

Genuine Lexmark C782 Brand Laser Cartridges vs. Three Brands of Remanufactured Cartridges

APRIL 2012

Buyers Laboratory LLC (BLI) was commissioned by Lexmark International Inc. to conduct an independent comparative lab evaluation of the performance of new Lexmark brand extra-high-yield print cartridges against that of remanufactured brand cartridges in the Lexmark C782 color laser printer. Test cartridges for the following three representative remanufactured brands were obtained on the open market: NewproNet, TonerBoss and Sun Data Supply.

The test was designed to objectively compare the performance of genuine Lexmark cartridges to that of the remanufactured brands, and their claim of having equal performance to that of new Lexmark cartridges. All testing was conducted between October 2011 and March 2012 in BLI's 10,000-square-foot test lab located in Hackensack, NJ (USA; www.buyerslab.com).

Approximately 467,000 pages were printed during the test. Nine cartridges of each color from each brand were evaluated across three printers, so that three cartridges per color were tested in each printer. The cartridges were run to end of life utilizing the five-page ISO 24712 color test file intended to be representative of typical customer usage (see Exhibit A below), during which time page yield, image quality and reliability performance were evaluated. Following the completion of testing for each brand, the printers were cleaned and serviced with new transfer belts, rollers and fusers. Waste toner containers were changed when prompted.

PERFORMANCE SUMMARY

Throughout BLI's test, the Lexmark OEM cartridges provided performance that was consistently superior overall in each of the three test categories (page yield, image quality and reliability) to that of the remanufactured brand cartridges tested.

In fact, while the only problem encountered with the original Lexmark cartridges was with one magenta cartridge expiring prematurely, the test results for the 108 remanufactured cartridges revealed a number of significant problems in all three performance categories as follows:

- **Reliability:** 60 (56%) of the 108 remanufactured cartridges overall experienced reliability failures (30% black, 85% cyan, 63% magenta, 44% yellow), with 13 failing out of box (0% black, 15% cyan, 22% magenta, 11%

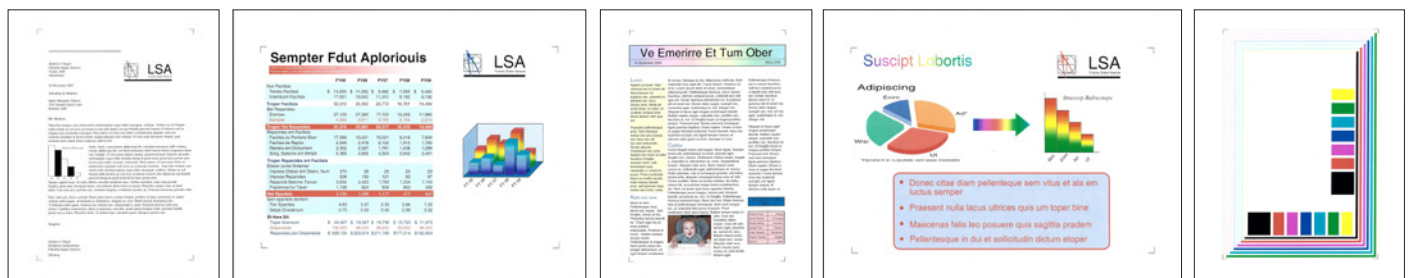


Exhibit A: ISO 24712 Test Suite

yellow) and 47 expiring prematurely for a variety of reasons, including 100% magenta toner coverage on pages, toner dumping, early image fade, cartridges not being identified by printers, excessive extraneous images on pages and physical damage. In addition, one printer was damaged beyond repair due to excessive toner dumping by a remanufactured cartridge.

- **Page yield:** The overall average third-party cartridge page yield achieved was only 62% of that achieved by the Lexmark cartridges.

- **Image quality:** All but one third-party image quality sample had at least one gross printing defect such as oversaturation of colors, poor color fidelity, poor registration, toner flaking off pages, recurrent extraneous background or toner streaking, and in many cases, more than one issue. In fact, it is BLI’s opinion that the severe color defects on pages produced with the remanufactured cartridges render the pages virtually useless. In contrast, the Lexmark cartridges gave a strong and consistent image quality performance, with only the one magenta cartridge that prematurely expired exhibiting a print defect (streaking on pages).

