

## Are Refilled Print Cartridges Really Cheaper for Mail Addressing?

### HP TIJ 2.5 Industrial (OEM) print cartridges vs. refilled print cartridges

#### Executive Summary

Cost effectiveness, in all phases of the operation, is critical to success for mail shops. The current economic situation puts even more competitive pressure on productivity and attention to cost.

*SpencerLAB*, an independent research laboratory, performed tests to understand the cost-effectiveness of HP TIJ 2.5 industrial (OEM) print cartridges and lower priced refilled print cartridges for thermal inkjet mail addressing. The testing compared Reliability, Print Quality and Yield in a mail addressing industry context.

#### Findings:

- **Cost:** *SpencerLAB* concluded that HP (OEM) print cartridges are a cost-effective choice for mail shops. Considering the cost structure of mail shops, downtime, waste, and customer satisfaction issues associated with reliability and quality problems become serious considerations.
- **Reliability:** Not a single tested HP print cartridge failed. For every tested refill supplier, multiple cartridges failed.
- **Print Quality:** HP cartridges provided the best overall and most consistent print quality of all tested suppliers, with few refilled cartridge brands able to deliver comparable quality in selected ink type/media combinations.
- **Yield:** The tested HP and refilled cartridges had roughly comparable yields; however, some refilled cartridge yields were more variable than HP's.

Overall, *SpencerLAB* concluded that HP cartridges were a more effective solution than the tested refilled cartridges for mail shops; apparent savings in the lower price of refilled cartridges are outweighed by the reliability risks of increased labor costs, waste, and harm to customer satisfaction.

#### Test Overview

*SpencerLAB*, an independent research laboratory with over two decades of experience in measuring printing system performance, was commissioned by HP to perform an unbiased third party test to compare HP (OEM) print cartridges with cartridges from eight (8) representative refill suppliers in the areas of Reliability, Print Quality and Yield. Please see the Appendix for the test files.

The tested HP cartridges and inks are those typically used by mail shops.

- HP Versatile Black Print Cartridge (C8842A)
- HP Fast Dry Black Print Cartridge (C6195A)
- HP 45A Print Cartridge (51645A)
- HP Spot Red Print Cartridge(C6168A)
- HP Spot Blue Print Cartridge (C6170A)

Cartridges from the following representative refill suppliers were included in the test:

- IJR
- Coast to Coast
- Supplies for Mailers
- Office Depot
- Ink4Mail
- Infinity Mail Solutions
- Cartridge World
- Ink-Refills-Ink

Not all of the cartridges in the test set were available from all refill suppliers at the time of testing, Summer 2010. The HP cartridge sample was purchased through standard retail channels from three sources to ensure production lot variation. Refilled cartridges were purchased directly from the suppliers.

### Reliability Testing results

Not a single tested HP cartridge failed while multiple cartridges failed for each tested refill supplier. There were seventy six (76) failures among the tested refilled print cartridges for an average failure rate of 7.5%. HP’s failure rate was zero. Some refill suppliers exhibited failure rates over 10% – as high as 13%. See Figure 1 for details.

Two types of failures were identified.

- Dead on Arrival (DOA) cartridges were those that failed to print out-of-the-box or had significant visible leakage upon receipt
- Early Failures (EF) were cartridges that printed for less than 1% (roughly 189 envelopes) of the expected output before failing

Thirty of each available cartridge type were tested per supplier. 150 total HP cartridges and 1020 total refilled cartridges were tested.

