

Print Quality Assessment Study

HP Color LaserJet CM1312nfi vs. Samsung CLX-3175FN

Revision 1.0

January 14, 2009

Table of Contents

Introduction	3
Test Results.....	3
Print Quality Grading	3
Head to Head comparison	5
Significance of Print Quality Factors.....	5
Detailed Methodology Description.....	7
Test Targets	7
Test Platform	8
Printer Setup	8
Grading.....	9
About QualityLogic	10

Introduction

QualityLogic Inc., an independent test firm, recently completed an evaluation for HP comparing the print quality of the HP Color LaserJet CM1312nfi to the Samsung CLX-3175FN. This document summarizes the results from that evaluation.

Ten different test targets were printed on the HP Color LaserJet CM1312nfi and Samsung CLX-3175FN, using the best print quality settings available. The test targets were provided in pairs (one test target from the HP and one from the Samsung) to nine QualityLogic graders who were asked to make the following comparisons:

1. Print Quality – grade each sample on a scale of 1-10 using a high quality color monitor with the image of the test target as a reference
2. Head to head comparison of HP to Samsung for each test target
3. Judge the significance of various print quality factors on the quality of the page



HP CLJ CM1312nfi



Samsung CLP-3175FN

Test Results

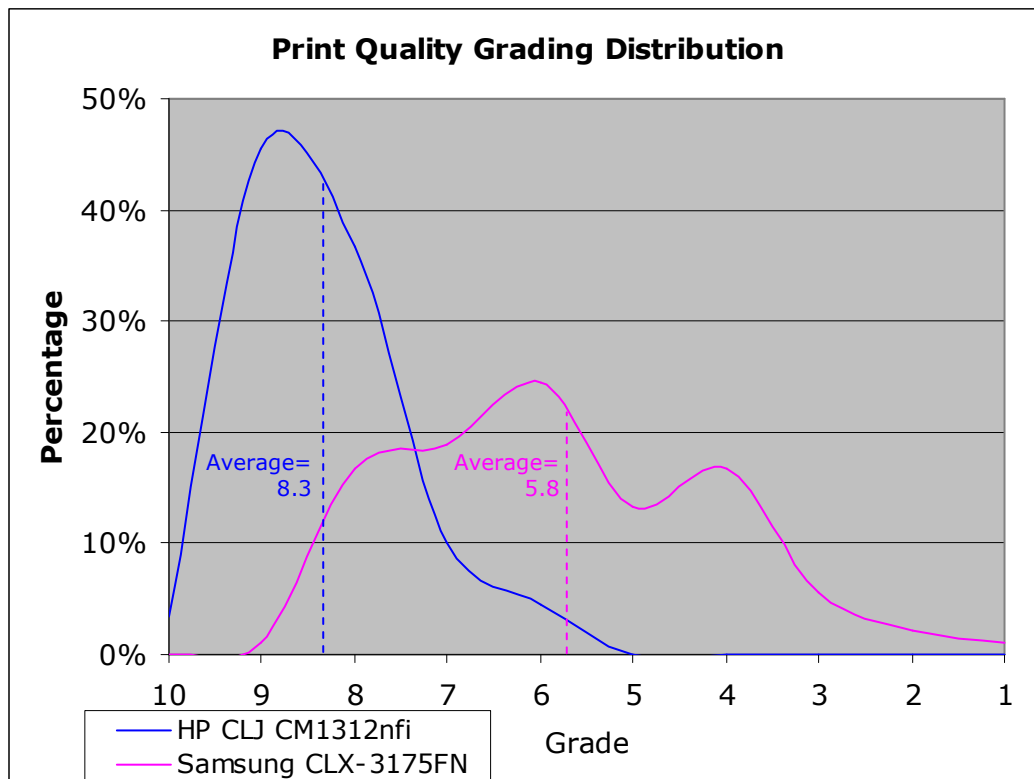
Print Quality Grading

Using a scale of 1 – 10 with 10 being best, the test targets printed on the HP Color LaserJet CM1312nfi averaged an 8.3 rating compared to 5.8 for the Samsung CLX-3175FN. The following table compares the average grades for each sample:

File Name	HP CLJ CM1312nfi	Samsung CLX-3175FN
Devil's Staircase	8.2	4.4
Solving Testing Puzzle	8.1	4.6
Office Automation	7.3	4.1
Project Status	8.2	5.2
World We Share	8.8	6.4
Employee Benefits	7.4	5.2
Gourmet Short Course	9.0	7.8
Hospital Data	8.4	6.1
Osteoporosis	9.0	7.7
Real Estate	8.8	6.2
Average	8.3	5.8

