TEST REPORT

spencerLAB DIGITAL COLOR LABORATORY

Competitive Ink Comparison Study – North America

Original HP Ink vs. Remanufactured Ink Cartridges

The *spencerLAB* DIGITAL COLOR LABORATORY has conducted cartridge reliability comparison testing of original HP Inc. [HP] inkjet cartridges and twelve (12) of the top-rated Amazon US non-HP brands of Remanufactured ink cartridges in North America (NA). The study included testing of HP #64XL, #67XL, #910XL, and #962XL cartridge SKUs. All cartridges were sourced in North America.

The non-HP brands included Remanufactured cartridges from: Acaves, Ankink, AXESET, EaseFusion, GREENSKY, LEMERO, Linkmay, Pitooler, SAILNER, Thcbme, TOKYOINK, and ValueToner. Nine (9) cartridges for each brand and SKU were allocated for testing to obtain representative results. A total of 540 cartridges were tested on 13 printers, entailing over 400 testing hours, in which more than 360,000 pages were printed across all tested brands.

The analysis compared the Page Yield, Reliability, and Wasted Pages throughout the life of the ink cartridge models tested for each brand. Cartridge Reliability factors, such as Dead-on-Arrival (DOA) and Premature Failure (PF) [see definitions in Appendix 2], were evaluated to determine the total number of Problem Cartridges. Print Quality issues were also considered.

Key Findings

- Original HP ink cartridges tested yielded 121% more pages on average, or greater than 2.2 times more pages, than non-HP tested cartridges.*
- Original HP ink cartridges tested showed no Problem Cartridges, whereas 60% of non-HP ink cartridges were deemed Problem Cartridges tested, including, on average, 41% Dead-on-Arrival and 19% Premature Failure.
- Tested Non-HP ink cartridges produced 15 times more Wasted Pages on average than the original HP ink cartridges.
- Original HP ink cartridges tested met and exceeded their expected page output based on stated yield, while tested non-HP achieved only 47% of their expected yield.
- During testing, use of non-HP ink cartridges resulted in a printer failure that rendered the device inoperable, while original HP ink cartridges did not cause any damage.

Page Yield Comparison		
Cartridge Brand	Number of Cartridges Tested	Average Percentage More Pages* Printed by HP Cartridges
HP	108	121%
Non-HP	432	

Test Results

Page Yield

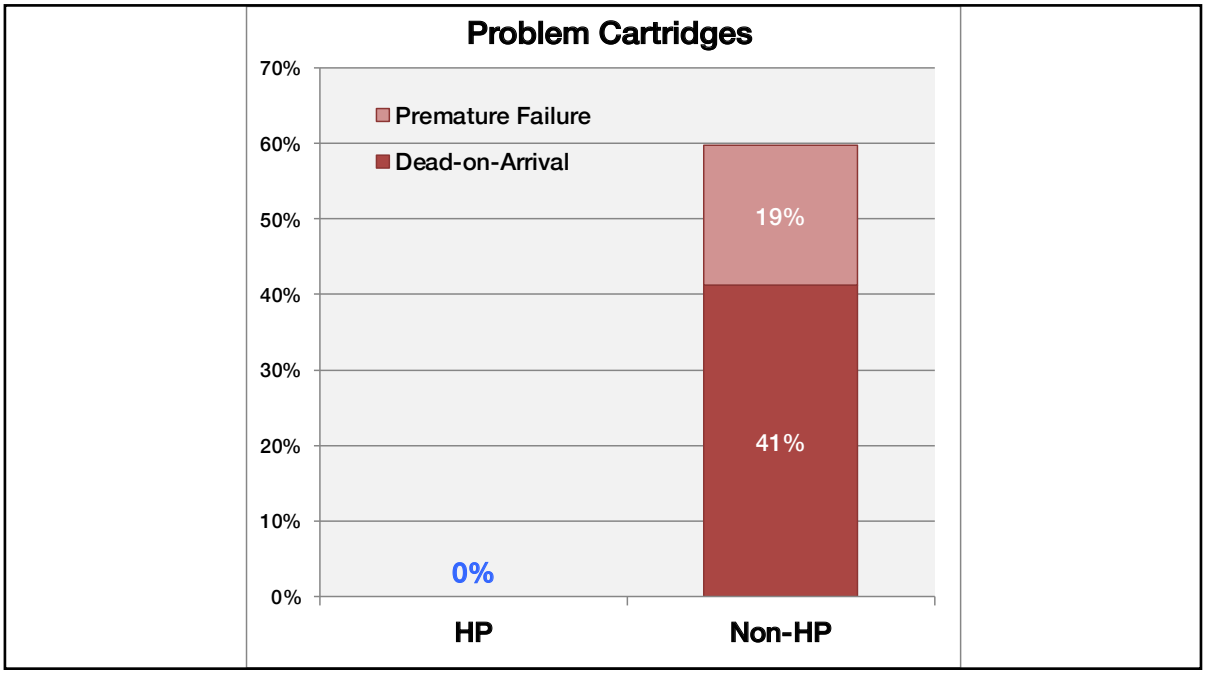
Testing concluded that the Original HP cartridges produced an average of 121% more pages* (total pages printed less wasted pages) than the non-HP cartridges tested. The tested non-HP ink printed (on average) 45% fewer pages than Original HP ink cartridges tested.

