Designation: F1445 – 00 (Reapproved 2009)

Standard Test Method for Determining Static Thermal Sensitivity of Direct Thermal Media[1]

This standard is issued under the fixed designation F1445; 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 covers the static thermal response of direct thermal media (paper, film, and paper/film laminates) to determine temperatures required for activation, functional and saturated densities. Static thermal response is a key test for determining heat stability characteristics of direct thermal media.

1.2 The instrument described in this test method may be used to develop product specifications, specification acceptance, product development, or research applications.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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 *ANSI Standard:*

IT 2.17-1995 Density Measurements – Geometric Conditions for Reflection Density[2]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *functional temperature*—temperature which generates an optical density of 1.00.

3.1.2 *static thermal response*—the generation of the thermal response of a thermal media within a given printing system over a specific range of temperature levels.

4. Summary of Test Method

4.1 This test method is intended to determine the static thermal response of direct thermal media. The temperature versus density curve obtained is a characterization of a given coating and media substrate. Curves can be used to determine uniformity within and between direct thermal media lots. The test equipment and test procedures are not intended to simulate thermal response under actual end-use conditions in a direct thermal printer. Although no specific manufacturers have been identified for this equipment, any temperature controller, temperature sensor, and test fixture with equivalent signal output capabilities would be suitable.

4.2 To determine the static thermal response of direct thermal media, a sample is inserted into the test fixture with the coated surface up towards the heated platens. When fully inserted, a switch is tripped clamping the test media in contact with the heated platens under a given pressure for a prescribed length of time set with a timing mechanism.

4.3 The temperature controllers allow the heated platens to be adjusted to specific surface temperatures.

4.4 The thermal response or density saturation curve can be obtained by exposing samples from given direct thermal media to various temperatures for a specified time period.

5. Significance and Use

5.1 This test method enables static thermal response comparisons between direct thermal media and facilitates process control.

5.2 Comparisons can be made between and within thermal media production lots from the same manufacturer.

5.3 Comparisons can be made between thermal media product grades from different manufacturers.

5.4 This test method is useful in predicting heat stability for end-use applications.

6. Interferences

6.1 Wide variations in environmental conditions (especially relative humidity) will affect the resulting image density with this test method.

[1] This test method is under the jurisdiction of ASTM Committee F05 on Business Imaging Products and is the direct responsibility of Subcommittee F05.06 on Carbonless and Thermal Imaging Products.

Current edition approved Oct. 1, 2009. Published October 2009. Originally approved in 1992. Last previous edition approved in 2004 as F1445 – 00(2004). DOI: 10.1520/F1445-00R09.

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

6.2 The length of elapsed time between sample exposure to the heated plate and density readings may affect actual readings. For best results, density readings should be made within 30 min of imaging.

6.3 Since direct thermal media are sensitive to light exposure, samples should be covered or otherwise protected from light between tests. Excessive exposure to light can affect final test results.

6.4 Variations in the length of time direct thermal media contact the heated platens will affect the resulting image density.

6.5 Very large differences in the basis weight of direct thermal media samples and coating thickness may have a significant affect on the results obtained.

6.6 This test method is not useful for predicting performance in direct thermal printers.

7. Apparatus and Materials

7.1 *Custom Built Thermal Response Fixture* (see Fig. 1).

7.2 *Description*—The test unit has a 2-in. diameter piston and a 48-in.^{2} (309.7 cm^2) footprint (12 heated blocks at 1 by 4 in. (2.54 cm by 10.16 cm)). At 40 psig, the gage pressure calculates out to 2.62 lb/in.^{2} (0.18 kg/cm^2). The pressure is not critical. Repeatable results can be achieved in the range from 1.8 to 2.6 lb/in.^{2} (0.12 to 0.18 kg/cm^2). The surface beneath the heated platen consists of a ¼-in. (0.64 cm) thick siliconized rubber pad on a flat steel surface. Temperature controllers are Omega 4001AJF-T Digital Temperature Controller, or equivalent.

