Throughput Speed, Print Quality Analysis, Ease-of-Use/Functionality
Comparative Study Test Results

HP Color LaserJet 2600n and Samsung CLP-300N Color Laser Printers

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Agenda

- **Executive Summary**
  - Project Objectives
  - Test Results Overview
- **Throughput Speed Performance**
  - Methodology
  - Test Results

Print Quality Analysis

  - Methodology
  - Test Results

- **Ease-of-Use/Functionality**

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Executive Summary - Project Objectives

Conduct Comparative Testing and Analysis

- Throughput Speed Performance
  - Test from printer *Ready* and *Powersave (sleep)* modes
  - Time intervals, including First Page Out and Total Print Times
- Print Quality Analysis
  - Including elements of Text, Lines, Tints, Blends, and Images
- Ease-of-Use/Functionality
  - Compare typical user experiences based upon set-up and installation, control panel interaction, printer driver/software, functionality, technical support, reliability, and general observations

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Executive Summary — Test Results Overview

Comparative Test and Analysis

- Throughput Speed Performance
  - *On tested documents, the HP CLJ 2600n had TOTAL PRINT TIME speeds up to twice as fast as the Samsung CLP-300N*
  - *On tested multi-page documents, the HP CLJ 2600n had faster FIRST PAGE OUT times than the Samsung CLP-300N*
- Print Quality Analysis
  - HP CLJ 2600n produces higher quality output, superior to the Samsung CLP-300N in elements of Text, Black and Color Lines, Tints, Blends and Images
  - HP CLJ 2600n renders excellent Images on specialty glossy and matte media
- Ease-of-Use/Functionality
  - HP CLJ 2600n offers user-friendly features and reliability
  - HP CLJ 2600n provides knowledgeable technical phone support
  - The HP CLJ 2600n LCD control panel display and user-friendly printer driver interface, enable easy printer and consumable monitoring
  - Samsung CLP-300N is lightweight and has a small footprint
  - The Samsung CLP-300N does not support printing on glossy media
  - Samsung CLP-300N phone support was inferior

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Throughput Speed Performance — Methodology

Test Documents

- *User-representative documents selected from the SpencerLab Printer Test Suite*
  - Letter with Chart (MS Word) – text with logo and graph, 1-page, 1 copy
  - Newsletter (Adobe PDF) – mixed text, graphics and photograph; 1-page, 15 copies
  - Color & Print Quality Report (Adobe PDF) – compound text, graphics and images in report format; 22-pages, 1 copy

Test Environment

- *PC configuration*
  - 3.0 GHz Dell OptiPlex Intel P4 workstation with a 40 GB hard drive and 512 MB RAM running Windows XP SP2
  - Connectivity via a 100Mb Ethernet network, one-at-a-time
- *Latest available printer drivers downloaded from manufacturer website*
  - HP driver, version 5.6.1112.0. Firmware date code, 20051206
  - Samsung driver, version 1.63 for Windows XP
- *Print Driver and Printer State Modes*
  - Plain Paper, default settings
    - *HP CLJ 2600n = Plain, NORMAL*
    - *Samsung CLP-300N = Plain Paper, NORMAL*
  - Ready Mode
    - *Printers forced to Ready state by sending a printer test file immediately prior to printing of test document*
  - Powersave Mode
    - *Printing from a Powersave (sleep) mode is typical of home/small office usage*
    - *Test documents printed after having ensured that each printer entered its Powersave mode, at intervals of precisely sixty minutes*
    - *Samsung CLP-300N set to enter Powersave mode at fifteen minutes of inactivity*
    - *HP CLJ 2600n utilizes "Instant-On" Technology, entering Powersave mode immediately upon completion of print job*

Test Timings

- *All measurement intervals begin with request-to-print (clicking PRINT in the application's print dialog box)*
  - *Engine Start, First Page Out, Last Page Out or Total Print Time*
- *Timings over several iterations to assure accurate results within one percent +/- one second*

