

Appendix C

Inkjet and Printer Cartridges

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Lexmark International, Inc.
740 West New Circle Road
Lexington, Kentucky 40550
USA

March 17, 2009

Mr. Max Gray
Department of Agriculture and Consumer Services
Bureau of Weights & Measures
3125 Connner Blvd. Lab 2
Tallahassee, FL 32399-1650

Dear Mr. Gray:

Thank you for providing the inquiry from cartridge refiller Dr. Ink, Inc., as well as the link to Tom Coleman's newsletter article dated March 2005. As we discussed briefly, Lexmark does not believe that the packaging for inkjet print cartridges is required to display the volume of ink contained within those devices. Lexmark also believes that despite some superficial appeal, such labeling is more apt to be misleading than illuminating to consumers.

Background

An inkjet print cartridge is not remotely similar to a bottle of milk or a tube of toothpaste; rather, it is one of the most technologically advanced micro-machines in commerce today. In fact, most of the sophisticated technology that comprised a printer in prior technologies is now contained within the print cartridge itself. Not surprisingly, then, the cost of the ink associated with a cartridge is a very small fraction of the total cost of the print cartridge mechanism and much of the price the customer pays for the cartridge is attributable to the micro-machinery, not the ink. Moreover, the capabilities of various cartridge models vary drastically in terms of print speed, print quality, drop size and resolution, and yield so a comparison of those machines based upon the quantity of ink they contain is an apples to oranges comparison. And as explained below, such a comparison could well mislead consumers into buying cartridges that will cost them more, not less, per print. Treating these sophisticated machines as though they were mere containers for ink is inappropriate.

Ink Exemption

Ink is expressly exempt from labeling as provided by the U.S. Fair Packaging and Labeling Act. See 16 C.F.R. 50.3.2(a), attached hereto. The exemption for ink has been consistently observed and applied for decades by the State of Florida, as well as every other state in the union. This is clearly demonstrated by the fact that during this period literally billions of ink pens, markers and highlighters have been sold without any labeling whatsoever as to the quantity of ink these devices contain. It cannot plausibly be denied that during the nearly 40 years the exemption has been in effect, enforcement officials of the Bureau have personally purchased a multitude of such

products and cannot possibly have failed to notice that none of them disclosed the quantity of ink.¹

Yet it does not appear that the Florida or any other state is currently considering requiring labeling of pens, markers and highlighters even though there is no principled way to treat them more leniently than print cartridges. Were the Bureau to abruptly change its longstanding policy regarding the ink, it would constitute a watershed change in Florida law that would encompass the entirety of two large industries that for decades have reasonably believed they were exempt. Any such unannounced deviation from established policy would create significant due process issues for the writing implement and printer companies affected.

Labeling Would Cause Confusion

As mentioned during our brief conversation, contrary to the objective of permitting meaningful comparisons of products, labeling ink volume of printing devices is more likely to cause confusion and in many cases, could cause consumers to make perfectly incorrect decisions. The ratio of the amount of ink contained in a cartridge versus the amount of printed pages a cartridge can produce is markedly different among various cartridge models. For example, a cartridge model that ejects relatively large drops of ink will consume far more ink to produce a given print than one with very fine drops and, ironically, the quality of the fine drop print will be better. Thus a consumer who chooses large-drop technology cartridge because it contains more ink than an equally priced fine-drop technology cartridge, will actually end up be paying more for each print, and obtain poorer print quality to boot.

In contrast, page yield estimates can provide a meaningful comparison of value to a consumer, at least if all manufacturers employ the same estimating assumptions and techniques. In this regard, the International Standards Organization (ISO), an independent, worldwide standard-setting body which is also interested in promoting accurate comparisons by consumers, has rejected reliance on ink volume or quantity. Instead, ISO, after studying for years the specific issue of inkjet cartridge performance and the consumer's need for meaningful comparative information, has developed a yield estimating and claiming methodology that permits cartridges to be compared using a consistent yardstick. Unlike ink volume measurements, these page yield measurements provide consumers a reliable way to compare the relative amount of printing that can be expected from competitive models of printers and their associated cartridges.

Coleman's Newsletter Article

Last, I would like to address Mr. Coleman's March 2005 newsletter article. To be honest, I am not entirely certain what this document is intended to be, but a non-regulatory agency employee's opinion set forth in a newsletter cannot possibly have the effect of countermanding the official Federal Trade Commission regulations that establish the exemption for ink. That regulation has the full force and effect of law and is recognized by all other states. Mr. Coleman's newsletter article simply is not an authoritative document that could formulate the basis for the sweeping regulatory change that Dr. Ink seeks.

