

Printer and Multifunction Consumable Yields

As part of our commitment to quality, reliability and customer satisfaction, Xerox supports industry standards such as those set by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

This document details Xerox® methodologies for testing and reporting estimated yields for consumables such as toner cartridges and solid ink sticks.

Contents

- 2 Consumable Yield Testing and Reporting Overview
- 3 ISO/IEC Standardization Efforts
- 3 The ISO/IEC Consumable Yield Standard
- 4 ISO/IEC Test Parameters and Conditions
- 5 Stated Yield vs. Actual Yield
- 5 Other Consumable Testing
- 6 Questions and Answers
- 8 Appendix — Color Test Suite

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Consumable Yield Testing and Reporting Overview

Customers are becoming increasingly aware of the cost of owning and operating their printers and multifunction products (MFPs). The cost of consumable supplies such as toner cartridges or solid ink sticks is a major component of the Total Cost of Ownership (TCO) for a printer or MFP. The per-page cost of printing is driving many printer and MFP purchase decisions today, as these costs can be combined with print volume and print coverage assumptions to give companies a reasonable estimate of the monthly and annual TCO for a specific printer or MFP.

In the past, printer and MFP original equipment manufacturers (OEMs) used different, proprietary methods for testing and reporting consumable yields. This made factual and accurate comparisons of products from differing OEMs impossible. Reporting was typically done using “5 % area coverage,” but that did not guarantee comparable results because many other testing variables affect the stated yield, including:

- Page size and margin settings
- Image types used to create 5 % area coverage
- Number of cartridges used during testing process
- Number of printers/MFPs used during testing process
- Environmental testing conditions (humidity, temperature, and so on)
- Lack of stated confidence level for published consumable yield

Any variation in these factors during the testing process can cause nontrivial differences in reported yields. The development of an industry standard methodology for testing and reporting consumables yields has helped alleviate these inconsistencies, and gives customers the reliable information they need to make their technology decisions.



ISO/IEC

Standardization Efforts

The International Organization for Standardization (ISO), based in Geneva, Switzerland, is composed of national standards bodies that formulate and issue technical standards that play a key role in the development, manufacturing and supply of products and services.

The ISO collaborates on all matters of electro-technical standardization with the International Electrotechnical Commission (IEC), the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies. Draft standards are circulated amongst members of the ISO and IEC, and require approval of at least 75 % of voting members.

Xerox is a member of several ISO committees, and is instrumental in developing of standardized measurement and reporting methods for printer and MFP consumables. Xerox supports ISO/IEC standards for toner and solid ink yields and encourages all printer and MFP OEMs to do the same. Xerox believes that if all OEMs adhere to a single reporting standard, customers will be able to confidently evaluate and compare yields across products and OEMs.

Further information about the ISO organization and its standards can be found at www.iso.org. More information on the IEC can be found at www.iec.ch.

The ISO/IEC Consumable Yield Standard

The ISO and IEC have adopted a standard for black-and-white devices – ISO/IEC 19752 which is described as a “method for the determination of toner cartridge yield for monochromatic electrophotographic printers and multifunction devices that contain printer components.” Black-and-white printers and MFPs reporting toner yields under ISO/IEC 19752 use the following explanation:

Toner Cartridge Yield:

Average XX,XXX standard pages¹

¹ Declared yield in accordance with ISO/IEC 19752.

Yield will vary based on image, area coverage and print mode.

ISO/IEC 19798 is a similar standard that has been adopted for color laser devices. ISO/IEC 19798 is described as “a method for the determination of toner cartridge yield for colour printers and multifunction devices that contain printer components.”

Reporting format is as follows:

Average Continuous CMYK Yield: XX,XXX pages

Or

Average Continuous CMY Yield: XX,XXX pages

Average Continuous Black Yield: XX,XXX pages

(if the Black Yield is different than Color)

ISO/IEC 24711 is another standard that has been adopted for inkjet and solid ink devices. ISO/IEC 24711 is described as “a method for the determination of ink cartridge yield for colour inkjet printer and multifunction devices that contain printer components.” Reporting format is similar to ISO/IEC 19798 shown above.

The ISO/IEC Consumable Yield Standard (continued)

Different implementations of color tables and color balance optimization among manufacturers can lead to yield variations between color cartridges, even if they have the same toner weight. To account for this, ISO supports a second reporting method called “composite yield,” allowing a single average reporting yield for Cyan, Magenta and Yellow toner cartridges. Black is reported separately as an individual yield.

