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**Information technology — Method for the  
determination of toner cartridge yield for  
monochromatic electrophotographic  
printers and multi-function devices that  
contain printer components**

*Technologies de l'information — Méthode pour la détermination du  
rendement des cartouches de toner pour les imprimantes  
électrophotographiques monochromatiques et pour les dispositifs  
multifonctionnels qui contiennent des composants d'imprimantes*

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## Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 19752 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 28, *Office equipment*.

This corrected version of ISO/IEC 19752:2004 incorporates the corrected title, which has been changed from "Information technology — Method for the determination of toner cartridge yield for monochromatic electrophotographic printers and multi-function devices that may contain printer components" to "Information technology — Method for the determination of toner cartridge yield for monochromatic electrophotographic printers and multi-function devices that contain printer components".

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## Introduction

The purpose of this International Standard is to provide a process for determining the page yield for toner cartridges for monochromatic printers using a standard office consumer type test page.

This standard prescribes the following:

- The test method that manufacturers should use to determine cartridge yield.
- The method for determination of declared yield values from the test results.
- The appropriate method of describing the yield of cartridges in documentation supplied to the consumer by the manufacturer.

The end of life is judged with either of two phenomena - "image fade" caused by toner depletion of the cartridge in the printing system or "automatic printing stop" by the Toner Out detection function.

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# Information technology — Method for the determination of toner cartridge yield for monochromatic electrophotographic printers and multi-function devices that contain printer components

## 1 Scope

The scope of this International Standard is limited to evaluation of toner cartridge yield for toner containing cartridges (i.e. all-in-one toner cartridges and toner cartridges without a photoconductor) for monochrome electrophotographic printers. This International Standard could also be applied to the printer component of any multifunctional device that has a digital input-printing path (i.e. multi-function devices that contain printer components).

This International Standard is only intended for the measurement of toner cartridge yield. No other claims can be made from this testing regarding quality, reliability, etc.

**NOTE** Application of this International Standard for yield measurement of toner replenishment systems (i.e. toner cartridge- and bottle type systems where the toner reservoir is internal to the printing system and not user-replaceable) requires some procedural modifications specifically noted herein. This international Standard is intended for equipment used in the office space and does not apply to production volume or large format printing machines where the major cost of ownership is not caused by the consumable yield measured in this International Standard.

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## 2 Terms and definitions

For the purposes of ISO 19752, the following terms and definitions apply.

### 2.1

#### **Fade**

a phenomenon whereby a noticeable reduction in density uniformity across the page occurs

**NOTE** In this test, fade is defined as a noticeably lighter, 3 mm or greater, gap located in the text or boxes around the periphery of the test page. The determination of the change in lightness is to be made referenced to the 100th page printed for each cartridge in testing. For examples of fade, please consult Annex A.

### 2.2

#### **Shake Procedure**

in the case that the cartridge user's manual instructs cartridge shaking and its method, shaking the cartridge according to the procedures specified

**NOTE** If a shake procedure is used in testing it will be noted in the report.

### 2.3

#### **Toner Low**

a signal generated by the printer when it has been detected that the amount of toner is such that a toner change will be required soon

**NOTE** It does not indicate that the system is out of toner.

## 2.4

### Toner Out

a signal generated by the printer when the toner in the system is depleted and the printer is incapable of reliable printing without user intervention

NOTE For the purpose of this test, the toner out signal will only be used if it causes the printer to stop printing and requires toner replacement to continue printing.

## 2.5

### End of Life

when the printer declares "Toner Out"

NOTE 1 The general intent of this definition is to allow 2 shake procedures near end of life and to declare end of life at the first fade after the 2 shake procedures. Nominally the shake procedures are to be executed at print fade. However, if the printer is equipped with a Toner Low device, then the first, second or both shake procedures can be executed at Toner Low instead of at fade as a convenience for the tester. If the user's guide does not specify a shake procedure then the shake procedures are not done and end of life occurs at the first fade.

NOTE 2 When fade occurs before Toner Out and no shake procedure is specified, then end of life is declared at the fade. If a shake procedure is specified for a printer with a Toner Out device, then up to 2 shake procedures can be executed as described in the paragraph above when fade occurs before Toner Out. In this case, if fade occurs after 2 shake procedures but before Toner Out, then end of life is declared at the third fade. If Toner Out occurs at any time during testing, the cartridge is considered to be at end of life.

NOTE 3 When applied to replenishment systems (bulk toner replacement or multi-part toner systems), the intent of this definition is to declare a quasi-end of cartridge life at a regular predetermined point. If the printer is equipped with a Toner Low or Toner Out signal, these can be used as the point of quasi-end of life. In either case, the end of life condition chosen must be noted in the test report.

NOTE 4 When shake procedures have been performed during the test, the test report will note for both the first and second shake procedures whether they were done at Toner Low or at fade. Any faded pages printed during the test are to be excluded from the cartridge page count.