¹ Inkjet print cartridges have similarly been sold for in every state at least 25 years.


Moreover, Mr. Coleman's article does not address the ink exemption discussed above. Nor does it consider or discuss the lengthy and uniform custom and practice by the Federal government and every state government relating to ink products. It does not address the matter of whether billions of pens, markers and highlighters must, as a direct consequence of his position, must also be labeled. In this regard, there is not a single reason Mr. Coleman cites in support of his opinion that does not apply with equal force to the billions of pen, marker and highlighter packages that also do not display liquid volumes.

Although during our brief conversation you mentioned that the high cost of inkjet cartridges distinguishes them from pens, there is absolutely no provision in any packaging laws or regulations that exempts inexpensive items or provides a higher level of regulation for more highly priced items. If anything, pens, markers and highlighters are dramatically closer to being mere bottles of ink (like milk cartons) than the sophisticated micro-machines that comprise inkjet cartridges. There simply is no conscionable way for the Bureau to require the marking of high-tech ink delivery devices while permitting low-tech ink delivery devices such as pens and markers (which are purchased by more consumers and far more often) continue to be unmarked.

Conclusion

Lexmark very much hopes that based on the foregoing, the Bureau will deny Dr. Ink's request. However, if the Bureau is inclined to change its policy of nearly four decades upon which at least two huge industries have relied in good faith, Lexmark hereby requests that it do so only after giving Lexmark and all other members of the both affected industries notice and a formal opportunity to be heard regarding the complex set of regulatory and compliance issues presented by the change desired by Dr. Ink.

Very truly yours,



Charles S. Kratzer
Associate General Counsel

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Citation: **16 cfr 503.2**

16 CFR 503.2

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*** THIS SECTION IS CURRENT THROUGH THE FEBRUARY 26, 2009 ISSUE OF ***
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TITLE 16 -- COMMERCIAL PRACTICES
CHAPTER I -- FEDERAL TRADE COMMISSION
SUBCHAPTER E -- RULES, REGULATIONS, STATEMENT OF GENERAL POLICY OR INTERPRETATION AND EXEMPTIONS UNDER THE FAIR
PACKAGING AND LABELING ACT
PART 503 -- STATEMENTS OF GENERAL POLICY OR INTERPRETATION

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16 CFR 503.2

§ 503.2 Status of specific items under the Fair Packaging and Labeling Act.

Recent questions submitted to the Commission concerning whether certain articles, products or commodities are included under the definition of the term "consumer commodity", as contained in section 10(a) of the Fair Packaging and Labeling Act, have been considered in the light of the Commission's interpretation of that term as set forth in § 503.5 of this part as follows:

(a) The Commission is of the opinion that the following commodities or classes of commodities are not "consumer commodities" within the meaning of the Act.

Antifreeze.
Artificial flowers and parts.
Automotive accessories.
Automotive chemical products.
Automotive replacement parts.
Bicycle tires and tubes.
Books.
Brushes (bristle, nylon, etc.).
Brooms and mops.
Cameras.
Chinaware.
Christmas light sets.
Cigarette lighters.
Clothespins (wooden, plastic).
Compacts and mirrors.
Diaries and calendars.
Flower seeds.

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Footwear.
Garden tools.
Gift ties and tapes.
Glasses and glassware.
Gloves (work type).
Greeting cards.
Hand tools.
Handicraft and sewing thread.
Hardware.
Household cooking utensils.
Inks. ←
Jewelry.
Luggage.
Magnetic recording tape.
Metal pails.
Motor oil (automobile).
Mouse and rat traps.
Musical instruments.
Paintings and wall plaques.
Photo albums.
Pictures.
Plastic table cloths, plastic placement and plastic shelf paper.
Rubber gloves (household).
Safety flares.
Safety pins.
School supplies.
Sewing accessories.
Silverware, stainless steelware and pewterware.
Small arms ammunition.
Smoking pipes.
Souvenirs.
Sporting goods.
Toys.
Typewriter ribbons.
Woodenware.

(b) The Commission is of the opinion that the following commodities or classes of commodities are "consumer commodities" within the meaning of the Act:

Adhesives and sealants.
Aluminum foil cooking utensils.