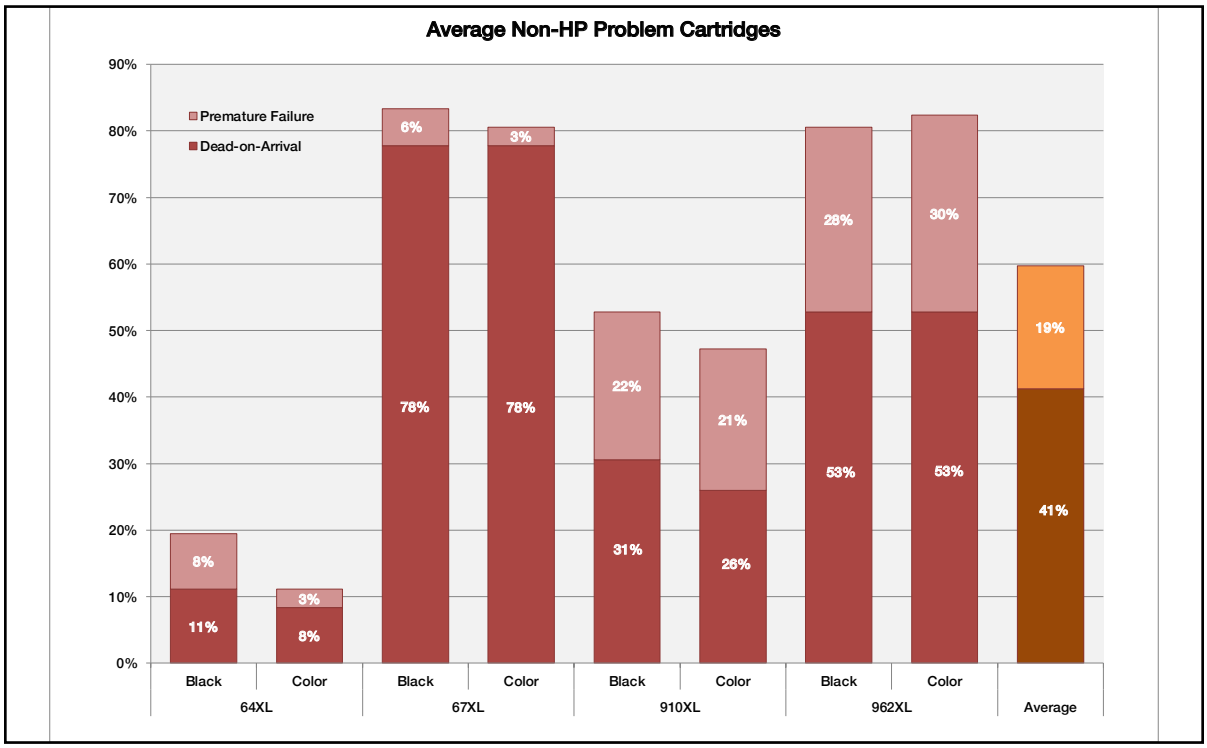
A total of 108 original HP cartridges and 432 non-HP cartridges were tested. Black and Color cartridge yields were combined to determine an overall average. The yields of individual CMY color cartridges (Cyan, Magenta, and Yellow) were averaged to calculate an average Color yield for 910XL and 962XL SKUs.

