



# Certificate of Analysis

## Standard Reference Material<sup>®</sup> 1008

### Photographic Film Step Tablet

This Standard Reference Material (SRM) is intended for use in the calibration of optical densitometers and similar equipment used in the photographic, graphic arts, and x-ray fields. SRM 1008 is a photographic silver density film step tablet 25.4 cm (10 in) long by 3.5 cm (1.375 in) wide. The tablet has 23 steps 1.0 cm (0.39 in) wide perpendicular to the long edge of the film with certified transmission densities ranging from nominally 0.200 to 4.000. The serial number is located at one end of the step tablet.

**Determination of Certified Transmission Density:** The transmission density of each step of the tablet was measured using the NIST Diffuse Transmittance Densitometer [1]. The instrument and measurements conform to the conditions specified for American National Standard Diffuse Visual Transmission Density,  $D_T$  (90° Opal;  $S_H$ : # 10°;  $V_T$ ) [2,3]. The certified transmission densities listed in Table 2 were measured on a 3 mm diameter circle at the center of each step, and apply only to that area. When measured, the side of the tablet with the serial number was in contact with the diffuser of the densitometer.

**Expiration of Certification:** The certification of this SRM is deemed to be valid, within the uncertainties specified, for a period of **three years** from the calibration date given in Table 2, provided the SRM is stored and handled in accordance with the “Instructions for Use” and “Storage and Handling” sections of this certificate. However, certification will be nullified if the SRM is damaged or contaminated.

**Storage and Handling:** The densities of this photographic film step tablet may change with time. To minimize such changes, the film should be stored in a cool, dry place, where it will not be exposed to light, or other radiant energy, or to chemical fumes, or to dust in the air. Scratches, abrasion marks, or foreign matter on the film can change the density. Fingerprints are a common source of contamination. Fingerprints on the film surfaces can be avoided by handling the step tablet only by the edges and by wearing clean cloth gloves available from photographic film dealers for this purpose. Any attempt to clean a film step tablet, other than to remove dust with a soft camel-hair brush, is not recommended as it is likely to change the densities.

**Discussion of Uncertainties:** Uncertainties were calculated according to the procedures outlined in reference 4. Measured (Type A) uncertainties were assumed to be Gaussian-distributed, and were calculated from the standard deviations. Estimated or inferred (Type B) uncertainties were also assumed to be Gaussian-distributed, and were calculated from the measurement equation. The uncertainties were combined by adding their variances in quadrature. Table 1 is a list of all identifiable sources of uncertainty. The measured standard deviations are listed in (a); the inferred standard deviations are listed in (b).

The certificates were calibrated by Robert Bousquet under the technical direction of David Allen. The technical direction and physical measurements leading to certification were provided by E.A. Early with assistance from C.L. Cromer, D. Dummer, T.R. O’Brian, X. Xiong, and R.D. Saunders of the NIST Optical Technology Division and P.F. Wychorski of the Eastman Kodak Co.

Film step tablets were produced by the Tiffen Company (Long Island, New York).

The support aspects involved in the issuance of this SRM were coordinated through the NIST Measurement Services Division.

Albert C. Parr, Chief  
Optical Technical Division

Robert L. Watters, Jr., Chief  
Measurement Services Division

Gaithersburg, MD 20899  
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*See Certificate Revision History on Page 2*

## INSTRUCTIONS FOR USE

Remove the film from its protective sleeve and place the center of a step on the diffuser of the densitometer to be calibrated, with the side of the step tablet with the serial number in contact with the diffuser. Calibrate the densitometer using the transmission density of that step, and repeat this procedure with other steps of the step tablet.

Table 1. Tabulation of Uncertainties	
Source of Uncertainty	Uncertainty in Transmission Density
(a) Measured (Type A) Uncertainties	
Source Stability	$\pm 0.001$
Signal Noise	$\pm 0.001$
Amplifier Gain	$\ll 0.001$
Detector Linearity	$\pm 0.001$
Step Uniformity	$\pm 0.001$
(b) Inferred (Type B) Uncertainties	
Voltmeter Accuracy	$\ll 0.001$
Diffusion Coefficient	$< 0.001$
Opal Reflectance	$< 0.001$
Spectral Product	$\ll 0.001$
Combined Uncertainty ( $1\sigma$ )	$\pm 0.002$
Expanded Uncertainty ( $3\sigma$ )	$\pm 0.006$

## REFERENCES

- [1] Early, E.A.; O'Brian, T.R., Saunders, R.D.; Parr, A.C.; *Film Step Tablet Standards of Diffuse Visual Transmission Density - SRM 1001 and SRM 1008*; NIST Special Publication 260-135, U.S. Government Printing Office: Washington, DC (1998).
- [2] ANSI/ISO 5.2; *Photography - Density Measurements - Part 2: Geometric Conditions for Transmission Density*; American National Standards Institute: New York, NY (1991).
- [3] ANSI/ISO 5.3; *Photography - Density Measurements - Part 3: Spectral Conditions*; American National Standards Institute: New York, NY (1995).
- [4] ISO; *Guide to the Expression of Uncertainty in Measurement*; ISBN 92-67-10188-9, 1st ed., International Organization for Standardization: Geneva, Switzerland (1993); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297, U.S. Government Printing Office: Washington, DC (1994); available at <http://physics.nist.gov/Pubs/>.

**Certificate Revision History:** 30 January 2006 (This revision reflects a correction in the date of issue and editorial changes); 28 September 05 (This revision reflects a change in manufacturer and a change of upper and lower limits of Density to nominal values) 3 March 2000 (This revision reflects a change in the expiration period); 27 February 1998 (Original certificate date).

*Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-4751; e-mail [srminfo@nist.gov](mailto:srminfo@nist.gov); or via the Internet at <http://www.nist.gov/srm>.*

Table 2. Transmission Densities of SRM 1008

Serial No.:		Calibration Date:	
Step Number	Transmission Density <sup>a</sup>		
1			
2			
3			
4			
5			
6			
7			
8			
9			
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18			
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21			

<sup>a</sup> Expanded uncertainty ( $k = 3$ ) of the transmission density of each step is  $\pm 0.006$  (see Table 1).