6	61.9	34.5	16.0	6.7	79.2	58.3	31.4
650	87.8	61.4	34.3	15.9	6.6	80.2	58.1	31.9
660	88.0	61.1	34.0	15.9	6.6	81.4	57.9	32.4
670	88.1	61.2	33.8	15.9	6.6	82.5	57.8	32.8
680	88.3	61.6	33.7	15.9	6.6	83.5	57.7	33.4
690	88.5	62.1	33.5	15.9	6.6	84.4	57.6	34.1
700	88.7	62.7	33.3	15.9	6.6	85.3	57.5	35.3

Table 3 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group B** *(continued)*

Wavelength nm	**12 B 25**	**12 B 29**	**18 B 17**	**18 B 21**	**18 B 25**	**18 B 29**	**22 B 15**	**22 B 17**
400	8.1	5.8	40.7	28.4	16.3	7.2	44.4	39.8
410	8.5	5.8	54.7	32.8	17.4	7.3	64.1	52.8
420	8.9	5.6	59.1	33.5	17.5	7.2	71.8	57.1
430	9.5	5.4	59.9	33.5	17.4	7.2	73.2	58.3
440	10.3	5.3	60.3	33.4	17.3	7.1	73.6	59.2
450	10.9	5.2	60.5	33.4	17.2	7.0	74.0	59.9
460	11.1	5.2	60.6	33.3	17.1	6.9	74.8	60.3
470	11.2	5.2	60.5	33.3	17.0	6.8	75.7	60.3
480	11.4	5.3	60.8	33.4	17.0	6.8	76.8	59.9
490	11.8	5.5	61.6	33.5	16.9	6.7	77.9	59.7
500	12.4	5.7	61.6	33.7	16.8	6.6	77.6	59.6
510	13.1	6.1	61.6	33.8	16.7	6.6	76.9	58.3
520	14.1	6.6	62.7	33.6	16.6	6.6	77.3	56.6
530	14.8	6.9	63.0	33.4	16.4	6.5	77.2	56.2
540	15.3	7.0	61.4	33.1	16.2	6.4	76.0	56.2
550	15.4	6.9	60.7	32.8	16.0	6.3	75.8	54.2
560	15.3	6.8	60.3	32.5	15.8	6.2	76.5	52.2
570	15.1	6.6	59.4	32.1	15.5	6.1	77.2	53.2
580	14.8	6.4	58.4	31.7	15.2	6.0	77.3	55.8
590	14.5	6.3	57.5	31.3	14.9	5.9	77.0	57.1
600	14.1	6.3	56.8	30.7	14.6	5.8	76.8	57.3
610	13.7	6.3	56.4	30.2	14.3	5.7	76.7	57.2
620	13.5	6.3	56.5	29.8	14.1	5.6	76.9	57.3
630	13.7	6.3	57.0	29.5	13.9	5.6	77.3	58.0
640	14.1	6.4	58.1	29.2	13.8	5.6	78.1	59.3
650	14.5	6.5	59.2	28.9	13.8	5.5	79.0	60.6
660	14.9	6.5	60.0	28.7	13.8	5.5	80.3	61.5
670	15.1	6.6	60.2	28.6	13.7	5.5	81.7	61.9
680	15.2	6.6	60.1	28.5	13.5	5.5	83.5	61.8
690	15.4	6.6	60.1	28.4	13.2	5.5	85.3	61.8
700	15.9	6.7	60.6	28.2	12.9	5.5	87.0	62.5