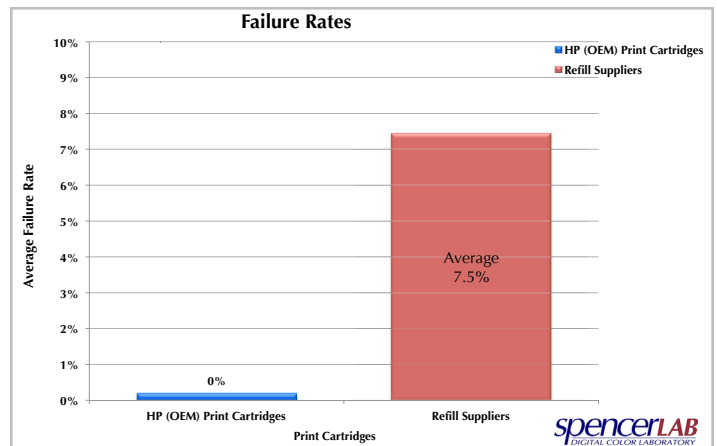
Vendor	Cartridges tested	Failures: DOA & EF	Failure Rate
<b>HP</b>	<b>150</b>	<b>0</b>	<b>0%</b>
Refill Supplier A	150	17	11%
Refill Supplier B	150	14	9%
Refill Supplier C	150	5	3%
Refill Supplier D	150	9	6%
Refill Supplier E	150	4	3%
Refill Supplier F	120	15	13%
Refill Supplier G	120	9	8%
Refill Supplier H	30	3	10%
<b>Refilled Cartridges Total</b>	<b>1020</b>	<b>76</b>	<b>7.5%</b>

*With no failures, HP cartridges were more reliable than refilled cartridges in the test*

**Figure 1: Failure Detail**



**Figure 2: Refill Supplier cartridges Dead on Arrival (DOA) due to significant leakage**



**Figure 3: Average Failure Rates**

## Print Quality Evaluation results

In *spencerLAB's* evaluation, HP (OEM) print cartridges provided both the best overall print quality and the most consistent print quality. Print Quality of the tested refilled cartridges was generally rated poor to acceptable, whereas HP Print Quality was generally rated acceptable to very good across the different tested cartridge and media types. In fact, the HP Print Quality was never rated lower than any tested refilled cartridge on a media; only a few refill suppliers were able to deliver Print Quality comparable to HP. Several refilled cartridges' print quality was inconsistent, with streaking and uneven density. In addition, a couple of refill suppliers' cartridges even produced unreadable postal barcode prints. All HP cartridge postal barcode output was readable.

Print Quality issues observed in refilled cartridge output included blurring of text, bleed into adjacent areas, loss of detail and ghosting.

Print Quality for Text, Lines, Tints, and Solid Fills was evaluated for all cartridges. Output was assigned an overall quality rating based on expected industrial inkjet addressing application requirements: very good, good, acceptable, or poor. Bar code readability was

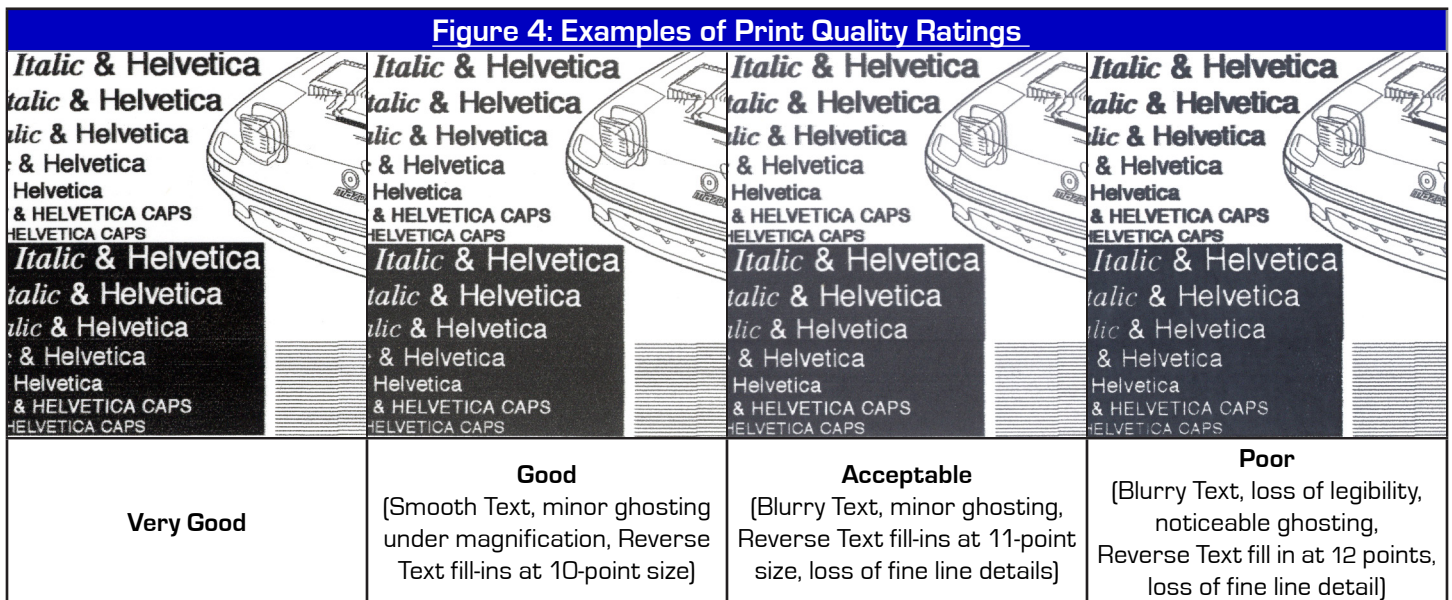
evaluated for the black cartridges using a Honeywell 4600g barcode scanner. Four cartridges for each cartridge type from each supplier were evaluated for print quality. Output for print quality evaluation was printed on a variety of typical postcard media:

