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Information technology — Method for the determination of ink cartridge yield for monochrome inkjet printers and multi-function devices that contain inkjet printer components

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see http://patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of this document is to provide a process for determining the ink cartridge yield for a given monochrome inkjet print system (i.e. integrated ink cartridges and ink cartridges without integrated printheads) using a standard test page.

In the case where a cartridge set can be used in multiple printer models, only one yield test needs to be performed as long as the difference between printer models does not impact yield.

NOTE A cartridge supplier can choose to use more than one market identifier for a single physical cartridge. In this case, only one yield test is performed as long as there are no differences in the cartridges other than market identifiers.

This document prescribes the following:

— the test method that manufacturers, test labs, etc., use to determine ink cartridge yield;

— the method for determination of allowable declared yield value from the test results;

— the appropriate method of describing the yield of cartridges in documentation supplied to the consumer by the manufacturer.

The cartridge yield is determined by an end of life judgement, or signalled with either of two phenomena: *fade,* caused by depletion of ink in the cartridge or *automatic printing stop* caused by an ink out detection function.

It is envisioned that one of the uses of this document is for the calculation of cost per page (CPP). While this document measures a portion of this cost, it is not used as the sole component of CPP calculation. Additional factors are considered for CPP calculations.

Information technology — Method for the determination of ink cartridge yield for monochrome inkjet printers and multi-function devices that contain inkjet printer components

1 Scope

The scope of this document is limited to the evaluation of black ink cartridge page yield for ink-containing cartridges (i.e. integrated ink cartridges and ink cartridges without integrated printheads) for monochrome inkjet print systems. This document can also be applied to the printer component of any multifunctional device that has a digital input printing path, including multi-function devices that contain inkjet printer components. Both liquid and solid ink products can be tested using this document.

This document is only intended for the measurement of ink cartridge page yield when printing on plain paper. No other claims can be made from this testing regarding quality, reliability, etc.

This document can be used to measure the yield of any cartridge that is used in a significant amount during the printing of the test page defined in ISO/IEC 19752.

This document is not for use with printers whose minimum printable size is equal to or greater than A3 or for printers designed or configured to print photos (for example, maximum printable size less than A4 or a printer configuration intended for photo only printing). In addition, this document only applies to drop on demand printing systems.

NOTE Integrated ink cartridge is a cartridge that includes at least: an ink containment part, an ink deposition mechanism and an ink transport part (see ISO/IEC 29142-1).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 19752, *Information technology — Office equipment — Method for the determination of toner cartridge yield for monochromatic electrophotographic printers and multi-function devices that contain printer components*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
fade
phenomenon in which a significant reduction in uniformity occurs due to ink depletion

Note 1 to entry: In this test, fade is defined as a noticeably lighter, 3 mm or greater, gap located in the text, in the bar chart, or in the boxes around the periphery of the *test page* (3.9). The determination of the change in lightness is to be made referenced to the 25th page printed for each cartridge in testing. For examples of fade, please consult Annex A.

Note 2 to entry: In some printer systems, fade can occur prematurely due to the way that ink is provided to the printing system. If a printer exhibits fade, a five-minute pause is allowed to provide for recovery of the ink delivery system and printing can continue. If fade appears on the next page, then the cartridge is judged at *end of life* (3.7) and the additional page printed is not counted in the yield calculation. If fade does not appear on the next page, then printing can continue until the next fade or *ink out* (3.6) is encountered and the additional page shall be counted.

3.2
streaks
very thin lines of colourant or missing colourant, other than intended in the test document

Note 1 to entry: Streaks differ from *fade* (3.1) in the width and severity of increase in lightness, L*, or reduction in density. Streaks can appear due to a number of reasons, thermal issues and clogged nozzles being two of the main causes. If these streaks occur in three consecutive *test pages* (3.9), then a *streak removal operation* (3.2) is required. For examples of streaks, please consult Annex B.

3.3
streak removal operation
procedure used to restore the print performance by removing *streaks* (3.2)

Note 1 to entry: If streaks are observed on 15 consecutive *test pages* (3.9), first the printer can be left idle for five minutes. Then an additional 15 test pages are printed. If the streaks are still observed, then a streak removal operation is conducted according to the latest printer manufacturer documentation. Due to the significant amount of ink that is used for cleaning, the maximum permissible number of times that the streak removal operation can be used on a given cartridge is prescribed in 5.2.2.

Note 2 to entry: All test pages printed during this process are included in the page count for determining the yield.

3.4
printhead alignment operation
function that aligns newly installed printheads

Note 1 to entry: If it is mandatory according to the latest printer manufacturer documentation, this operation is performed during testing. The pages used in the alignment procedure are not counted in the measurement of yield.