Table 4 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group C**

Wavelength nm	**02 C 33**	**02 C 37**	**02 C 39**	**02 C 40**	**04 C 31**	**04 C 33**	**04 C 37**	**04 C 39**
400	41.3	19.9	10.7	7.9	43.3	37.3	14.8	6.6
410	54.0	21.5	10.8	7.8	63.8	46.0	15.3	6.5
420	57.0	21.5	10.6	7.5	72.7	47.4	15.1	6.5
430	56.8	21.3	10.2	7.3	74.6	46.9	14.7	6.4
440	56.2	21.2	9.8	7.1	75.2	46.4	14.5	6.3
450	55.6	21.0	9.5	7.0	75.6	46.1	14.2	6.2
460	55.1	20.9	9.1	6.8	76.1	46.2	14.0	6.2
470	54.3	20.7	8.7	6.7	76.6	46.6	13.8	6.1
480	53.4	20.3	8.2	6.4	77.0	47.3	13.6	6.1
490	52.7	19.8	7.8	6.2	77.4	48.2	13.5	6.0
500	52.4	19.1	7.5	6.0	77.7	48.8	13.6	6.0
510	52.5	18.1	7.1	5.7	77.9	48.9	14.2	6.1
520	52.9	17.0	6.7	5.5	78.1	48.7	15.0	6.3
530	53.9	16.4	6.5	5.5	78.4	48.3	15.4	6.3
540	54.4	16.3	6.7	5.5	78.8	48.2	15.7	6.4
550	52.6	15.9	6.7	5.7	79.5	49.5	15.9	6.7
560	51.3	15.4	6.6	6.0	80.8	53.1	16.9	7.3
570	53.8	15.8	7.2	6.2	82.7	58.8	19.6	8.6
580	59.5	18.1	9.2	6.5	84.9	64.9	24.0	10.8
590	66.4	24.1	12.7	6.9	87.0	70.0	29.1	13.7
600	73.2	33.7	16.3	7.5	88.3	73.8	33.6	16.7
610	76.9	40.0	18.4	8.5	89.1	75.9	36.3	18.8
620	78.5	42.1	19.4	9.7	89.6	77.1	37.9	20.0
630	79.3	42.4	19.8	10.9	89.9	77.9	38.8	20.8
640	80.2	42.3	19.9	11.8	90.2	78.6	39.5	21.4
650	81.2	42.2	19.8	12.6	90.5	79.1	40.1	21.9
660	82.4	42.8	19.7	13.4	90.8	79.8	40.9	22.5
670	83.7	44.2	19.6	14.0	90.9	80.6	42.0	23.2
680	85.2	46.0	19.5	14.4	91.2	81.4	43.5	24.0
690	86.8	47.7	19.3	14.8	91.4	82.4	45.3	24.8
700	88.2	49.0	19.2	15.4	91.6	83.4	47.2	25.6

Table 4 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group C** *(continued)*

Wavelength nm	**06 C 33**	**06 C 35**	**06 C 37**	**06 C 39**	**06 C 40**	**08 C 31**	**08 C 33**	**08 C 35**
400	27.2	22.4	11.6	4.9	6.0	41.6	29.3	16.6
410	31.4	24.3	11.5	4.9	6.1	54.7	33.6	17.6
420	32.9	24.2	11.1	4.8	6.0	58.1	34.0	17.8
430	34.5	23.8	10.8	4.8	5.8	58.2	33.7	18.0
440	36.8	23.6	10.5	4.8	5.7	58.0	33.7	18.3
450	38.5	23.5	10.4	4.9	5.6	58.0	34.1	18.8
460	39.1	23.5	10.5	4.9	5.6	58.1	35.1	19.4
470	39.4	23.5	10.7	5.0	5.6	58.8	36.6	20.4
480	39.8	23.7	11.0	5.1	5.6	60.8	39.4	22.1
490	40.8	24.2	11.4	5.3	5.6	64.5	43.7	25.1
500	42.6	25.6	11.8	5.5	5.7	69.1	48.3	29.2
510	45.0	29.4	12.7	5.9	5.9	72.7	51.3	33.3
520	48.0	35.4	14.0	6.5	6.1	74.3	52.4	35.9
530	51.3	39.4	15.3	7.3	6.2	74.9	52.6	37.2
540	54.5	40.8	16.2	8.0	6.3	75.0	52.6	38.1
550	57.2	41.2	17.9	8.5	6.4	75.4	52.9	39.6
560	59.7	42.0	21.7	9.3	6.7	76.2	54.0	42.4
570	62.7	44.5	27.2	10.8	7.3	78.1	56.7	46.6
580	66.0	50.0	31.2	13.1	8.1	80.7	60.7	51.1
590	68.9	57.9	32.8	15.3	9.0	83.1	64.8	54.6
600	70.9	64.4	33.2	16.2	9.7	85.1	68.4	56.9
610	71.8	67.9	33.4	15.7	10.2	86.2	70.5	58.4
620	72.1	69.7	33.8	14.9	10.4	86.8	71.8	59.6
630	72.2	70.8	34.5	14.3	10.6	87.3	72.7	60.6
640	72.4	71.6	35.7	13.8	10.7	87.8	73.4	61.9
650	72.6	72.4	37.3	13.3	10.8	88.1	74.1	63.4
660	73.0	73.2	39.6	13.2	11.0	88.6	74.9	65.1
670	73.5	74.2	42.6	13.5	11.1	89.0	75.8	66.8
680	74.2	75.3	46.5	14.2	11.2	89.4	76.8	68.5
690	75.1	76.5	51.4	15.3	11.3	89.9	77.9	70.1
700	76.1	77.7	57.0	16.5	11.4	90.3	79.0	71.8