- Matte: Cover C2S 100# (NewPage Productolith)
- Glossy: Gloss C1S 12-point (Mead Westvaco Tango)
- Uncoated: Opaque Smooth 80# Cover (Domtar Cougar)

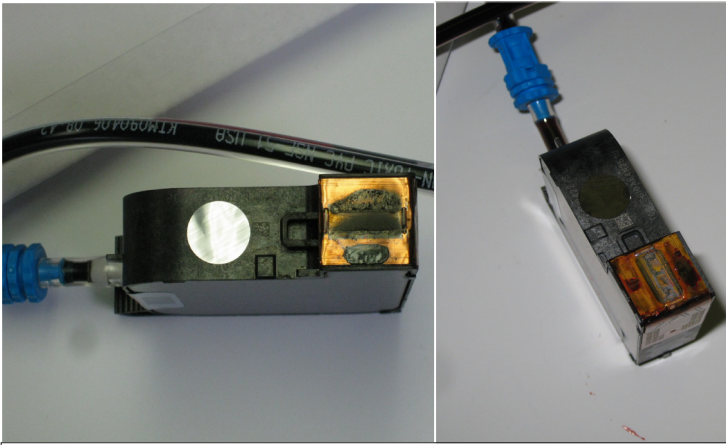
## Yield Testing Results

A limited sampling of both standard capacity cartridges and bulk cartridge systems were tested for ink cartridge Yield. Yields for the standard capacity HP Fast Dry Black and HP Spot Red Print Cartridges were higher than the yields of comparable cartridges for any of the tested refill suppliers. For other tested cartridge types, some refill suppliers had comparable or slightly higher Yields than the HP cartridges, but these yields were accompanied with Reliability, and Print Quality problems. Yields for some of the standard refill suppliers were more variable than Yields for HP.

HP bulk cartridges contain 370 ml of ink while a key supplier of refilled bulk cartridges advertises 412 ml,







**Figure 5: Refill Suppliers**  
**- Bulk Cartridge Printhead Overheating Failures -**

over 10% more. However, Yields from refilled bulk cartridges in the test were lower compared to the HP Bulk Black Ink Supply. Some of the low yield can be traced to bulk cartridges that stopped printing due to printhead overheating as shown in Figure 5.

The yield test protocol leveraged the principles of ISO/IEC 19752 and ISO/IEC 24711 standards for measuring yield. Three standard capacity cartridges were tested per cartridge type for HP and up to 8 different refill suppliers. For bulk cartridge systems, HP Bulk Black Ink Supplies were compared to cartridges from a major supplier of refilled bulk cartridges. Two bulk cartridge systems were evaluated for each available cartridge type per supplier. Testing of additional bulk systems would increase confidence in these results. Yield testing was done on Plain #10 envelopes.

## Why Reliability & Print Quality Matter

In the schedule-driven printing environments common for mail shops, cartridge failures and print quality inconsistency can have significant cost impacts. Job interruptions from cartridge failure or decline in print quality have the potential to reduce productivity, increase labor costs and put schedules at risk.