In commenting on the overall performance of the Lexmark cartridges, Anthony Polifrone, BLI’s Managing Director, noted: *“Throughout BLI’s test, the Lexmark brand C782 cartridges clearly outperformed the remanufactured brands overall. In fact, in addition to providing average page yields that well exceeded those of the remanufactured cartridges, the original Lexmark cartridges displayed consistently superior image quality and a virtually flawless reliability performance, whereas the remanufactured cartridges had serious print defects in virtually all print samples and an overall failure rate of 56 percent.”*

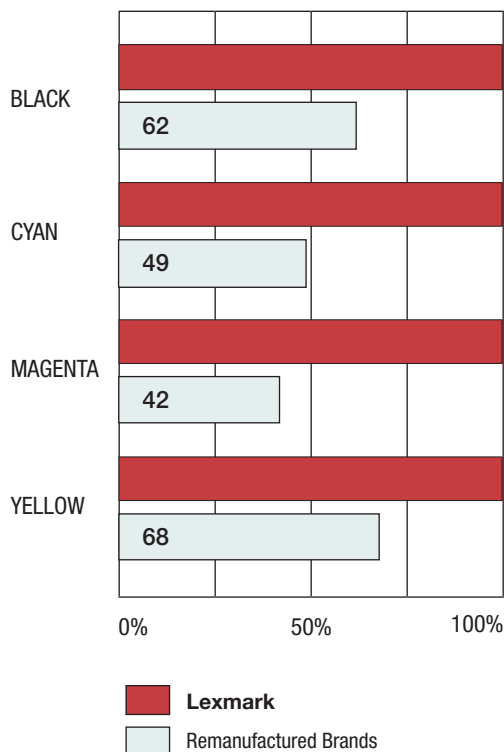
OVERALL PERFORMANCE

Average Page Yield Performance

With regard to page yields, 97 (or 90%) of the 108 remanufactured brand cartridges achieved average yields that fell well short of the 15,000-page claimed yields, as did the overall average achieved for each color, as follows: 11,242 pages for black, 7,315 pages for cyan, 6,817 pages for magenta, and 10,456 pages for yellow. In contrast, the average page yields for each of the Lexmark cartridge types surpassed the 15,000-page target yield, with 18,167 pages for black, 15,027 for cyan, 16,099 for magenta and 15,484 for yellow—and well surpassed the remanufactured cartridges by 6,925 pages for black, 7,712 pages for cyan, 9,282 pages for magenta and 5,028 pages for yellow.

The overall average page yield per color for the remanufactured cartridges was only 62% of Lexmark’s yield for black, 49% for cyan, 42% for magenta and 68% for yellow.

GRAPH 1: Page Yield Performance



Reliability

As previously noted, the only failure experienced with the Lexmark cartridges was with one magenta cartridge expiring prematurely. However, of the 108 remanufactured cartridges tested, 60 failed (47 premature expires, 13 out-of-box failures), resulting in a collective failure rate of 56%. In fact, the Brand B black cartridges were the only remanufactured brand to not have at least one reliability failure, although four Brand B color cartridges expired prematurely and eight failed out of box.

Cartridge Failures

	Out-of-Box Failure	Premature Expire	TOTAL
Lexmark	0	1	1 (3%)
Brand A	2	18	20 (56%)
Brand B	8	4	12 (33%)
Brand C	3	25	28 (78%)
TOTAL REMAN FAILURES	13	47	60 (56%)

The reliability failures were classified as:

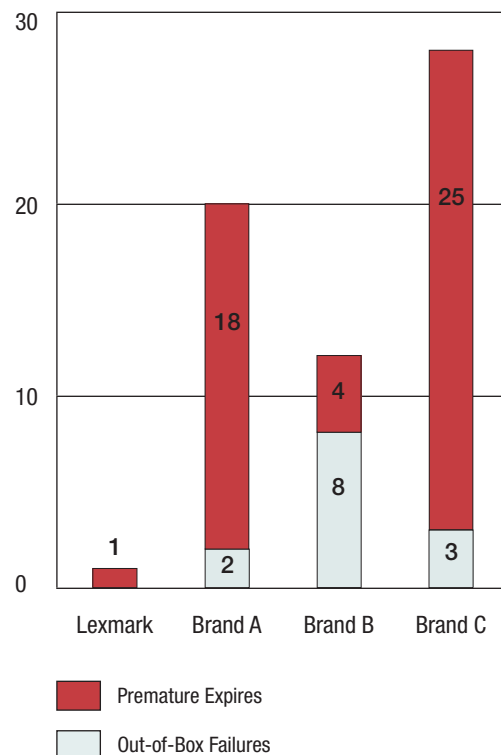
- Out-of-Box Failures – a cartridge that was inoperable upon installation or produced 20 or fewer acceptable pages
- Premature Expires – a cartridge that produced below 75% of the average expected comparative page yield
- Image Quality Failures – a cartridge that developed unacceptable image quality during life

