Designation: D7680 – 10

Standard Practice for Preparing Prints of Paste Printing Inks by a Motor-Driven Printability Tester[1]

This standard is issued under the fixed designation D7680; 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 practice describes the procedure for preparing laboratory prints of paste printing inks using a motor-driven printability tester.

1.2 This practice covers printability testers of four different designs, referred to as Tester A, B, C, and D. These testers feature "push-button" control of printing speed and pressure and facilitate measurement of exact ink film thickness.

1.3 This practice is intended primarily for lithographic and letterpress inks that dry by oxidation or penetration. With appropriate drying or curing equipment, it is also applicable to other systems such as heat-set or energy curable.

1.4 This practice is applicable to the preparation of single-color solid-area prints by dry offset (also know as letterset) or by letterpress on any flat surface including paper, paperboard, plastic film, textiles, and metal.

1.5 The values stated in SI units are to be regarded as the standard. The only other unit of measurement used is fpm.

1.6 *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]

D528 Test Method for Machine Direction of Paper and Paperboard (Withdrawn 2010)[3]

D1475 Test Method For Density of Liquid Coatings, Inks, and Related Products

D5039 Test Methods for Identification of Wire Side of Paper (Withdrawn 2009)[3]

D6073 Test Method for Relative Setting of Heatset Printing Inks

D7189 Test Method for Relative Mileage of News Ink on Newsprint

D7305 Test Method for Reflection Density of Printed Matter

2.2 *Other Standards:*[4]

ISO 187 Paper, board and pulps—Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples

ISO/DIS 2835–1 Graphic technology—Laboratory preparation test prints–Part 1: Paste inks

ISO 2846–1 Graphic technology—Specification for color and transparency of printing ink sets–Part 1: Inks for heat-set web offset lithographic printing

ISO 2846–2 Graphic technology—Specification for color and transparency of printing ink sets–Part 2: Inks for coldset offset lithographic printing

3. Terminology

3.1 *Symbols:*

fpm	=	feet per minute (fpm ÷ 200 = m/s)
kgf	=	kilograms of force (kgf = 9.81 N)
kp	=	kilopascals of pressure (kp = 9.81 N)
m/s	=	meters per second (m/s × 200 = fpm)

3.2 *Symbols for ink film thickness calculations:*

A_S	=	printed area on the substrate, cm^2
D	=	density of the ink, g/cm^2
IFT_P	=	ink film thickness on the plate, µm
IFT_S	=	ink film thickness on the substrate, µm
µm	=	micrometers

[1] 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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[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] The last approved version of this historical standard is referenced on www.astm.org.

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

W_A = weight of inked plate after printing, g
W_B = weight of inked plate before printing, g
W_P = weight of ink carried on the plate, g
W_{PO} = weight of the clean uninked plate, g
W_S = weight of ink on the substrate, g
W_{SA} = weight of ink on the substrate per unit area, g/m^2

4. Summary of Practice

4.1 The designated printing speed and pressure are preset on the print maker of the printability tester. A specified volume of ink is metered to the rollers of the inking system and distributed for 15 to 25 s for heatset and newsinks, 60 s or more for other inks. The printing disk is inked for the same period of time, installed on the print maker, and a print made on the designated substrate.

4.2 The prints are dried by appropriate means and measured for reflection density in order to verify that the target value has been achieved.

4.3 If required by the test, the inked disk is weighted before and after printing and the exact ink film thickness on the substrate is computed.

4.4 After a suitable lapse of time, the prints are subjected to the intended end use test(s). Results are compared to those of reference prints prepared in the identical fashion.

5. Significance and Use

5.1 It is generally recognized that the best method for evaluating printing properties of ink-substrate combinations is by actual printing. this practice provides a convenient method for preparing repeatable laboratory prints at realistic conditions of printing speed, printing pressure and ink film thickness.