- DOA failures, while disruptive, may be quickly discovered and potentially compensated under warranty. Early Failures may have an even greater impact on cost and productivity. Mail table operators may not realize a cartridge

has failed until significant waste material has been produced. Replacing failures also adds complexity and cost to purchasing and inventory management. And, if the mail addressing firm isn't compensated by the ink supplier, overall ink costs would also increase. Failures are unpredictable and when you're running a critical job, predictability is a must.

- Cartridges with lower or inconsistent Print Quality also have significant implications for cost. Even if customers are willing to accept a slightly lower print quality for some kinds of pieces, unanticipated and unpredictable problems with print quality consistency could drive significant extra labor for verification of print job accuracy – sorting, restarting the job and reprinting – as well as wasted materials. Every bit of rework reduces productivity.

In mail addressing applications where 4-cartridge arrays are used to print 2-inch swaths, reliability and print quality consistency effects are multiplied. Even if three out of four cartridges are functioning well, failure or inconsistent print quality of the fourth one can compromise many pieces and waste ink from functioning cartridges.

***A refill supplier actual failure rate of 7.5% can become an effective failure rate of 26% for an array of 4 cartridges.***

- Yield consistency and more reliable availability of sufficient inventory of all needed cartridge types can also result in lower purchasing costs and more streamlined inventory management operations. While care was taken to select representative suppliers, several did not carry all of the tested cartridge types and one refill supplier is no longer doing business.

***For a shop that has invested in expensive equipment for 250 print-per-minute addressing, efficiency eroded by a cartridge failing shortly after installation or producing inconsistent print quality could have a negative financial impact.***

## Cost Analysis

Based upon *spencerLAB* test results for a typical direct mail job, the cost contribution of ink using HP (OEM) standard capacity cartridges is estimated at less than 1/10<sup>th</sup> cent (\$0.001) per piece. An analysis of the cost of addressing a direct mail piece using publicly available data from the MFSA Performance Profiles survey (2008) indicates the cost of using HP (OEM) print cartridges would only be about 2% of the mail shop production cost, as shown in Figure 6.

In addition to mail shop production cost, successful completion of even a 'simple' job requires all key mailing steps to be fulfilled effectively. These include: list import, CASS-certification, NCOA, presorting, folding, addressing, tab application, tray and delivery to the post office. Considering this substantially higher total fulfillment cost, the cost of using HP (OEM) print cartridges is significantly lower than even the small fraction of mail shop production cost.

