Designation: D332 – 87 (Reapproved 2011)

Standard Test Method for Relative Tinting Strength of White Pigments by Visual Observation[1]

This standard is issued under the fixed designation D332; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method describes the procedure for determining the relative tinting strength of white pigments by visual assessment of blue tints.

1.2 This test method is applicable only for comparing the test pigment with a reference standard of the same type and grade.

NOTE 1—Test Method D2745 describes a procedure for instrumental evaluation of black tinted samples.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D262 Specification for Ultramarine Blue Pigment[3]

D2745 Test Method for Relative Tinting Strength of White Pigments by Reflectance Measurements

3. Summary of Test Method

3.1 Specified amounts of white pigment and blue tinting pigment are dispersed together in oil using a glass hand muller or an automatic muller. Both the test and standard pigments are treated identically. The pastes are drawn-down together on a panel and visually assessed for tinting strength. To obtain a numerical rating of tinting strength, dispersions with the standard white pigment and more or less of the tinting pigment are made until the lightness of the test pigment paste is matched. The weight of the tinting pigment is used to calculate relative tinting strength.

4. Significance and Use

4.1 This test method is used as a referee method and for quality control. The vehicle (oil) for preparing the dispersions and the tinting pigment (ultramarine blue) are specified but other vehicles and tinting pigments can be used. Any such changes in the test method must be agreed upon between the purchaser and the seller.

4.2 The results obtained with a muller do not necessarily agree with an industrial situation where different dispersing conditions exist. However, dispersing with a muller is a fast and relatively inexpensive way of testing tinting strength for routine quality control.

5. Apparatus

5.1 *Balance*, laboratory-type, sensitive to 0.1 mg, equipped with a counter-balanced watch glass.

5.2 *Buret*, 1-mL capacity, stopcock controlled, graduated in 0.1-mL divisions, or other suitable dispensing apparatus with a delivery accurate to 0.05 mL.

5.3 *Glass Hand Muller*—A weighted glass hand muller with beveled edge having a total weight of 6.8 kg (15 lb) and a grinding face of from 70 to 75 mm (2¾ to 3 in.) in diameter. The face shall be free of blowholes and other imperfections and kept roughened by lightly grinding with No. 303 optical emery, or its equivalent, and turpentine.

5.4 *Rubbing Surface*—A ground glass plate, at least 355 by 510 mm (14 by 20 in.), the surface of which is kept roughened by lightly grinding with No. 303 optical emery, or its equivalent, and turpentine.

5.5 *Automatic Muller*, automatic,[4] equipped with a weight that exerts a permanent 50-lbf (220-N) force and an additional

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

[4] The sole source of supply of the muller known to the committee at this time is Hoover Color Corp., P. O. Box 218, Hiwassee, VA 24347. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

weight exerting a 50-lbf making a total of 100-lbf (445-N). The two glass plates shall be kept sharp by removing from the machine and grinding them face-to-face with No. 303 optical emery or equivalent, and water.

5.6 *Spatula*—A flexible spatula having a chromium-plated or plastic blade 75 to 150 mm (3 to 6 in.) long.

5.7 *Panels* of bright tin, glass, or white-lacquered cardboard.

5.8 *Scraper*—A French scraper or stiff scraping knife having a blade that is about 75 to 100 mm (3 or 4 in.) wide with a straight edge.

6. Materials

6.1 *Tinting Material*—Ultramarine blue conforming to Specification D262 or a grade agreed upon by the purchaser and the seller.

6.2 *Oil*—Refined linseed oil with an acid number of approximately 4.

6.3 *Reference Standard*—A standard white pigment of the same type and grade as the pigment to be tested, as agreed upon between the purchaser and the seller.