Table 4 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group C** *(continued)*

Wavelength nm	**08 C 37**	**08 C 39**	**10 C 31**	**10 C 33**	**10 C 35**	**10 C 39**	**12 C 31**	**12 C 33**
400	7.8	5.1	38.7	27.8	15.3	5.1	38.4	26.0
410	7.8	5.1	49.8	32.1	15.8	5.2	49.6	29.3
420	7.7	5.1	52.7	33.1	15.6	5.2	52.3	29.7
430	7.7	5.1	53.2	33.5	15.5	5.2	52.5	29.9
440	7.6	5.1	53.7	34.2	15.6	5.3	52.8	30.4
450	7.7	5.1	54.6	35.4	16.0	5.3	53.6	31.3
460	7.7	5.1	56.0	37.5	17.0	5.4	55.1	32.9
470	7.7	5.1	58.1	40.4	18.6	5.5	57.4	35.2
480	7.8	5.2	61.0	44.4	21.5	5.6	61.3	38.9
490	8.1	5.3	64.7	49.8	26.1	5.8	67.2	44.6
500	8.8	5.7	68.4	55.4	31.9	6.1	73.7	51.1
510	11.1	6.5	71.2	59.7	36.8	6.9	78.2	56.2
520	15.2	7.7	73.1	62.2	38.7	8.0	80.0	59.0
530	18.3	8.4	74.6	63.8	38.3	8.7	80.6	60.4
540	19.8	8.6	75.7	65.3	38.5	9.2	79.6	61.3
550	20.8	8.8	77.1	67.2	41.5	10.0	78.1	61.6
560	22.4	9.9	78.8	69.2	46.7	11.0	77.6	61.1
570	24.7	11.7	80.8	71.4	50.0	12.0	78.6	60.3
580	27.2	13.0	82.1	73.1	50.8	12.6	79.5	59.6
590	29.0	13.3	82.7	74.2	50.8	12.2	79.6	59.1
600	30.1	13.4	83.2	75.0	50.6	11.4	79.4	58.5
610	30.5	13.3	83.7	75.5	50.4	10.6	79.4	58.0
620	30.6	13.1	84.2	75.7	50.2	10.2	79.6	57.7
630	30.6	13.0	84.8	75.9	50.2	9.9	79.9	57.7
640	30.5	13.0	85.5	76.0	50.2	9.7	80.6	58.2
650	30.4	12.9	86.3	76.1	50.3	9.5	81.4	58.9
660	30.4	12.8	87.1	76.1	50.3	9.5	82.4	59.9
670	30.3	12.8	87.8	76.1	50.1	9.7	83.6	60.6
680	30.3	12.8	88.5	76.2	50.0	10.0	85.1	61.0
690	30.3	12.7	89.1	76.1	49.8	10.5	86.6	61.2
700	30.3	12.7	89.6	76.1	49.8	10.9	88.1	61.8

Table 4 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group C** *(continued)*

