

T 480 om-09

TENTATIVE STANDARD – 1951
OFFICIAL STANDARD – 1972
REVISED – 1978
OFFICIAL TEST METHOD – 1985
REVISED – 1990
REVISED – 1992
REVISED – 1999
REVISED – 2005
REAFFIRMED – 2009
©2009 TAPPI

The information and data contained in this document were prepared by a technical committee of the Association. The committee and the Association assume no liability or responsibility in connection with the use of such information or data, including but not limited to any liability under patent, copyright, or trade secret laws. The user is responsible for determining that this document is the most recent edition published.

CAUTION:

This Test Method may include safety precautions which are believed to be appropriate at the time of publication of the method. The intent of these is to alert the user of the method to safety issues related to such use. The user is responsible for determining that the safety precautions are complete and are appropriate to their use of the method, and for ensuring that suitable safety practices have not changed since publication of the method. This method may require the use, disposal, or both, of chemicals which may present serious health hazards to humans. Procedures for the handling of such substances are set forth on Material Safety Data Sheets which must be developed by all manufacturers and importers of potentially hazardous chemicals and maintained by all distributors of potentially hazardous chemicals. Prior to the use of this method, the user must determine whether any of the chemicals to be used or disposed of are potentially hazardous and, if so, must follow strictly the procedures specified by both the manufacturer, as well as local, state, and federal authorities for safe use and disposal of these chemicals.

Specular gloss of paper and paperboard at 75 degrees

1. Scope

1.1 This method is for measuring the specular gloss of paper at 75° (15° from the plane of paper). Although its chief application is to coated papers (1), it is also used for a variety of uncoated papers.

1.2 This method is suitable for low- to high-gloss papers. For very high-gloss papers such as cast-coated, lacquered, highly varnished (2-4) or waxed papers (5), and high-gloss ink films (6), TAPPI T 653 “Specular Gloss of Paper and Paperboard at 20 Degrees” is preferred. T 480 has been shown to be suitable for gloss measurements of most ink films on paper or paperboard. Differences in the color and diffuse reflectances of these ink films have a negligible effect on measured gloss. For example, when white and black surfaces which are otherwise identical are tested, the white surface will measure less than one gloss unit higher than the black.

1.3 This method does not measure image-reflecting quality.

2. Significance

This method is widely used as a partial measure of the surface quality and shiny appearance of coated paper.

3. Apparatus

3.1 *Gloss meter*¹, having the general arrangement and relative dimensions of the critical parts shown in Fig.

¹Names of suppliers of testing equipment and materials for this method may be found on the Test Equipment Suppliers list, available as part of the CD or printed set of Standards, or on the TAPPI website general Standards page.

Approved by the Standard Specific Interest Group for this Test Method



Documents
Document Sharing Hub

1. It consists of a source of light, a lens giving a converging beam of rays incident on the test specimen, a suction plate to hold the specimen flat, and a light detector to receive and measure certain rays reflected by the test specimen. These components are combined in a light-tight housing that is matte black inside and is structurally and optically stable during warming and at the operating temperature. Details of the geometric, spectral, and photometric characteristics of the instrument and of the specimen holder are given in Appendix A.

3.1.1 *Area of specimen illuminated.* The area illuminated is controlled by the dimensions of the aperture stop A-A specified in Fig. 1. If the outline of this spot is projected sharply onto the specimen, the illuminated area will be rectangular, $0.100d \pm 0.010d$ wide and $0.050d \pm 0.005d$ times $1/\cos 75^\circ$ long. When the value for d is 100 mm, the illuminated spot will have a width between 9.0 and 11.0 mm, and a length between 17.4 and 21.3 mm, resulting in an illuminated area between 156 and 234 mm².

3.2.1 *Gloss standards*¹. The theoretical specular-gloss standard is an ideal, completely reflecting, plane mirror having an assigned value of 384.4 gloss units. A flat, clean, and highly polished surface of black glass having a refractive index of 1.540 for the sodium D line may be shown by the Fresnel equation (7) to measure 100 gloss units on this scale.

$$R_S = 0.5 \left[\frac{\sin^2(i-r)}{\sin^2(i+r)} + \frac{\tan^2(i-r)}{\tan^2(i+r)} \right]$$

where:

i = angle of incidence (70 deg), (calculations made with angles converted to radians)

r = angle of refraction $\left(\sin^{-1} \left(\frac{\sin(i)}{n} \right) \right)$

and

n = refractive index

Alternatively, (R_S) may be written in the following way which is consistent with ISO 8254.

$$R_S = 100 \cdot K$$

$$K = \frac{\left(\frac{n^2 \cos i - (n^2 - \sin^2 i)^{1/2}}{n^2 \cos i + (n^2 - \sin^2 i)^{1/2}} \right)^2 + \left(\frac{(n^2 - \sin^2 i)^{1/2} - \cos i}{(n^2 - \sin^2 i)^{1/2} + \cos i} \right)^2}{\left(\frac{n_0^2 \cos i - (n_0^2 - \sin^2 i)^{1/2}}{n_0^2 \cos i + (n_0^2 - \sin^2 i)^{1/2}} \right)^2 + \left(\frac{(n_0^2 - \sin^2 i)^{1/2} - \cos i}{(n_0^2 - \sin^2 i)^{1/2} + \cos i} \right)^2}$$

where:

i = angle of incidence

n = refractive index of gloss being tested

n_0 = refractive index of gloss which reads 100.0 gloss units (1.540)

3.2.1 *High-gloss working standard*, a clean plaque of polished black glass for which the 75° specular reflectance has been computed from its refractive index as measured for the sodium D line.

3.2.2 *Intermediate-gloss standards*, having a reflected flux distribution comparable to that of the paper to be tested. Such standards may consist of ceramic tiles which are flat enough so that they do not rock when placed in the position of the specimen and are uniform in gloss over their central area. Each of these tiles is calibrated against the black glass standard on an instrument conforming with 3.1. For the purpose of this method, evaluated paper standards may be used for intermediate gloss verification.