3.5
ink low
warning generated by the printing system when it has determined that the amount of ink is such that a cartridge change may be required soon

Note 1 to entry: It does not indicate that the system is out of ink.

3.6
ink out
signal generated by the printing system when the useable ink in the system is depleted and the printer stops printing

3.7
end of life
condition determined by one of two mechanisms: *fade* (3.1) or *ink out* (3.6)

Note 1 to entry: In the event that the printer can continue printing after ink out is reported, the cartridge is still considered at end of life.

3.8
monochrome inkjet printer
printer only capable of printing black and not configurable to print another colourant

Note 1 to entry: More than one black cartridge can be installed simultaneously if they have the same cartridge identifier.

3.9
test page
test file that is printed as a single job

Note 1 to entry: The test page refers to ISO/IEC 19752.

3.10
individual cartridge yield
value determined by counting the number of *test pages* (3.9) printed between cartridge installation and *end of life* (3.7)

3.11
declared cartridge yield
value at or below the lower 90 % confidence bound of the mean as prescribed in 6.1

3.12
non-colourant ink
material designed for liquid state deposition on a substrate, such as gloss optimizers and fixatives, not containing a colourant

3.13
black ink cartridge
cartridge containing black colourant and no other colourant

Note 1 to entry: Black ink cartridge may contain *non-colourant ink* (3.12).

4 Test parameters and conditions

4.1 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's website or the supplied driver with the printer. The driver version shall 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 shall take precedence except if changes are recommended for printer or driver settings.

At the start of the test, all printers shall be set-up using a priming cartridge to ensure that the ink used in testing is primarily for printing, not for initial priming/cleaning. After the printer is set-up according to the manufacturer's instructions, the priming cartridge shall be used to print a minimum of 25 copies of the standard test page. The priming cartridge shall be removed and replaced with a new cartridge that is used for testing yield. The pages printed during this step are not counted towards yield. Even if required by the printer, printhead alignment does not have to be performed on the priming cartridges. The number of pages used in the priming operation shall be included in the test report.

All image and print quality modifiers shall be at their factory pre-set configuration for the printer and default- installed condition for the driver. If auto media detection is available on the printer, it shall be disabled and media-type set to plain paper. This is to avoid inaccurate sensing of the media. If the printer and driver settings differ, then the driver defaults shall be used. Any user selectable ink conservation modes, (e.g. draft) shall be disabled during testing.

For printers that default to duplex printing, the default shall be overridden and the printer shall be set to simplex for yield testing.

To assure that the test page is printed correctly, any page size modifiers such as Fit to Page and font substitution shall be turned off. The test page shall be printed using the fonts embedded in the test page and shall be printed on the page in a size corresponding to the dimensions in the test page defined by ISO/IEC 19752. Page placement modifiers such as page centering can be used to place the image properly on the page.

To facilitate automated testing, the test page may be pre-generated using the printer driver. This is often accomplished using a print to file command. This method is only valid if it does not affect the measured yield. If a pre-generated file is used, it shall be noted on the test report.

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 shall be noted on the report.

The application software (for example, Adobe Acrobat Reader©[1)]), printer driver and printer can have page size modifier functions, such as Fit to Page. Ensure that all of these functions are disabled.

4.2 Sample size

The sample size shall be determined such that a minimum of three physical cartridges are tested in each of three printers. Therefore, the minimum number of tested cartridges is 9 (3 cartridges × 3 printers).

When testing additional engines and cartridges above the minimum, an effort shall be made to test an equal number of cartridges on each engine. For example, if an additional engine were to be tested then the minimum number of cartridges to be tested would be 12 (3 cartridges × 4 printers) for a one-cartridge system.

When testing cartridges for a commercially available product, it is recommended that cartridges and printers be procured from various sources or sampled from different production lots. The printers and cartridges shall be within their useful life as stated in their user's manual.

It is recommended that additional engines and/or cartridges be used in testing.

4.3 Print mode

For reporting cartridge yield, the test shall be run in semi-continuous simplex printing and set in the driver default print mode at or near rated print speed. Each copy of the test page shall be printed as a separate one-page print job. This allows for some intra-job servicing and calibration to take place. Additional pauses can take place due to paper refills and idle time due to end of workdays.

NOTE 1 This does not mean that the printer is required to stop between printed jobs.

Inkjet printers commonly need to service the printing system after a number of prints, or when the device has been powered down or not used for a given amount of time. This servicing uses ink that could have been used to print additional pages. It is realized that customers do not normally print in a continuous fashion, but these changes are made to decrease testing time and increase the repeatability of the testing process.

NOTE 2 Depending on use conditions, the yield experienced by a given user can vary significantly from the yield measured by this test method.

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