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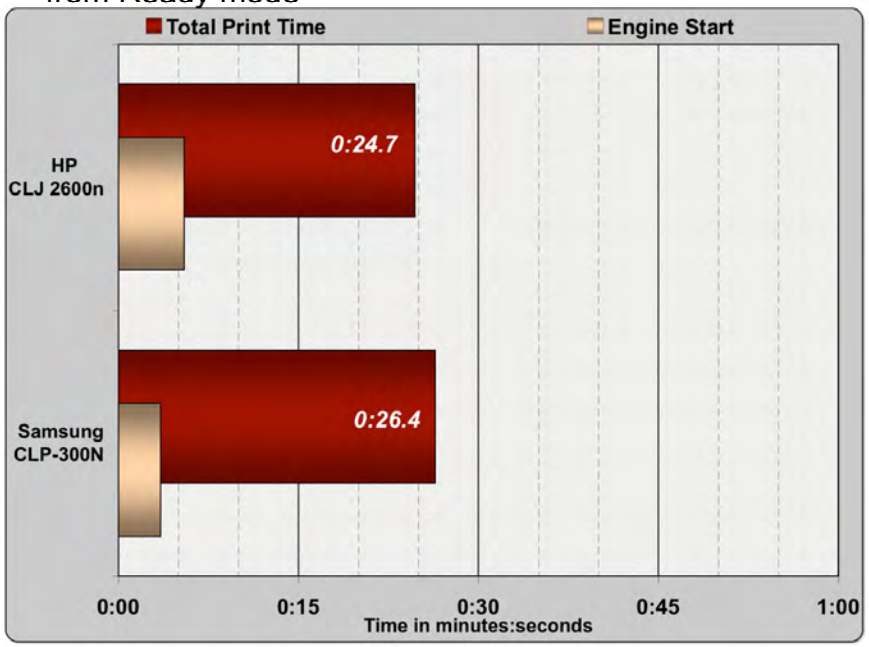
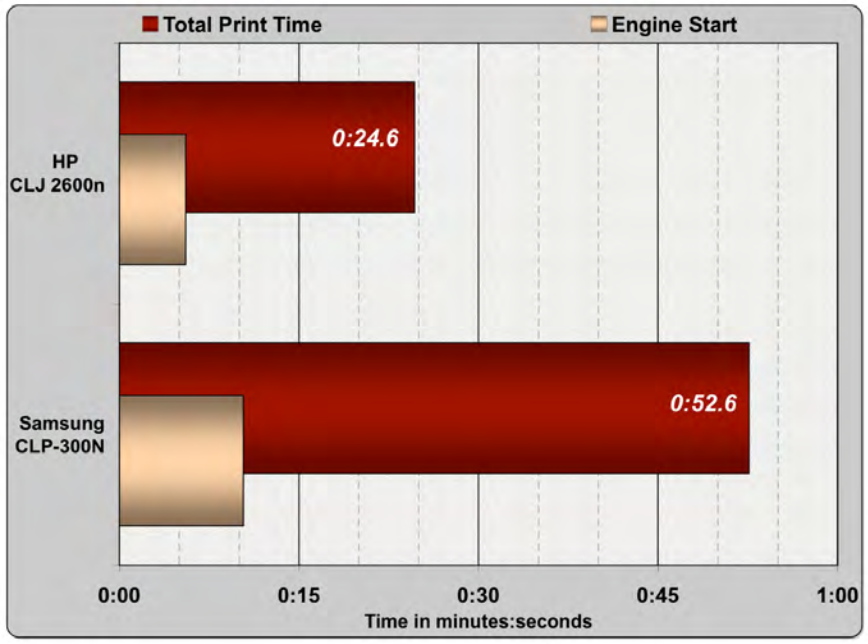
Throughput Speed Performance — Test Results

