



Designation: ~~D4214–07 (Reapproved 2015)~~ D4214 – 23

## Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films<sup>1</sup>

This standard is issued under the fixed designation D4214; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

### 1. Scope

1.1 These test methods cover the evaluation of the degree of chalking on white or tinted exterior paint films. These test methods describe the procedures recommended for transferring the chalk to a fabric or fingertip, which is then compared to photographic reference standards, or in the case of adhesive tapes, compared to a reflectance table or photographic reference standards, to determine the degree of chalking.

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

1.3 *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, safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

[D662 Test Method for Evaluating Degree of Erosion of Exterior Paints](#)

[D3330 Test Method for Peel Adhesion of Pressure-Sensitive Tape](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)

[E1347 Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry](#)

#### 2.2 ~~Other Document:~~

~~[Pictorial Standards of Coating Defects](#)<sup>3</sup>~~

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *chalking, n*—the formation on a pigmented coating of a friable powder evolved from the film itself at or just beneath the surface.

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and are the direct responsibility of Subcommittee D01.25 on Evaluation of Weathering Effects.

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<sup>2</sup> 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.

**4. Significance and Use**

4.1 The procedures provide a broad range of techniques and photographic references to evaluate chalking of exterior paints.

**5. Type of Chalking**

5.1 Only one type of chalking is recognized, as defined in Section 3.

**6. Use of Photographic Reference Standards**

6.1 The photographic following two photographic reference standards that are part of these test methods are representative of the degrees methods. Each represents the degree of chalking on a paint film. The photographs shown in Fig. 1 and Fig. 2 are for illustration purposes only and should not be used for evaluation to be used for the evaluation of degree of chalking.

6.2 The use of photographic reference standards illustrated in Fig. 1 and Fig. 2 requires the following precautions:

6.2.1 The degree of chalking will may vary over any given area. Therefore, an average It is important, therefore, to select a representative portion of the coating should be evaluated coated material to evaluate. On large surfaces, it is recommended that the rating be made at several locations and the mean and range reported.

6.2.2 It is difficult to make readings readings outdoors on a windy day and day, and making readings at such time should be avoided. It should also be noted that rain, snow, or moisture in any form will remove chalk, so that readings should be made after a period of clear weather and when the surface is dry.

6.2.3 Chalking and erosion (Note 1) are closely related. However, the rate of chalking as measured by these test methods, and the rate of erosion may not be comparable because some pigment combinations tend to retain chalk on the surface while other pigment combinations exert a self-cleaning action by natural means.

NOTE 1—For the evaluation of erosion, see Test Method D662.

6.3 Records may be kept on forms in a manner such as shown in Fig. 3. Reporting of the results shall include the information given in Section 8.

6.4 When these test methods is are referenced in specifications for performance, the permissible degree of chalking is established between the producer and the user.