(Position Provided by NIST WMD February 2005)

Due to the discussion of inkjet cartridges, over the NIST W&M list server, WMD has investigated this situation. WMD concludes that inkjet cartridges need a net quantity statement in liquid measure to comply with Handbook 130 requirements. Our analysis is below and further discussion is welcomed.

Inkjet and Printer Cartridge Considerations

The model weights and measures law contains several relevant sections that apply to ink cartridges.

Weights and Measures Law, Section 19. “Information Required on Packages:”

Except as otherwise provided in this Act or by regulations promulgated pursuant thereto, any package, whether a random package or a standard package, kept for the purpose of sale, or offered or exposed for sale, shall bear on the outside of the package a definite, plain, and conspicuous declaration of:

- the identity of the commodity in the package;
- the quantity of contents in terms of weight, measure, or count;
- the name and place of business of the manufacturer, packer, or distributor, in the case of any package kept, offered, or exposed for sale, or sold in any other place other than on the premises where packed.

Weights and Measures Law, Section 17. “Method of Sale:”

The method of sale shall provide accurate and adequate quantity information that permits the buyer to make price and quantity comparisons, except as provided by established trade custom and practice. While trade custom and practice is a consideration in some instances... the burden to provide “accurate quantity information” by means of a designated “method of sale” is the responsibility of the manufacturer.

Count alone does not fulfill this requirement.

A declaration of quantity in terms of count shall be combined with appropriate declarations of the weight, measure, and size of the individual units unless a declaration of count is fully informative.

Packaging and Labeling Regulation, Section 6.4. – “Terms:” If there exists a firmly established general consumer usage and trade custom with respect to the terms used in expressing a declaration of quantity of a particular commodity, such declaration of quantity may be expressed in its traditional terms, provided such traditional declaration gives accurate and adequate information as to the quantity of the commodity. Any net content statement that does not permit price and quantity comparisons is forbidden.

Weights and Measures Law, Section 15. – “Misrepresentation of Quantity:” No person shall represent the quantity in any manner calculated or tending to mislead or in any way deceive another person. If “accurate quantity information” is not provided, consumers are certainly being misled or deceived and cannot possibly make price and quantity comparisons.

The Federal Trade Commission (FTC) has informed us that the following commodities (partial list only - similar products) are excluded from FTC jurisdiction.

- Ink
- Fountain Pens
- Kindred Products (ball point pens, lead pencils, lead refills, etc.)
- School Supplies
- Stationery and Writing Supplies
- Typewriter Ribbon
- Printer Cartridges*

*While printer cartridges are not listed specifically in Handbook 130, FTC has indicated to NIST that commodities of this nature do not fall under their jurisdiction.

Metric “Only” Labeling:

Since the labeling of printer ink cartridges fall under state labeling regulations, dual unit labeling is not required. Hence, these packages may be labeled in only metric units.

Packaging and Labeling Regulation, Section 11.33. “Inch-Pound Units, Exceptions – Consumer Commodities:”

The requirements for statements of quantity in inch-pound units shall not apply to packages that bear appropriate International System of Units (SI). This exception does not apply to foods, drugs, or cosmetics or to packages subject to regulation by the FTC, meat and poultry products subject to the Federal Meat or Poultry Products Inspection Acts, and tobacco or tobacco products.

NIST Handbook 133, “Checking the Net Content of Packaged Goods,” Fourth Edition, January 2005 – Product Testing:

NIST Handbook 133 has been prepared as a procedural guide for compliance testing of net content statements on packaged goods. The gravimetric test method (outlined in Chapter 2) uses weight measurement to determine the net quantity of contents of packaged goods. The handbook provides general test methods to determine the net quantity of contents of packages labeled in terms of weight and special test methods for packages labeled in terms of fluid measure or count. Gravimetric testing is the preferred method of test for products, such as inkjet and other types of printer cartridges. Therefore, the test method to verify the net contents of ink in printer cartridges exists. However, NIST recognizes the difficulties associated with determining the net content of these cartridges, such as, density determination, product cost, tare verification (cartridge), the cleaning of tare and standards, and finally, inspection lot size. Unless the products are checked at the plant or warehouse, it may be difficult to find a sufficient “retail” lot, adequate in size to obtain an appropriate sample.