Letter with Chart
1-page, 1-copy

from Ready mode



from Powersave mode



HP CLJ 2600n delivered Faster Total Print Times than Samsung CLP-300N

- from both Ready and Powersave modes -

° *HP 6% faster TOTAL PRINT TIME than Samsung from Ready Mode*

° *HP 53% faster TOTAL PRINT TIME than Samsung from Powersave Mode*

Testing performed using default driver settings for Plain paper

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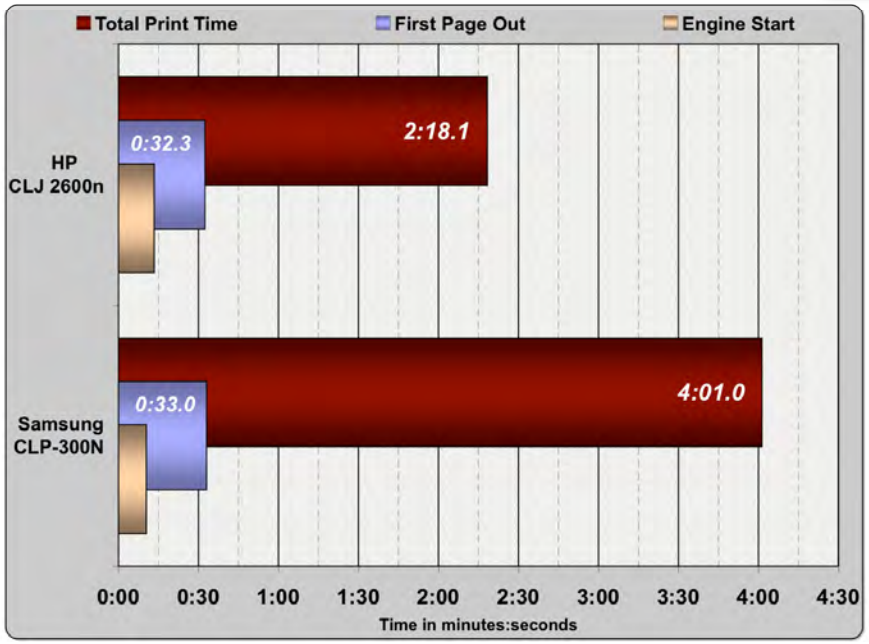
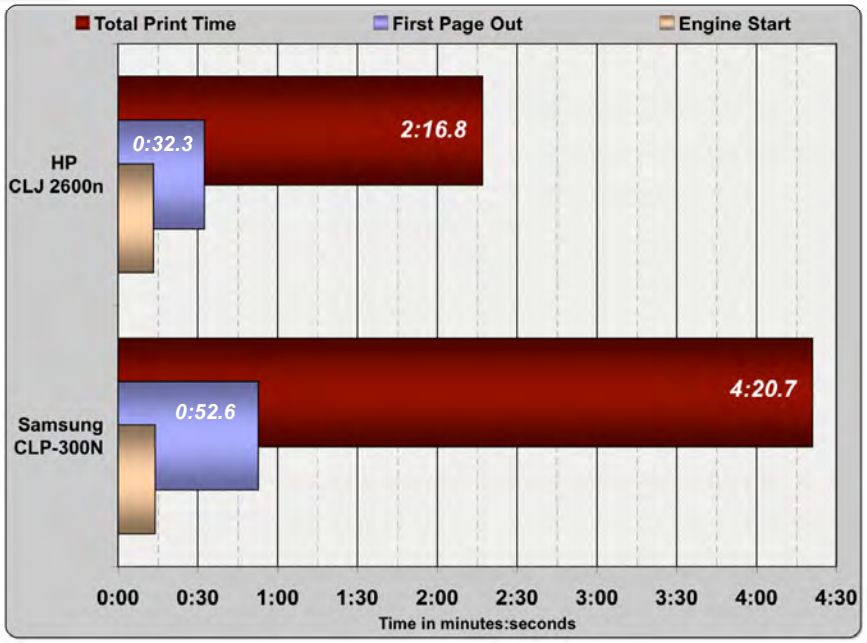
Throughput Speed Performance — Test Results (cont'd)