**7. Recommended Procedures**

7.1 Test Method A—Cloth Tape Method:

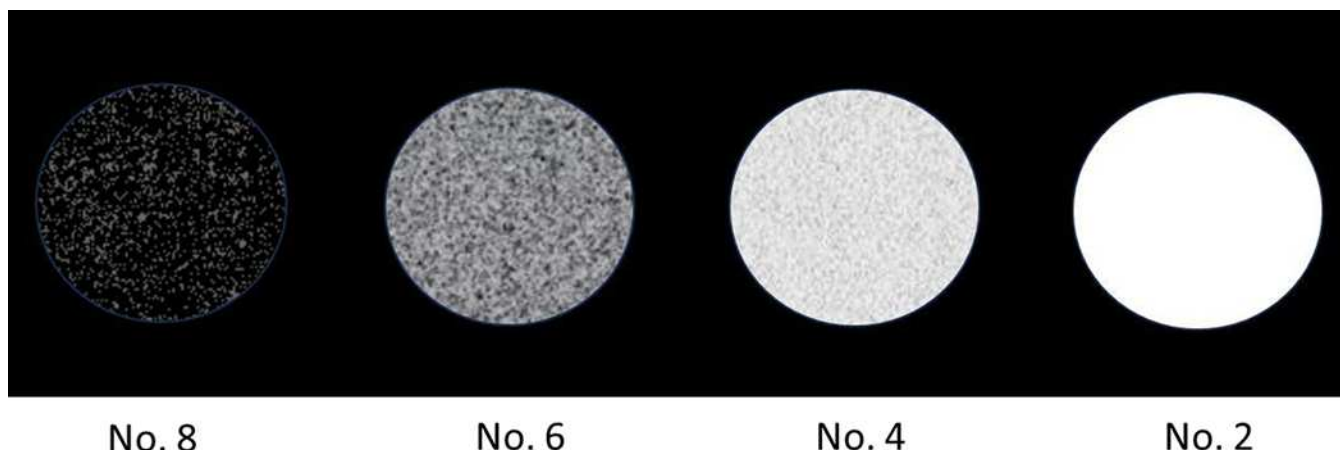


FIG. 1 Photographic Reference Standard No. 1—Test Method 1D659

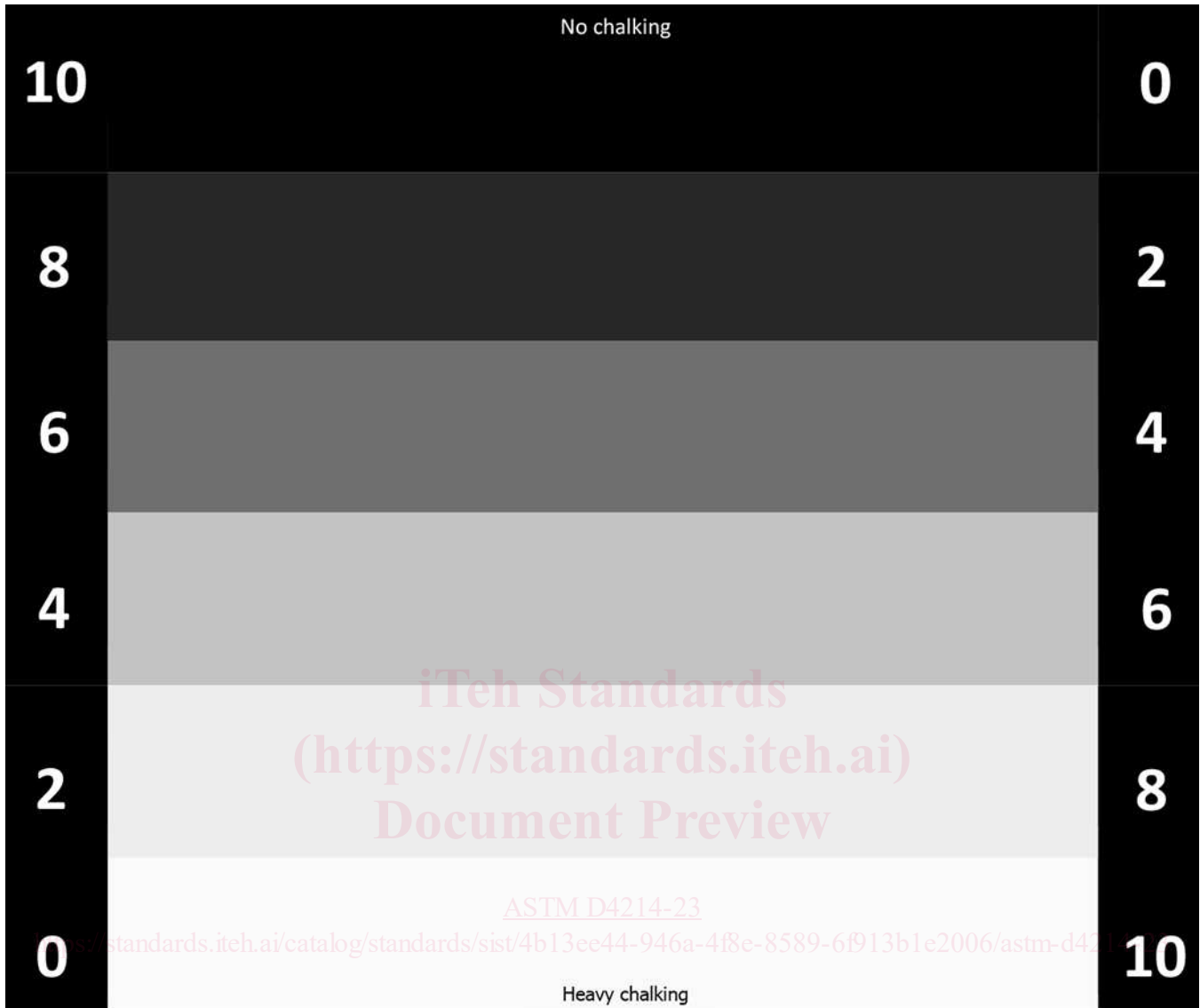


FIG. 2 Photographic Reference Standard No. 2—Verifinstituteut TNO

7.1.1 *Material*—Fabric, as agreed upon between the producer, user, or other interested parties, to rub against the surface being tested. Black (or white for dark coatings) wool felt, velvet, and velveteen have proven particularly effective.

7.1.2 *Procedure*—Wrap the fabric around the index fingertip, then make a ~~50 to 75 mm (2 to 3 in.)~~ 50 mm to 75 mm (2 in. to 3 in.) stroke with medium pressure on the coating under observation. Remove the fabric and compare the spot of chalk on it with Photographic Reference Standard No. 1.