5.2 This practice is useful for quality control, specification acceptance between producer and user, product development and research. Printed samples have found widespread applications for color matching, gloss-ink holdout and other appearance properties, permanency, abrasion, drying time and many other tests of interest to the printing ink, paper and allied industries.

6. Apparatus

6.1 *Printability Tester* having the following components:

6.1.1 *Print Maker,* a motorized printing press that can be accommodated on a laboratory bench. As noted in Table 1 and Fig. 1, Testers A and C are flat-bed presses, Testers B and D are cylinder presses. Printing speed and pressure are set simply by turning appropriate dials except on Tester D, where they are computer-controlled.

6.1.2 *Inking System,* consisting of three rollers on which the ink is distributed. the bottom two rollers, at least one of which oscillates, are metal, while the top roller is of synthetic composition. A top roller of special composition is required for glycol-based and energy curable inks. As seen in Table 1 and Fig. 1a and Fig. 1c, Testers A and C contain built-in inking systems, while Fig. 2 illustrates the separate inking systems that are required for Testers B and D. Several inking systems are thermostated, an important feature for running heatset inks. All are engineered so as to provide multiple inking stations, each of which contains a device to support the disk during the inking process.

6.1.3 *Printing Disk,* to serve as the printing plate. As seen in Table 1, disks are 2 to 7 cm wide and ~ 20 cm in circumference. They are constructed of light-weight polished aluminum or rubber-covered aluminum or as a core with an aluminum or rubber covering. If rubber disks are used, it it recommended to procure two or more so as to minimize waiting time after cleanup.

NOTE 1—Disks of other sizes and surface coverings are available. For the purpose of this practice, the discussion is limited to those listed in Table 1.

6.1.4 *Carrier,* a "sled" on which flexible substrates are mounted for making prints on the two flat-bed testers, A and C. Carriers are constructed of stiff plastic with a rubber coating. Heavy cardboard and metal specimens may possibly be run without benefit of a carrier. When disks of different widths are being used with thin substrates, separate carriers are required so that indentation from the narrower disk does not mar the appearance of prints made subsequently with the wider disk.

6.2 *Ink Pipette,* consisting of a metal cylinder and plunger, 2 mL capacity, accurate to a minimum of 0.01 mL.

6.3 *Timer,* with clear 1 s divisions.

6.4 *Tongs or Rubber Gloves (optional),* for handling the disk when making gravimetric measurements.

6.5 *Analytical Balance (optional),* accurate to 0.0001 g with 150 g capacity to accommodate the printing disk described in 6.1.3.

6.6 *Accelerated Drying Equipment (optional)* such as a source of heat as in Test Method D6073, or energy-curing, as needed.

6.7 *Reflection Densitometer or Spectrodensitometer (optional)* conforming to Test Method D7305.

6.8 *Weight per Volume Cup (optional)* for measuring ink density in accordance with Test Method D1475.

7. Materials

7.1 If the test sample is a printing ink:

7.1.1 *Reference Ink,* of the same type, rheology and color as the test ink and having known printing properties.

7.1.2 *Standard Substrate,* as specified in the test method or as agreed upon between producer and user.

7.2 If the test sample is a substrate:

7.2.1 *Reference Substrate,* of the same type as the test substrate and having known printing properties.

7.2.2 *Standard Ink,* as specified in the test method or as agreed upon between producer and user.

7.3 *Target Value(s)* for reflection density or gravimetric-based end result or both.

7.4 *Was up Solvent,* such as mineral spirits or other compatible with the printing ink system and the composition surfaces.

7.5 *Rags or Wipers,* clean, absorbent, lint-free.

