



Standard Practice for Determining the Toner Usage for Color Printer Cartridges¹

This standard is issued under the fixed designation F2632; 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.

^{ε1} NOTE—Revised the units presentation and added a units statement editorially in April 2013.

1. Scope

1.1 This practice describes the procedure to determine the weight of toner used for printing a single page using an electrophotographic color printing process. This practice uses a solid area 5 % page coverage target for each color. This practice requires specific tools and skills for disassembling and reassembling printer cartridges.

1.2 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.

1.3 *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

F1206 Test Method for Evaluating Color Image Output from Color Printers and Copiers

F1856 Practice for Determining Toner Usage for Printer Cartridges

3. Summary of Practice

3.1 An electrophotographic printer using color toner supply cartridges or all-in-one toner cartridges is set up to determine the toner usage for a single page. A test target page with 5 % solid area of each toner cartridge color is used. 5 % coverage of the printable area for each color is the accepted average page coverage for office printers. Office color printers are used to produce color graphic images and photographs along with text.

¹ This practice is under the jurisdiction of ASTM Committee F05 on Business Imaging Products and is the direct responsibility of Subcommittee F05.04 on Electrostatic Imaging Products.

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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.

3.2 The all-in-one toner cartridges are disassembled to separate the toner hopper from the waste toner collection bin. The weight of the full toner hopper is measured. A specified number of 5 % coverage prints are created at specific test intervals. The weight of each hopper is measured at the beginning and end of each test interval. The toner used for one page is calculated. The results can be used to estimate the total page yield of the color toner cartridge. A comparison can be made between the toner usage for the control cartridges and any other cartridges tested.

3.3 Print quality, print density, and color measurement test targets can be printed only when the specified 5 % coverage test intervals are not being printed.

4. Significance and Use

4.1 This practice can be used for the evaluation of new and remanufactured color toner cartridges and their respective components used in an electrophotographic process.

4.2 This practice is suitable for research and development and for quality acceptance evaluations.

5. Interferences

5.1 Relative humidity can impact test results. The tests should be performed at a controlled temperature and humidity within the operating humidity range of the printer. This is usually between 20 % and 80 % relative humidity (RH). All equipment and materials should be conditioned in the same temperature and relative humidity for at least 24 h prior to testing.

5.2 In a comparative cartridge test, the same test target (data) and the same printer must be used. Same model printers can have significant toner usage variations under the same environmental conditions.

5.3 The test target should not produce uneven wear on the cartridge components as this will affect the test results. Adjust the location of the printed areas to create an even distribution.

5.4 The software used to make the test target should cause the printer to print the pure color from each color cartridge. This ensures that only toner from one cartridge is used to produce the color on the test target.



FIG. 1 Test Target Layout—Portrait

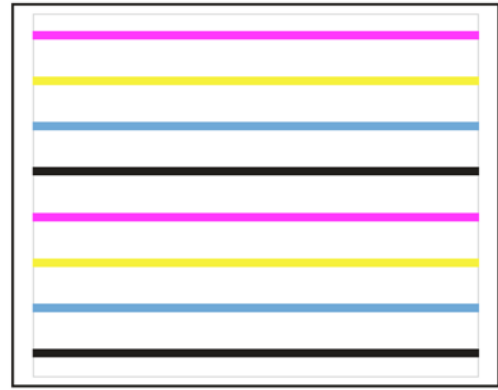


FIG. 2 Test Target Layout—Landscape

5.5 Printer related items such as the power supply, density control settings, resolution enhancements, toner saver settings, economy mode settings, color calibration, and laser optics may impact image quality and toner usage.

5.6 Test printers should be in good mechanical and electrical condition. Preferably, printers with a continuous history of preventative maintenance should be used. Printer failures can invalidate the test.

5.7 A calibrated balance must be used to obtain the weights of the toner hopper.

5.8 The techniques used for cartridge disassembly should avoid toner spillage and ensure accurate toner weight measurements.

6. Equipment and Materials

6.1 *Electrophotographic test printer*, suitable for testing purposes.

6.2 *Printer data system*, capable of supplying 5 % page coverage of the printable area for each color cartridge. The printable area is 8 by 10 in. (203 by 254 mm), making it usable for standard letter and A4 paper sizes. This 5 % test target data can be created using available software.

6.2.1 The 5 % test target has eight color bands made up of two sets of four color bands. Each band has an area of 2.5 % of the printable area. The eight color bands on the target are arranged in the following order from top to bottom: magenta, yellow, cyan, black, magenta, yellow, cyan, and black.

6.2.2 The portrait target is used for printers processing the media with the short edge perpendicular to the direction of paper movement. This target layout is shown in Fig. 1.