Out-of-Box Failures

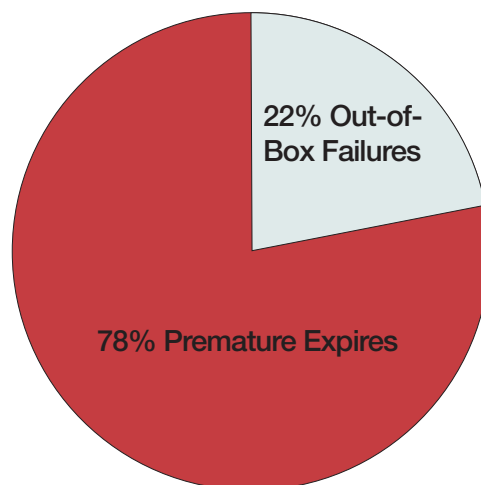
Of the 60 remanufactured brand cartridge failures, 13 were deemed out-of-box failures for the following reasons:

- Blue dots on the side of pages (1)
- Red dots on side of pages (1)
- Physical cartridge damage (3)
- Non-recognition of cartridge by printer (1)
- Excessive toner coverage (5)
- Excessive toner dumping out of box (1)
- Red lines on the side of pages (1)

GRAPH 2: Failures per Brand



GRAPH 3: Total Reliability Failures of Remanufactured Brands



The following exhibits are representative of the types of failures encountered with the remanufactured cartridges that resulted in them being classified as out-of-box failures.

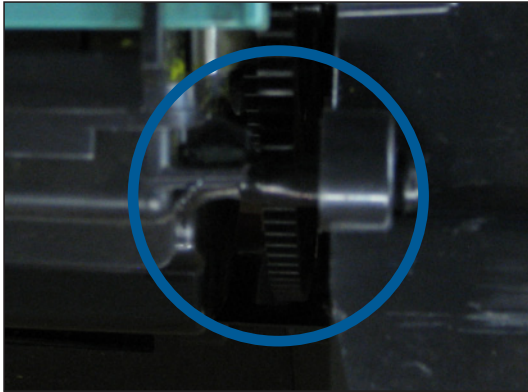


EXHIBIT B: Physical damage to a remanufactured cartridge - broken developer housing post

