



Designation: D281 – 12 (Reapproved 2021)

Standard Test Method for Oil Absorption of Pigments by Spatula Rub-out¹

This standard is issued under the fixed designation D281; 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 This test method covers the determination of the oil absorption of pigments by the spatula rub-out technique.

1.2 The values stated in SI units are to be regarded as 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, 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:*²

D1483 Test Method for Oil Absorption of Pigments by Gardner-Coleman Method

3. Summary of Test Method

3.1 A stiff, putty-like paste is formed by the dropwise addition of linseed oil to pigment that is being thoroughly rubbed with a spatula. The amount of oil required to produce the end point is used to calculate an oil absorption value.

4. Significance and Use

4.1 The oil absorption value obtained by this test method gives information about the vehicle demand of the pigment

when it is used in a pigment paste. Oil absorption values can be used to characterize pigments or batches of a given pigment.

4.2 This test method differs from Test Method D1483 in that D1483 involves only a gentle stirring and folding of the pigment, whereas this test method requires a thorough rubbing action. Because the end points are different, the values obtained from the two test methods generally differ.

5. Apparatus and Materials

5.1 *Balance*, capable of weighing to 0.001 g.

5.2 *Dropping Bottle*, fitted with ground-in pipet and rubber bulb or buret, graduated in 0.1-mL divisions.

5.3 *Smooth Glass Rub-up Plate or Marble Slab* (glass should have a surface similar to Hoover Muller Plates).

5.4 *Spatula*, sharp-edged, steel, having a blade of 15 or 20 mm by 100 mm ($\frac{1}{2}$ or $\frac{3}{4}$ by 4 in.).

5.5 *Oil*, linseed, raw, conforming to the following specification:

| | |
|----------------------|-------------|
| Specific Gravity | 0.926–0.931 |
| Boiling Point | >149°C |
| Acid Number | 3 \pm 1 |
| Saponification Value | 185–196 |
| Iodine Value | 170 minimum |
| Gardner Color | 13 maximum |

5.5.1 Linseed oil used in comparative tests must have the same acid value. Other liquids, such as refined oil, may be used by mutual agreement.

6. Procedure

6.1 *Procedure A (Weighing Bottle)*—Weigh exactly 1 g, or any multiple thereof (Note 1), of the thoroughly mixed and air dried pigment and place upon a glass plate or marble slab. Weigh to 0.01 g a dropping bottle containing raw linseed oil along with the pipet and rubber bulb. Add the linseed oil gradually, drop by drop (by means of the pipet), to the pigment. After the addition of each drop, thoroughly incorporate the oil by rubbing up with the spatula. The test is complete when exactly enough oil has been incorporated with the pigment to produce a very stiff, putty-like paste, that does not break or separate. Weigh the bottle and oil to 0.01 g and determine by difference the weight of oil used. The time that it took to run the test (in minutes) should be noted. Subsequent tests on the

¹ This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.24 on Physical Properties of Liquid Paints & Paint Materials.

Current edition approved June 1, 2021. Published June 2021. Originally approved in 1928. Last previous edition approved in 2016 as D281 – 12 (2016). DOI: 10.1520/D0281-12R21.

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.

same kind of pigment should be performed in approximately the same period of time. Any device capable of measuring minutes may be used.

NOTE 1—The specimen weight depends upon the specific gravity, fineness, and other characteristics of the pigment. For example, 20 g is taken for white lead, but about 1 g is sufficient for carbon black. In any event, the specimen size should be large enough so that at least 1 g of oil is required.

6.2 Procedure B (Buret):

6.2.1 Follow Procedure A, except add the linseed oil from a buret rather than a dropping bottle pipet. Calculate the weight of oil in grams by multiplying the volume oil used by its density (0.93 g/mL).

6.3 It is suggested that when a new pigment is to be tested, a preliminary rub-out be made to determine an approximate end point. Once this is established, the actual determination should be made with a slower addition of oil and a more vigorous rub-out through the critical region, therefore permitting a more precise assessment of the correct oil absorption end point.

7. Calculation

7.1 From the weights of oil and pigment used in the test, calculate the number of grams (pounds) of oil required to exactly wet grams of oil per 100 grams of pigment or 100 pounds of pigment.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/

8. Report

8.1 Report the oil absorption of the pigment as the number of grams (pounds) of oil required to exactly wet 100 grams (pounds) of pigment.

8.2 Report the time taken to run the test.

9. Precision and Bias

9.1 On the basis of an interlaboratory study of this test method in which one operator in each of five laboratories tested two grades of zinc oxide covering a small oil absorption range by spatula rub-out, the within-laboratory coefficient of variation was found to be 4.6 % at 10 df and the between-laboratories coefficient of variation 11.6 % at 8 df. Based on these coefficients, the following criteria should be used for judging the precision of results at the 95 % confidence level:

9.1.1 *Repeatability*—Two results obtained by a single operator should be suspect if they differ by more than 14.3 % relative.

9.1.2 *Reproducibility*—Two results obtained by operators in different laboratories should be considered suspect if they differ by more than 38.0 % relative.

9.2 *Bias*—Since there is no accepted reference material suitable for determining bias for the procedure in this test method, bias cannot be determined.

10. Keywords

10.1 oil absorption; pigments (general properties); spatula rub-out test