Designation: D 6073 – 96 (Reapproved 2001)

Standard Test Method for Relative Setting of Heatset Printing Inks by the Sinvatrol Tester[1]

This standard is issued under the fixed designation D 6073; 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.

1. Scope

1.1 This test method describes the procedure for determining the relative setting speed of heatset inks using a specific tester.[2]

1.2 This test method is applicable to printing inks intended to be dried by the application of heat and for which a suitable reference standard is available.

1.3 Although heatset inks are normally printed by the offset process, this test method specifies the direct letterpress mode because the higher ink film thicknesses obtained tend to amplify subtle differences in ink setting speed.

1.4 This tester[2] reads temperature and belt speed in nonmetric terms; therefore, instrument settings in this test method are stated first in U.S. Customary Units (inch pound units of measurements). The values given in parentheses are for information only.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1316 Test Method for Fineness of Grind of Printing Inks by the NPIRI Grindometer[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *heatset printing ink*—an ink typically containing aliphatic hydrocarbon solvents that evaporate at elevated temperatures.

4. Summary of Test Method

4.1 A printing gage is used to prepare a laboratory print containing both the test sample and a standard ink. The freshly prepared print is immediately subjected to forced hot air in the tester,[2] which is initially set at 350°F (177°C) and a belt speed of 30 fpm (0.15 m/s).

4.2 The print is cooled, overlaid with a clean sheet of stock, passed through the printing apparatus, and examined for setoff.

4.3 The process is repeated at different belt speeds or temperatures until either the test sample or the standard exhibits setoff and the other does not, or it is established that both are the same. The sample is then reported to dry faster than, slower than, or equal to the standard.

5. Significance and Use

5.1 The setting speed of heatset printing inks is important because it influences the efficiency of the drying process. This test method provides a means for comparing the setting of a heatset ink directly against a standard at the same conditions of temperature and exposure time. While the method does not determine the setting speed of an ink on a production press, it is useful for specification acceptance between the supplier and the customer.

5.2 The setting speed of a printing ink depends on a number of variables such as the stock on which it is printed, the film thickness on the print, the temperature of the forced air, the rate of air flow, and the time that the print is subjected to heat. For these reasons, it is important to conduct the tests under conditions that are controlled and as realistic as practical.

6. Apparatus

6.1 *Tester*,[2] equipped with a forced hot air oven and print delivery system. The air temperature can be adjusted between 100 and 600°F (38 and 315°C) and the speed of the print delivery unit between 0 and 100 fpm (0 and 0.5 m/s). The print delivery system allows the print to be exposed to hot air from the top and bottom at the same time.

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[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 D01.56 on Printing Inks.

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[2] The sole source of supply of the tester, Sinvatrol known to the committee at this time is the Flint Ink Corp., 25111 Glendale, Detroit, MI 48239. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

[3] *Annual Book of ASTM Standards*, Vol 06.02.

6.2 *Laboratory Flatbed Printing Apparatus*.

6.3 *Printing Gage*,[4] consisting of a type-high block of steel 0.918 in. (23.3 mm) in height; the top surface is precision-machined to contain a single constant-depth path approximately 3 by 7½ in. (76 by 190 mm), which is inked by means of a drawdown blade. A milled depth of 0.4 mils (10 µm) is recommended for coated paper and other smooth substrates. Deeper plates may be necessary for rougher substrates. Typical path depths and corresponding ink film thicknesses are given in Table 1.

TABLE 1 Relationship Between Gage Depth and Ink Film Thickness

Machined Depth of Gage		Ink Film Thickness		
		On Gage[A]	On Substrate	
mils	µm	µm	Letterpress,[B] µm	Dry Offset,[C] µm
0.2[D]	5	4	2	1
0.3	7.5	6	3	1.5
0.4[D,E]	10	8	4	2
0.6[D]	15	12	6	3

[A] Presuming 80 % path fillage.
[B] Presuming 50 % ink transfer from gage to substrate.
[C] Presuming 50 % ink transfer both to blanket and to substrate.
[D] Available on the 3-path FPBAA Plate C. Each path is 1¼ by 4 in. (3.2 ca by 10 cm).
[E] Available on the single-path gage[4] (described in 6.3).

6.4 *Drawdown Blade*,[4] 4 in. (102 mm) in length, so as to span the width of the printing gage.

6.5 *Metal Surface*, to cool the print immediately after it has passed through the tester.

6.6 *Metal Block*,[4] type-high, of similar top dimensions as the printing gage.

7. Materials

7.1 *Standard Heat-set Ink*, as agreed upon between the supplier and the customer. The standard ink must be of the same color and transfer characteristics as the test ink. This ink should not be so old that changes in properties have occurred since its manufacture.

7.2 *Printing Substrate*, such as paper, paperboard or other as agreed upon between the supplier and customer, cut to 8½ by 11 in. (216 by 280 mm) or other size appropriate to the printing apparatus.

7.3 *Carrier*, consisting of a sheet of cardboard approximately 8½ by 11 in. (216 by 280 mm), with a hole cut in the center that is slightly larger than the size of the print produced by the laboratory printing apparatus.

