Designation: F 1206 – 94 (Reapproved 2000)

Standard Test Method for Evaluating Color Image Output from Color Printers and Copiers[1]

This standard is issued under the fixed designation F 1206; 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 evaluation of color output from printer/plotters and copiers. The output may be from an ink jet, thermal transfer, electrostatic or electrophotographic device.

1.2 *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 2244 Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates[2]

3. Summary of Test Method

3.1 A printer or copier is set up to standard operating parameters and operated under a controlled environment for a length of time sufficient for stable performance. A color test image is created using a program for the printer or a standard color chart for copiers. A colorimeter is used to measure the printer or copier output by determining color difference values which correlate to visual color assessment.

4. Significance and Use

4.1 This test method is used to evaluate the color output capability of color printer/plotters or copiers. The color copy, print, or plot is measured such that the results can be correlated to human color vision.

4.2 This test method can be used to make machine-to-machine comparisons. It can be used to compare color printer or copier processes (ink jet, thermal transfer, etc.).

4.3 This test method can be used to compare imaging supplies such as toner, ink, thermal transfer ribbons, and paper.

5. Interference

5.1 Any changes in the color of the paper, surface properties, or brighteners may affect the color measurement.

5.2 The measured color may be affected by the location on the paper due to uneven toning or positional variations in the imaging process.

5.3 If the print samples to be tested are not completely opaque, the color measurements will be affected by the backing material.

5.4 The preferred colorimeter geometry excludes gloss from the measurements. Any differences in sample gloss will not be measured by the colorimeter.

6. Apparatus

6.1 *Colorimeter*, capable of measuring human vision color parameters. The colorimeter shall be capable of measuring in units of L^*, a^* and b^* using 45°/0° or integrating sphere geometry. Refer to Test Method D 2244 for definitions of color scales. The 45°/0° geometry is the closest approximation of actual office reading environment. The illuminant shall be illuminant *C*.

6.2 *Printer or Copier*, to be evaluated.

7. Reagents and Materials

7.1 Sufficient quantities of paper and imaging supplies to run the evaluation.

7.2 A reference color test target.

7.2.1 For printers and plotters the reference color test target can be made from color chips or selected printer/plotter output. The colors must include red, green, blue, yellow, cyan, magenta, black, and white. Each color must cover a sufficient area to permit measurement by the colorimeter. A 25.4 mm (1 in.) diameter circular area is sufficient for most colorimeters.

7.2.2 For color copiers the reference color test target can be made from selected color chips and is used as the original to be copied. The colors must include red, green, blue, yellow, cyan, magenta, black, and white. A 25.4 mm (1 in.) diameter circular area is sufficient for most colorimeters.

8. Conditioning

8.1 The paper, imaging supplies, and printer or copier should be conditioned in the test environment for 24 h prior to initiating the test.

8.2 The environment in which the following procedure is carried out should be controlled to reduce adverse effects. The temperature should be controlled ± 2.77°C (±5°F) around the

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[2] *Annual Book of ASTM Standards*, Vol 06.01.

mean temperature selected for the test. The relative humidity (RH) should be controlled ±10 % around the mean RH selected for the test.

9. Procedure

9.1 The copier or printer should be thoroughly cleaned by an authorized service representative and any prescribed preventive maintenance performed prior to running the test.

9.2 If the device is a color printer/plotter, set up and run a test program which will produce color images sufficient in size for measurement using the colorimeter. Generate three sets of each color for measurement. The following colors are required:

9.2.1 Red,
9.2.2 Green,
9.2.3 Blue,
9.2.4 Cyan,
9.2.5 Magenta,
9.2.6 Yellow,
9.2.7 Black, and
9.2.8 White (blank for printer/plotters).

9.3 If the device is a color copier which prints one color regardless of the color of the original, use a test target capable of producing a solid area, sufficient in size for measuring, using the colorimeter. If a selection of colors is available, make copies with each color using the same original. Use black or the same color for the original.

9.4 If the device is a color copier capable of producing colors similar to the colors on the original, use the color reference test chart described in 7.2.2 as the original. Make three sets of each color for measurement.

9.5 Calibrate the colorimeter according to the manufacturer's instructions. If possible, set the measurement parameters at 45°/0° geometry, 2° observer, illuminant *C* and *L**, *a**, *b** units. Record all colorimeter settings.

9.6 Determine if the copier original or any output samples are opaque by placing them in the colorimeter and alternately backing them with black and then white materials. If there is no difference in the value obtained, then the sample is considered opaque. Samples determined not to be opaque must be backed during all color measurements. A sufficient number of backing sheets, which are the same paper as the sample, should be used such that there is no difference in color measurements when the sample with backing sheets is backed with black or white materials.

9.7 Measure the colors on the reference color test chart using the colorimeter. Record the *L**, *a**, *b** values.

9.8 Measure the colors on the three sets of color output generated in 9.2, 9.3 or 9.4 using the colorimeter. Take five readings on three separate locations within the same test area and average the values. Repeat for the remaining two sets. Use the average of the three sets in the calculation.

9.9 Calculate the ΔL^*, Δa^* and Δb^* values by subtracting the values measured in 9.7 from the values measured in 9.8. Calculate the total color difference, $\Delta E^* = [(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2]^{1/2}$. Colorimeter systems with computers will calculate the ΔE^*, ΔL^*, Δa^* and Δb^* values directly. If the colorimeter system is capable, generate a graphic display of the results.

10. Interpretation of Results

10.1 The ΔE^*, ΔL^*, Δa^* and Δb^* values for each color parameter can be compared relative to printer or copier process, manufacturer, imaging supplies source, environmental conditions, etc.

10.2 The ΔE^*, ΔL^*, Δa^* and Δb^* values generated when the reference color test chart is used as the original for a multicolor copier, indicate the ability of the copier to reproduce selected colors.

10.3 Expected values for ΔE^*, ΔL^*, Δa^* and Δb^* can be assigned to the copier or printer and supplies.

11. Precision and Bias

11.1 The test method will provide repeatable ranking order results within the same laboratory.

12. Keywords

12.1 color copier; color printer; color toner; inkjet

APPENDIX

(Nonmandatory Information)

X1. REPRODUCIBILITY RESULTS

X1.1 Reproducibility of results among several laboratories was determined by a round robin test using the same color print samples and different colorimeters. The average standard deviations for the colorimeter values (*L**, *a**, *b**) of the reference chips were:

45°/0° geometry:	0.55
Integrating sphere:	0.99
Diffuse geometry:	1.92

X1.2 The average standard deviations for the colorimeter difference values (ΔE^*, ΔL^*, Δa^*, or Δb^* = print sample − reference chip) were as follows:

45°/0° geometry:	1.48
Integrating sphere:	1.56
Diffuse geometry:	2.42