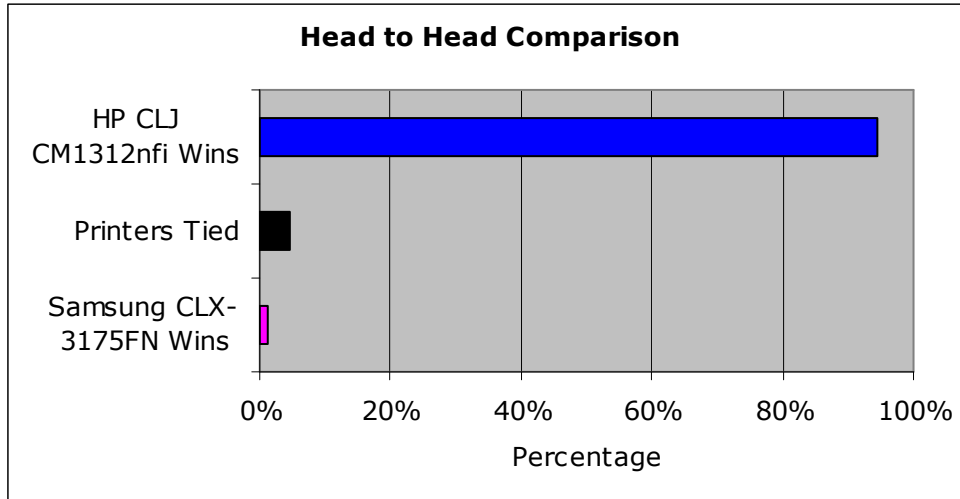
The HP printer had no score below 6 given by any evaluator for any of the ten samples, while the Samsung printer had some scores as low as 1.

The following graph represents the distribution of evaluator responses for all samples and all evaluators. From the graph, it is clear that the HP printer had much better overall print quality and a tighter, more consistent distribution of grades.



Head to Head comparison

When comparing the ratings on a head to head basis, printouts from the HP printer were chosen as better 85 of 90 times, or 94%. The Samsung and HP printers were considered equivalent in 4 instances, (an instance being a single evaluator/sample data point), while the Samsung was chosen over the HP in 1 instance.



Significance of Print Quality Factors

After grading a test target, QualityLogic evaluators were asked to judge the significance of various print quality factors on their grade and asked whether this factor had an “impact” or a “significant impact” on the grade given.

The following table shows the percentage of pages graded where a QualityLogic evaluator said there was a print quality factor that had an “impact” or a “significant impact” on their grade for that page.

Factor	Significantly Impacted		Impacted		Both Factors	
	HP CLJ CM1312nfi	Samsung CLX-3175FN	HP CLJ CM1312nfi	Samsung CLX-3175FN	HP CLJ CM1312nfi	Samsung CLX-3175FN
Color Correctness	10%	69%	37%	13%	47%	82%
Color Registration	0%	30%	2%	8%	2%	38%
Banding	4%	34%	12%	7%	17%	41%
Streaking	1%	29%	4%	6%	6%	34%
Gradient Fills	4%	26%	10%	9%	14%	34%
Sharpness	0%	33%	3%	10%	3%	43%
Image Quality	7%	38%	10%	10%	17%	48%
Other	8%	6%	0%	1%	8%	7%

Note: more than one factor can impact the grade for any evaluator sample pair.

All print quality factors which impacted their grade more than 30% of the time are highlighted in red. The Samsung printer had four of eight factors that were mentioned more than 30% of the time as "Significantly Impacting" the score. The HP printer had no factor above 30% that "Significantly Impacted" the score and only one factor above 30% that was noted as "Impacting" the score. When the responses are totaled the Samsung printer had seven factors above 30% while the HP printer had only one.

Detailed Methodology Description

The test methodology used for this evaluation was developed by QualityLogic, with input from HP, and is outlined below.

Test Targets

Ten single page test targets from QualityLogic’s library of test pages were chosen for this test. The documents were chosen to span a variety of applications with color content and varying levels of complexity. The table below outlines the document name, print media used, file name and source application. The collage of images following the table are thumbnail samples of the actual documents used.