Wavelength nm	**12 C 37**	**12 C 39**	**14 C 31**	**14 C 35**	**14 C 39**	**14 C 40**	**16 C 33**	**16 C 37**
400	6.5	5.2	43.5	26.8	8.2	6.0	39.5	18.3
410	6.5	5.2	61.3	31.2	8.2	6.0	51.8	20.2
420	6.6	5.1	67.5	32.7	8.1	5.9	55.4	20.9
430	6.6	5.1	68.3	34.1	7.9	5.9	56.0	21.4
440	6.8	5.1	68.4	36.1	7.8	5.9	56.4	22.1
450	7.1	5.2	68.5	37.9	7.8	5.9	57.2	23.1
460	7.5	5.2	68.7	39.0	7.8	6.0	58.3	24.5
470	8.1	5.3	69.4	39.7	8.1	6.2	59.8	25.9
480	9.4	5.3	71.1	40.4	8.8	6.4	61.5	26.6
490	11.6	5.5	74.7	41.4	10.3	6.5	63.3	26.8
500	15.3	5.8	79.0	42.9	12.2	6.6	64.5	26.9
510	19.2	7.0	81.7	44.6	13.4	6.8	65.0	27.4
520	21.6	9.3	82.0	46.3	13.3	7.0	64.5	27.6
530	22.6	10.7	81.8	47.8	12.4	7.1	63.1	26.7
540	23.2	10.4	80.8	48.3	11.2	7.1	61.1	25.3
550	23.8	10.7	78.2	47.2	10.0	7.0	58.9	23.4
560	24.1	11.5	75.3	44.6	8.8	6.9	56.7	21.0
570	23.9	11.8	74.1	41.9	8.1	6.7	54.8	19.0
580	23.3	11.0	73.8	40.0	7.8	6.4	53.1	17.7
590	22.1	9.6	73.3	38.7	7.6	6.1	51.7	16.7
600	20.6	8.4	72.6	37.6	7.3	5.8	50.5	15.2
610	19.2	7.7	71.9	36.7	7.1	5.4	49.5	13.7
620	18.2	7.4	71.6	36.1	7.0	5.2	49.0	12.9
630	17.5	7.2	71.5	36.0	7.0	5.0	48.9	12.5
640	17.0	7.0	71.8	36.2	7.0	4.9	49.3	12.3
650	16.6	6.9	72.4	36.8	7.1	4.9	50.0	12.3
660	16.4	6.9	73.1	37.7	7.3	4.9	50.9	12.5
670	16.4	7.0	73.6	38.3	7.4	4.9	51.6	13.1
680	16.5	7.3	73.9	38.5	7.2	5.0	51.9	13.9
690	16.7	7.5	74.0	38.7	7.0	5.0	52.1	14.6
700	16.9	7.8	74.5	39.2	6.8	5.1	52.7	15.1

Table 4 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group C** *(continued)*

Wavelength nm	**18 C 31**	**18 C 35**	**18 C 39**	**20 C 33**	**20 C 37**	**20 C 40**	**22 C 37**	**24 C 33**	**24 C 39**
400	44.8	36.8	11.1	44.0	27.1	7.8	30.0	42.1	16.4
410	65.4	46.1	12.1	62.2	32.2	8.3	34.8	57.7	18.1
420	73.8	48.3	12.6	68.8	33.5	8.5	34.9	62.3	18.3
430	75.2	48.5	12.9	70.0	33.9	8.6	33.8	62.3	17.5
440	75.5	48.5	13.3	70.3	34.1	8.8	32.6	61.7	16.3
450	75.9	48.4	13.7	70.3	34.2	8.8	31.5	61.0	15.1
460	76.5	48.3	14.0	70.1	34.2	8.7	30.5	60.3	13.8
470	77.4	48.2	14.2	70.0	33.8	8.5	29.6	59.7	12.3
480	78.6	48.1	14.2	70.2	33.2	8.2	28.5	58.9	10.9
490	80.0	48.0	14.0	70.1	32.1	7.8	27.0	58.0	9.8
500	81.2	47.7	13.6	69.1	30.4	7.3	25.1	56.9	8.8
510	81.7	47.0	12.9	67.1	28.4	6.9	23.0	55.7	8.2
520	81.6	46.0	12.1	63.9	26.7	6.3	21.2	54.3	7.9
530	81.2	44.8	11.2	61.3	25.1	5.7	19.7	53.1	7.7
540	80.7	43.5	10.1	59.7	23.5	5.4	18.5	52.6	7.6
550	80.1	42.1	9.0	58.3	21.6	5.2	17.6	52.5	7.9
560	79.2	40.7	8.0	56.1	19.4	5.0	16.6	52.5	8.4
570	78.7	39.7	7.3	54.2	17.7	4.8	16.0	53.6	8.9
580	78.8	38.8	6.8	53.5	17.2	4.8	16.5	56.1	9.5
590	79.1	37.7	6.6	53.8	17.7	4.8	18.2	60.0	10.3
600	79.1	36.1	6.4	53.9	18.2	4.8	20.3	63.4	11.3
610	78.8	34.5	6.3	53.1	18.1	4.8	21.5	64.3	12.8
620	78.7	33.1	6.3	52.0	17.9	4.8	22.1	63.9	14.3
630	79.0	31.9	6.3	51.5	18.0	4.8	22.8	63.8	15.4
640	79.8	30.9	6.3	52.3	18.3	4.9	23.8	64.7	16.0
650	80.6	30.0	6.5	54.4	18.8	5.0	25.1	66.1	16.3
660	81.4	29.4	6.6	56.8	19.5	5.0	27.0	67.5	16.7
670	81.7	28.9	6.7	58.1	20.1	5.1	29.5	68.3	17.7
680	81.5	28.5	6.8	58.1	20.3	5.1	32.6	68.4	18.9
690	81.3	28.1	6.9	57.2	20.4	5.1	36.7	68.2	20.0
700	81.2	27.9	7.0	55.8	20.8	5.2	41.3	67.8	20.8