NOTE 2—Medium pressure can be quantified by placing the finger on a balance or scale, and pressing downward until ~~3 to 5 lb~~ 1.360 g to 2.270 g (3 lbs to 5 lbs) pressure is obtained.

7.2 *Test Method B—Wet Finger Method:*

7.2.1 *Procedure*—Moisten a fingertip and with medium pressure make one continuous rub ~~50 mm~~ 50 mm to 65 mm (2 in. to 2½ in.) in length on the surface under test. The chalk from this test method should be rated as None, Visible, or Severe; however, some may prefer to use an even numbered scale of 10 to zero.

7.3 *Test Method C—Transparent Tape Method:*

# D4214 Tape Chalk Rating Worksheet

## Reflectance Method C

Client Name: \_\_\_\_\_

Order #: \_\_\_\_\_

Exposure Time: \_\_\_\_\_

Sample	1st reading	2nd reading	Average Y (%)	Corrected Value	ASTM Chalk Rating
Tape+Sheet					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Date: \_\_\_\_\_

Inspected by: \_\_\_\_\_

FIG. 3 Example of Worksheet

7.3.1 *Materials:*

7.3.1.1 *Cellulose Adhesive Tape, Pressure Sensitive Adhesive Tape, natural rubber adhesive, clear, single-sided, 13-mm (1/2-in.) wide, pressure-sensitive. in.) wide.*

(1) Tensile strength shall be 26.3 N/10 mm to 52.6 N/10 mm (15 lbs/in. to 30 lbs/in.).

(2) Elongation shall be 10 % to 40 %.

(3) Peel strength shall be 3.28 N/10 mm to 4.93 N/10 mm (30 lbs/in. to 45 lbs/in.); Test Method **D3330** Method A.

(4) Total thickness (backing plus adhesive) shall be 0.041 mm to 0.066 mm (1.6 mils to 2.6 mils).

NOTE 3—The specific brand of tape shall be agreed upon between supplier and user, but must meet the above requirements. A product 3M #681 tape has been found that meets these requirements.

7.3.1.2 *Eraser*, approximately  $\frac{3}{4}$  in. (20 mm), wrapped with cellophane tape, clear pressure sensitive adhesive tape.

7.3.1.3 *Masking Tape*, 13-mm approximately 13 mm ( $\frac{1}{2}$ -in.) wide.

7.3.1.4 *Plastic Sheet Protector*, clear.

7.3.1.5 *Single-edge Razor blade*.

7.3.1.6 *Photographic Reference Standard No. 2*, TNO.<sup>3</sup>

7.3.1.7 *Reflectance Standard*, polished black glass.

7.3.1.8 *Reflectance Standard*, white tile.

NOTE 4—The black reference standard is necessary as the background backing substrate for this measurement, since the reflectance of black paper is too high. Reflectometers (tristimulus colorimeters), with 0 to 45° geometry, use the measurement. Measure the CIE tristimulus Y value, using a reflectometer with 0/45° geometry, D65 illuminant, 2° observer.

7.3.1.9 *Permanent marker*.

7.3.1.10 *Colorimeter or Spectrophotometer capable of measuring a CIE Tristimulus Y value (D65, 10° observer)*

7.3.2 *Optional Materials:*

7.3.2.1 *China Marker*, black.

7.3.2.2 *Razor Blade*.

7.3.2 *Preparation:*

7.3.2.1 Separately mount and apply two 279-mm (11-in.) pieces of masking tape along tape, approximately 279 mm (11 in.) long, along the right side of the clear plastic sheet cover leaving 32 cover, leaving about 32 mm ( $\frac{1}{4}$  in.) of space between the pieces (see Fig. 4).<sup>4</sup>

7.3.2.2 Remove a 50-mm (2-in.) long piece of 13-mm ( $\frac{1}{2}$ -in.) cellulose, pressure-sensitive adhesive tape from the roll; roll, measuring approximately 50 mm (2 in.) long; place it across the masking tape strips, and adhere it to the sheet using a 20-mm (an eraser (see  $\frac{3}{4}$ -in.) 7.3.1.2 eraser, wrapped with cellophane tape.). Label this tape “blank” on the clear plastic sheet cover. A black china marker has been found useful for this purpose.

NOTE 5—The average reflectance measurements of the initial and ending “blank” tapes less the correction value for the clear plastic sheet divided by 100 are used to verify a rating of 10 using Table 1.<sup>5</sup>

7.3.3 *Procedure:*

<sup>3</sup> The TNO Method and photographic reference standard are provided was provided in the past as a courtesy of Verfinstituut TNO Paint Research Institute TNO, Schoemakerstraat 97, Delft, Nederland. The original source of the photographic reference standard illustrated in Delft, Nederland. It is no longer available from TNO, but Fig. 2 is the Paint Research Institute, TNO. The mentioned here for historical purposes. The ASTM numerical rating of chalking shown on the photographic reference standard is in the opposite order to the original TNO scale.