File and page	Print Media	File Name	Source Application
Devil's Staircase	Standard	IE6PB1CC_HTML	Internet Explorer 6
Puzzle # 1 - Solving the Testing Puzzle (page 1)	Standard	PWTTQ1CC-2.ppt	PowerPoint 2003
Puzzle # 3 – Office Automation (page 2)	Standard	PWTTQ1CC-2.ppt	PowerPoint 2003
Project Status	Standard	Project Status.ppt	PowerPoint 2003
World We Share	Standard	PS7PA1CC.psd	Photoshop 7
Employee Benefits	Standard	IND5ZE1DC_2.PDF	Acrobat 9
Gourmet Short Course	Standard	C1 w ISO Image.indd	InDesign CS4
Hospital Data (page 1)	Standard	EXTT71DC.xls	Excel 2003
Osteoporosis Newsletter (page 1)	Brochure paper	FM8Z71DC.PDF	FrameMaker 8
Real Estate	Presentation	GB0560701D-2.doc	Word 2003



Test Platform

All printing was done using a desktop personal computer with an Intel P4 3.2GHz processor with 2GB of memory, using the Microsoft Windows XP Professional Edition operating system with Service Pack 2. All printers were connected to the test computer using a USB connection.

Printer Setup

The printers tested were acquired by QualityLogic on the open market. The printers were installed on the PC system using the default printer driver shipped with the printer. The drivers used for this evaluation are as follows:

Printer	Driver & version
HP Color LaserJet CM1312nfi	DriverVer = 09/27/2007, 1.8.0.124
Samsung CLX-3175FN	DriverVer=03/27/2008, 3.04.52

For all testing, the “Best” mode available in the driver shipped with the printer and appropriate paper selections were used. For the HP printer, this meant using the default settings. For the Samsung printer, the “Best” mode was selected in the driver under the Graphic tab’s Quality option. This mode had to be selected each time a job was printed; in other words, it was not configurable as a standard method of printing for the Samsung device.

Where possible, papers used for printing were the printer manufacturer’s brands. HP provides a broad range of HP-labeled media and paper, and suitable media was chosen from what HP has. For this methodology, if the vendor did not provide media, then commonly-available papers that are equivalent to the corresponding HP media were used. There are no papers or media labeled by or available from Samsung.

The papers used for this evaluation were:

Standard Media – used for all pages except “Osteoporosis” and “Real Estate”

- For HP printers, HP Multipurpose paper, 96 Bright, 20 lb. was used.
- For the Samsung printers Staples Multipurpose paper, 96 Bright, 20 lb., item # 513099 was used.

Brochure Media – Used for “Osteoporosis”

- For HP printers, HP Matte Brochure Laser Paper, 160 gsm, 43 lb., item # Q6543A was used.

- For the Samsung printers Staples Brochure & Flyer paper (ink & laser) Matte White double sided, 170 gsm, item # 610488 was used.

Presentation Media – Used for “Real Estate”

- For HP printers, HP Soft Gloss Presentation Laser Paper, 120 gsm, 32 lb, item # Q6541A was used.
- For the Samsung printers Hammermill Color Laser Gloss, 32 lb., #16311-0 was used.

There were no special recommendations in regards to setup of the printers in the user’s manuals. All test samples were printed in an office environment. Toner levels were monitored prior to and after printing to ensure that adequate toner was in the device under test.

This was a user-based test, thus nothing was done to impact or modify the print quality of the device in any way that is not typical of what a user would do. No special adjustments were required or used except as noted above.

Grading

The evaluation and grading were done as follows:

The 10 samples were presented in pairs to the evaluators/test subjects. The ordering of the pairs, HP versus Samsung, was changed between each sample and the pair sequence was also reversed between each evaluator.

A high quality color monitor was used to compare the intent of the original source material against the final printed image. The evaluators were asked to provide the following information for each pair of samples:

1. Provide a score between 1 and 10, with 10 being best.
2. Provide attributes of the samples that impacted the grading in a negative way. The following categories were used for this portion of the evaluation. The test subjects categorized their responses as either “Significantly Impacting” or “Impacting” the grade in the following categories:
 - Color Correctness – In general the color does not match the expected results when compared to the screen. This can be overall color mismatch, shift from expectations in gradients or spot mismatches.
 - Color Registration – This can show up in any number of ways, including white around text or graphics, yellow halo around colored text or unusual shadows, for example.
 - Banding – Light and dark lines (or bands) of color displayed across the page.

- Streaking – Very thin lines of color or the lack of color displayed across the page.
- Gradient Fills – Fills were inconsistent or did not match.
- Sharpness – The text or line art displayed bleeding or was fuzzy in appearance.
- Image Quality/Sharpness – The images in the printed document, when compared to the images in the original image displayed on the high quality color monitor, lacked the expected level of detail and quality.
- Other – The incorrect display of page borders, white specks of missing toner, or mottling - usually in gray areas.

About QualityLogic

QualityLogic is a leading Software Quality Services Company offering a variety of testing services and related tools focused on conformance, performance, and interoperability testing needs, from low-level firmware testing, to high-level multi-tier application testing. QualityLogic has over 23 years' experience, both in developing specialized test tools and providing comprehensive testing services for top industry manufacturers.

This study was commissioned by HP.