G.J. Neville

Design & Development Company
812-B Lincoln Boulevard, Dillon Court Alley Entrance
Venice, California 90291
Tel: 310-795-4301
E-mail: gjneville@verizon.net

January 21, 2010

Attn: Mr. Don Onwiler, Executive Director
National Committee on Weights and Measures
1135- "M" Street, Ste. 110
Lincoln, NE 68508

Sent by E-mail: info@ncwm.net

**Re: Citizen comment on
270-9 HB 130- Uniform Regulation for Method of Sale
of Commodities—Packaged Ink and Toner
Cartridges**

Dear Mr. Onwiler:

On 01-19-10 I spoke with Ms. Lisa Warfield this morning and she directed me to certain print sources pertaining to the upcoming NCWM meetings, including the subject of Packaged Printer Ink and Toner Cartridges. Furthermore, she recommended I might speak with Mr. Ed Williams in Sacramento regarding these anecdotal experiences and observations.

I then spoke with Mr. Williams and he felt I should direct the following commentary to you for possible inclusion as citizen input in your upcoming committee meeting report.

I don't do this much and I have a propensity for HOT AIR...hope this isn't too bad.

After having done my homework by reading Publication #15, Item 270-9, I shall first respond to certain comments made in Lexmark's Fox in the Henhouse letter to Mr. Max Gray, dated, March 17, 2009 supporting the current ISO-developed standard for Toner-Ink measurement methodology; then offer a personal experience to illustrate the current standard's shortcomings; then a few observations and unsolicited recommendations; and lastly, a closing comment on the need for furthering a new design paradigm and how your NCWM Conference can do something about it!

Item 1 -- It is irrelevant that the Ink/Toner component is a small part of the overall cost of a new or replacement cartridge—what matters is that the ink/Toner requires a costly and complex cartridge container for delivery. THEY ACT AS A UNIT! Lexmark's implication that the relatively low cost of the Ink/Toner alone renders proper regulatory scrutiny unnecessary is totally spurious.

In fact, the opposite is true—the Ink/Toner and Cartridge combination is an EXTREMELY EXPENSIVE Ink/Toner Delivery System because Content and Container act as a unit which, furthermore, is uniquely designed (with certain patent protection) to fit the corresponding printer model(s). Whether an OEM or lower-priced Name Brand cartridge, the Unit is surprisingly expensive!

Items 2, 3 --Re standards for Page Yield and current ISO solutions—"yield estimating and claiming methodology that permits cartridges to be compared using a consistent yardstick":

G.J. Neville

Design & Development Company
812-B Lincoln Boulevard, Dillon Court Alley Entrance
Venice, California 90291
Tel: 310-795-4301
E-mail: gjneville@verizon.net

My layman's opinion is that the "consistent yardstick" approach alone is inadequate. It prevents quantification of the contents—the essential ingredient inside the cartridge. Why not require the OEM Ink/Toner Cartridge/Printer industry to comply with freshly conceived DESIGN CRITERIA with at least one goal being to provide the consumer with a simple, yet accurate "back-up indicator" of a cartridge's actual toner content?

Personal observations:

The purpose of the foregoing recommendation would be to empower the consumer with a GUARANTEE for DELIVERY of the ENTIRETY of the purchased Ink/Toner.

This approach is meant only to supplement, not replace, the simpler, more convenient ISO-approved Page Count approach. The secondary consumer benefit would be to eliminate the "wobble room"-based dealer responses to Ink/Toner shortage customer complaints as not many consumers are inclined to pry toner cartridges apart or properly argue issues of equity in the event of suspected shortages.

Whether by software revisions or hardware re-design, mandated new performance-based criteria can provide the consumer with a long-overdue checks-and-balances Tool to level the manufacturers' playing fields.

Solutions can take many forms—whether alpha- numerics via existing LCD windows or by color bar chart display graphics or even by adoption of primitive "clear plastic" toner cartridges. At the very least, the consumer would then have some kind of needed VERIFICATION TOOL.