6.2.3 Color bands for the portrait target are 8.00 in. (203.20 mm) in length and 0.25 in. (6.35 mm) in width.

6.2.4 For the portrait target, the color bands are placed horizontal on the page separated by 1.25 in. (31.75 mm) center-to-center.

6.2.5 The landscape target is used for printers processing the media with the long edge perpendicular to the direction of paper movement. This target layout is shown in Fig. 2.

6.2.6 Color bands for the landscape target are 10.00 in. (254.00 mm) in length and 0.20 in. (5.08 mm) in width.

6.2.7 For the landscape target, the color bands are placed horizontal on the page separated by 1.00 in. (25.40 mm) center-to-center.

6.3 *Control and Test cartridges* designed for use in the test printer.

6.4 *Balance* capable of measuring the cartridge toner hopper with a precision of ± 0.1 g and readability of 0.1 g.

6.5 *Conditioned Paper* that meets the requirements of the printer. This same paper type and manufacturer should be used for all comparative tests.

6.6 *Hygrometer and Thermometer*.

6.7 *Special tools and instructions* for disassembling and reassembling the printer cartridge.

7. Test Procedure

7.1 Set up the test printer. Set the printer to the “factory default” print mode. Do not use the “toner saver mode.” Set and record the printer attributes that can affect the print quality. The attributes may include: density, resolution, resolution enhancement, color, and so forth. Use separate, known good cartridges to verify that the printer is working properly. Check that the 5 % test target source is operating correctly.

7.2 Measure and record the temperature and humidity in the test area.

7.3 Select the color cartridges to be tested. Remove the seal, if any. Separate the hoppers from the waste bins and measure the full hopper weight in grams.

7.4 Run the cartridges according to 7.5 using the 5 % coverage color test target. When the test intervals are not required, other test targets can be used for determining print density, print quality, and color measurement tests.

7.5 During the running of the cartridges, weights are determined at the beginning and end of 1, 2, or 3 intervals of 1000 pages each. While the test intervals are printing, only the 5 %

TABLE 1 Test Intervals for Color Toner Cartridges

Expected Pages	Test Interval 1		Test Interval 2		Test Interval 3	
	Start	End	Start	End	Start	End
1000	0	1000				
2000	500	1500				
3000	500	1500				
4000	500	1500	2000	3000		
5000	1000	2000	3000	4000		
6000	1000	2000	3000	4000		
7000	2000	3000	4000	5000		
8000	2000	3000	4000	5000	6000	7000
9000	2000	3000	4000	5000	6000	7000
10 000	2000	3000	4000	5000	6000	7000
11 000	2000	3000	5000	6000	7000	8000
12 000	3000	4000	6000	7000	8000	9000
13 000	3000	4000	6000	7000	9000	10 000
14 000	3000	4000	6000	7000	9000	10 000
15 000	4000	5000	7000	8000	10 000	12 000
16 000	4000	5000	7000	8000	10 000	12 000

page coverage target can be used. For the expected life of the cartridge, the start and end page counts are listed in **Table 1**.

7.6 If a cartridge has run out of toner while the other cartridges are still running, replace the empty cartridge with another usable cartridge. Note the page count. Do not measure weights for the replacement cartridge. The test ends when all starting cartridges have completed the last required test interval.

7.7 At the end of the test, clean the toner hoppers and measure the empty weight. The toner available can be calculated from these weights and the weights measured in **7.3**.

8. Calculation

8.1 Calculate and record the weights of toner used during each test interval. The toner used is the weight difference between the start and end weights of the 5 % coverage test intervals.

8.2 Toner usage (mg/page) is the weight of toner (g) used during the 1000 page interval. The grams of toner used for 1000 pages is the same as the milligrams of toner for one page.

9. Report

9.1 Report test conditions (temperature and humidity), measured weights with page counts, cartridge identification, printer

setup conditions, printer identification, test target data identification, and the toner usage for each color cartridge.

10. Interpretation of Results

10.1 The toner usage determined by this practice relates only to the conditions used. It is useful in making direct comparisons between cartridges.

10.2 The average page yield for the cartridge can be estimated by dividing the total weight of the available toner by the average toner usage. The available toner is determined by calculating the difference between the initial toner weight and the remaining toner weight at end of usable printing.

10.3 Practice **F1856** can be used to determine the toner usage for text only.

10.4 Test Method **F1206** can be used to measure the color from specific targets run between the test intervals described in **Section 7**.

11. Keywords

11.1 cartridge; color printer; color toner; electrophotographic; laser printer; non-impact printer; page yield; toner usage

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