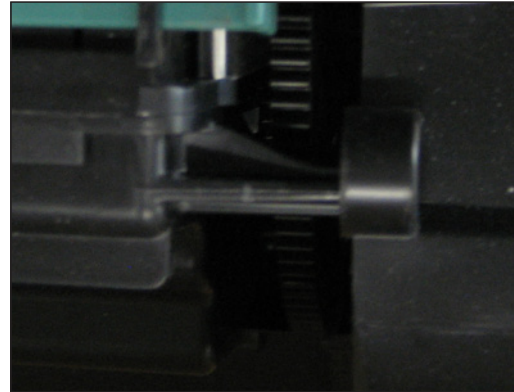


EXHIBIT C: Undamaged cartridge

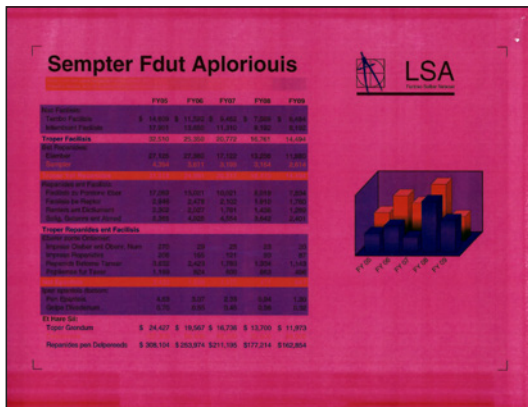


EXHIBIT D: Excessive Toner Coverage



EXHIBIT E: Excessive Toner Dumping

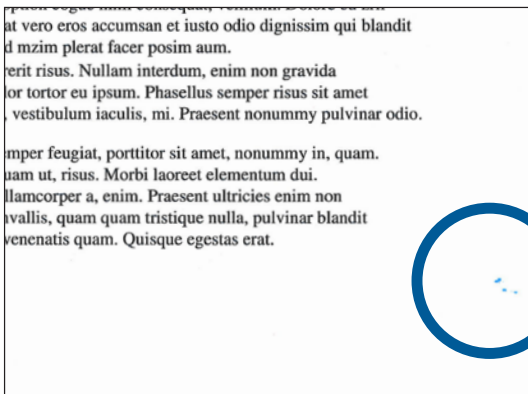


EXHIBIT F: Extraneous Background Patterns (blue dots)

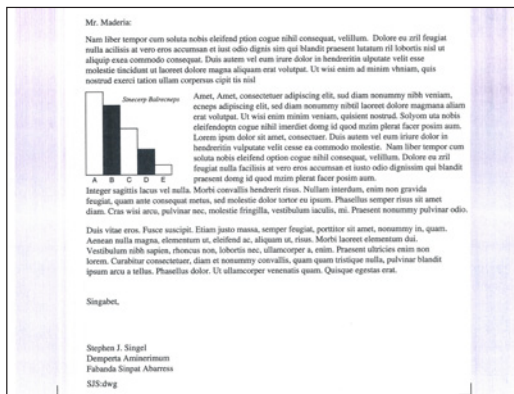


EXHIBIT G: Toner Streaking on Right and Left Sides

Premature Expires

Of the 47 remanufactured cartridges that expired prematurely, 25 expires were due to early fading of images, six were due to physical damage (defective cartridge), and 16 were because of severe image quality defects that rendered output clearly unacceptable. In several instances toner flaking caused printer jamming, while toner streaking had the most occurrences, at nine. Other defects included splotches or red or blue marks on pages.

The following exhibits are representative of the types of problems encountered with the remanufactured cartridges that resulted in them being classified as premature expires.