Naturally, Lexmark's letter to Mr. Gray fails to address any constructive new solutions as none were previously required by any regulatory agency. To illustrate the need for the foregoing, consider my particular frustration which occurred because of the absence of a Verification Tool:

My personal experience (Haven't we all had them?):

The following sequence occurred in my design office. We purchase Brother or Staples TN-350 Toner Cartridges for my Brother MFC 7420 desktop laser printer (purchased several years ago), which has generally been lightly used (average 3-15 copies daily) since purchase:

EVENTS IN MY OFFICE:

- Periodically, the printer shuts down and will not print any longer...until a replacement Toner Cartridge is purchased and inserted into the printer!
NOTE:
 - No easily noticeable, if any, Print Counter capability on the cartridge or the printer. The Toner Cartridge is a proverbial "Black Box".
 - Printer shutdown appears to occur SIGNIFICANTLY BEFORE the estimated 2500 pages of usage.
 - No warning whatsoever of the pending total shutdown, i.e. printing quality drop-off or fade-out.
 - All printed copies 100% perfect prior to shutdown.
- Printer LCD Display Message then appears, saying something like "Out of Toner" or "Replace Toner Cartridge"

G.J. Neville

Design & Development Company
812-B Lincoln Boulevard, Dillon Court Alley Entrance
Venice, California 90291
Tel: 310-795-4301
E-mail: gjneville@verizon.net

- Printer cannot be cajoled into operating again without a new replacement cartridge, i.e. pushing the rocker switch to OFF, waiting 30 seconds, then back to ON; rocking toner cartridge; sliding the corona wire; etc.

EVENTS FOLLOWING AT THE STORE:

- I take “suspect” cartridge to office supply dealer (where I purchased the printer, cartridges and all office supplies). A question and complaint is planned prior to purchasing a new replacement cartridge.
- The Store Manager recites the manufacturer’s mantra about the difficulty of estimating toner consumption, varying printed text/page densities, etc.
- I then suggest we investigate the circumstances together—we remove End Cap from cartridge and....guess what....a SIGNIFICANT amount of toner spills out!
- The Store Manager then claims “Equipment Malfunction” may be responsible—did I purchase a Warranty? Ultimately, he reluctantly offered me a new replacement cartridge at half-price—but it was like pulling teeth from a donkey!.

EPILOGUE:

Was I satisfied? Yes and No

- Yes, because of the Manager’s offer--I didn’t feel like a total idiot.
- No, because of the repair disruption and the waste of my time.
- No, because of my uncertainty of a future repeat experience.
- No, because of the lack of final problem resolution—was the printer the real culprit or was it a batch of poorly designed Ink/Toner cartridges? Without the benefit of a built-in Diagnostic or Verification Tool(s)--either answer might be wrong. Will I, in the future, prematurely purchase again one or both of this manufacturer’s products?

To avoid that risk of becoming a true idiot (the second time burn), will I switch manufacturers to avoid that possibility?

- Probably yes. What a shame, because otherwise, the printer offers excellent value!

Final Thoughts/Conclusions:

The cartridge Page Yield Estimate, purportedly reflecting quantity of content, provides inadequate consumer protection without at least one additional design feature (in mechanism or software) to deliver to, and assure, consumer of **full usage** of the cartridge’s Ink/Toner contents.

Should not better Consumers Protection apply to the design of COMPLEX or PERMANENTLY SEALED CONTAINERS (i.e. Ink/Toner Cartridges)? These devices, during design, should trigger **design compliance with additional new standards and regulations**, generated by the appropriate agency, to assure the customer of:

1. Quantity of container’s Contents
2. Delivery of Entirety of Contents, as is practical.
3. Provide consumer with a Print Count or Ink/Toner quantity verification tool, (on Cartridge or Printer Display Screen) as offered in larger printers.

G.J. Neville

Design & Development Company
812-B Lincoln Boulevard, Dillon Court Alley Entrance
Venice, California 90291
Tel: 310-795-4301
E-mail: gjneville@verizon.net

WHICH COMPARISON IS MORE APT?

Consider the comparison of a sophisticated, complex, injection-molded Ink/Toner Cartridge vs. an old-fashioned Burlap Bag for Grain or Paper Bag for Cement, where measurement can be easily confirmed because of the container's scale, flexibility and negligible weight --after all, it's just a BAG!

Now consider the same Toner Cartridge vs. a craftily-designed rigid Magician's Box with a false bottom (designed by the Magician or Manufacturer), which by accident or design, conceals a portion (i.e.30%) of the grain--which remains unused and ultimately is then unknowingly discarded by the Consumer. Is that right?

Throughout history, did not the science of measurements ultimately evolve in most every society so as to identify and prevent the proliferation of deceptive and/or irregular measurement practices (whether for government tax gain or for the public's protection)?

So Why Not Now?