TABLE 1 Features of Printability Testers[A]

Component	Feature	Tester A	Tester B		Tester C[B]	Tester D
Print Maker	Printing geometry					
	Printing plate (disk)	Cylindrical	Cylindrical		Cylindrical	Cylindrical
	Impression surface	Flat	Cylindrical		Flat	Cylindrical
	Printing speed m/s	0.5-6, 10 or 12	0.2-5		0.3	0.5-3
	fpm	100-1200...or 2400	40-1000		60	100-600
	Printing pressure, N	100-1000 or 1600	50-1000		50-1000 or 200-800	30-1000
Inking Unit	Relationship to print maker	Built-in	Separate[C]	Separate[D]	Built-in	Separate
	Thermostatted	Yes	Yes	No	No	Yes
	Speed, m/s	0.7	0.2-1.2	0.3	0.3	0.16-1.16
	Number of inking stations	4	1, 2 or 4	2 × 2	1	4
	Surface area per station, cm^2	570	1537, 729 or 328	1187	700	579
Printing Disk	Dimensions, width × circumference					
	Aluminum, cm	4 × 20	3.2 or 5 × 20		2, 3.5 or 5 × 20	3.5 or 5 × 21
	Rubber, cm	4 × 20	3.2 or 5 × 20		2, 3.5, 5 or 7 × 20	3.5 or 5 × 21
	Surface area					
	Aluminum, cm^2	80	64 or 100		40, 70 or 100	74 or 105
	Rubber, cm^2	80	64 or 100		40, 70, 100 or 140	74 or 105
	Specimen size, cm	4.5 × 28	min. 5.5 × 28		5.5 or 7.5 × 28	5.5 × 28

[A] Features given in this table are restricted to single-color solid-area printing of paste inks at constant speed.
[B] Tester C comprises a range of different models. See the manufacturer's operating manual for the combination of conditions available on a particular model.
[C] this column refers to the high speed inking unit. The four station unit is depicted in Fig. 2A.
[D] This column refers to the slow speed inking unit depicted in Fig. 2B. It is no longer produced but is listed because of the many units already in the field.

Fig. 1A – Tester A

Fig. 1B – Tester B

Fig. 1C – Tester C

Fig. 1D – Tester D

FIG. 1 Printability Testers Covered in this Practice

Fig. 2A – High Speed Unit for Tester B

Fig. 2B – Slow Speed Unit for Tester B

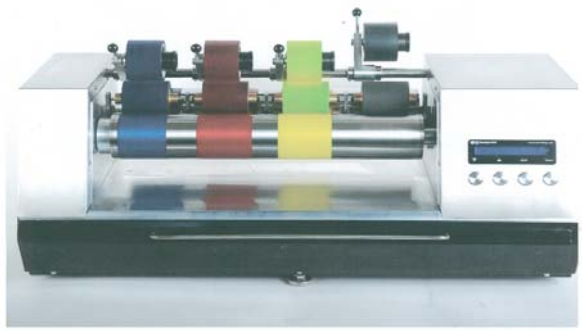

Fig. 2C – High Speed Unit for Tester D

FIG. 2 Inking Systems for Use with Testers B and D

7.6 *Plastic Sheet,* large enough to cover the instrument(s).

7.7 *Manufacturer's Operating Manual,* for the specific instrument model.

8. Hazards

8.1 **WARNING**—Since solvents may be hazardous to the skin and eyes, wear rubber gloves and safety glasses during cleanup to avoid solvent contact with skin and eyes. In case of contact, wash skin and eyes for 15 min with water and call a physician. See supplier's Material Safety Data Sheets for further information on each solvent used.

8.2 Use local exhaust/ventilation during solvent cleanup.

8.3 Never let a vehicle or ink dry completely on the surface of the rollers or disks.

8.4 Be careful not to cause any damage during the cleaning process or by leaving the rollers and disks in contact when not in use.

9. Test Specimens

9.1 *Printing Ink:*

9.1.1 Printing ink samples should be press-ready. Because of the small surface areas of the inking stations shown in Table 1, and as can be surmised from the data in Table 2 (to be discussed in more detail in 12.4.2), very little ink, less than one mL, is usually sufficient to make prints of the required number of replicates.

9.1.2 Make sure the test specimen is free of bubbles, skin and other contamination. Prior to transferring to the ink pipette, it may be useful to place a small quantity on a clean glass plate and gently work up with a small spatula without aerating. Add ink to the pipette, using the spatula to force the ink in while slowly pulling back the ram. Wipe excess material off the tip of the pipette.