Cartridge Reliability

Original HP ink cartridges tested as more reliable than the non-HP tested brands; none of the original HP cartridges were deemed as Problem Cartridges (DOA or PF). All HP cartridges completed the tests without any cartridge or printer failures.

While there were no DOA or PF cartridges for original HP supplies, 3 out of 5 of the non-HP Black and Color cartridges tested experienced either DOA or PF. The non-HP tested cartridges exhibited Reliability issues during and after installation.

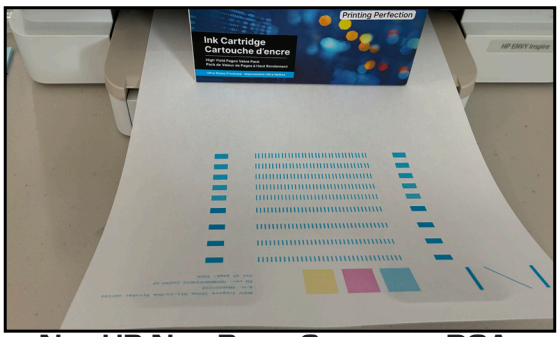




Of the 432 non-HP cartridges tested, 60% were deemed Problem Cartridges and were either Dead-on-Arrival (DOA), or Premature Failure (PF), both of which determined an early End-of-Life.

Nineteen percent (19%) of the tested non-HP cartridges expired prematurely (PF), and forty-one percent (41%) were DOA. Common causes of DOA included poor Print Quality with defects such as streaking, color not printing, and incompatible cartridges not being recognized upon installation.

Premature Failure included low yield cartridges (provided less than 75% of HP stated yield for that cartridge SKU), or displayed poor print quality (such as streaking, banding, and missing color). Many non-HP brands claim higher page yields than Original HP ink cartridges, yet testing indicated they did not meet their advertised yield claims [see Appendix 5].



Non-HP New Black Cartridge - DOA Not Recognized by Printer/Would not Print

Non-HP Cartridge Ink Mist Residue

The chart on page 3 shows the DOA and PF cartridge breakdown for each color and SKU tested. The individual color cartridge (Cyan, Magenta, and Yellow) percentages were averaged for 910XL, and 962XL SKUs.

Wasted Pages

The non-HP cartridges produced 1,690 Wasted Pages (0.85% of total non-HP pages), whereas original HP ink cartridges produced only 64 Wasted Pages (0.05% of total HP pages). Overall the non-HP cartridges produced over 14.7 times more Wasted Pages than HP cartridges. On average, original HP inks produced 15.6 times fewer Wasted Pages than non-HP inks tested.

Wasted Pages are defined as pages that exhibit noticeably poor print quality, including defects such as streaking, ink smearing, and blurred characters. Pages used for alignment due to user intervention, as well as cleaning pages required to recover from poor print quality, are also classified as Wasted Pages.

Wasted pages represent more than the direct loss of paper and ink. Each incident also incurs a measurable productivity cost. Identifying a print quality issue, reviewing troubleshooting guidance, and attempting corrective actions can take several minutes and often involves multiple test prints.

If initial efforts fail, users may contact technical support, extending the disruption through phone calls, chats, or email exchanges - sometimes for tens of minutes. These interruptions pull users away from their primary tasks.

