



Designation: D6688 – 20

# Standard Practice for Relative Resistance of Printed Matter to Liquid Chemicals by a Sandwich Technique<sup>1</sup>

This standard is issued under the fixed designation D6688; 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.

## 1. Scope

1.1 This practice covers the evaluation of the relative resistance of printed matter to liquid chemicals, as evidenced by lack of discoloration, bleeding, or loss of gloss.

1.2 This practice utilizes a sandwich procedure similar in principle to ISO/TC 130 N 589. Spotting or immersion procedures are covered in Test Methods [D1308](#), [D1647](#), and [D2248](#).

1.3 This practice is applicable to prints on any flat substrate including paper, paperboard, metallic foil, metal plate, and plastic films, and produced by any printing process including letterpress, offset lithography, flexography, gravure, silk screen, and non-impact.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *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.* For specific hazard statements, see Section 7.

1.6 *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>

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee [D01](#) on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee [D01.56](#) on Printing Inks.

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

[D1308](#) Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes

[D1647](#) Test Methods for Resistance of Dried Films of Varnishes to Water and Alkali (Withdrawn 2004)<sup>3</sup>

[D2248](#) Practice for Detergent Resistance of Organic Finishes

### 2.2 Other Standards:

[ISO/TC 130 N 589](#) Graphic Technology-Prints and Printing Inks-Assessment of Resistance to Various Agents<sup>4</sup>

## 3. Summary of Practice

3.1 Prints of the test and reference printing inks are each sandwiched between filter paper, which has been saturated with the specified liquid. After the agreed upon contact times, the prints and filter paper are dried and then examined for objectionable changes such as discoloration, bleeding, or loss in gloss. The test print is then rated as better, equal, or worse than the reference print.

## 4. Significance and Use

4.1 Many types of printed matter, notably container labels, packaging materials, magazine and book covers, must be resistant to liquid materials that may contact them advertently or inadvertently. This practice permits an assessment of resistance of printed matter to several types of liquids.

4.2 The requirement that a reference print be run at the same time as the test print minimizes effects of atmospheric conditions (humidity and temperature) and other variations which may develop.

4.3 This practice can be used to determine whether new formulations are suitable for the end-use purpose and for specification acceptance between producer and user.

## 5. Apparatus

5.1 *Glass Plates*, 60 by 90 mm, two for each printed specimen (minimum four per test).

5.2 *Petri Dish*, at least 100 mm in diameter.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

5.3 *Weight*, 1 kg.

5.4 *Timer*, calibrated in minutes up to 24 h.

5.5 *Oven*, capable of maintaining 50°C.

## 6. Materials

6.1 *Reference Print*, of known resistance to the specified test liquid, cut to 20 × 50 mm and marked with *R*.

6.2 *Filter Paper*, white neutral for qualitative analysis, with a very smooth and soft surface, cut to 60 by 90 mm. Minimum eight pieces per test. Mark four pieces with a *R* and four pieces with a *T*, for each test.

6.3 *Soft, Pliable Nonporous Film*, such as food wrap.

6.4 *Test Liquid*, as agreed upon between the producer and user. See examples in [Table 1](#).

## 7. Hazards

7.1 Some test liquids may be harmful to the skin and eyes. Wear safety glasses and protective gloves when handling such chemicals. In case of contact, wash skin with water; flush eyes for 15 min with water and call a physician. See supplier's Material Safety Data Sheet for further information on each chemical used.

7.2 After testing is completed, dispose of leftover chemicals according to prevailing regulations.

## 8. Test Specimens

8.1 This practice does not cover preparation of printed samples. The color, substrate, method of printing, and ink film thickness shall be consistent with that of the reference print.

8.2 Cut test specimens to 20 by 50 mm and mark with a *T*. If freshly prepared prints are utilized, wait at least 72 h before conducting resistance tests. Set aside at least one specimen for comparative purposes.

8.3 Include the unprinted substrate as a blank in tests conducted with colored liquids. It may also be useful to test the unprinted substrate in cases where the print fails to remain intact.

8.4 Unless otherwise specified, at least two specimens are to be run with each test liquid.

## 9. Procedure

9.1 Unless otherwise specified, conduct tests at 23 ± 2°C.

9.2 Pour a quantity of the test liquid into a petri dish.

9.3 Take four pieces of filter paper marked *T* and using forceps, immerse them completely in the liquid. Remove and drain until no free liquid drips from the papers.

9.4 Place two pieces of the saturated filter paper on a glass plate, center the 20 by 50 mm specimen of test print on top of the filter paper, and cover with the other two pieces of saturated filter paper.

9.5 Cover with the other glass plate and center the 1 kg weight on top of the sandwich. Set the clock for the test duration indicated in [Table 1](#), or as agreed upon between producer and user.

NOTE 1—When using a highly volatile liquid such as ethyl alcohol, there is a possibility that the liquid will evaporate through the space between the two glass plates that make up the sandwich. This would have the effect of reducing the amount of time the prints were in contact with the test liquid. To avoid this, wrap the sandwich in a pliable nonporous film such as a food wrap, to seal off the space between the glass plates.

9.6 Immediately repeat 9.3 – 9.5 with the reference print, using filter paper marked *R*. Note the elapsed time on the clock.

9.7 After the specified time has elapsed, remove the prints and filter papers from the sandwiches and wash in deionized water. Dry the test pieces for 30 min at about 50°C.

NOTE 2—In lieu of an oven, the intact prints and filter papers can be air dried overnight.

9.7.1 Unless otherwise specified, use the contact times specified in [Table 1](#).

9.8 Repeat 9.2 – 9.6 with a second specimen of the test and reference prints.

## 10. Evaluation

10.1 Examine the treated test print by comparison with the untreated test print. Observe any changes, such as discoloration or loss of gloss.

10.2 Examine the corresponding filter papers for staining or ink transfer, or both.

10.3 Repeat 10.1 and 10.2 with the reference prints.

## 11. Report

11.1 The report shall include the following information for both the test and reference prints.

11.1.1 Identifying information, such as pigmentation, substrate, printing process, ink film thickness.

11.1.2 The liquid chemical used for the test.

11.1.3 The contact duration.

11.1.4 The changes observed in the treated prints and filter papers, such as discoloration, bleeding, or loss of gloss.

## 12. Keywords

12.1 bleed resistance; chemical resistance; printed matter; printing inks

**TABLE 1 Suggested Contact Times for Liquid Chemicals**

| Liquid                           | Suggested Contact Time                   |
|----------------------------------|--|
| Distilled water                  |  |
| Lactic acid (5 %)                |  |
| Citric acid (1 %)                |  |
| Acetic acid (1 %)                |  |
| Hydrochloric acid (1 %)          | 24 h                                     |
| Sulfuric acid (1 %)              |  |
| Alcohols                         |  |
| Oils (Vegetable, Lubricating)    |  |
| Soap or Detergent Solution (1 %) | 3 h                                      |
| Lactic Acid (10 %)               | 1 h                                      |
| Citric Acid (5 %)                |  |
| Acetic acid (5 %)                | 30 min.                                  |
| Hydrochloric acid (5 %)          |  |
| Sulfuric acid (5 %)              | 10 min.                                  |
| Sodium hydroxide (1 %)           |  |
| Wax (molten wax)                 | 5 min.                                   |
| Other                            | As agreed upon between producer and user |