Table 5 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group D**

Wavelength nm	**04 D 44**	**04 D 45**	**06 D 43**	**06 D 45**	**08 D 41**	**10 D 43**	**10 D 45**
400	8.5	5.8	7.3	5.7	24.4	6.7	5.9
410	8.6	5.6	7.4	5.7	27.0	6.8	6.0
420	8.4	5.4	7.6	5.7	27.1	6.9	5.9
430	8.2	5.2	7.7	5.7	27.0	6.9	5.8
440	8.1	5.1	8.0	5.8	27.0	7.1	5.7
450	7.9	5.0	8.3	5.8	27.1	7.4	5.7
460	7.8	5.0	8.7	6.0	27.4	8.0	5.7
470	7.7	4.9	9.3	6.2	27.9	8.8	5.8
480	7.6	4.8	10.5	6.5	28.8	10.2	6.0
490	7.6	4.8	12.5	6.8	29.8	12.4	6.3
500	7.5	4.8	15.6	7.2	31.7	16.4	7.1
510	7.5	4.7	18.8	8.3	35.7	23.0	9.8
520	7.5	4.7	20.7	9.8	42.9	31.5	15.8
530	7.5	4.9	21.4	10.6	51.8	38.5	22.0
540	7.6	4.9	21.8	10.9	59.1	42.1	25.3
550	8.0	5.0	23.1	11.2	62.7	44.1	27.1
560	9.0	5.4	26.4	12.0	64.4	45.9	28.0
570	11.2	6.5	32.7	13.9	66.0	48.3	27.9
580	15.6	8.8	40.6	17.0	68.3	50.7	27.0
590	22.7	13.3	47.0	20.6	71.4	51.7	26.1
600	30.2	19.2	50.8	23.9	74.3	50.6	25.7
610	34.7	23.5	52.4	25.9	75.7	48.8	25.8
620	37.2	26.0	52.9	27.2	76.3	47.5	26.2
630	38.7	27.7	53.0	28.0	76.7	46.7	27.0
640	39.9	28.9	52.9	28.6	77.2	46.2	28.1
650	41.0	30.0	52.7	29.3	77.8	45.9	29.5
660	42.3	31.2	52.6	30.0	78.6	46.2	31.2
670	43.7	32.8	52.3	30.8	79.3	47.3	33.0
680	45.4	34.6	52.2	31.7	80.1	48.8	34.9
690	47.2	36.8	52.0	32.6	80.9	50.4	36.9
700	49.1	39.1	51.7	33.6	81.6	51.8	38.9

Table 5 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group D** *(continued)*