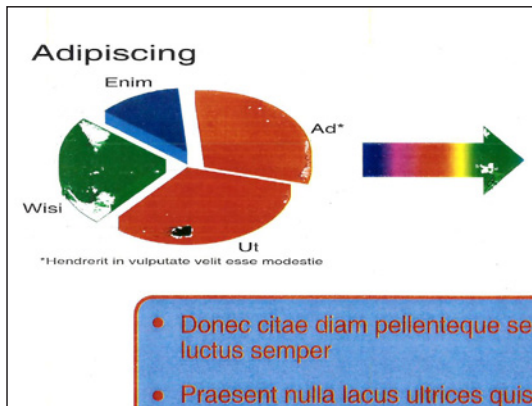


EXHIBIT H: Toner Flaking

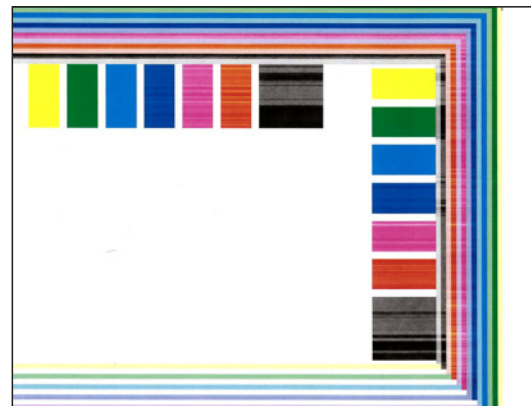


EXHIBIT I: Toner Streaking

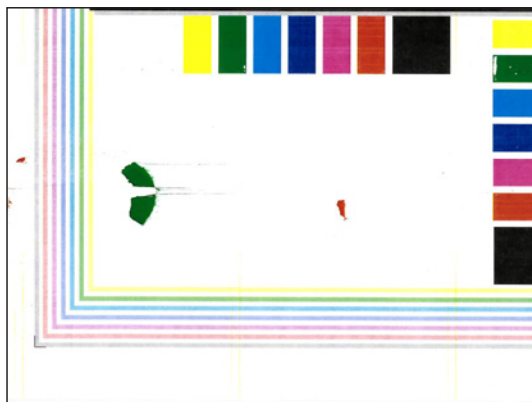


EXHIBIT J: Toner Splotching

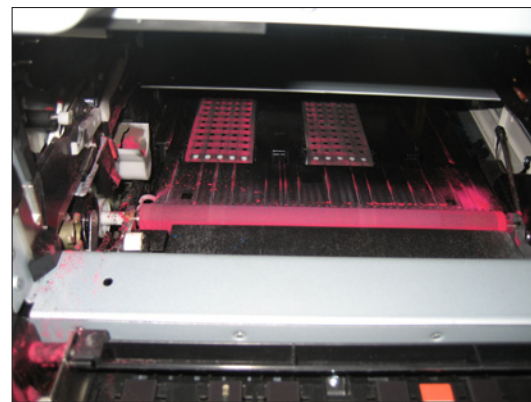


EXHIBIT K: Toner under Removed ITU

Also noteworthy is that following test completion of the Brand B cartridges, which were the first remanufactured brand to be tested, one of the three printers had to be replaced because of toner dumping that was so severe that the printer could not be cleaned and restored to operating condition, as noted in Exhibit K above.

Print Quality

In addition to evaluating functional performance, print samples for each test cartridge were evaluated for consistency and quality throughout life. Images were evaluated for six criteria (text, line art, solids, color business graphics, color photographic images and density), as well as visually for acceptability for customer use. Evaluation samples were taken at the start of testing, at approximate midpoint, and just prior to image fade/cartridge end of life. Each sample was evaluated for clarity and definition of text and line art, crispness of characters, production of solids, quality of color business graphics and color photographic images, as well as for image quality defects such as oversaturation of color output; improper color production (poor fidelity); toner flaking, streaking, scattering or overspray; background in white areas; banding in solids; jittering; and halo effect.

Though Brands B and C provided print quality samples with black images (text, line art and solids) that were on par with the Lexmark cartridges, the Brand A samples were clearly below that of the Lexmark cartridges in all performance areas. However, in terms of color image quality, the Lexmark cartridges proved to be far superior to the remanufactured brands. In fact, all remanufactured cartridges were judged to be poor overall for color print quality, with the print evaluation samples for each brand containing severe color defects, such as oversaturation of colors and poor color fidelity. Moreover, poor toner adhesion (with toner flaking off pages) was observed with the Brand B remanufactured cartridges, while severe image registration problems were observed with Brands A and C. In addition, excessive banding and graininess were observed with all three remanufactured cartridge brands.

Oversaturation of colors—particularly in the red and magenta regions—were the most severe and prevalent print quality defects with the remanufactured cartridges, which was evident in the majority of the print samples evaluated from all brands. Poor registration was another issue, shared by Brands A and C, while toner streaking was noticed with Brands B and C, and a “moving spot on the page” (signaling damage to the drum) was experienced with Brands A and B. Other problems included toner overspray, speckling and extraneous background patterns. All these defects contributed to the underwhelming image quality provided by the three remanufactured brands.

The following exhibits are representative of the types of image quality defects encountered with the remanufactured cartridges:

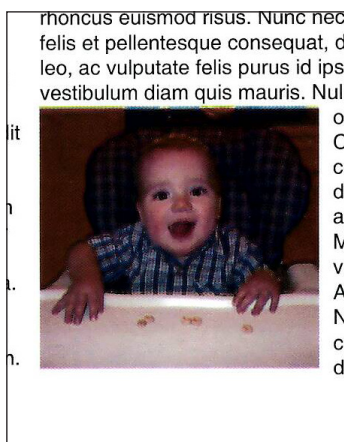


EXHIBIT L: Oversaturation

Sempter Fdud Aploric				
	FY05	FY06	FY07	FY08
Nuc Facilis:				
Tembo Facilis	\$ 14,609	\$ 11,592	\$ 9,462	\$ 7,500
Intemboint Facilis	17,901	13,650	11,310	9,100
Troper Facilis	32,510	25,350	20,772	16,700
Bet Reparides:				
Elamber	27,125	27,380	17,122	13,200
Sempter	4,394	3,611	3,195	3,100
Troper Yet Reonides	31,515	24,991	20,317	16,700
Reparides ent Facilis:				
Facilis zu Pontone Eber	17,069	13,021	10,021	8,000
Facilis be Reptor	2,946	2,478	2,102	1,900
Renters ent Dictiument	2,302	2,027	1,761	1,400
Solig, Getenre ent Almed	5,385	4,925	4,554	3,800