Newsletter
1-page, 15-copies

from Ready mode



from Powersave mode



HP CLJ 2600n delivered *Faster Total Print Times* and *Faster First Page Out* than Samsung CLP-300N

- from both Ready and Powersave modes -

° *HP 43% faster TOTAL PRINT TIME than Samsung from Ready Mode*
° *HP 48% faster TOTAL PRINT TIME than Samsung from Powersave Mode*
° *HP 39% faster FIRST PAGE OUT TIME than Samsung from Powersave Mode*

Testing performed using default driver settings for Plain Paper

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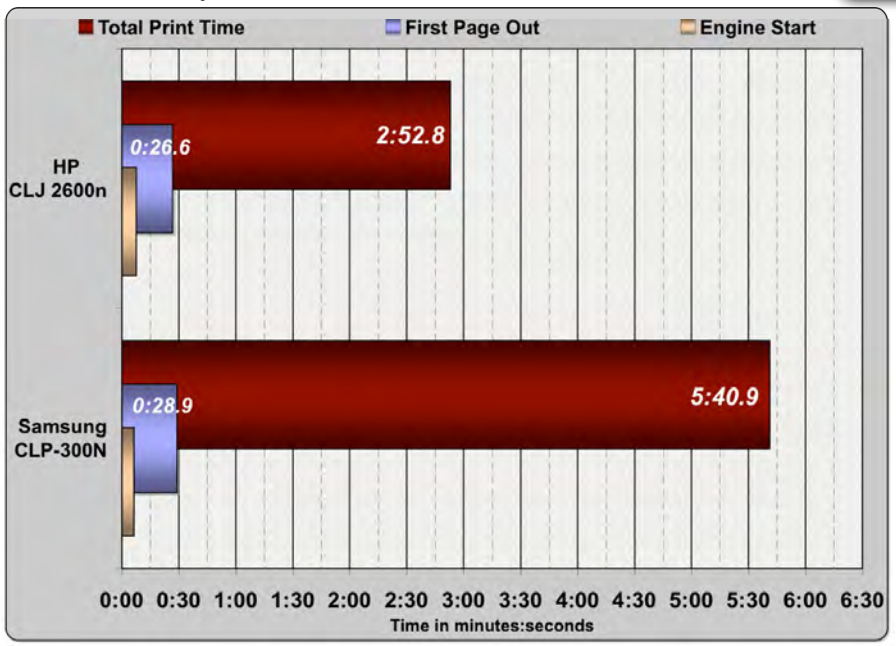
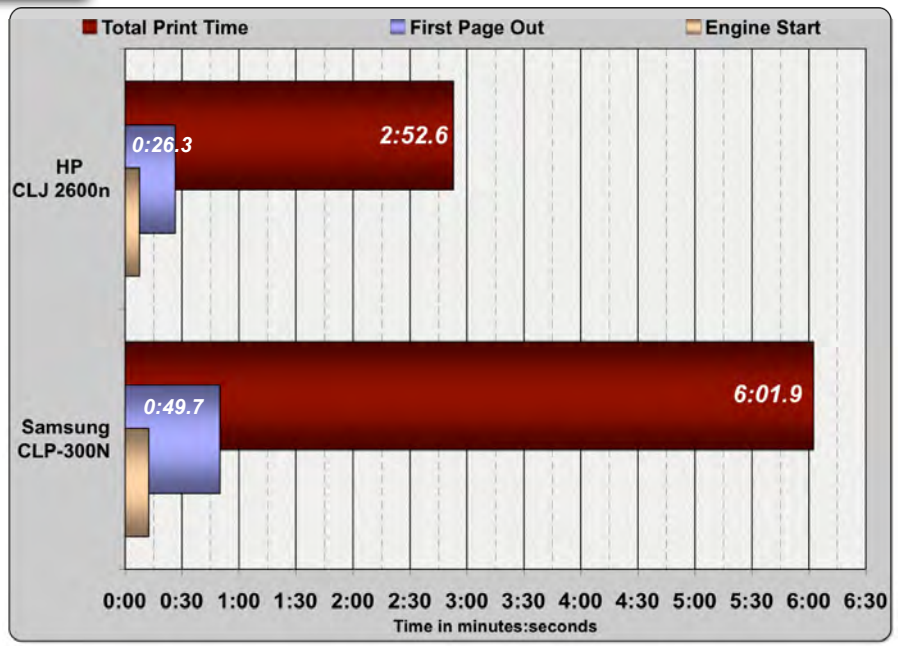
Throughput Speed Performance — Test Results