Beyond troubleshooting, additional time is lost as users must refocus on their original work, recreate or retrieve content, and reprint documents. Even a single wasted page event can consume significant time, and when repeated, these losses accumulate into hours of reduced productivity. As a result, Wasted Pages impose costs that extend well beyond consumables - affecting overall efficiency and workflow continuity.

Printhead and Printer Damage

No printhead damage was observed during testing with Original HP ink cartridges. However, use of non-HP ink cartridges led to a printhead failure that necessitated replacement of the printer.

Ink-related printhead or printer failures introduce significant operational and financial consequences beyond routine consumable usage. Such failures can render the device partially or fully inoperable, necessitating diagnostic

Wasted Pages Comparison

Cartridge Brand	Total Pages Printed	Wasted Pages	% Wasted Pages
HP	117,935	64	0.05%
Non-HP	198,652	1,690	0.85%

evaluation, service intervention, and, in some cases, component or system replacement. Printhead replacement may require specialized procedures, calibration, and post-replacement verification, while printer replacement involves procurement, installation, configuration, and validation before normal operation can resume.

During these events, device availability is reduced or eliminated, resulting in workflow interruption and deferred output

Administrative overhead, including coordination with vendors, warranty evaluation, asset tracking, and disposal or return logistics, further contributes to the total impact. When a failure escalates to full printer replacement, these indirect costs often exceed the cost of the hardware itself.

Collectively, ink-induced hardware failures increase total cost of ownership through unplanned downtime, service labor, and asset replacement, representing a material operational risk distinct from routine consumable waste.

Cartridge Damage

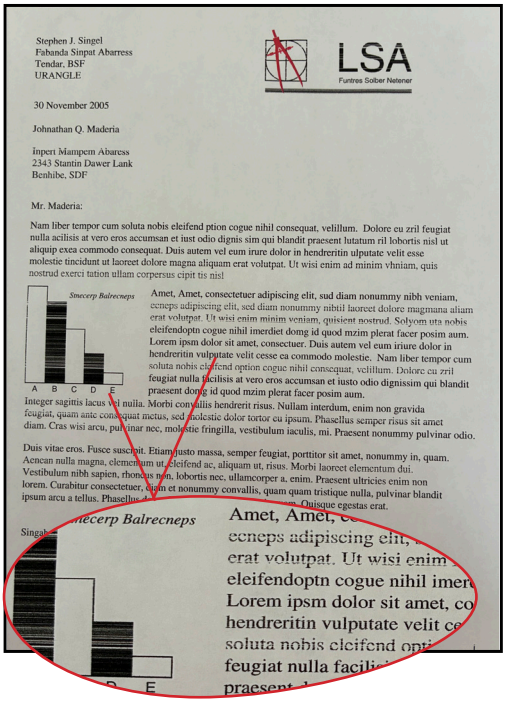
Some non-HP cartridges were not recognized by the printer and were unable to function. Conversely, Original HP ink cartridges demonstrated 100% recognition and operational reliability across all tested printers.

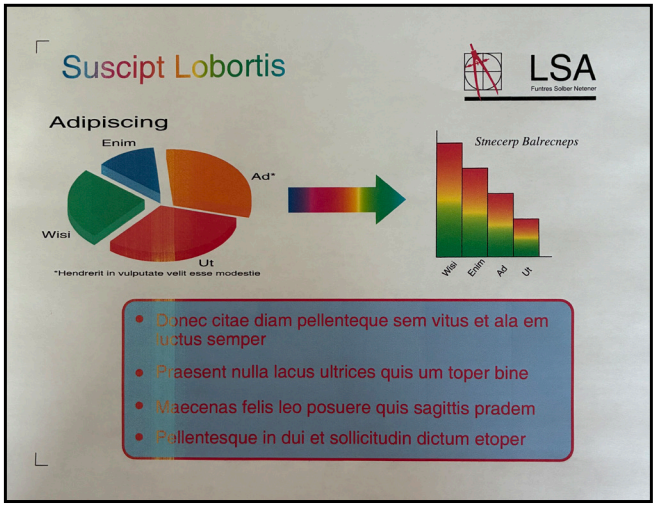
When an ink cartridge is not recognized by the printer, the device is unable to operate as intended, resulting in immediate loss of functionality. This condition triggers unplanned downtime while the user attempts corrective actions such as reseating or replacing the cartridge, restarting the device, and consulting manufacturer documentation. If the issue persists, additional time is spent engaging technical support and sourcing a replacement cartridge.