9.2 *Substrates:*

9.2.1 Cut the number of specimens required for both the test and reference prints. Three are recommended for most purposes; up to ten or more may be needed for special tests. Specimen sizes (4.5 to 7.5 by 28 cm) are listed at the end of Table 1.

NOTE 2—Multiple replicates are advisable because of the likelihood of nonuniformity in substrate properties. For example samples taken from a ream of commercially supplied paper can be assumed to be cut from as many as seven or more reels, each with slightly different properties. For this reason, studies of a research nature are best conducted with samples cut from a single reel.

9.2.2 Specimens should be free of wrinkles, creases, watermarks and other types of contamination and consistent as to side and direction. Mark each specimen with the side (felt or wire, which may be determined by Test Method D5039) and machine direction (in or across, as determined by Test Method D528). Handle specimens only by the edge, as touching the surface with bare fingers may cause localized changes in absorbency.

9.2.3 The side and direction used for making the prints depends on the anticipated end use. Unless otherwise specified, specimens for testing inks should be cut so that the longer direction is in the machine direction and felt side up. Papers are frequently tested on both sides and, if intended for sheet-fed printing, in both directions. Paperboard is tested only on the printing side and across the machine direction.

10. Conditioning

10.1 The transfer and absorbency properties of printing ink are highly sensitive to temperature, while those of paper and other celluloic substrates are sensitive to relative humidity. For those reasons, reproducible printing requires that the test and reference samples be conditioned. ISO 187 specifies 23 ± 1°C temperature and 50 ± 2 % relative humidity.

10.2 New composition rollers and rubber disks should be broken-in before use. For example, apply vehicle from the test ink system to the inking unit, run for about 15 min, wash up and repeat once or twice.

11. Equipment Setup and Maintenance

11.1 Locate the printability tester on a sturdy bench in a draft-free environment preferably conditioned as in 10.1.

11.2 Unless otherwise specified, set the thermostat of the inking system to 25°C,

11.3 Cover the instrument with a plastic sheet overnight to minimize dust deposits.

11.4 The lifetime of the composition rollers and rubber disks is limited to a maximum of about three years. Effects of changes in test results are minimized by running the reference sample at the same time as the test sample. Nevertheless, a scheme for replacement as recommended in the manufacturer's operating manual should be considered.

11.5 Replace cylinder packing after three months maximum. Replace the sled after one year.

TABLE 2 Ink Volume[A,B] Required for a Film Thickness of One Micrometer on the Printing Disk

Tester A		Tester B		Tester C		Tester D	
Disk width cm	Ink volume mL	Disk width cm	Ink volume mL	Disk width cm	Ink volume mL	Disk width cm	Ink volume mL
4	0.065	3.2	0.039[C]	2.0	0.074	3.5	0.065
		5	0.043[C]	3.5	0.077	5	0.068
		3.2	0.125[D]	5	0.080	...	...
		5	0.129[D]	7	0.084	...	...
		3.2	0.160[E]	...	...	...	...
		5	0.164[E]	...	...	...	...

[A] The ink volume per micrometer is computed by adding the area in cm^2 of the inking station to that of the printing disk and multiplying the sum by 10^{-4}.
[B] One g/m^2 is equivalent to one micrometer for an ink having a density of 1.0 g/cm^3.
[C] Using the high speed inking unit having four inking stations.
[D] Using the slow speed inking unit.
[E] Using the high speed inking unit having one inking station.

11.6 Schedule maintenance as recommended in the manufacturer's manual.

12. Selection of Printability Tester Conditions

12.1 *Printing Disk*—The rubber disk, which simulates dry offset (letterset) printing, is the preferred disk for general printing. The metal disk is used for letterpress printing or specialty purposes as described in Section 16.

12.2 *Printing Pressure*—As noted in Table 3, less pressure is recommended when the rubber disk and smooth substrates are used compared to the metal disk and rough substrates.