Color & Print Quality Report
22-pages, 1 copy

from Ready mode



from Powersave mode



HP CLJ 2600n delivered *Faster Total Print Times* and *Faster First Page Out* than Samsung CLP-300N

- from both Ready and Powersave modes -

- *HP 49% faster TOTAL PRINT TIME than Samsung from Ready Mode*
- *HP 52% faster TOTAL PRINT TIME than Samsung from Powersave Mode*
- *HP 47% faster FIRST PAGE OUT TIME than Samsung from Powersave Mode*

Testing performed using default driver settings for Plain paper

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Print Quality Analysis — Methodology

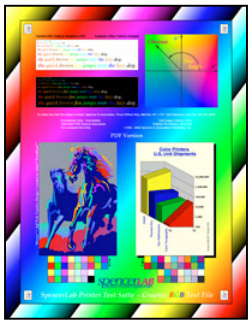
Analysis Procedure

- *Results based on element types, including:*
  - Text
  - Lines
  - Tints
  - Blends
  - Images
- *SpencerLab Test Suite test documents utilized*
  - Range of test documents, covering a variety of printing requirements
  - Printed on each of the printers in a range of print modes
  - Printed on regular office paper and specialty laser glossy and matte media
  - A single printer of each manufacturer was used in analysis and assumed to be representative
  - Test documents printed using Adobe Acrobat Reader 8.0

Enhanced Black

Color Spectrum

Graphic RGB



Newsletter

Photo Suite

Castle

Covered Bridge

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Print Quality Analysis — Results

Overall, the HP CLJ 2600n Print Quality is superior to Samsung CLP-300N

- *Black & Color Text*
  - HP Text exceptionally sharp and well-rendered
- *Lines*
  - HP Black and Color Lines are smooth and sharp
- *Tints*
  - HP Tints are vibrant and smooth
- *Blends*
  - HP Blends are uniform with even transitions
  - Highlight areas appear a bit blown-out, and shadow areas overly dark
- *Images*
  - HP Images are pleasing with sufficient richness and vibrancy
  - High saturation sometimes results in loss of fine shadow details

HP CLJ 2600n color image reproductions are of excellent quality on regular and specialty media, particularly from a laser printer targeted for a typical office environment

Print quality generalizations apply to default modes, unless otherwise stated.