From a cost perspective, non-recognition events can render cartridges unusable, resulting in direct consumable loss. In environments where replacement cartridges are not immediately available, printing delays may require workarounds such as rerouting jobs to alternate devices, increasing load on other printers and potentially raising operating costs.

Operationally, repeated cartridge recognition failures reduce system availability and reliability, disrupt workflow continuity, and introduce uncertainty into printing operations. Collectively, cartridge non-recognition increases total cost of ownership through lost productivity, consumable waste, support labor, and reduced device utilization.

Non-HP Brands - Poor Print Quality





NOTE: IMAGES MAY NOT BE ACCURATELY REPRODUCED WHEN PRINTED FROM THIS REPORT

The *spencerLAB* Digital Color Laboratory

With over 37 years of industry experience, Spencer & Associates Publishing, Ltd. has established a premier reputation for expertise in digital color imaging and printing evaluation. Its independent test division, the *spencerLAB* DIGITAL COLOR LABORATORY, is internationally recognized as a leader in unbiased, third-party research and comparative analysis of digital imaging and printing system performance. The laboratory maintains strict adherence to methodological integrity, even in commissioned studies.

SpencerLAB leads in both quantitative and qualitative benchmarking, evaluating key performance metrics across all classes of digital printing systems—from desktop printers to high-end digital color presses. Its services include research and evaluation, compliance certifications, benchmark test software and hardware, and focus group management.

Major vendors and organizations that rely on printing as a mission-critical function turn to *spencerLAB* for strategic support and benchmarking of Print Quality, Ink/Toner Yield and Cost-per-Print, Throughput, Availability, Reliability, and Usability across ink-, toner-, and other printing technologies. Corporate users also depend on *spencerLAB* for guidance in print system acquisition and optimization of printing operations.

For more information, please visit www.spencerlab.com.

January 2026

*SpencerLab 2026 study of printer inks sold in North America commissioned by HP for on-average performance of 12 brands of non-HP remanufactured cartridges vs. Original HP ink SKUs 64XL, 67XL, 910XL, 962XL. To account for reliability-driven supplies issues, defective and failed cartridges were included in the page yield calculations. Consequently, the reported page yield numbers are not based on ISO/IEC 24711 Standard methodology, as it requires that defective supplies be excluded from page yield calculation.

Appendix 1: Methodology

Test Parameters

The test included original HP Inkjet cartridges, twelve (12) of the top-rated Amazon US non-HP brands of Remanufactured ink cartridge sold as substitutes, compatibles, and replacements in North America (NA). All original HP and non-HP cartridges, and all test printers were acquired by *spencerLAB* either through retail, online, or direct channels. All testing activities were conducted by *spencerLAB* DIGITAL COLOR LABORATORY trained technicians. The tables below shows the various brands, model, and printer combinations used in testing.

Non-HP Brands Tested		
Acaves	Ankink	AXESET
EaseFusion	GREENSKY	LEMERO
Linkmay	Pitooler	SAILNER
Tchbme	TOKYOINK	ValueToner
All are remanufactured cartridges		

In order to obtain user-representative results, printers and cartridge SKUs from a wide range of HP's current and older generation product portfolio were selected for testing. These printers and SKUs represent a large portion of products currently in use in the market. Since the tested cartridge SKUs are compatible with several HP printer models, the user experience reported in this study would be representative of all compatible printer models [see table in Appendix 3]. Multiple printers were used to test each brand to obtain user-representative results. Nine (9) cartridges of original HP and each non-HP brand for each cartridge SKU were tested.