<sup>4</sup> Test Method D4214 Method C is a standard with a large number of prescriptive requirements, which may not be necessary in all cases and for all applications. All sections within Method C are maintained here for those that use the prescriptive methodology. For those not requiring the details contained within the historical Method C, however, the essential requirements are similar: Tape is used to remove chalk from a panel and is placed on a clear plastic sheet. The sample ID is written next to the sample. A reflectometer is standardized and the tristimulus Y value is measured of the tape+chalk when the plastic sheet is placed over a black tile. A clear piece of tape is also placed on the plastic sheet (that is, tape that has not first been applied to a test panel) and is measured for tristimulus Y over the black tile. This “blank” serves as a correction factor. The corrected Y value (that is, the initial Y value, less the Y value of the blank) is used to look up the chalk value found in Table 1.

<sup>5</sup> Kronos-Titan Table for Chalk Rating from Reflectance Reading using the Transparent Tape Method is provided as a courtesy of Kronos-Titan GmbH, Leverkusen, West Germany. The original source of Table 1 is Kronos-Titan GmbH.

## D4214 Tape Chalk Rating Worksheet

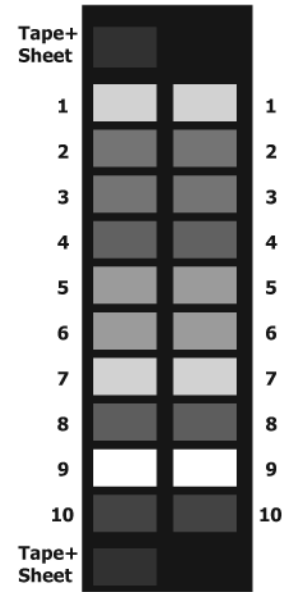
### Reflectance Method C

Client Name: ABC Company

Order #: 16443

Radiation to Date: 616 MJ/m<sup>2</sup> of UV

Sample	1st reading	2nd reading	Average Y (%)	Corrected Value	ASTM Chalk Rating
Tape+Sheet	2.38	2.36	0.0237	--	--
1	24.20	24.14	0.2417	0.2180	3.0
2	16.46	17.55	0.1701	0.1464	4.5
3	16.91	16.19	0.1655	0.1418	4.5
4	14.65	15.76	0.1521	0.1284	5.0
5	22.14	20.66	0.2140	0.1903	3.5
6	21.33	20.00	0.2067	0.1830	3.5
7	23.11	22.98	0.2305	0.2068	3.0
8	9.54	7.70	0.0862	0.0625	7.5
9	35.79	37.33	0.3656	0.3419	0.5
10	5.86	5.27	0.0557	0.0320	10.0



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<https://standards.iteh.org/standards/sist/4b13ee44-946a-4f8e-8589-6f913b1e2006/astm-d4214-23>

Inspected by: *Jane Doe*

FIG. 4 Completed Worksheet

7.3.3.1 Apply clear adhesive tape, approximately 50 mm (2 in.) long, to the surface being tested. Rub the tape ten times with moderate pressure using the covered eraser to remove all bubbles and prevent scratching. Remove the tape from the surface and adhere it to the sheet by rubbing with the eraser. Label the specimen.

7.3.3.2 Apply a 50-mm (2-in.) long piece of 13-mm (½-in.) wide tape to the surface being rated. Rub ten times with moderate pressure using the covered eraser, to remove all bubbles and prevent scratching. Remove the tape from the surface and adhere it to the sheet by rubbing with the eraser. Label specimens using a black china marker. Place successive tapes vertically adjacent to previous tapes, separated by approximately 3 mm (⅛ in.). Follow the instructions given in 7.3.3.4.1, and place the final “blank” tape across the masking tape strips and label “blank” on the clear sheet. When completed, use a razor blade to cut along the inside edges of the masking tape, cutting through the adhesive tapes. Remove the masking tape. The removal of the masking tape will leave only the tapes to be measured and evaluated with the sample number of each tape listed on the sheet (see worksheet example in Fig. 4). Before proceeding, check to ensure all sample numbers have been recorded on the sheet. (See footnote associated with 7.3.2.1).

7.3.3.3 Insert the 13-mm (½ in.) or smaller aperture and calibrate the reflectometer according to the manufacturer’s instructions, setting the reflectometer for zero reflectance using the black reflectance standard and standardizing with the white reflectance standard and record the values. Refer to Test Method E1347 should there be any question on the correct procedure to follow in the calibration of the instrument.