U. S. Department of Commerce
Juanita M. Kreps
Secretary

National Bureau of Standards
Ernest Ambler, Acting Director

National Bureau of Standards
Certificate of Calibration
Standard Reference Material 701d
Booklet of Faded Strips
of
Light-Sensitive Paper

This certifies that the faded strips of light-sensitive paper, identified as NBS Standard Reference Material 700d, in this booklet have been exposed in the NBS Master Fading Lamp for a length of time which is within one-half Standard Fading Hour (SFH) of the number printed for each faded strip. The SFH was defined originally by NBS fading paper lot 1554; the calibration of this booklet was carried out by comparison with NBS fading paper lot 700b which in turn had been calibrated by previous lots of paper. This booklet is to be used only with NBS Standard Fading Paper Lot 700d.

The NBS Master Lamp is an Atlas Electric Devices SMC-R Fade-Ometer with a drum diameter of twenty inches, using No. 70 Solid Carbons and No. 20 Cored Carbons. The black panel temperature for this calibration was $150 \pm 5\,^{\circ}F$ ($66 \pm 3\,^{\circ}C$) and the relative humidity measured at the air exit of the lamp was $30 \pm 5\%$. The temperature of this exit air was $120 \pm 1\,^{\circ}F$ ($49 \pm 0.5\,^{\circ}C$). Under these conditions and using the arc voltage and current conditions recommended by the manufacturer, twenty hours of operation of the lamp produced approximately 18 SFH of fading action.

The fading rate of this paper is sensitive to temperature and humidity, and the relationship between hours of lamp operation and the SFH produced will vary significantly with conditions other than those used here. The relationship will also be seriously affected by drum size, type of carbon, and by the type of lamp. This calibration will not be valid for lamps other than carbon-arc lamps operated at a black-panel temperature of $150 \pm 5\,^{\circ}F$ ($66 \pm 3\,^{\circ}C$) measured as defined in AATCC Standard Test Method 16A-1971 Appendix A1.3 and at a relative humidity of 30%.

While these papers are primarily designed for visual estimation using the procedure described in the attached NBS Miscellaneous Publication 260-41, "Use of Standard Light-Sensitive Paper for Calibrating Carbon Arcs Used in Testing Textiles for Colorfastness to Light," we also give as a part of this certificate a curve and table of CIE tristimulus luminous reflectance factor Y against SFH. This luminous reflectance value Y is as measured on a properly calibrated Gardner-Type Hunter Color and Color Difference meter, but it is not a certified value. The papers may be used with instrumental measurement of reflectance, but when doing so it must be borne in mind that various instruments may give significantly different readings. Thus, when such measurements are used for test evaluation, the procedure outlined in Miscellaneous Publication 260-41 should be carefully followed.

Washington, D.C. 20234
January 15, 1977

J. Paul Cali, Chief
Office of Standard Reference Materials

(over)

Errors

A detailed analysis indicates that the standard error to be expected when a single piece of paper is exposed in the lamp is 1.3 SFH at 8 SFH and 1.8 SFH at 20 SFH when the luminous reflectance measurement error is approximately 0.0004.

The paper was prepared at the NBS pilot-scale papermill under the supervision of Donald G. Fletcher. The calibration was carried out at the National Bureau of Standards, Institute for Materials Research by P. J. Shouse and L. A. Wood of the Polymers Division.

Luminous Reflectance Factor Y
As A Function of Exposure in SFH for Light-Sensitive Paper
NBS Standard Reference Material 700d
(Y = 0.1550 for unexposed paper)

SFH	Y	Difference	SFH	Y	Difference
5.5	0.1942	17×10^{-4}	16.0	0.2260	14×10^{-4}
6.0	.1959	16×10^{-4}	16.5	.2274	13×10^{-4}
6.5	.1975	16×10^{-4}	17.0	.2287	13×10^{-4}
7.0	.1991	16×10^{-4}	17.5	.2300	14×10^{-4}
7.5	.2007	15×10^{-4}	18.0	.2314	13×10^{-4}
8.0	.2022	16×10^{-4}	18.5	.2327	13×10^{-4}
8.5	.2038	15×10^{-4}	19.0	.2340	13×10^{-4}
9.0	.2053	15×10^{-4}	19.5	.2353	13×10^{-4}
9.5	.2068	16×10^{-4}	20.0	.2366	13×10^{-4}
10.0	.2084	15×10^{-4}	20.5	.2379	13×10^{-4}
10.5	.2099	15×10^{-4}	21.0	.2392	12×10^{-4}
11.0	.2114	16×10^{-4}	21.5	.2404	12×10^{-4}
11.5	.2130	14×10^{-4}	22.0	.2416	12×10^{-4}
12.0	.2144	15×10^{-4}	22.5	.2428	12×10^{-4}
12.5	.2159	15×10^{-4}	23.0	.2440	12×10^{-4}
13.0	.2174	14×10^{-4}	23.5	.2452	12×10^{-4}
13.5	.2188	15×10^{-4}	24.0	.2464	12×10^{-4}
14.0	.2203	14×10^{-4}	24.5	.2476	12×10^{-4}
14.5	.2217	14×10^{-4}	25.0	.2488	12×10^{-4}
15.0	.2231	14×10^{-4}	25.5	.2500	12×10^{-4}
15.5	.2245	15×10^{-4}	26.0	.2512	

Y is measured as R_d on a Gardner-type color difference meter, Model C-1, with green filter.