NOTE 5 Application of this definition may be clarified by reference to a flow chart and examples found in Annex B.

## 2.6

### Individual Page Yield

the number of "standard page file" pages printed between cartridge installation and end of life (as defined in Section 3.5)

NOTE For replenishment systems, the individual page yield is determined by counting the number of "standard page file" pages printed between prescribed quasi-end of life conditions (defined in Section 3.5).

## 2.7

### Declared Page Yield

(see Clause 6)

## 3 Test Parameters and Conditions

### 3.1 Set-up

Place the printer on a horizontal surface and set-up the printer according to the installation guide provided in the printer user's manual. Use the most recent printer driver available from the manufacturer. The driver version will be specified on the test report. Cartridge installation shall be completed following the instructions in the cartridge installation guide. If there is a contradiction between the printer and cartridge manuals for the cartridge installation, the cartridge manual will take precedence except if changes are recommended for printer or driver settings.

If the cartridge used in testing is a toner replenishment or toner bottle type, then one complete toner cartridge will be used in each printer before the start of the test. The pages printed to deplete this priming cartridge do



not have to be recorded and printing can be conducted at any environment. This priming cartridge is used to bring the printing system to a set toner level condition.

All image and print quality modifiers should be at their factory pre-set configuration for the printer and default installed condition for the driver. If the printer and driver differ, then the driver defaults should be used. Any user selectable toner conservation modes should be disabled during testing.

If the printer under test uses an internal PDF interpreter, it is ok to use it as long as the printer defaults are set to not substitute fonts. If the internal interpreter is used, this should be noted on the report.

To assure that the test page is rendered correctly, any page size modifiers such as “Fit to Page”, “Page Centring” and font substitution should be turned off. To further insure that font substitution does not occur, fonts should be downloaded as TrueType fonts if the driver provides that option. If the option exists, rendering of graphics should be performed by the printer, not the application software or operating system. The file should be printed using the fonts embedded in the file and should be rendered on the page in a size corresponding to the dimensions in the test page description. Page placement modifiers such as page centering can be used to place the image properly on the page. If there is a question about rendering settings affecting the yield, the setting should be noted in the report.

NOTE The application software (i.e. Adobe Reader), printer driver and printer may have page size modifier functions, such as “Fit to Page”. Make sure that all of these functions are disabled.

### 3.2 Sample Size

A combination of at least three cartridges shall be run on a combination of at least three printers (for a minimum of nine cartridges and three printers). This is the minimum number of engines and cartridges that should be used for testing. When feasible it is recommended that additional engines and cartridges be used in testing. When testing additional engines and cartridges above the minimum, an effort should be made to test equal number of cartridges on each engine. For example, if an additional engine is to be tested then the minimum number of cartridges to be tested would be 12 (3 cartridges X 4 engines). When testing cartridges for a released product, it is recommended that cartridges and printers are procured from various sources, or selected from different production lots. The printers and cartridges must be within their useful life as stated in their user's manual.

NOTE It is recommended that an additional cartridge be procured to allow for the possibility of cartridge failure during testing.

### 3.3 Print Mode

For reporting cartridge yield, the test shall be run in continuous print mode simplex printing, with printed output occurring at or near rated printer speed. The actual print speed will be semi-continuous because of printing being interrupted for paper replenishment etc. Every attempt should be made to have printing be continuous from the start of a cartridge to the end of cartridge life.

### 3.4 Print Environment

The temperature and humidity can have a profound effect on test results. For this reason, the test must be carried out according to the following test conditions:

Temperature: Testing room average  $23.0\text{C} \pm 2\text{C}$

Readings to be made with a running average of 1 hour with readings recorded at least every 15 minutes, all running average temperatures are to be between  $20.0\text{C}$  and  $26.0\text{C}$ .

Relative Humidity: Testing room average  $50\% \pm 10\% \text{RH}$

Readings to be made with a running average of 1 hour with readings recorded at least every 15 minutes, all running average RHs are to be between 35% and 65%.

Example: An example of the calculation of the temperature is shown below for temperature readings taken on 15-minute intervals for the testing of one cartridge.

	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>4</sub>	t <sub>5</sub>	t <sub>6</sub>	t <sub>7</sub>	t <sub>8</sub>	t <sub>9</sub>	t <sub>10</sub>	t <sub>11</sub>	t <sub>12</sub>	
Temperature	24.0	23.4	20.5	24.2	23.6	22.0	25.5	24.7	22.1	20.8	22.0	23.5	Testing Room Average
Running Average	N/A	N/A	N/A	23.0	22.9	22.6	23.8	24.0	23.6	23.3	22.4	22.1	23.0

$$\text{Running Average at } t_i = (t_{i-3} + t_{i-2} + t_{i-1} + t_i) / 4$$

$$\text{Testing Room Average} = (t_1 + t_2 + \dots + t_{12}) / 12$$

From this the testing room average would be 23.0C, the maximum running average reading 24.0C and the minimum running average reading 22.1C. These values can be found highlighted in the table of temperature measurements. It should be noted that the testing room average for both temperature and RH are averages of all measurements, not the running averages.

