



# Standard Practice for Determining Toner Usage for Printer Cartridges<sup>1</sup>

This standard is issued under the fixed designation F 1856; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice covers a procedure to determine the weight of toner used for printing a single page derived from an electrophotographic process. The practice uses a printer text target specifically developed for each printer for a page coverage of  $5 \pm 0.5\%$  of the printable area. 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 the standards. The SI units given in parentheses are for information only.

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:*<sup>2</sup>

F 335 Terminology Referring to Electrostatic Copying

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *toner usage*—amount of toner (milligrams per print) removed from the toner hopper during the printing of one page.

## 4. Summary of Practice

4.1 An electrophotographic printer utilizing an all-in-one supply cartridge is set up to determine the toner used for a single page of print. A test page with  $5 \pm 0.5\%$  text print output for the control cartridge is used. 5% text coverage of the printable area is the industry accepted average page coverage for office printers. The all-in-one cartridge is 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 prints are created on the printer using this cartridge and the weight of the used toner hopper is measured. The toner used for one print is calculated. In addition, the results can be used to estimate the total page yield of the toner cartridge. A comparison can be made between the toner used for the control cartridge and any other cartridge tested using this practice.

## 5. Significance and Use

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

5.2 This test is suitable for research and development, and quality acceptance evaluations.

## 6. Interferences

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

6.2 In comparative cartridge test the same test target (data) and printer must be used. The number of characters and the type of characters, font and font size have a direct affect on toner consumption.

6.3 The test pattern should not produce uneven wear on the cartridge components as this will affect the test results.

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

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

6.6 A calibrated balance must be used to obtain weights.

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

<sup>1</sup> 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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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

## 7. Equipment and Materials

7.1 *Electrophotographic Test Printer*, suitable for testing purposes.

7.2 *Printer Data System*, capable of supplying a  $5 \pm 0.5$  % text page for the specific test printer based on the control cartridge (average original printer manufacturer's cartridge). This  $5 \pm 0.5$  % test target data can be created by printing text and determining the page coverage with a calibrated scanning or digital display device. Software and a computer program to calculate the coverage will be required. The amount of text is changed and the process repeated until a  $5 \pm 0.5$  % coverage of the printable area is obtained. The printable area is 8 by 10 in. (0.203 by 0.254 m) making is usable for standard letter and A4 paper sizes. The specific test data must be created for each printer model and manufacturer. Test input devices<sup>3</sup> and  $5 \pm 0.5$  % text test target data<sup>4</sup> for specific printers are available.

7.3 *Reference Cartridge*, that produces a  $5 \pm 0.5$  % coverage text page on the specific test printer.

7.4 *Test Cartridge*, designed for use in the test printer.

7.5 *Balance*, capable of measuring the cartridge toner hopper with a precision of  $\pm 0.1$  g and readability of 0.1 g.

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

7.7 Special tools and instructions for disassembling and reassembling the printer cartridge.

## 8. Procedure

8.1 Select the cartridge to be tested. Remove the seal, if any. Separate the hopper from the waste bin and measure the *full hopper weight*,  $W_{fh}$  in grams.

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

8.3 Set up the test printer. Set the printer for the "factor 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, etc. Use a separate, known good cartridge to verify that the printer is working properly. Check that the  $5 \pm 0.5$  % test target source is operating.

8.4 Run 1000 sheets of the conditioned paper using the test target data specific to the test printer.

8.5 Remove the cartridge from the printer, separate the hopper from the waste bin and measure in grams the *used hopper weight*,  $W_{uf}$ .

## 9. Calculation

9.1 Calculate the toner used and the toner usage per page:

$$\begin{aligned} \text{toner used (g)} &= (W_{fh} - W_{uf}) \\ \text{toner used per page (g)} &= (W_{fh} - W_{uf})/1000 \end{aligned}$$

and:

$$\text{toner usage (mg/page)} = (W_{fh} - W_{uf})$$

## 10. Report

10.1 Report test conditions (temperature and humidity), measured weights, cartridge identification, printer setup conditions, printer identification, test target data identification and the toner usage.

## 11. Interpretation of Results

11.1 The toner usage determined by this test method relates only to the conditions used. It is useful in making comparisons between cartridges. Variations can be expected according to the interferences described in Section 6.

11.2 For longer life cartridges with expected print count in excess of 2000 prints some variation in the toner usage may be expected. To report an estimate of the number prints for the available toner, an average of several tests is required. For expected usage less than 8000 prints, run the test (Sections 8, 9 and 10) at  $\frac{1}{3}$  and again at  $\frac{2}{3}$  of the total expected prints. For expected usage greater than 8000 prints, run the test (Sections 8, 9 and 10) at  $\frac{1}{4}$ ,  $\frac{1}{2}$ , and again at  $\frac{3}{4}$  of the total expected prints. Use the average of the test results for calculating the estimate.

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

## 12. Keywords

12.1 cartridge; electrophotographic; laser printer; non-impact printer; toner; toner usage

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<sup>4</sup> Static Control Components, Inc. 3010 Lee Avenue, Sanford, NC 27330.

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