Cartridge Model/SKU	Cartridge Type	Test Printer
#64XL	Black	HP Envy Inspire 7255e
	Tri-Color (CMY)	
#67XL	Black	HP DeskJet 4255e
	Tri-Color (CMY)	
#910XL	Black	HP OfficeJet Pro 8015e All-in-One
	Cyan	
	Magenta	
	Yellow	
#962XL	Black	HP Officejet Pro 9015e All-in-One
	Cyan	
	Magenta	
	Yellow	

This study tested average performance of the market, not individual brand performance. The brands and providers selected are top-rated and commonly available and make up a large portion of the overall market for remanufactured ink cartridges in North America.

Printing was performed in a continuous manner, with stops for paper replenishment, overnight, etc., until ink cartridges reached End-of-Life [see definition in Appendix 2]. All test supplies, such as printers, ink cartridges, and paper, were acclimated to normal office testing environment for at least 12 hours prior to testing (environmental conditions specified in ISO/IEC 24711). The ISO/IEC 24712 five-page color test suite was printed from a Windows 11 operating system using the current version of Acrobat Reader 2024.005.20421. Test files were printed in printer default mode for plain paper, on Hammermill Copy Plus 20lb., 92 Brightness, office paper. All test printing was performed by *spencerLAB* technicians.

The HP Envy Inspire 7255e (64XL) and the HP DeskJet 4255e employ two print cartridges (black and tri-color), while the HP OfficeJet Pro 8015e printers (910XL) and HP OfficeJet Pro 9015e printers (962XL) both use four print cartridges – Black (K), Cyan (C), Magenta (M), and Yellow (Y). In order to reconcile the individual color cartridge data for the 910XL and 962XL model individual cartridges with data of the 64XL and 67XL tri-color cartridges, the overall yields of the CMY individual color cartridges were averaged together before aggregating into summary results. Additionally, to replicate typical user experience with failed and/or defective cartridges, the defective cartridges were included in the page yield calculations reported.

A total of 108 Original HP cartridges were tested, and a total of 432 non-HP cartridges were tested. All printer and cartridge sources were located in North America.

Cartridge Reliability Testing

Prior to printing, all cartridges were carefully unpacked and inspected for any ink leakage and/or broken parts; any DOAs were noted and photographed.

Print Quality Assessment

Print quality assessments were made throughout the running of all the test cartridges.

The number of Wasted Pages was calculated from the sum of the secondary cartridge alignment pages, pages printed during the printhead cleaning processes, and unusable pages due to print quality issues.

Secondary cartridge alignments are any alignments performed following the initial alignment performed upon installation of the first set of cartridges. Pages for initial alignments are not included in the Waste Page calculation because this process is printer-initiated and common across all brands.

When print quality of printed output deteriorated, exhibiting issues such as streaking, banding, fade, etc., a printhead cleaning was performed. The number of allowable cleanings per cartridge set was per ISO/IEC 24711 guidelines, which are based upon cartridge stated yield.

If the print quality of the output improved to acceptable following the cleaning process, the test continued. If the print quality remained unsatisfactory, either additional cleanings were performed (within the cleaning limit number), or the cartridge was deemed to be at End-of-Life.

End-of-Life determination could be made on a number of factors, including unusable output due to streaking, fade, banding, etc.