Average Continuous Composite CMY Yield: XX,XXX pages

Average Black Continuous Yield: XX,XXX pages

ISO/IEC 19752, ISO/IEC CD 19798, and ISO/IEC 24711 specify the use of a standard test page for black-and-white and multiple test pages for color products, explicit testing procedures, statistical sampling, environmental controls and well-defined cartridge end-of-life status. More detail on these specifications is available under the Test Parameters and Conditions section of this document.

Xerox has adopted ISO/IEC 19752 for testing and reporting toner cartridge yields for its black-and-white printers and MFPs. Likewise, Xerox has adopted ISO/IEC 19798 for testing and reporting color toner cartridge yields, as well as ISO/IEC 24711 for testing and reporting solid ink stick yields, for its color printers and MFPs. Adopting ISO/IEC yield reporting standards benefits manufacturers and customers by enabling consumable yield comparisons across product lines and manufacturers.

Test Parameters and Conditions

Printers and Cartridges — A minimum of three printers or MFPs are tested, using a minimum of three toner cartridges per device. Toner cartridges are procured in the open market from multiple sources, and for newly developed printers or MFPs cartridges should be sourced from different production lots. Testing nine samples of each toner cartridge produces lowest predicted yield estimates with 90 % statistical significance.

Standardized Test Page — A single page (see Figure 1) is used for testing. Area coverage on the page is just below 5 % . Pages are printed in a semi-continuous print mode, stopping only for paper replenishment.

Device Setup — Printers are set up according to manufacturer instructions using default drivers and settings. New printers must run through one complete toner cartridge before starting the test.

Environmental Conditions — Testing must be done in an environment where temperature and humidity can be maintained within acceptable parameters.

A. Temperature Range: $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($73^{\circ}\text{F} \pm 4^{\circ}\text{F}$)

B. Humidity Range: $50\% \pm 10\% \text{ RH}$

Specific “Toner Out” Conditions — If a printer is equipped with “Toner Out” sensing, printing stops when this message is issued and the printer will no longer function. If a manufacturer recommends shaking toner cartridges, this is done at “Toner Low” but not more than two times. If a printer does not stop at “Toner Out”, cartridge testing is stopped as soon as fading bars appear. If a printer has “Toner Out” sensing but fading bars appear (even after toner shaking), testing will stop.

Stated Yield vs. Actual Yield

The ISO/IEC standard allows for objective comparisons of stated toner yields for different printers or MFPs, regardless of OEM. Many prospective customers use consumable yield information to estimate the toner life they can expect to experience with their particular applications, and adherence to the ISO/IEC standard enables this analysis.

It is important to note that the ISO/IEC yield is a comparative statistic and not a predictive tool. The number of pages that customers will get for their own applications will depend on a variety of factors, with page coverage having the highest impact. Research has shown that the industry average black-and-white page coverage is between 4% and 5%. There is an inverse relationship between page coverage and toner yield — the lower the page coverage, the more pages the toner will yield. Conversely, higher coverage pages result in lower toner yields.

Customers utilizing heavy page coverage applications will achieve lower toner/ink yields. Many Xerox Phaser® and WorkCentre® printers and MFPs contain an important feature called Usage Profile that gives customers access to page coverage data on a job-by-job basis, or on average for all jobs printed by a specific printer. This data can be downloaded to a Microsoft® Excel file, or viewed online via Xerox CentreWare® IS Embedded Web Server. Using this information, customers can estimate if they will achieve higher or lower toner yields compared to the declared ISO/IEC standard yields.

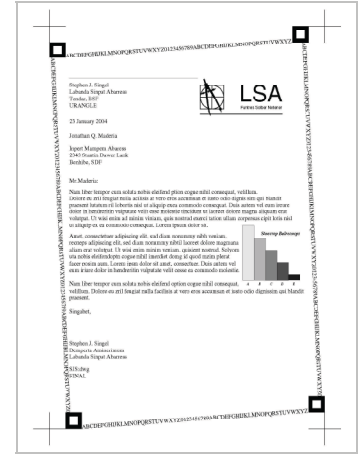


Figure 1 — ISO/IEC 19752 monochrome test page; for color suite, see appendix.

