



Designation: D4214 – 07 (Reapproved 2015)

Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films¹

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 (ϵ) 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 practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

D662 Test Method for Evaluating Degree of Erosion of Exterior Paints

E1347 Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry

2.2 Other Document:

Pictorial Standards of Coating Defects³

3. Terminology

3.1 Definitions:

¹ 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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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 Copies of the pictorial photographic reference standards applicable to Test Method A are contained in the publication *Pictorial Standards of Coatings Defects* and may be obtained from the Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422.

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.

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 reference standards that are part of these test methods are representative of the degrees 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.

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 vary over any given area. Therefore, an average portion of the coating should be evaluated. 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 on a windy 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 forms⁴ such as shown in Fig. 3. Reporting of the results shall include the information given in Section 8.

⁴ These record sheets may be obtained from the Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422.

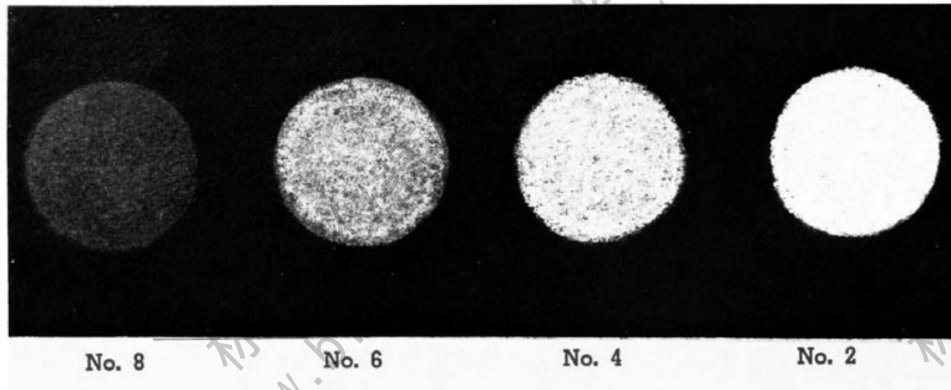


FIG. 1 Photographic Reference Standard No. 1—Test Method D659

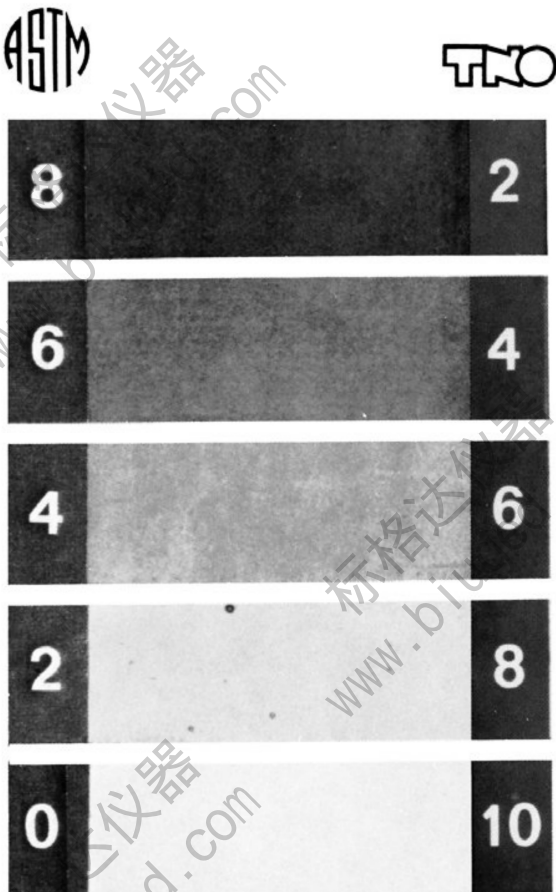


FIG. 2 Photographic Reference Standard No. 2—Verfijnstituut TNO

6.4 When these test methods is 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:

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.) 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 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 to 65 mm (2 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:⁵

7.3.1 Materials:

7.3.1.1 *Cellulose Adhesive Tape*, 13-mm (½-in.) wide, pressure-sensitive.