Wavelength nm	**12 D 41**	**12 D 43**	**12 D 45**	**16 D 45**	**18 D 43**	**20 D 41**	**20 D 45**	**22 D 41**	**22 D 45**
400	19.4	6.6	5.5	7.4	23.7	41.3	16.0	43.1	24.8
410	21.1	6.7	5.5	7.8	27.9	57.4	18.7	60.9	28.3
420	21.5	6.7	5.5	8.2	29.2	63.5	19.8	66.8	28.2
430	22.0	6.8	5.5	8.6	30.1	65.0	20.7	67.1	26.7
440	22.6	6.9	5.5	9.2	31.1	65.5	21.8	66.2	24.5
450	23.4	7.2	5.6	10.1	32.2	65.2	22.8	64.9	22.1
460	24.5	7.7	5.8	11.7	32.9	64.3	22.8	63.1	19.9
470	26.0	8.5	6.1	13.8	33.6	62.8	22.1	61.0	17.5
480	28.5	9.7	6.4	15.6	34.4	60.9	20.7	58.5	15.1
490	33.3	11.6	7.0	16.6	35.1	59.5	18.5	55.7	13.6
500	41.1	14.9	7.8	16.6	35.2	57.8	16.4	52.4	12.4
510	51.0	20.7	9.8	15.7	33.8	55.1	14.9	49.5	10.6
520	59.8	28.3	13.2	14.2	30.7	52.3	13.3	46.9	9.2
530	64.8	34.3	16.3	12.4	27.2	50.6	11.6	44.3	8.8
540	66.3	36.7	17.7	10.5	23.7	48.4	10.2	42.6	8.6
550	67.4	36.9	18.0	8.7	20.2	44.3	9.0	42.0	7.7
560	68.6	35.4	18.2	7.3	17.1	40.9	7.9	41.3	7.3
570	68.5	32.9	18.2	6.4	15.0	39.7	7.2	41.0	7.8
580	66.5	30.7	17.6	5.8	14.1	39.3	6.9	42.0	8.9
590	63.3	29.0	16.0	5.4	13.8	38.6	6.8	43.0	9.4
600	59.5	27.3	13.9	5.0	13.5	37.8	6.7	43.6	9.5
610	56.7	25.9	12.3	4.8	13.3	37.3	6.6	43.8	9.5
620	54.9	25.1	11.5	4.7	13.3	37.2	6.6	44.2	9.6
630	54.0	24.7	11.0	4.7	13.8	37.8	6.7	44.8	9.8
640	53.4	24.7	10.8	4.8	14.6	39.1	7.1	45.9	10.3
650	52.9	25.3	10.7	4.8	15.4	40.5	7.6	47.4	10.9
660	52.9	26.0	10.9	4.9	15.9	41.6	8.0	49.4	11.9
670	53.5	26.0	11.5	5.1	15.8	41.9	8.0	51.9	13.4
680	54.5	25.4	12.3	5.2	15.1	41.8	7.8	55.0	15.4
690	55.7	24.6	13.1	5.3	14.4	41.8	7.5	58.8	18.2
700	56.6	23.7	13.8	5.4	14.2	42.5	7.5	62.9	21.7

Table 6 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group E**

Wavelength nm	**04 E 49**	**04 E 51**	**04 E 53**	**04 E 55**	**04 E 56**	**04 E 58**	**06 E 50**	**06 E 51**	**06 E 56**
400	42.8	14.5	5.8	4.9	5.3	6.9	21.7	13.1	5.3
410	60.4	14.9	5.8	4.9	5.2	6.8	23.1	13.5	5.3
420	66.4	14.6	5.7	4.9	5.1	6.7	22.8	13.3	5.2
430	67.1	14.3	5.6	4.9	5.0	6.5	22.4	13.1	5.2
440	67.0	14.1	5.5	4.9	5.0	6.4	22.3	13.1	5.2
450	67.0	13.9	5.3	5.0	5.0	6.4	22.4	13.1	5.3
460	66.9	13.8	5.2	5.0	5.1	6.4	22.8	13.1	5.3
470	66.8	13.8	5.2	5.0	5.2	6.4	23.8	13.1	5.4
480	66.7	13.9	5.2	5.1	5.4	6.4	25.1	13.2	5.5
490	66.6	13.9	5.3	5.1	5.6	6.4	26.4	13.3	5.7
500	66.7	14.1	5.6	5.2	5.7	6.3	28.2	14.1	6.3
510	67.5	14.6	5.8	5.3	5.8	6.2	31.4	17.0	8.1
520	68.7	15.2	5.7	5.4	5.7	6.1	36.6	21.7	11.6
530	69.5	15.8	5.8	5.5	5.6	6.0	42.9	24.9	14.8
540	69.8	16.3	6.0	5.8	5.6	5.9	49.2	26.4	15.1
550	70.8	17.3	6.1	6.5	5.6	5.8	55.9	28.9	14.0
560	73.6	20.1	6.8	8.3	5.9	5.6	64.0	34.8	15.0
570	78.2	25.7	8.9	12.8	6.4	5.6	71.1	45.6	20.2
580	82.4	35.2	14.8	21.0	8.3	6.0	76.0	57.9	29.7
590	85.0	48.7	25.8	31.9	14.6	7.3	79.4	68.0	37.1
600	86.5	63.2	39.4	43.6	26.3	10.3	82.0	75.2	40.7
610	87.4	73.3	49.6	52.6	39.1	13.8	83.7	79.3	42.3
620	87.9	79.6	56.5	58.8	51.8	16.3	85.0	81.7	43.3
630	88.4	83.0	61.2	62.7	62.9	18.1	86.0	83.1	44.1
640	88.9	84.9	64.6	65.2	70.7	20.1	86.8	84.2	44.8
650	89.3	86.0	67.3	66.9	75.1	22.1	87.5	85.0	45.6
660	89.8	86.8	69.7	68.2	77.7	23.9	88.1	85.8	46.3
670	90.1	87.4	71.9	69.4	79.3	25.3	88.6	86.4	47.1
680	90.5	87.9	74.0	70.5	80.4	26.2	89.1	87.1	47.9
690	90.8	88.4	76.1	71.6	81.3	26.9	89.5	87.7	48.7
700	91.1	88.8	78.1	72.7	82.1	27.9	89.9	88.2	49.5