7. Procedure A—Glass Hand Muller

7.1 Weigh 2 g of the standard white pigment and the amount of ultramarine blue listed in Table 1 to ±2 mg. Transfer the weighed portions of white and blue pigments to the ground-glass plate. Add the amount of oil specified in Table 1 from the buret (Note). Be sure to allow the buret to drain to its true level because variations in the amount of oil decrease the precision of the test. Work the pigments and oil into a paste with the spatula; then rub up the paste with the glass hand muller, spreading it over an area 75 to 100 mm (3 to 4 in.) wide and from 305 to 380 mm (12 to 15 in.) long. In counting the rubs, one stroke up and one stroke back is considered one rub. Allow the muller to travel up one side and back the other side, twisting it slightly at the top and bottom of each stroke. After each 25 rubs with the muller, "pick up" the paste with the spatula by scraping the face of the muller and gathering the paste on the slab into a mound. Repeat until the paste has been given 100 rubs.

NOTE 2—Where the resulting paste is too fluid or too thick for mulling, adjust the quantity of oil to give a workable paste and prepare a new paste, mulling as before. Report the amount of oil used.

7.2 Work 2 g of the test pigment in exactly the same manner as prescribed in 7.1 for the standard, using the same amount of tinting material and oil.

TABLE 1 Quantities of Materials for Tinting Strength Tests

Pigment Type	Weight of Pigment, g	Weight of Ultramarine Blue Tinting Pigment, g	Amount of Oil, mL
White Lead	2	0.2	0.5
Zinc oxide	2	0.2	0.7
Zinc oxide, leaded	2	0.2	0.5
Titanium dioxide			
(anatase)	2	0.4	1.0
(rutile)	2	0.4	0.9

7.3 Spread the paste of the standard and test pigments in parallel contiguous rectangular areas on the panel, each about 25 mm (1 in.) wide and 50 mm (2 in.) long. Use the scraper to smooth the surface of the pastes (here called "draw-downs") by drawing the scraper lightly over the pastes to give a straight and even line of contact between them. Keep the drawn-downs sufficiently thick to obscure the panel.

7.4 Immediately examine the draw-downs of the two pastes, on the top side only, for relative lightness of tint. If the sample is lighter than the reference standard it has greater tinting strength. If the sample differs appreciably from the reference standard in lightness of tint, and if a numerical rating is desired, prepare other pastes of the reference standard white pigment using different amounts of the tinting material. Make a draw-down of the sample paste with each standard as described in 7.3. Select the draw-down in which the standard pigment paste most closely matches the test pigment paste in lightness. Use the weight of tinting material in this method to calculate the tinting strength of the test pigment.

8. Procedure B—Automatic Muller

8.1 In order to minimize the effect of the difference in grinding of the area near the center of the plates as compared to the area near the periphery of the plates, draw two concentric circles under the base plate of the muller in such a way that they show clearly through the plate. These circles can be drawn either on a paper inserted under the plate, or drawn directly on the bottom of the plate. The inner circle should be 63 mm (2½ in.) in diameter and the outer circle 115.3 mm (4½ in.) in diameter.

8.2 Carefully weigh the pigment as described in 7.1, transferring the pigment to the base plate of the muller. Add the oil and work the pigment and oil into a paste with the spatula. Distribute the paste within the area between the two concentric circles on the plate, close the muller, and add a 23-kg (50-lb) weight (to make a total weight of 45 kg (100 lb)) pressing the plates together. Carry out three mulling stages of 50 revolutions each, collecting the paste from both plates with the spatula after each stage, spreading it around the path on the lower plate and wiping the spatula on the upper plate as before.

8.3 Continue the treatment of the paste of the test and standard pigments as described in 7.2, 7.3, and 7.4.

9. Calculation

9.1 Calculate the tinting strength of the sample as follows:

$$TS = (B/A) \times T$$

where:

TS = tinting strength of the test pigment, lbf (or N),
A = weight of tinting material used with standard to give equality of tint, g,
B = weight of tinting material used with test sample, g, and
T = arbitrary tinting strength value given to the standard.

10. Precision and Bias

10.1 The precision and bias are to be determined.

11. Keywords

11.1 tinting strength; visual; white pigments; white pigment strength