7.3.1.2 *Eraser*, ¾ in. (20 mm), wrapped with cellophane tape.

7.3.1.3 *Masking Tape*, 13-mm (½-in.) wide.

7.3.1.4 *Plastic Sheet Protector*, clear.

7.3.1.5 *Photographic Reference Standard No. 2*, TNO.⁶

7.3.1.6 *Reflectance Standard*, polished black glass.

7.3.1.7 *Reflectance Standard*, white tile.

NOTE 3—The black reference standard is necessary as the background for this measurement, since the reflectance of black paper is too high. Reflectometers (tristimulus colorimeters), with 0 to 45° geometry, use the Yvalue.

7.3.2 Optional Materials:

7.3.2.1 *China Marker*, black.

⁵ Permission to include this test method is provided as a courtesy of NL Chemicals, Wyckoff Mills Rd., Hightstown, NJ 08520.

⁶ The TNO Method and photographic reference standard are provided as a courtesy of Verfijnstituut TNO Paint Research Institute TNO, Schoemakerstraat 97, Delft, Nederland. The original source of the photographic reference standard illustrated in Fig. 2 is the Paint Research Institute, TNO. The ASTM numerical rating of chalking shown on the photographic reference standard is opposite to the original TNO scale.



TAPE CHALK RATING WORKSHEET

Reflectance Method

Client Name _____

Order # _____

Radiation to date _____

	Measurements	Avg /%	Corrected Value	Rating
Sheet
Tape & Sheet
	1st Set	2nd Set		
1
2
3
4
5
6
7
8
9
10
Tape & Sheet
Sheet

Date _____

Inspected by _____

NOTE 1—Label sample numbers, apply initial blank tape, and proceed with tape specimens of the samples.

FIG. 3 Example of Worksheet

7.3.2.2 Razor Blade.

7.3.3 Preparation:

7.3.3.1 Separately mount and apply two 279-mm (11-in.) pieces of masking tape along the right side of the clear plastic sheet cover leaving 32 mm (1¼ in.) of space between the pieces (see Fig. 4).

7.3.3.2 Remove a 50-mm (2-in.) long piece of 13-mm (½-in.) cellulose, pressure-sensitive adhesive tape from the roll; place it across the masking strips, and adhere it to the sheet using a 20-mm (¾-in.) 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 4—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 1.⁷

7.3.4 Procedure:

7.3.4.1 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 3 mm (⅛ in.). Follow the instructions given in 7.3, 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. 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.

7.3.4.2 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.

7.3.5 Reflectometer Measurements:

7.3.5.1 Leave the transparent tapes mounted on the clear plastic sheet. Remove the black paper that may have been inserted behind the sheet and fold back the unused portion of the sheet. Measure the reflectance of the clear plastic sheet using the black reflectance standard of the instrument (Note 3) as a backing or background and record its value. Move the sheet until the first tape is exposed to the light source with the adhesive side toward the light and the black reflectance standard behind the area being measured, and record the value.

7.3.5.2 Continue this procedure until ten tapes have been measured, then check reflectance values for the white and black standards. If no changes have occurred, proceed with measurements. If values have changed, restandardize and record values before proceeding to the remaining tapes. Following the final tape measurement, record reflectance values of the clear plastic sheet cover, and the white and black reflectance standards.

7.3.5.3 Subtract the mean reflectance value of the sheet from each reading, enter on worksheet form (Fig. 4), or other form used, and determine from Table 1 the chalk rating value of each tape to the nearest 0.5 unit. Record the rating on the worksheet or other form. The worksheet form (Fig. 4), inserted into the plastic sheet protector with a black background gives a clear permanent record of these measurements and evaluations.

7.3.5.4 These tape chalks may also be compared to Photographic Reference Standard No. 2 as an alternative procedure.

⁷ 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.