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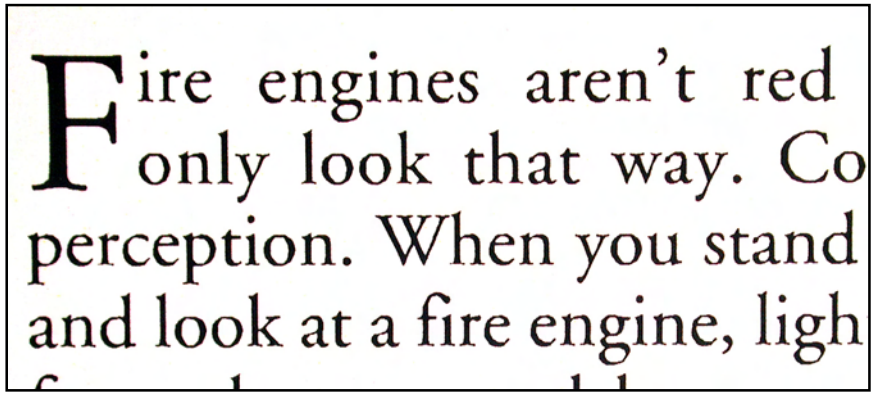
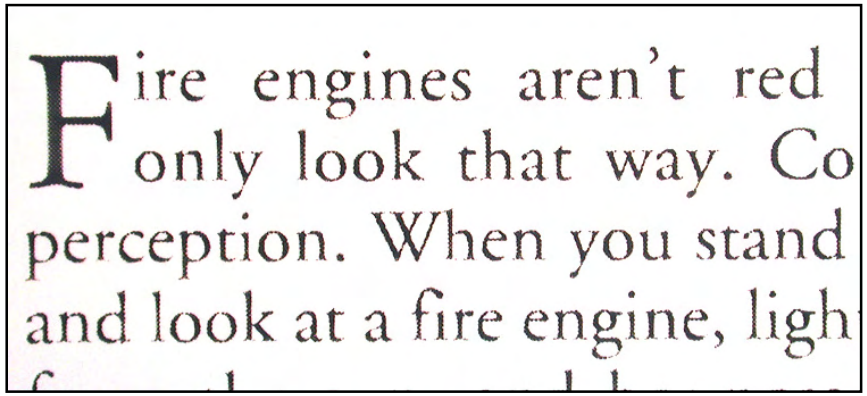
Print Quality Analysis — Results (cont'd)

Black Text

- HP CLJ 2600n
  - *Superior to Samsung CLP-300N in sharpness and clarity*
  - *Text is well-defined and fairly smooth*
  - *Text legible to 2-point size and dropout free to 6-point size*
- Samsung CLP-300N
  - *Text lacks sharpness and contains noticeable dropouts*
    - Serifs not properly produced
  - *Text is rendered a bit thick*
    - Lower point sizes have reduced legibility



HP CLJ 2600n



Samsung CLP-300N

Magnification of 12-point Text

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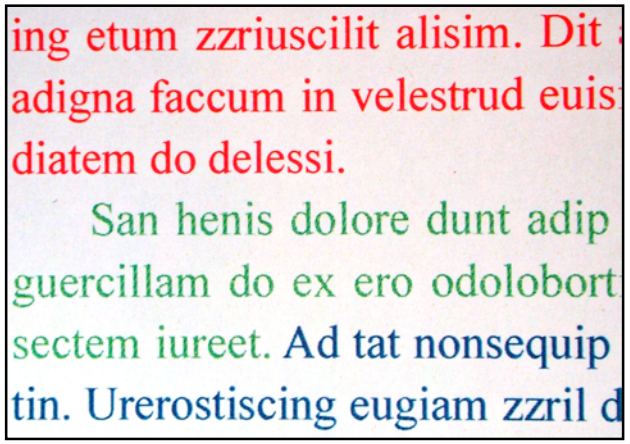
Print Quality Analysis — Results (cont'd)

Color Text

HP CLJ 2600n

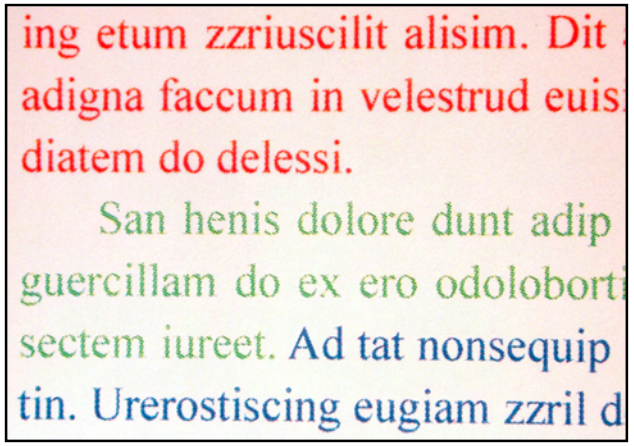
- *Superior to Samsung CLP-300N with sharp, uniform, smooth, legible characters*
- *Excellent screening*
- *Legible to 4-point size*