12.3 *Printing Speed*—A survey of the published literature, summarized in Table 4, demonstrates that a broad range of printing speeds has been used for various purposes. Make certain that the speed selected does not cause picking of the substrate.

12.4 *Ink Volume*—If the ink volume has not been specified, preliminary experiments must be run to determine the volume of ink required for the particular combination of ink, substrate, printability tester conditions and required target value for either reflection density or gravimetric-based end result.

12.4.1 *Reflection Density*—Using a specified or estimated ink volume, make a print as in Section 14, dry as in 15.1, and measure reflection density as in 15.2. If the measured value does not agree with the target value, repeat the operation with a different volume of ink until the target value is achieved.

12.4.2 *Gravimetry*—Data in Table 2 provide a useful guide to the starting ink volume for gravimetric-based end results. Let us say, for example, that the test requires a print film thickness of two µm (or 2 g/m^2 if ink density is 1.0 g/cm^3). Presuming ink transfer of 50 % (more or less) divide 2 by 0.5, giving 4 µm on the disk. Examine Table 2 for the printability tester and disk width, and use four times the volume listed. Make a print, check the weight, and adjust the volume for the next trial accordingly.

12.5 *Ink Station*—To avoid contamination, like colors should be run on the station reserved for that color.

12.6 *Sled or Cylinder Packing*—If disks of different widths are used, make sure the sled or cylinder packing is dedicated to the particular disk.

13. Preparations for Printing

13.1 Select and preset where possible the printability tester conditions as in Section 12. Prepare the ink pipette as in 9.1.2, and the substrate specimens as in 9.2.1.

13.2 Before the first run of the day, moisten a pad with solvent and wipe the rollers and disk. The reason is so that the conditions for the first printing will be the same as for subsequent printings.

14. Procedure for Printing

14.1 Position the composition roller atop the metal rollers of the inking system.

14.2 Install the disk (using tongs or rubber gloves) on the disk holder out of contact with the composition roller.

NOTE 3—Parentheses around tongs or rubber gloves indicates that the use of either is highly advisable to keep finger oils or moisture off the disk when weighting is called for. Neither need be used when weighing is not required.

14.3 Take the pipette containing the ink and meter out other specified volume in two or three stripes across the tip roller to within about 5 mm of the two ends. If necessary for heavy-bodied inks, turn the roller by hand to start distribution.

14.4 Turn the inking system on, noting the time.

14.5 Let run for the specified duration. For heatset and newsinks, as little as 15 to 25 s should suffice. Heavier bodied inks may require 60 s or more.

14.6 Lower the printing disk onto the top roller, noting the time. Let run for the same duration as in 14.5.

14.7 Carefully lift the disk holder up. Turn the inking system off.

14.8 Remove the disk (using tongs or rubber gloves) from its holder.

14.9 (Optional) Transfer the disk to the analytical balance. Record the weight to ±0.0001 g as W_b, the weight of the inked disk before printing.

14.10 Install the inked disk (using tongs or rubber gloves) on the appropriate shaft of the print maker.

TABLE 3 Recommended Printing Pressures

Disk	Substrate	Tester A			Tester B			Tester C			Tester D		
		Disk width	Pressure[A]		Disk width	Pressure		Disk width	Pressure		Disk width	Pressure	
		cm	N	N / cm	cm	N	N / cm	cm	N	N / cm	cm	N	N / cm
Aluminum	Unspecified	4	1000	250	3.2	700	220	3.5	400	115	3.5	700	200
					5	700	140	5	700	140	5	1000	200
								7	700	130			
Rubber	Smooth				3.2	200	65	2	120	60	3.5	200	60
					5	300	60	3.5	200	55	5	300	60
								5	300	60			
								7	700	100			
	Rough				3.2	450	140	2	250	125	3.5	400	110
					5	650	130	3.5	400	115	5	650	110
								5	600	125			
								7	900	130			
	Unspecified	4	600	150									

[A] The pressure on Tester A is set in kp or in kgf; either = 9.81 N (rounded to 10).