7.3 *Simpson Electric Company Temperature Adapter, (–50 to +150°C) with Simpson 467 Digital Display Multimeter,* or equivalent equipment.

7.4 *Reflection Densitometer,* with aperture smaller than the image area to be measured and meeting the requirements of ANSI IT 2.17-1995, operating in visual density mode.

8. Test Specimen

8.1 The test specimen shall be from sheets or roll samples of direct thermal media that has not been adulterated since it was manufactured.

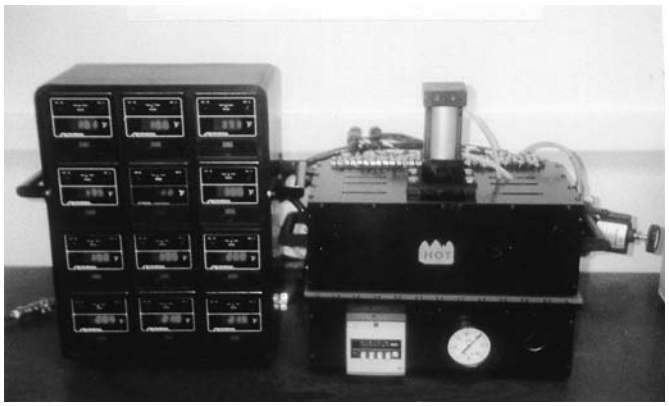

FIG. 1 Thermal Response Fixture

8.2 Cut samples into individual strips 5 by 18 in. (127 by 457.2 mm) if the test instrument described in this test method is used, or cut to a size that will fit the test instrument used.

9. Calibration

9.1 Calibrate the electronic thermal sensor head at the interval prescribed by the equipment manufacturer. Use a temperature pyrometer like the Simpson Electric unit described in 7.3 to perform calibrations. Measure temperature to within ±1°C.

9.2 Calibrate the densitometer in accordance with the manufacturer's instructions.

10. Conditioning

10.1 Although no special conditioning of thermal media samples is required, it would be prudent to compare only tests run under the same environmental and aging conditions.

10.2 Under ideal conditions, the test instrument should be operated in a conditioned room.

11. Procedure

11.1 Switch the test instrument on and set temperature controllers to desired settings. Recommended temperature settings would start at 65°C and increase in 4° increments to 109°C. To obtain above or below the recommended range, the temperature controllers can be reset and additional tests conducted. Additional temperature settings will increase the test accuracy in the critical region or where a small increase in temperature results in a significant increase in image density.

11.2 Set the timer device on the unit for 5-s dwell.

11.3 Set the platen pressure for 40 psig or 2.6 lb/in^2 (0.18 kg/cm^2) .

11.4 Insert the test sample horizontally into the test area with the thermal coated side up. A micro switch will sense the sample presence and initiate the test.

11.5 Remove the sample from the test instrument and measure the image density.

11.6 Record three density readings for each temperature and record the average value. Plot the average of the three on graph paper with temperature (°C) on the *x* -axis and density on the *y*-axis (see Fig. 2).