EXAMPLE OF THE NEW PARADIGM--REFILL THE REFILL:

The job of providing "replacement toner" could be done just as well with a Refill-the-Refill design. An affordable, small, lightweight, saltshaker-sized, two-ounce \$3.00 Ink/Toner refill snap-on module or squeeze-dispenser bottle enabling a customer to conveniently refill an empty toner cartridge (purchased in \$18.00 six-packs instead of buying one \$50.00 traditional cartridge on six separate trip occasions). When do we "outlaw" UNAFFORDABLE, LARGE, HEAVY, PACKAGED, PALLETED and TRANSPORTED cartridges produced and sold in the usual way?

A side-by-side Energy Audit of the two approaches would indicate at least NINE BILLION DOLLARS OF WASTE and FAR MORE IN UNNECESSARY ENERGY COSTS in the ten billion dollars per year Ink/Toner Cartridge Industry. Did I read ten billion somewhere?

In closing, the Ink/Toner cartridge is only one of countless ethically-challenged manufactured products cluttering and consuming our environment. My experience, though very minor in the big scheme of things, again illustrates the range of social and environmental losses resulting from the current license manufacturers often have to legally harvest unearned profits and waste substantial energy in the process of producing these small-scale consumer products. The public suffers.

Respectfully,

Gary J. Neville

cc: Lisa Warfield,
Ed Williams



Information Technology Industry Council
Leading Policy for the Innovation Economy

Printer Toner and Ink Cartridges:

Best Practices for Conveying Yield Performance to the consumer

This paper has been prepared by the Information Technology Industry Council (ITI). ITI is the premier voice, advocate, and thought leader for the information and communications technology (ICT) industry. ITI is widely recognized as the tech industry's most effective advocacy organization in Washington D.C., and in various foreign capitals around the world. ITI's members include the leaders of printer manufacturing technologies including Epson, Hewlett Packard, Kodak, and Lexmark, among others.

Executive Summary:

The ultimate goal of any product measure is to provide information to a customer that facilitates an informed purchase decision. At first glance, comparing the volume or weight of ink or toner would seem to be a good proxy for the page yield. For a host of reasons this is often not the case. Toner and ink cartridges are complex mechanisms designed to deliver a consistent customer experience and because of this, ink or toner can be used in different amounts when printing and for purposes other than printing. All of this is highly dependent on the design of the larger printing system of which the cartridge is a critical but not independent part.

The printing industry realized the difficulty of presenting cartridge performance information to the customer and because of this voluntarily chose to develop several standards for measuring yield performance. These standards are developed specifically for these devices and use standard test patterns and methods to provide accurate and repeatable measurement. Moreover, the standards include protocols for clear and consistent communications to users regarding cartridge yields. The industry wholly believes that these test procedures provide a more reliable means of measurement and a more accurate method for consumers to determine value than comparing the volume or weight of ink or toner.

Printer Toner and Ink Cartridges:

Best Practices for Conveying Yield Performance to the consumer

Objectives of weights and measures regulations include facilitating value comparisons and providing a standard of fairness in the marketplace. When it comes to selecting printer hardware and replacement supplies, these objectives dictate that weights and measures criteria that could lead the consumer to making economically incorrect decisions regarding value should not be implemented.

Some customers are interested in making comparisons on the relative value between printing supplies, both at the initial printer purchase and afterwards when purchasing additional supplies. In addition to cost, product reliability, brand reputation and print quality another important measure considered by some customers during the supply purchase is page yield. At first glance, comparing the volume or weight of ink or toner would seem to be a good proxy for the page yield. Unfortunately this is often not the case. This paper will outline the drawbacks of using weight or volume as a proxy for page yield and highlight the reasons why all major printer manufacturers use a set of ISO/IEC standards to measure and communicate printer yield.

Depending on the printing technology, the use of ink or toner can be impacted by several factors.

The amount of toner applied in printing pages compared to the amount of toner supplied in the cartridge is dependent on many factors and that a simple measure of the weight of the toner will not give a clear indication of ultimately how many pages can be printed. In electro-photographic (laser) printers, different toner formulations will use different amounts of toner when printing the same page. This is due to charge, particle size and formulation variation between toners. These attributes are engineered and varied by each cartridge vendor to provide what they feel to be the best experience to their customers. Some customers prefer thin sharp lines and fine detail, others prefer thick bold lines. Depending on the choices that a given manufacturer makes in toner formulation (base polymer, particle size, charge distribution and charge control agents), the amount of toner used to print the same page may vary. Additionally, the amount of toner cleaned and deposited in the waste hopper depends on several variables including the job size, coverage environment and printer design. Finally, the bulk densities of toners are not the same; for a given volume of toner, there can be significant differences in weights. All of these factors result in the reality that two different toner supplies of the same weight will not necessarily deliver the same number of pages.