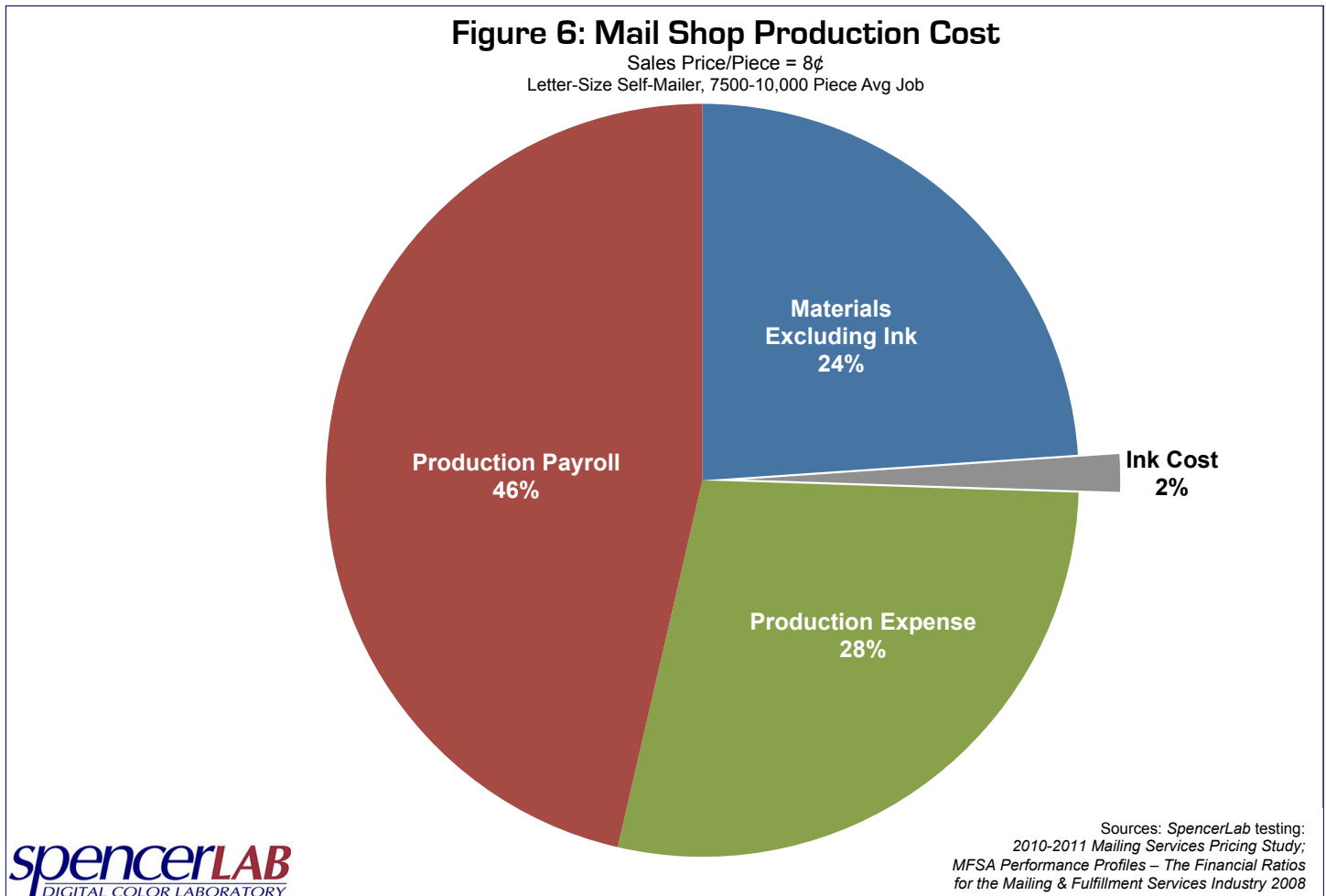
Using refilled cartridges that could jeopardize successful job completion due to cartridge failures or inconsistent print quality – all for expected savings on a minor cost component – is bad economics.

Given this small cost of ink relative to the entire production cost, the risk of high cost failures easily outweighs any ink cost savings. Reducing the risk of potentially high-cost failures by investing in high-quality OEM ink cartridges is cost-effective.

## Conclusions:

### HP Ink Cartridges Offer High-Value

*SpencerLAB* concludes that HP TIJ 2.5 industrial (OEM) print cartridges are a cost effective choice for mail shops compared to refilled print cartridges. Given the cost structure of the mail addressing industry, downtime, waste, and customer satisfaction issues associated with reliability and quality problems become serious considerations. HP cartridges had



superior reliability and overall high print quality in *spencerLAB* testing.

- Throughout the testing, not a single tested HP print cartridge failed, while for every tested refill supplier multiple cartridges failed.
- HP (OEM) print cartridges typically produced sharp legible text and lines and always produced readable postal barcode output.
- HP (OEM) print cartridges had overall consistent yield. Even when expected yield is roughly comparable, effective yield is greater for HP when failures and print quality consistency are considered.
- In addition, predictable availability of supplies can help lower purchasing costs and streamline operations. HP cartridges performed well across the whole cartridge set and on a variety of media. HP offers the entire set of cartridges used by mail shops.

Ink is a small part of the overall cost structure for mail shops. However, problems resulting from cartridge failures and print quality inconsistency can lead to significantly higher labor costs to address failures, and sort out and reprint low quality prints. Further, the likelihood of USPS fines may increase and customer satisfaction may be damaged if poor printing is not successfully retrieved and reprinted. Schedules may be at risk due to job interruptions and rework. Are Refilled Print Cartridges Really Cheaper for Mail Addressing?