Table 6 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group E** *(continued)*

Wavelength nm	**08 E 51**	**08 E 55**	**10 E 49**	**10 E 50**	**10 E 53**	**10 E 55**	**12 E 51**	**12 E 53**	**12 E 55**
400	5.4	5.4	31.1	17.6	5.9	6.3	7.5	5.0	8.0
410	5.4	5.4	36.9	18.4	5.9	6.4	7.6	5.1	8.1
420	5.5	5.4	38.2	18.2	5.9	6.5	7.6	5.3	8.2
430	5.5	5.4	38.6	18.1	6.0	6.6	7.7	5.6	8.2
440	5.6	5.5	39.2	18.2	6.1	6.8	7.8	6.2	8.4
450	5.7	5.6	40.5	18.7	6.4	7.2	8.4	7.1	8.7
460	5.8	5.7	42.7	19.8	6.9	7.9	10.0	8.8	9.1
470	5.9	5.8	46.2	21.6	7.7	9.1	13.8	11.9	9.6
480	6.0	6.0	51.1	24.9	9.0	11.4	20.6	17.0	10.5
490	6.3	6.5	57.3	30.6	10.9	15.5	29.1	23.9	12.0
500	7.3	7.7	63.8	38.3	14.1	22.3	37.0	31.7	14.4
510	10.8	11.5	69.3	47.0	20.7	32.0	43.6	38.5	20.1
520	19.6	20.3	73.1	56.0	34.3	44.1	50.1	42.9	31.4
530	31.8	31.3	75.6	64.8	51.9	55.8	58.1	45.2	43.1
540	43.3	38.9	77.1	71.7	67.3	65.0	65.9	46.5	48.0
550	52.0	41.7	78.2	75.6	76.1	71.5	69.7	47.3	46.0
560	58.5	44.0	79.2	77.0	79.2	75.5	69.8	47.3	40.9
570	63.3	51.1	79.9	77.5	79.2	77.7	67.7	46.1	35.6
580	66.5	63.4	80.2	78.2	77.8	78.7	64.4	43.4	30.7
590	68.3	74.7	80.1	79.2	75.1	79.2	60.5	39.4	26.2
600	69.2	81.5	79.7	79.8	71.0	79.3	56.3	34.8	21.5
610	69.4	84.3	79.2	79.9	66.9	79.5	53.3	31.5	18.0
620	69.4	85.6	79.1	80.0	64.0	79.7	51.6	29.6	15.8
630	69.3	86.4	79.2	80.1	62.2	79.9	50.5	28.7	14.6
640	69.3	87.0	79.6	80.6	60.9	80.3	49.8	28.3	13.8
650	69.5	87.4	80.0	81.1	59.7	80.7	49.3	28.0	13.2
660	69.8	87.8	80.7	81.6	59.1	81.2	49.3	28.5	12.9
670	70.3	88.1	81.4	81.9	59.5	81.8	50.0	29.7	13.1
680	71.1	88.4	82.0	82.2	60.7	82.4	51.2	31.4	13.7
690	72.0	88.7	82.7	82.4	62.4	83.0	52.4	33.0	14.5
700	73.1	89.0	83.2	82.6	64.3	83.7	53.5	34.1	15.4

Table 6 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group E** *(continued)*