Similar to laser printers, inkjet printer cartridge vendors manipulate several variables in their ink formulation to meet the needs they identify as important for their customers. Some of the variables that manufacturers consider and apply include: different ink formulations; dye vs. pigment inks, actual loads of pigment or dye in the ink formulation, and drop size. Different combinations of these ink content characteristics will result in substantially different ink consumption rates while printing the

same page. In addition, all inkjet systems perform routine servicing, and those servicing routines may be driven by a number of factors such as the ink formulation, usage and content. In addition, changes to non-ink materials by the inkjet cartridge manufacturers or during remanufacture can affect the amount of ink that can be used in printing pages. Finally, for the same volume of ink, two different systems or the same model cartridge from two different vendors can print a different number of pages.

Ultimately what matters to many customers is answering the question, “How much can I print with a cartridge in a given printer?” Page yield reported using the ISO/IEC methodology better addresses this question than weight or volume. ISO/IEC JTC1 SC28 identified this as a consumer need in 2000 and started working on a family of standards that address this customer need. Standards now published measure yield for monochrome laser printers (ISO/IEC 19752), color laser and color inkjet printers (ISO/IEC 19798 & ISO/IEC 24711) using a common test suite (ISO/IEC 24712). Currently under development are standards to measure photo yield consisting of a methodology for inkjet printers (ISO/IEC 29102) and a photo test suite for any printing technology (ISO/IEC 29103). These standards are based on common design philosophies and change their methods slightly, depending on the technology being measured. The following attributes are endemic to each standard:

1. Use of a well defined consumer type document for printing – Coverage can vary depending on how it is measured and depending on what choices are made in defining coverage; the same “coverage” page can perform differently. For the ISO/IEC standards, the test pages were defined so that a consumer can more easily relate them to their work stream. These pages are freely available so customers can view and understand what the standard is based on. These test pages can be found at www.iso.org/jtc1/sc28.
2. Testing of multiple printers and cartridges to account for printer and supply variation – There is manufacturing variation not only with how much ink or toner is put in a supply, but how effectively a printing system uses that ink or toner. This usage is also impacted by the specific printer used during test; some printers of the same model will use more or less ink or toner. For this reason, the ISO/IEC standards require a minimum of three cartridges to be used on a minimum of three printers (minimum of 9 cartridges tested). The yield information from these 9 cartridges is reported using a lower 90% confidence bound (LCB) on the mean. This gives a reliable estimate of lowest predicted average yield with 95% statistical confidence. The LCB not only takes into account the average performance of the cartridges tested, but also the breadth of variation in the cartridges and printers tested. The goal is to try and characterize the end user experience taking into account some of the normal variations in printers and supplies.
3. A well controlled printing environment – The environment that a printing system operates in can have an impact on the number of pages printed for a given amount of ink or toner. For laser systems both temperature and humidity can impact the amount of toner used. For this reason both the temperature and humidity are controlled for toner yield testing. For inkjet,

temperature is the main environmental driver for ink usage, so only temperature is controlled during testing.

4. A well defined end of life criteria – For the purposes of the ISO standards, end of life is defined in one of two ways. First, when the printer stops printing and reports that the supply should be changed. The other method requires a visual assessment of elements on the test targets. This visual assessment is defined as a visually significant fade in the target elements greater than 3mm as compared to the 100th print for that cartridge. These two methods are meant to represent the two common criteria that users would choose to determine if a supply has to be changed.

When the publication of the first yield standard occurred in the summer of 2004 it was accepted by industry and consumer's groups as the best method for conveying one attribute of cartridge performance that was of interest to customers. Building on this acceptance, ISO/IEC JTC1 SC28 created additional standards for yield; these have been met with similar market acceptance as the original.

Because well established methods for the measure of cartridge yield exist and weight and volume are not as useful or meaningful in making value comparisons, this group recommends that cartridge performance information be conveyed to customers using the developed ISO/IEC yield standards.

Footnotes to press releases and reception of ISO yield standards:

<http://www.pcmag.com/article2/0,2817,2183959,00.asp>

<http://www.hp.com/hpinfo/newsroom/press/2004/040617b.html>

<http://www.incits.org/press/2007/pr200701.pdf>

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