EXHIBIT M: Poor Registration

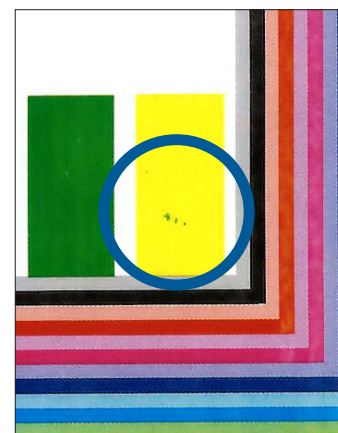


EXHIBIT N: Extraneous Background Patterns (blue dots)

SUMMARY

This extensive test, which included approximately 467,000 pages printed, demonstrates the superiority of the page yield, reliability and print quality performance of genuine Lexmark extra-high-yield C782 cartridges over the remanufactured brands tested. It also provides independent test verification that overall the remanufactured brands fall short of their claim of providing equal to new Lexmark performance. These results are consistent with an earlier BLI comparative test of Lexmark genuine cartridges vs. remanufactured brands. In commenting on the results, Anthony Polifrone noted: *“In today’s challenging business environment, consumers need to be extra diligent in getting the best overall value and performance for every dollar they spend on printing. We believe this test demonstrates that, in this case, Lexmark cartridges may be the best way to achieve that goal.”*

LAB TEST DATA

Data Table 1: Overall Tested Page Yields—Black

Brands	Number of Cartridges Tested	Yield Claim (Pages)	Mean
Lexmark New	9	15,000	18,167
Brand A	9	Equals OEM	14,093
Brand B	9	Equals OEM	15,102
Brand C	9	Equals OEM	4,531
Remanufactured Brands	27		11,242

Lexmark’s claimed yield is based on testing using the ISO 24712 document.

Data Table 2: Overall Tested Page Yields—Cyan

Brands	Number of Cartridges Tested	Yield Claim (Pages)	Mean
Lexmark New	9	15,000	15,027
Brand A	9	Equals OEM	6,903
Brand B	9	Equals OEM	8,348
Brand C	9	Equals OEM	6,694
Remanufactured Brands	27		7,315

Lexmark’s claimed yield is based on testing using the ISO 24712 document.

Data Table 3: Overall Tested Page Yields—Magenta

Brands	Number of Cartridges Tested	Yield Claim (Pages)	Mean
Lexmark New	9	15,000	16,099
Brand A	9	Equals OEM	6,186
Brand B	9	Equals OEM	9,073
Brand C	9	Equals OEM	5,191
Remanufactured Brands	27		6,817

Lexmark’s claimed yield is based on testing using the ISO 24712 document.

Data Table 4: Overall Tested Page Yields—Yellow

Brands	Number of Cartridges Tested	Yield Claim (Pages)	Mean
Lexmark New	9	15,000	15,484
Brand A	9	Equals OEM	12,128
Brand B	9	Equals OEM	8,643
Brand C	9	Equals OEM	10,597
Remanufactured Brands	27		10,456

Lexmark’s claimed yield is based on testing using the ISO 24712 document.

Data Table 5: Cartridge Reliability Failures

Brands	Number of Cartridges Tested	Out-of-Box Failure	Premature Expiration	Total Failures
Lexmark New	36	0	1	1
Black	9	0	0	0
Cyan	9	0	0	0
Magenta	9	0	1	1
Yellow	9	0	0	0
Remanufactured Brands	108	13	47*	60
Black	27	0	8	8
Cyan	27	4	19	23
Magenta	27	6	11	17
Yellow	27	3	9	12

* Of the premature expires, 25 were due to early fading of images, 16 due to image quality failures, and six because of physical damage or a defect that prevented the device from recognizing the cartridge.