Prior to testing, the printer, paper and cartridges should be acclimated to the above conditions for a minimum of 8 hours. Before acclimation, packaging and shipping materials should be opened with care taken to prevent any light damage from occurring to the cartridge during acclimation. Paper may be acclimated in the ream wrapper. Before final acclimation, all materials should be temperature acclimated to an office environment.

Any water condensation must be avoided when printer, paper and cartridges are carried in the test environment

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### 3.5 Paper

The paper used in this test should represent a "common" medium weight paper, and must conform to the printer's list of approved papers. The paper manufacturer, weight and size, A4 or equivalent, used in the test will be noted on the report.

### 3.6 Maintenance

Printer maintenance shall be performed throughout yield testing per the printer and cartridge user's manual. (For example, developer roller or fuser replacement)

### 3.7 Print File

The print test file is outlined and specified in detail in Annex C. The test must be conducted using the most recent official electronic test file as the input. The most recent official file can be located at <http://www.iso.org/jtc1/sc28>. Failure to use the exact file specifications will invalidate test results. In addition to the PDF test file, the latest version of the printer driver will be used to print the test pages. If the printer under test uses an internal PDF interpreter, it is ok to use it as long as the printer defaults are set to not substitute fonts. If the internal interpreter is used, this should be noted on the report. The version of the test file and version and maker of the PDF reader will be included in the test report. Previous to starting the test a sample file should be printed to check the image and assure the proper size. A measurement should be made between A – B for short edge feeding paper and the dimension be 170.0mm±1%. For long edge feeding paper these measurements should be A – C 250.0mm ±1%.as shown in Annex C. This is done because image stretch can occur in the feeding direction that does not affect the use of toner.

NOTE To aid in counting and tracking pages, a header or footer can be added to the test page. Every attempt should be made by reducing the size of this addition to reduce the effect on calculated yield.

If the given tolerances cannot be met with all scaling modifiers off, then testing cannot continue.

## 4 Test Methodology

### 4.1 Testing Procedure

- 1) Install at least three printers following the user's manual. If the cartridge used in testing is a toner replenishment or toner bottle type, then one complete toner cartridge will be used in each printer before the start of the test. The pages printed to deplete this priming cartridge do not have to be recorded and printing can be conducted at any environment.
- 2) Install corresponding cartridges following the cartridge installation guide. If there is a contradiction between the printer and cartridge manuals for the cartridge installation, the cartridge manual will take precedence except if changes are recommended for printer or driver settings.
- 3) Begin test and start tracking the number of pages run on each test cartridge.
- 4) When the 100<sup>th</sup> page is printed for the cartridge, save page for use as the fade reference.
- 5) When end of life is reached on any cartridge, record Individual Page Yield as described in section 3.6.
- 6) Repeat steps 2 through 5 for remaining toner cartridges.

### 4.2 Procedure for handling a defective cartridge or printer

During testing, a failure of the cartridge or printer may occur. This will be handled in the following manner. Cartridge failures are defined as occurrences of problems that would result in replacement of the toner cartridge before end of life. Examples of this could be Optical Photo-Conductor (OPC) damage, excessive toner leakage, structural failure, etc. Printer failures are defined as non-user clearable errors that prevent normal printer operation from occurring. An example of this might be the failure of the laser beam on the printer.

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#### 4.2.1 Defective Cartridge

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In the case of a defective cartridge, the last page printed shall be recorded on the report, and reason for failure. The cartridge will then be replaced with a new cartridge and the testing continued. For the purposes of yield calculation, the defective cartridge will not be used. For the test to be considered valid at least 9 cartridges must be run to end of life as defined in Section 3.5.

#### 4.2.2 Defective Printer

In the case of a defective printer, the printer shall be repaired or replaced and new cartridge shall be used for subsequent testing. On the report, the last page printed by the cartridge will be recorded and it noted that the cartridge was replaced due to printer failure. The failure of the printer will be noted and the replacement printer serial number recorded. For the test to be considered valid at least 9 cartridges must be run to end of life as defined in Section 3.5. If a printer fails during testing, the completed cartridges that have been run on the engine are still valid for calculation. Three additional cartridges do not have to be tested on the new engine.

If the printer used in testing is a toner replenishment or toner bottle type, then one complete toner cartridge will be used in the repaired or replaced printer before continuation of the test. The pages printed to deplete this priming cartridge do not have to be recorded and printing can be conducted at any environment.