Other Consumable Testing

Currently, only toner cartridges and solid ink sticks are subject to ISO/IEC yield standards. Drums (or imaging units), fuser units, and maintenance kits are not covered. Yields are published based on the OEM's own testing methodology. Users should be aware of the factors that can impact drum and fuser yields, as these are longer-life consumables that can be significantly impacted by usage patterns and certain types of media. Xerox printers and MFPs reporting drum and fuser yields will use the following description/disclaimer:

Drums/Imaging Units:

Approximately XX,XXX standard pages²

² Declared Yield based on an average job size of X pages letter/A4-size.
Yield will vary based on job run length, media size and orientation.

Note: Most drum yields are based on 3-page or 4-page average job size. On some high performance products (such as the Phaser 5550), drum yields are based on 5-page average job size.

Fusers/Maintenance Kits:

Approximately XXX,XXX standard pages³

³ Declared Yield based on letter/A4-size 20 lb. (75 gsm) pages. Yield will vary based on media type, size, weight, orientation and usage patterns.



Questions and Answers

Xerox compliance with ISO/IEC standards

Q: Will Xerox provide “ISO/IEC certificates” for supplies that have been ISO/IEC yield tested?

A: The ISO/IEC certification process does not result in the issuance of certificates. By declaring a yield according to ISO/IEC standards, Xerox warrants that it has done the testing according to ISO/IEC standards and guidelines. This declaration will be found in data sheets or collaterals that list consumable supplies yields.

Q: Does Xerox publish its ISO test results?

A: Yes. They can be found online at www.office.xerox.com/iso/.

Stated Yield vs. Actual Yield

Q: Can I get the ISO/IEC yield for my specific printing application?

A: No. The ISO/IEC standard ensures that the stated consumable yields of different printer and MFP OEMs are comparable by specifying a set of common testing parameters and conditions. It is not guaranteed that users will get the declared yields in their own applications, as page coverage varies by application, and page coverage has the highest impact on actual yields. User applications running at approximately 5 % page coverage under normal office operating conditions can expect on average to experience yields that are similar to the ISO declared yields.

Q: What are the factors that will impact the yields users get from toner cartridges?

A: The most important factor affecting yield is page coverage. Coverage analysis has consistently shown that in office environments, the average black-and-white page coverage is in the range of 4 % to 5 % . However, it is not unusual for office applications to run above or below that average. In general, pages with significant dark or shaded areas (logos or pictures) or a large amount of fine print will generate area coverage higher than 5 % . Other factors that can reduce toner cartridge yield include higher temperature, higher humidity levels and using a higher print resolution setting.

Questions and Answers

Stated Yield vs. Actual Yield (continued)

Color coverage varies by product class, but is generally much higher than black-and-white products. Letter/A4-size color printers and MFPs can have average page coverage in the 7% to 15% range (depending on application and mix between color and black-and-white documents). Tabloid/A3-size color printers and MFPs tend to drive higher color page coverage in the range of 10% to 30% in office environments. In graphic arts environments, average color page coverage can increase to the 40% to 60% range. The ISO/IEC color standard is based on an overall page coverage in the range of 20% — users whose average color coverage is under 20% are likely to experience greater yields than reported, while those running higher coverage applications will experience lower yields than reported.

Q: If a page coverage percentage assumption is not part of the ISO/IEC standard, how can it be useful in helping customers estimate how much yield they will get for their applications?

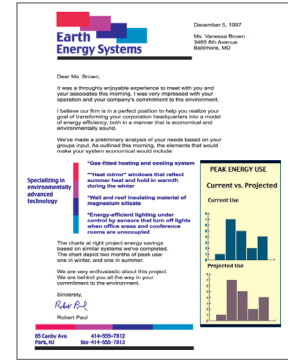
A: The color and black-and-white ISO/IEC Yield Standards make use of predefined, standardized pages that are representative of typical office documents. The black-and-white test page has approximately 5% coverage, while the color testing suite averages approximately 20% coverage. Differences in print engine technology and imaging firmware mean the same document will not register the same coverage across different engines. Customers who determine the average coverage of their combined applications can estimate whether they will get more or less than the published ISO/IEC yields. Customers who experience toner yields below published ISO/IEC yields are likely printing documents with higher page coverage than ISO/IEC testing specifies.

Q: How is color page coverage calculated?

A: Color page coverage is the sum of the individual coverage for cyan, yellow, magenta and black toners or solid ink. Color applications tend to be more elaborate (often including charts and images), so the area coverage tends to be much higher than monochrome pages on average. It is not unusual to find color pages (like pictures) with total coverage in the range of 40% to 60%, or even in excess of 100% if “process black” is used (where cyan, yellow and magenta are combined to create black). The color test suite for ISO/IEC CD 19798 and ISO/IEC 24711 is composed of five representative samples of office color printing (see Appendix).