12. Report

12.1 Report the following information:

12.1.1 *Sample Identification:*

12.1.1.1 Coated roll batch or lot number,

12.1.1.2 Manufacture and product code,

12.1.1.3 Date or time, or both,

12.1.1.4 Test conditions, dwell time and platen pressure, and

12.1.1.5 Ambient temperature and relative humidity.

12.1.2 Report the density data obtained in tabular form or as curves such as those shown in Fig. 2.

12.1.3 The density versus temperature curves generated by the test samples may be compared for the rate at which they

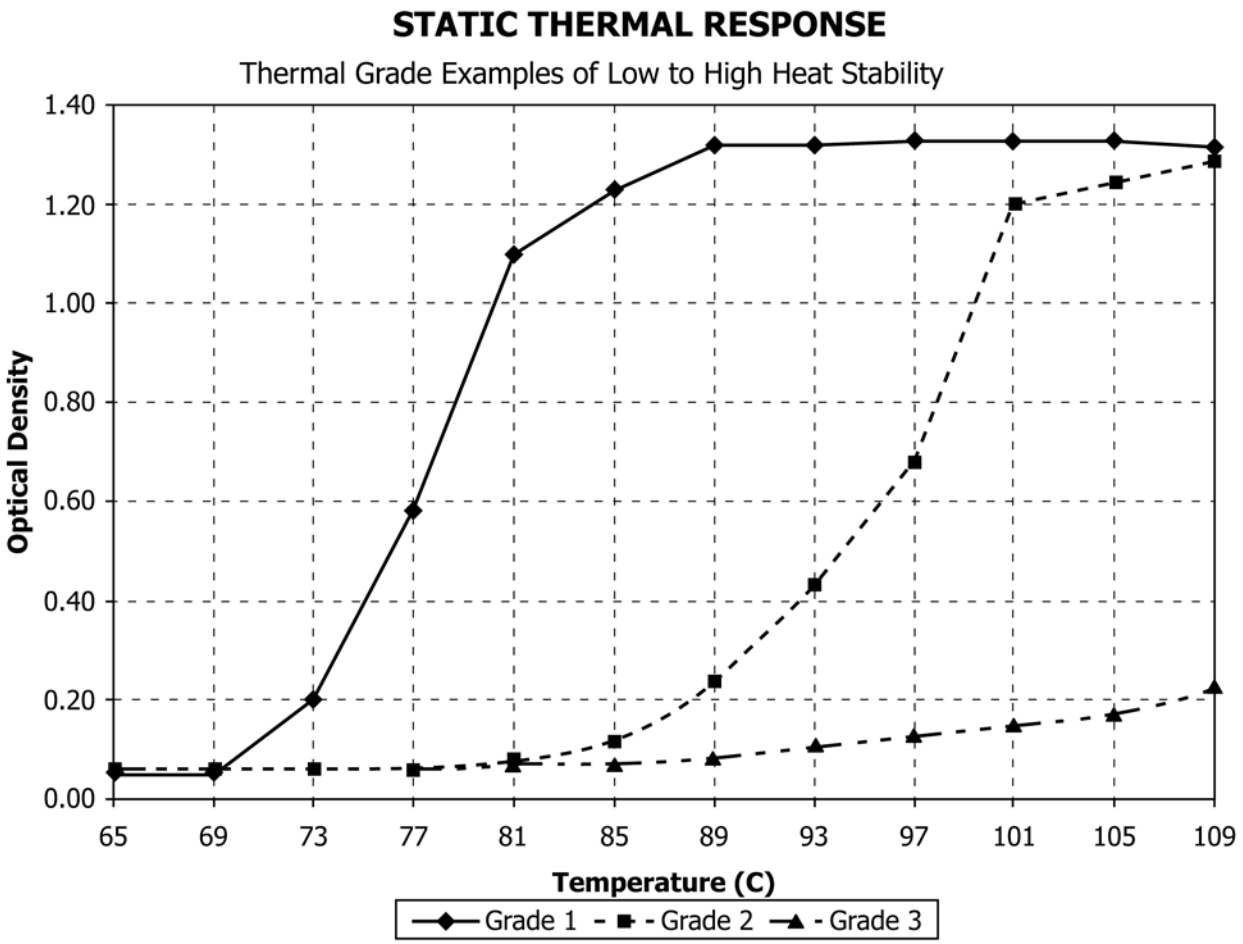

FIG. 2 Static Thermal Response Curve

reach saturation (maximum darkness), the maximum density obtained and the temperature at which the density starts to decrease.

13. Precision and Bias

13.1 Repeatable measurements on the same media and same test equipment should agree within ±6 % of the average optical density. This precision and bias statement is based on the equipment listed in Section 7.

13.2 Measurements between laboratories may not be reproducible because of differences in samples, test equipment, temperature/relative humidity, and testers. A laboratory correlation test may be used to minimize differences between test equipment and establish agreement between laboratories.

14. Keywords

14.1 direct thermal media (paper, film, and paper/film laminate); static thermal response; static thermal response curve