TABLE 4 Survey of Printing Speeds

Purpose	Types of Paste Ink	Printing Speed m/s	Printing Speed fpm	Reference
Color matching	Quickset sheetfed offset	3	600	NPIRI Task Force on Color Proofing, *TAGA Proc.*. 1991, pp. 490-512
Color matching	Heatset offset	5	1000	NPIRI Task Force on Color Proofing, *Am. Ink Maker*, March, 1993, pp. 38-46, 128
Colorimetric parameters	Standard web offset proofing (SWOP and EURO)	1 3	200 600	Bassemir, R. W. and Lavelle, J. S., *TAGA Proc.*, 1993, pp 327-347
Ink transparency	Standard web offset proofing (SWOP)	1	200	Bassemir, R. W. and Zawacki, W. F., *TAGA Proc.*, 1994, pp. 297-312
Ink transparency	Coldset lithographic (NAA-COLOR[A] AD-LITHO[B])	1	200	Bassemir, R. W. and Zawacki, W. F., *TAGA Proc.*, 1997, pp. 767-776
Ink mileage	Newsink	4	800	ASTM Test Method D7189
Reflection based and fastness tests	Offset and letterpress	0.3 1	60 200	ISO/DIS 2835–1
Color and transparency	Sheetfed and heatset web offset	0.3 1	60 200	ISO 2846–1
Color and transparency	Coldset lithographic	0.3 1	60 200	ISO 2846–2

[A] NAA-COLOR is a registered trademark of the Newspaper Association of America.
[B] AD-LITHO is a registered trademark of Sun Chemical Corporation.

14.11 For Testers A and C, mount the substrate specimen on the carrier and position in the appropriate track of the print maker. For Tester B and D, mount directly on the impression cylinder. Be careful not to touch the specimen surface with fingers.

14.12 Turn the print maker on, pull the print, turn off, and remove the print.

14.13 Remove the disk (using tongs or rubber gloves) from the print maker. If specified, transfer to the analytical balance. Record the weight to ±0.0001 g as W_A, the weight of the inked disk after printing.

14.14 Dry the print and verify reflection density in accordance with 15.1 and 15.2.

14.15 Clean the roller and disk in accordance with Section 17.

14.16 Repeat 14.1-14.15 two times with the same samples. To avoid having to wait for the rubber disk to come to equilibrium, use a second rubber disk.

14.17 Repeat 14.1-14.16 with reference samples.

15. Post Printing Operations

15.1 Dry prints in an appropriate manner; by running through a heat-set drier or curing device, or, if the ink dries by oxidation or penetration, by laying aside for 15 to 30 min depending on the setting properties of the ink.

15.2 Following the procedure set forth in Test Method D7305, measure reflection density at five equidistant positions along the length of the print. (A ruled guide may be useful for this purpose.) Stay close to the center of the print, at least 1 cm on either side of the unprinted seam, and at least 1 cm from either end of the print. Compute the mean.

NOTE 4—For prints that dry by oxidation or penetration, a small decrease in reflection density may occur between the initial measurements and those taken 24 h later. This density decrease should be accounted for when deciding whether the measured value matches the target value.

15.3 Wait an appropriate time before making other test measurements. For example, 72 h are typically recommended for gloss and chemical resistance tests.

16. Procedures for Specialty Tests

16.1 Certain tests such as ink mileage, ink receptivity of substrates, transparency of printed ink films, and ink transfer characterization require prints at a range of ink film thickness. Follow the general procedure in Sections 12-14 with the following exceptions:

16.1.1 Add a sufficient volume of ink to the inking system so as to obtain a minimum of four prints in the useful range, that is, having full coverage. For inks having volatile components, it may be necessary to clean up after each print and start over with a different volume of ink.