7% – 15% Coverage



10% – 30% Coverage



30% – 40% Coverage



40% – 60% Coverage

Questions and Answers

Drums and Fusers

Q: Are yields for drums and fusers also based on ISO/IEC standards?

A: Currently there are no ISO/IEC standards for reporting life on drums (imaging units) or fusers. Yields on these components are not significantly influenced by print area coverage.

Q: What is a drum (imaging unit)?

A: Drums collect toner-imaged information and transfer it to a sheet of paper. While most black-and-white printers combine the toner and drum into one cartridge, a majority of color printers separate the drum and toner cartridges.

Q: What impacts drum yields?

A: Average job size has the highest impact on drum yields. Drum yield testing often utilizes average job sizes of three to five pages — which reflect average office usage patterns. Customers who print only very short print jobs (where the average job size is one to two pages) will see reduced drum yields, while customers whose job size averages more pages are more likely to realize the full stated drum yield.

Many printers and MFPs capable of using tabloid/A3-size paper have input trays that allow letter/A4-size paper to feed in either the long-edge or short-edge direction. Drum life can be maximized by feeding letter/A4-size paper in the long-edge direction, as it decreases wear on the drum (and maximizes output speed). If you are unfamiliar with long-edge vs. short-edge feeding, consult your printer or MFP user manual.

Note — Some printer and MFP OEMs publish drum yields based on one “continuous run” print job — where one infinitely long print job runs until the drum wears out. Yields reported by this testing do not reflect real office printing conditions, and users can end up realizing noticeably lower actual yields. Xerox will list average-tested-job-size information when publishing stated drum yields, and suggests customers inquire about average tested job size to ensure stated yield is based on real office printing conditions.

Q: What is a fuser?

A: A fuser is a rubber roller with a heating element inside. It melts and fuses the toner onto the sheet of paper.

Q: What impacts fuser yields?

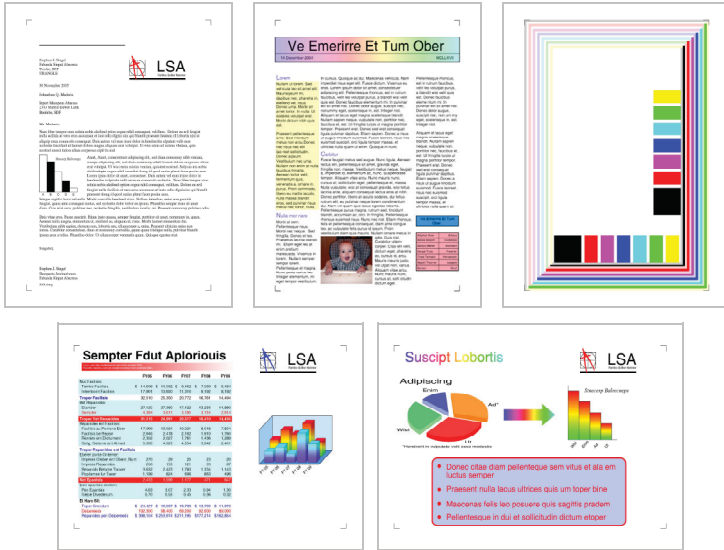
A: Fusers usually have long lives (100,000 pages or more depending on the product). Fuser yield is impacted most by stress placed on the heating element or heat regulators, which can lead to early fuser failure (fusers are generally not impacted by page coverage or average job size). Media type, size and weight have the highest effect on fuser stress. For example, long print runs on narrow media, such as envelopes, can contribute to reduced fuser life — envelopes absorb heat from only a small section of the fuser, causing the rest of the fuser to overheat. Envelopes are also at least twice as thick as regular paper, causing more heat absorption to occur along their path.

Note — Xerox tests fuser life primarily by using standard laser printer paper, as this is the most often used media in office environments. Specifically, fuser yields are based on A4/letter size pages of 20 lb. (75 gsm) weight.

Appendix

Color Test Suite

These color test pages are specified by the ISO/IEC CD 19798 and ISO/IEC 24711 standard for yield testing. These five pages are intended to simulate the average color documents printed in an office environment.



If you have any questions, please contact your Xerox sales representative or local reseller, call 1-877-362-6567 or visit us on the web at www.office.xerox.com