7.4 *Setoff Sheet*, cut to the same size as the printing substrate (7.2). If the printing substrate is paper, film or foil, use the same material. If paperboard, use coated paper 5 to 6 mils (1.1 to 1.4 µm) in thickness.

7.5 *Wash-up Materials*, including an appropriate solvent and lint free rags or tissues.

8. Sampling and Test Specimen

8.1 Carefully select a sample that is free of skin and other contamination and representative of the lot being evaluated. The minimum sample per print is less than 0.034 oz. (1 mL). Transfer to a clean container, protect with skin paper, close and seal.

8.2 When ready to make a print, remove enough sample for one test, then close and reseal the container.

9. Preparation of Apparatus

9.1 *Tester:*[2]

9.1.1 Prior to operation of the tester, carefully read the instructions in the manufacturer's literature.

9.1.2 Set the tester on a work bench in a laboratory having adequate ventilation and space to accommodate the printing apparatus in close proximity.

9.1.3 Provide a power supply consisting of a 30-A circuit or two separate 15-A circuits in order to accommodate the two 15-A heat guns without overload.

9.1.4 Adjust the speed control knobs to the starting point for the tests, typically 30 fpm (0.15 m/s). In older units, it may be necessary to adjust the speed with the carrier on the belt.

9.1.5 Prior to the first use of the day, warm up the tester to 350°F (177°C) by turning on the two heater units.

9.2 *Printing Apparatus*:

9.2.1 Remove the normal plate and the setoff plate (if any) from the bed of the printing apparatus.

9.2.2 Place an inked gage (in accordance with 10.2) in the bed of the press and pull a print in order to check whether the printing pressure is adequate. If not, place tympan or shim under the gage, or adjust according to the manufacturer's instructions.

9.2.3 Replace the printing gage with the metal block (6.6). Determine the number of setoff sheets needed for developing maximum practical pressure to achieve adequate setoff in 10.8. One sheet is usually sufficient.

9.3 *Printing Gage*:

9.3.1 Prior to use, clean the printing gage and drawdown blade with solvent. Make certain they are free of dust, lint, grease, solvents or oils.

9.3.2 Information relating to care of the gage and blade before and after use is given in Test Method D 1316.

10. Procedure

10.1 Make preparations as in Section 9. If necessary, adjust the belt speed to 30 fpm and warm up the tester to 350°F (177°C).

10.2 Place the clean dry printing gage on a bench top or in the bed of the proof press, whichever is more convenient to the operator. Using separate ink knives, place a small quantity of the test ink approximately 1 cm from the far end of the gage and across the right half of the channel. Place the standard sample next to it and across the other half of the channel.

10.3 Following the drawdown instructions in Test Method D 1316, hold the scraper in a vertical position and draw the inks in juxtaposition down the length of the path. Make the drawdown with a smooth steady stroke that takes about 5 s. For purposes of identification, use a pencil eraser or other nonmetallic material to inscribe the letter "*T*" close to the top of the

[4] The sole source of supply of the apparatus known to the committee at this time is the Precision Gage and Tool Co., 375 Gargrave Rd., Dayton, OH 45449. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

drawdown made with the test ink, or the letter "*S*" in the drawdown of the standard ink.

10.4 Place the inked gage in the proper position in the bed of the printing apparatus with the long direction parallel to the deadline bar. Attach the substrate to the impression cylinder and pull the print.

10.5 Tape the leading edge of the print onto the carrier (7.3) and run through the tester.

10.6 Remove the printing gage from the printing apparatus and replace with the metal block (6.6).

10.7 Bring the print to room temperature by passing it over a metal surface. Alternatively, set the print on a bench top for 15 s.

10.8 Place one or more clean sheets of the setoff substrate (as determined from 9.2.3) on top of the print, attach to the impression cylinder, and run through the printing apparatus. Examine the side that was in contact with the ink film for setoff.

10.9 If neither ink exhibits setoff, increase the tester belt speed by increments of 5 fpm (0.025 m/s) and repeat 10.2-10.8 to until one ink sets off and the other does not or until it is established that the drying speeds are essentially the same.

10.10 If both inks set off in the initial pass, either reduce the belt speed or raise the temperature of the tester by 25°F (14°C) and repeat 10.1-10.8.

NOTE 1—Each time a print is made, the gage and drawdown blade must be cleaned in order to ensure that a repeatable amount of ink is deposited in the gage. Since the thickness of the ink film is critical to the drying speed of the ink, a repeatable ink film thickness is important.

11. Report

11.1 Report the following information:

11.1.1 The drying speed of the ink as equal to, faster than or slower than the standard,

11.1.2 The temperature at which the endpoint was reached,

11.1.3 The speed of the carrier at the endpoint,

11.1.4 The method utilized for making the print, and

11.1.5 Any deviations from this test method.

12. Precision and Bias

12.1 An interlaboratory study[5] was conducted in which four laboratories tested the relative setting of three heat-set inks. All laboratories agreed on the relative rating. However, since the test is non-quantitative, it is not possible to compute repeatability, reproducibility, and bias.

13. Keywords

13.1 heat-set printing inks; printing apparatus; setting speed; tester

[5] Supporting data are available from ASTM Headquarters. Request RR: D01-1105.