Appendix 2: Test Terms and Definitions

Terms	Definitions
End-of-Life, (EOL)	A condition determined by one of six mechanisms: 1. Fade has occurred on the diagnostic page per ISO/IEC 24711 definition. 2. Significant reduction in density in the bands or blocks per ISO/IEC 24711 definition. 3. Streak removal procedure steps have been exhausted per ISO/IEC 24711 definition. 4. Significant ink leakage occurs before or during installation or any time during printing. 5. 10 consecutive pages contain color mix. 6. Cartridge fails to print or stops printing and efforts to recover are unsuccessful.
Page Yield	The number of Usable pages measured using the ISO/IEC 24712 five-page test suite where each brand and SKU is tested on a minimum of three printers with printers operating in factory default driver settings for "Normal" printing on plain paper.
Wasted Pages, (Unusable)	The number of Wasted Pages was calculated from the sum of the secondary cartridge alignment pages, pages printed during the printhead cleaning processes, and unusable pages due to print quality issues.
Individual Cartridge Yield	Calculated by counting the number of diagnostic pages printed between cartridge installation and end of life (EOL), then multiplying by five. The diagnostic page is the last page printed in the test suite. EOL is a condition determined by one of six mechanisms defined above.
Dead on Arrival, (DOA)	DOA has occurred when one of the four mechanisms below has occurred: 1. Cartridge found to have substantial leakage (as defined above) at start or during testing. 2. 10 or fewer pages printed by a cartridge when end of life occurs. 3. Cartridge fails to operate upon installation. 4. Out of box failure occurs.
Premature Failure, (PF)	PF has occurred when a cartridge has a page yield of less than 75% of the HP page yield specification for that cartridge model. Included causes may be printhead or printer damage, or out of box failure. Despite advertising higher page yields than Original HP cartridges, many non-HP brands met neither the 75% threshold nor their own advertised yield claims during testing [see Appendix 5].
Print Quality	A visual print quality assessment of each page printed which, based on mutually agreed PQ rating criteria, will classify all pages as being either: 1. Good for all uses. 2. Unusable. 3. Printhead alignment page or print quality check page used after a printhead cleaning event.
Average % More Pages	Calculated by counting the average number of Usable pages printed.
Test Page Suite	A series of five pages that are printed consecutively in order as a single job, ending with a diagnostic page, as per ISO/IEC 24712.
Fade	A significant decrease in density on the bands or blocks of the diagnostic page. This decrease in density does not have to necessarily occur completely across the page, but was determined using a comparison to the second diagnostic page generated during testing (the 10th page printed).
Streaks	Very thin lines of color, other than intended, in the bands surrounding the edge of the last page in the test suite (the diagnostic page). Streaks can appear for a number of different reasons, including thermal issues and clogged nozzles.

Appendix 2: Test Terms and Definitions (Continued)

Terms	Definitions
Printhead Cleaning	The cartridge cleaning process used to restore print quality and performance. As streaks or other defects were observed, the streak removal procedures were executed according to HP printer manual instruction. When printing with non-HP cartridges, multiple levels of cleaning were required, but if performed, were counted as one individual cleaning. Any pages printed during the cleaning process were not counted in the overall page yield. Following a cleaning procedure, an additional test suite was printed, and verified by observing the diagnostic page. The maximum number of cleanings per SKU was calculated based on the overall HP page yield, as per ISO/IEC 24711. EOL was determined when the allowed number of cleanings had been exhausted, and an additional cleaning was required due to print quality defects.
Substantial Ink Leakage	If a significant amount of ink visibly spilled on either the plastic bag or box containing the cartridge, or ink spilled over the printhead nozzles, the leakage was recorded, and the cartridge was determined to be DOA. If a significant amount of ink spilled during the refilling process, leakage was recorded, and the cartridge was determined to be DOA. If a significant amount of ink leaked inside of the printer during testing, and caused a substantial visible defect on the printed pages, EOL was determined based on cartridge leakage. If the defect was not substantial enough to consider the printed pages Unusable, testing continued, and the defect was monitored and recorded.