TEST METHODOLOGY

Test Conditions

BLI performed all testing in its 10,000-square-foot U.S. lab located in Hackensack, NJ. All tests were conducted under controlled conditions of temperature and humidity, with conditions monitored 24/7 by an Ex-tech RH S20 Digital RH/Temperature Recorder and Honeywell Model 61 Seven-Day Temperature/Humidity Chart Recorder. Running average temperature was 68°F to 78°F, and running average humidity range was 35% to 65%. All test devices and materials were conditioned for a minimum of eight hours prior to testing. Nine of each cartridge brand was tested over three printers, and printers were replaced whenever an individual unit showed signs of diminished performance. The printers were rebuilt after running all cartridges from one brand; this involved vacuuming the inside of the printer and changing the fuser, transfer belt and rollers. Toner waste containers were changed when prompted. The printers were all run in default (normal) mode.

Though the remanufactured brands are referred to as Brands A through C in this report, it should not be assumed that the order in which the remanufactured brands are identified on page 1 of this report directly corresponds to A through C throughout this report.

Page Yield

To evaluate page yield, BLI used the five-page ISO 24712 color test target. A cartridge was considered to be at the end of its life when a fade occurred following two cartridge shake procedures. The cartridges were shaken either at the appearance of a “Toner Low” message from the printer or if a fade occurred before the cartridge had been shaken twice. Premature image quality deterioration also denoted the end of cartridge life.

The total page count per cartridge was defined as the number of acceptable pages printed (that is, pages without image quality defects such as excessive streaking, textual imperfections or fading). The overall average page yield per color per brand was defined as the combined total number of acceptable pages printed by all of the cartridges, divided by nine. The average pages per gram of toner was defined as the page count divided by the grams of toner consumed, which was determined by weighing the cartridge before and after the test.

Print Quality

In assessing image quality, BLI’s lab test technicians assigned a rating of poor, fair, good, very good or excellent to each performance category. Averages of the individual cartridge grades were calculated in order to assign a value and overall grade to each brand of cartridge. Visual assessments were made in a Graphiclite D5000 Standard Viewer and with an Edmund Scientific PL-B776U PixeLINK Camera. Black density was measured with an X-Rite 508 Series Spectrodensitometer, and color density was measured with an X-Rite i-One/iO Color Spectrophotometer.

Print quality was evaluated based on the following criteria: text, line art, halftone range, halftone coverage, solids, color business graphics, color photographic images, and density, with test samples taken at the start of testing, approximate midpoint and just prior to fade/end of life. Based on the test target, each criterion was rated according to a cartridge’s performance in the following related sub-categories: boldness, sharpness, fullness of formation, and smoothness for Text; line consistency and formation of circles for Line Art; visible darkness/boldness and consistency of coverage for Solids; sharpness of fine detail, as well as banding, for Color Business Graphics; and smoothness of output for Color Photographic Images. Two density

measurements were taken for each print quality sample, one each on the right- and left-side of the page. Each sub-category was rated as being poor, fair, good, very good or excellent. The scores were totaled across each category and averaged to obtain a grade for each cartridge brand for the first four criteria; density was graded according to an improvised scale, again on a four-point scale. All criteria were then averaged and constitute the overall grade for each brand.

Reliability

Throughout testing, any cartridge malfunctions observed, such as operational/mechanical failure, physical defects, toner leakage and image quality failures, were recorded. Out-of-box failures: A cartridge that was inoperable upon installation, or produced 20 or fewer acceptable pages, was considered to be an “out-of-box” failure. Image quality failures: A cartridge that developed unacceptable image quality during life. Premature expire: Cartridges that produced below 75% of the average stated page yield were considered to be premature expires.

ABOUT BUYERS LABORATORY

Since 1961, Buyers Laboratory LLC (BLI) has been the leading global independent office-equipment test lab and business consumer advocate. In addition to publishing the industry’s most comprehensive and accurate test reports on office document imaging devices, each representing months of exhaustive hands-on testing in BLI’s US and UK laboratories, the company has been the leading source for extensive runnability testing on imaging media and consumables, as well as extensive specifications/pricing databases on MFPs, printers, scanners and fax machines. BLI also has a long-standing reputation for being the industry’s most trustworthy and complete source for quality testing services and global competitive intelligence.

In addition to testing over 200 office machines and related consumables annually for its subscribers, BLI provides consulting services to buyers and a range of private testing services that include document imaging device beta and pre-launch testing, performance certification testing, consumables testing (including toner, ink and photoconductors), solutions evaluations, and imaging media runnability testing.

For more information on BLI, call (201) 488-0404, visit www.buyerslab.com, or e-mail info@buyerslab.com.