Wavelength nm	**14 E 49**	**14 E 50**	**14 E 51**	**14 E 53**	**16 E 50**	**16 E 53**
400	41.8	34.1	13.9	10.1	37.3	17.6
410	57.7	42.3	14.8	10.7	49.4	19.9
420	63.5	44.9	15.2	11.0	54.2	20.9
430	65.1	46.3	15.6	11.4	56.7	21.9
440	66.4	48.1	16.3	12.0	59.1	23.4
450	67.9	50.0	17.5	13.1	62.0	25.3
460	69.8	51.7	19.6	15.0	65.6	27.9
470	72.5	54.2	22.6	17.9	69.3	32.0
480	75.6	57.0	27.1	21.9	72.2	36.6
490	78.7	59.7	33.6	27.4	74.1	39.5
500	80.9	62.3	41.0	32.8	74.6	40.1
510	82.2	65.0	46.4	35.6	73.8	38.5
520	83.1	67.6	48.1	35.1	72.3	35.4
530	83.2	70.0	47.1	32.7	69.9	31.5
540	82.2	71.2	44.3	29.5	66.8	27.3
550	80.9	70.4	40.5	25.6	63.4	23.0
560	79.3	67.8	36.3	21.6	59.6	18.9
570	77.2	64.2	32.0	18.1	55.9	15.7
580	74.9	60.1	27.7	15.1	52.0	13.6
590	72.5	55.4	23.4	12.5	48.1	12.1
600	69.4	49.9	19.3	10.3	44.0	10.7
610	66.4	45.3	16.8	9.0	41.0	9.7
620	64.3	42.2	15.5	8.3	39.2	9.0
630	63.0	40.3	14.8	8.0	38.5	8.6
640	62.2	38.9	14.5	7.9	38.3	8.4
650	61.5	37.6	14.3	7.8	38.3	8.3
660	61.1	36.9	14.5	7.9	39.0	8.4
670	61.1	36.9	15.3	8.3	40.3	8.5
680	61.7	37.5	16.3	8.8	42.1	8.6
690	62.7	38.6	17.2	9.3	43.9	8.6
700	64.0	39.8	17.9	9.6	45.5	8.6

Table 6 **Reflectance data from 400 nm to 700 nm in a 10 nm interval – Group E** *(continued)*

Wavelength nm	**18 E 49**	**18 E 50**	**18 E 51**	**18 E 53**	**20 E 51**	**20 E 53**	**20 E 56**	**24 E 53**
400	43.8	41.8	29.4	19.0	38.5	23.7	14.7	29.6
410	64.2	58.3	37.1	23.4	52.2	30.1	18.2	35.1
420	72.7	64.4	40.6	25.3	57.3	33.0	20.1	34.6
430	74.7	66.2	43.2	27.4	59.5	35.4	22.5	32.1
440	75.7	67.7	46.2	30.9	61.5	38.3	26.1	29.0
450	76.6	69.1	49.6	33.7	63.3	40.8	28.9	26.1
460	77.5	70.5	52.7	35.5	63.9	40.8	29.9	23.4
470	78.4	71.9	54.9	37.2	63.4	39.4	29.5	20.4
480	79.4	72.9	56.6	37.6	61.5	36.8	27.5	18.1
490	80.5	73.4	56.8	35.8	57.9	33.3	24.7	16.7
500	81.3	73.3	54.8	32.6	53.0	29.8	21.7	14.9
510	81.7	72.5	50.8	28.5	47.7	26.1	18.5	13.4
520	81.6	71.0	45.2	23.9	42.3	21.8	15.0	12.9
530	80.9	68.6	39.7	19.5	37.4	17.8	12.1	13.0
540	79.6	65.5	34.5	15.5	33.2	14.9	10.0	12.8
550	77.7	61.7	29.3	12.2	29.5	12.6	8.4	12.3
560	75.2	57.5	24.4	9.7	26.3	10.6	7.0	11.4
570	73.0	54.0	21.1	8.0	23.9	9.3	6.2	10.2
580	71.5	51.7	19.3	7.1	22.5	8.7	5.8	10.3
590	70.5	50.3	18.3	6.6	21.7	8.4	5.6	12.2
600	69.5	48.8	17.5	6.3	21.1	8.1	5.4	16.1
610	68.7	47.7	16.9	6.1	20.7	7.9	5.3	22.8
620	68.2	47.0	16.6	6.0	20.7	8.0	5.3	29.2
630	68.1	46.9	16.6	5.9	21.3	8.2	5.3	32.6
640	68.4	47.2	16.9	6.0	22.3	8.7	5.4	34.8
650	69.0	47.9	17.5	6.0	23.5	9.1	5.5	36.9
660	69.8	48.8	18.2	6.1	24.8	9.4	5.6	39.6
670	70.1	49.3	18.7	6.1	25.7	9.3	5.6	42.7
680	70.0	49.1	18.8	6.1	26.3	8.9	5.6	46.5
690	69.6	48.6	18.9	6.0	26.7	8.5	5.5	50.9
700	69.2	48.1	19.1	5.9	27.5	8.5	5.4	55.7

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