Appendix 3: Compatible Printers

HP 64XL	HP 67XL	HP 910XL	HP 962XL
		HP OfficeJet 8015e AiO	HP OfficeJet Pro 9015e AiO
HP ENVY Inspire 7255e	HP Deskjet 4155e AiO	HP OfficeJet Pro 8035e AiO	HP OfficeJet Pro 9025e AiO
HP ENVY Photo 7855 AiO	HP Deskjet 2755e AiO	HP OfficeJet Pro 8025e AiO	HP OfficeJet Pro 9025 AiO
HP ENVY Photo 6255 AiO	HP DeskJet 2755 AiO	HP OfficeJet Pro 8035 AiO	
HP ENVY Photo 7155 AiO	HP DeskJet Plus 4155 AiO	HP OfficeJet 8025e Pro AiO	
HP ENVY Inspire 7955e	HP DeskJet 4133e AiO	HP OfficeJet 8035e Pro AiO	
HP Envy Photo 7275 AiO	HP DeskJet 2734e AiO	HP OfficeJet Pro 8034e AiO	
HP ENVY Inspire 7958e	HP DeskJet 2855e AiO	HP OfficeJet Pro 8028e AiO	
HP Envy Photo 7975 AiO	HP DeskJet 2723e AiO		
HP Tango	HP DeskJet 2827e AiO		
HP Tango X	HP DeskJet 4255e AiO		
HP Tango Terra	HP DeskJet 4152e AiO		
	HP ENVY Pro 6475 AiO		
	HP ENVY 6455e AiO		
	HP ENVY 6055e AiO		
	HP ENVY 6075 AiO		
	HP ENVY 6055e AiO		
	HP ENVY 6455e AiO		

Appendix 4: Conclusion

HP Ink Outperforms Third-Party Inks			
Page Count	**Reliability**	**Wasted Pages**	**Printer Damage**
• Non-HP inks tested printed fewer than 45% the pages – on average – than tested Original HP ink cartridges. • Original HP ink cartridges printed more than 2.2x the pages – on average – than non-HP inks tested. • Original HP ink cartridges printed 121% more pages - on average - than non-HP inks tested. • Original HP ink cartridges met and exceeded their advertised page yield; whereas tested non-HP cartridges acheived only 41% of their advertised yield.	• Three out of five or 60% of the tested non-HP inks either failed during use [19% Premature Failure] or right out of the box [41% DOA]. • Original HP ink cartridges tested worked every time.	• Non-HP inks tested produced 15 times more wasted pages – on average – than Original HP ink cartridges. • Original HP inks produced 15.6 times fewer wasted pages – on average – than non-HP inks tested. • Original HP inks produced 94% less wasted pages – on average – than non-HP inks tested.	• Non-HP ink cartridges tested caused printhead and/or printer damage. • Tested Original HP ink cartridges did not cause any printhead nor printer damage.

Appendix 5: Non-HP Expected (advertised) Yield vs. Actual Tested Yield

Based on the non-HP brands stated yields, calculations were made to determine third-party manufacturers' advertised yield versus actual yield. Actual yield is 'good pages', defined as total pages printed less waste pages. Calculations are based on aggregate testing data and reflect the average page yield across multiple cartridge models.

- Tested non-HP cartridges produced 280,749 fewer pages than expected from the manufacturers' stated yields. This is a 59% reduction from expected page yields.
- The actual tested page yield produced by non-HP cartridges was less than half of the their advertised yield, at approximately 41%.
- Non-HP actual tested page yield was about 2.4 times less than what was advertised by their manufacturers.
- For the tested non-HP brands, nearly 3 out of every 5 expected pages were never delivered.
- The non-HP manufacturers' stated page yields overstated tested performance by approximately 143% compared to actual tested good output received.
- Of the tested non-HP cartridges, 41% were deemed DOA due to 10 or fewer pages printed by a cartridge when End-of-Life occurred due to poor print quality, the cartridge failed to operate upon installation, or the cartridge was incompatible with the printer.
- When non-HP tested cartridge yield was compared with its own manufacturer's stated yield, 26% of the tested non-HP cartridges expired prematurely. Premature Failure (PF) includes low yield cartridges (providing less than 75% it manufacturer's advertised yield for that cartridge SKU).

These figures indicate that third-party advertised page yields do not necessarily reflect real-world tested results and can significantly misrepresent the value and reliability consumers can expect.