Overall, *spencerLAB* concludes that mail shops will benefit from selecting HP cartridges rather than refilled cartridges for better general cost effectiveness and enhanced profitability. Apparent savings in the price of refilled cartridges may be outweighed by the risks of higher labor costs, waste, and customer satisfaction issues. As found in this research, these risks are not zero; there were failures with every tested refill supplier. And because the potential savings is an extremely small fraction of total cost, it may not be worth the risk.

## *SpencerLAB* DIGITAL COLOR LABORATORY

Over the past two decades, the *spencerLAB* DIGITAL COLOR LABORATORY, an independent test division of Spencer & Associates Publishing, Ltd., has earned international recognition for its expertise in evaluating key performance metrics of digital printing systems. *SpencerLAB* is broadly respected as a leader in unbiased, third-party comparative analysis of digital imaging and printing system performance.

Leading vendors and firms for whom printing is mission-critical rely upon *spencerLAB* to provide Print Quality, Ink/Toner Yield and Cost-per-Print, Throughput, Availability, and Usability as well as Reliability benchmarking for ink-, toner-based and other printing technologies. Spencer & Associates provides leadership in quantitative and qualitative comparisons – consultation and evaluation services, benchmark test software/hardware, and focus group management.

For more information, visit [www.spencerlab.com](http://www.spencerlab.com).

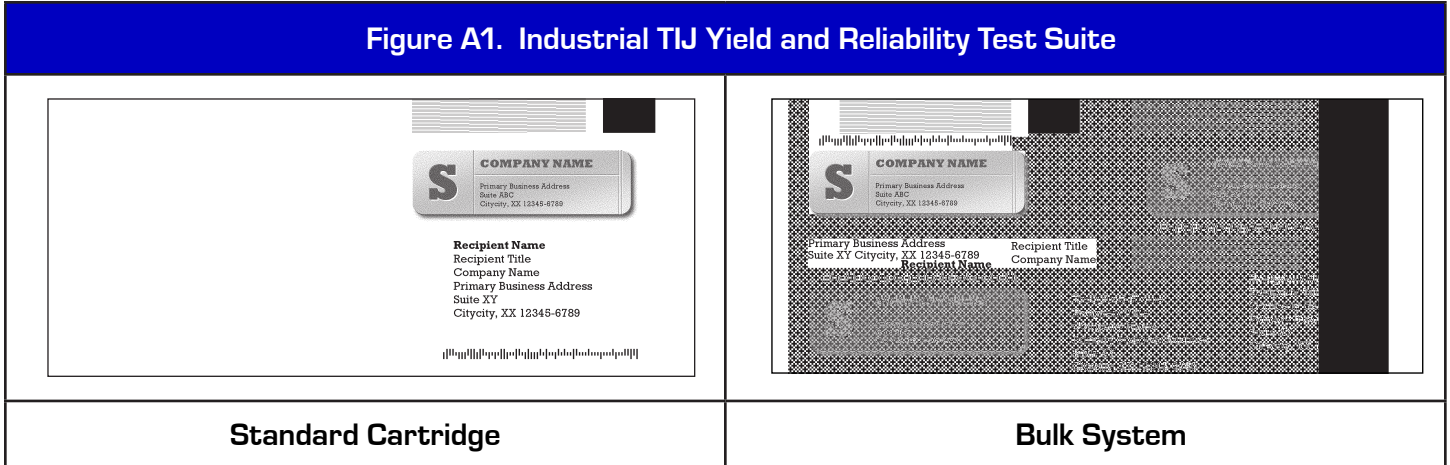
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# Appendix

## SpencerLAB Industrial TIJ Test Suite

Incorporating various elements from the *spencerLAB* PRINTER TEST SUITE – which has been used extensively for over two decades by many major printer manufacturers under license as well as in our own testing – *SpencerLAB* created two test suites specifically to evaluate print cartridges for the mail addressing industry. These suites were augmented with elements unique to this application. One suite was optimized for Yield and Reliability testing; the other was optimized for the analysis of Print Quality. Both suites were printed such that each printhead experienced the full content at its native resolution. Images of these suites are shown in Figures A1 and A2 below.

**Figure A1. Industrial TIJ Yield and Reliability Test Suite**



**Figure A2. Industrial TIJ Print Quality Test Suite**