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TAPE CHALK RATING WORKSHEET

Reflectance Method

Client Name ABC Company

Order # 164433

Radiation to date 616 MJ/m² of uv

Measurements	Avg/%	Corrected Value	Rating	
Sheet 0.44	0.0045	--	-	
Tape & Sheet 2.38	0.0239	0.0194	10.0	
1st Set	2nd Set			
1 24.20	24.14	0.2380	0.2335	3.0
2 16.46	17.55	0.1664	0.1619	4.5
3 16.91	16.19	0.1618	0.1573	4.5
4 14.65	15.76	0.1484	0.1439	5.0
5 22.14	20.66	0.2103	0.2058	3.5
6 21.33	20.00	0.2046	0.2001	3.5
7 23.11	22.98	0.2268	0.2223	3.0
8 9.54	7.70	0.0862	0.8616	7.5
9 35.79	37.33	0.3619	0.3574	0.5
10 5.86	5.27	0.0520	0.0475	9.0
Tape & Sheet 2.40	0.0239	0.0194	10.0	
Sheet 0.46	0.0045			

Date 6-20-87

Inspected by John R. Doe

NOTE 1—The cutout section is for illustration purposes only. The labeling (china marker) may be removed by rubbing the sheet with a clean tissue or cloth.

FIG. 4 Completed Worksheet

TABLE 1 Chalk Rating from Reflectance Reading^A

Reflectance Range	Chalk Rating
0–0.038	10
0.0381–0.044	9.5
0.0441–0.054	9.0
0.0541–0.062	8.5
0.0621–0.072	8.0
0.0721–0.082	7.5
0.0821–0.095	7.0
0.0951–0.105	6.5
0.1051–0.120	6.0
0.1201–0.131	5.5
0.1311–0.150	5.0
0.1501–0.165	4.5
0.1651–0.190	4.0
0.1901–0.210	3.5
0.2101–0.235	3.0
0.2351–0.260	2.5
0.2601–0.286	2.0
0.2861–0.310	1.5
0.3101–0.340	1.0
0.3401–0.366	0.5
>0.366	0

^A This table is based upon a correlation between tape reflectance measurements and visual evaluations of the same tape compared to the photographic standards prepared by Kronos-Titan.⁷

7.4 Test Method D—TNO Type Method:

7.4.1 Materials:

7.4.1.1 Photographic Reference Standard No. 2 for the determination of chalking, consisting of a photograph of five

strips of tape mounted on a black background, numbered 0, 2, 4, 6, and 8, and varying in this order from black to almost white.

7.4.1.2 Polyethylene Tape, transparent, 13 to 25 mm (½ to 1 in.) wide.

7.4.1.3 Black Velvet, dull black with a short pile and without a tendency to crush, size approximately 200 by 300 mm (8 by 12 in.), mounted on a flat substrate. Black construction paper may also be used. Place adjacent to the standard for the ratings.

7.4.2 Procedure—Apply a piece of tape, 63 to 100 mm (2½ to 4 in.) long to the coating by uniform gentle pressure of the finger, remove the tape, and lay it with the adhesive side on the piece of velvet. Under diffused light compare the tape on the black velvet with Photographic Reference Standard No. 2, and determine which of the five grades most closely matches the whiteness of the adhering pigment. If the degree of chalking is obviously between two adjacent grades, select the intermediate odd number as the chalk rating.

7.4.3 Chalk ratings may also be determined by following the procedures of 7.3.3 and comparing to the values shown in Fig. 1. The use of the worksheet form shown in Fig. 3 and Fig. 4 may be used as a permanent record.

8. Report

8.1 A record of the test method used, the rating, panel number, and other pertinent information must be clearly shown on the inspection report for each evaluation.



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8.2 The pertinent information should include: date of inspection, date of exposure start, purchase order number of testing organization, duration, remarks about unusual weather, etc., the name of the person making the inspection, and other information agreed upon between the producer and the seller.

9. Keywords

9.1 chalking; evaluation; exterior paint films

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