16.1.2 Because of the possibility of preferential transfer of ink components or paper dust/particles from the inked disk to the substrate, the disk must be cleaned after each printing. For this reason use the metal disk which can be cleaned with a fast-evaporating solvent, thus minimizing waiting time between printings.

16.1.3 Weighing of the inked disk before and after printing is mandatory, not optional. Use tongs or rubber gloves to handle the disk.

16.1.4 If the coverage on the substrate between the first and second printing is too close, run a small cloth (without solvent) along the metal roller in order to remove a small quantity of ink. Redistribute 5 or 10 s.

16.2 Complete characterization of ink transfer properties requires not only prints in the useful range, but also in the low coverage range. Because of the very small ink weights involved, use a five place analytical balance. Also required is the weight of the uninked plate. Any apparent change in weight of the disk due to heat buildup (or cooling from evaporation of the cleaning solvent) could be the source of enormous error.

Therefore, the weight of the clean disk must be checked during the course of the experiment, and the calculation of ink transfer adjusted accordingly.

17. Wash-up Procedure

17.1 Wet a rag or wiper with solvent. With rollers in contact and the inking system running, press the pad against the bottom of the front metal roller and then against the bottom of the back metal roller.

17.2 Repeat two or three times with a fresh wiper wet with solvent until all the ink is removed. Stop the machine. Remove the top roller (into the side wall recesses in Tester A) and clean more thoroughly, if needed.

18. Calculations

18.1 The weight of ink in g deposited on the substrate (W_S) is the difference between the weight of the inked plate after (W_A) and before (W_B) printing:

$$W_S = W_B - W_A,\ g \tag{1}$$

18.2 The weight per unit area of ink transferred to the substrate (WS_A) in units of g/m^2 entails dividing Eq 1 by the print area A_S in cm^2 :

$$W_{SA} = \frac{W_B - W_A}{A_S} \times 10^4,\ g/m^2 \tag{2}$$

18.3 The ink film thickness on the printed substrate (IFT_S) in units of micrometers, µm, entails dividing Eq 2 by the density, D, of the ink in units of g/cm^3:

$$IFT_{S\_} = \frac{W_B - W_A}{A_S D} \times 10^4,\ \mu m \tag{3}$$

NOTE 5—Ink density may be measured by Test Method D1475 using a weight-per-volume cup; if the measuring unit is pounds per gallon, divide the test result by 8.3454 to obtain g/m^3. Alternatively, use a pipette such as described in 6.2 to meter out an exact volume of ink into a tared closed container or onto a tared piece of aluminum; weigh on the analytical balance and compute the ink density in g/cm^3. Repeat at least twice.

18.4 In like manner, the ink film thickness in µm carried on the plate, IFT_P, is the weight of the inked plate before printing, W_B, minus the weight of the uninked plate, W_{PO}, divided by the area A_S and the density of the ink, D:

$$IFT_P = \frac{W_B - W_{PO}}{A_S D} \times 10^4,\ \mu m \tag{4}$$

19. Report

19.1 Complete identification of the test sample (printing ink or substrate).

19.2 If an ink, the type of substrate; if a substrate, the type of ink.

19.3 Reference samples used.

19.4 Printability Tester (manufacturer and model).

19.5 Inking system (manufacturer and model).

19.6 Printing speed and pressure.

19.7 Printing disk type and width.

19.8 Ink volume added to the distribution rollers.

19.9 Distribution and disk inking time.

19.10 Atmospheric conditions (temperature and relative humidity).

19.11 Ink on the print in g/m^2 or micrometers.

19.12 Print drying method.

19.13 Test result and whether it conforms to the target value.

19.14 Any operation not specified in this standard that may have influenced the test result.

20. Keywords

20.1 color matching; dry offset printing; energy curable inks; heatset inks; laboratory printing; letterpress inks; letterpress printing; letterset printing; lithographic inks; metal decorating; motor-driven printability tester; newsinks; paper; paperboard; paste printing inks; plastic film; printability tester; printing ink; print testing; reflection density; sheet-fed inks; textile printing