HP CLJ 2600n

Samsung CLP-300N

- *Text is grainy*
- *Screening patterns result in unsharp ("fuzzy") Color Text*
- *Exhibits noticeable "ghosting" on colored background*



Samsung CLP-300N

Magnification of 10-point Text

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Print Quality Analysis — Results (cont'd)

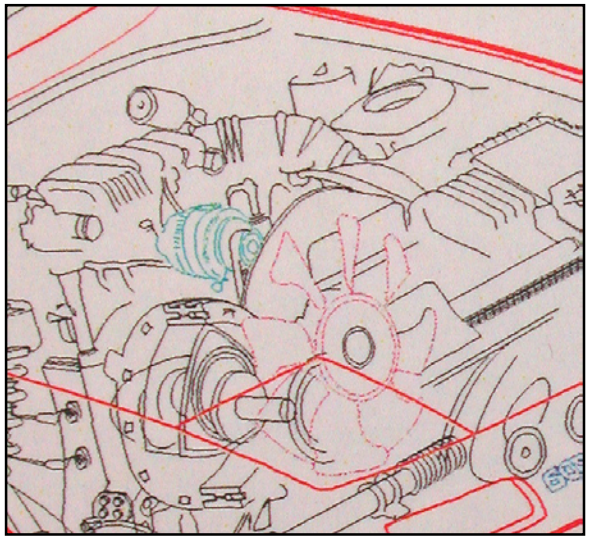
Lines

HP CLJ 2600n

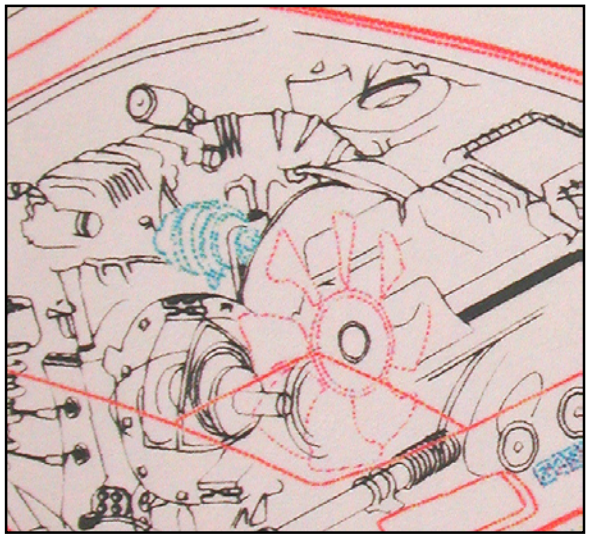
- *Black and Color Lines are sharp and crisp*
  - Color Lines produced on the Mazda car drawing are of exceptional quality, highlighting very fine details
- *Lines are clear and correctly rendered at requested thicknesses*
- *Thin Curved, Radial, and Angled Black Line renditions are good*
  - Minor stepping on Thin Curved Lines under magnification

Samsung CLP-300N

- *Black Lines are rendered a bit too thick, resulting in loss of fine detail*
- *Lines are not reproduced at the requested thickness*
  - 300 dpi, 600 dpi, 1200dpi, and 2400 dpi lines are produced with same thickness
  - Thin Near Horizontal and Vertical Lines appear to merge
- *Thin Color Lines show visible screening and lack saturation*
  - Appear as broken and dotted, resulting in detail loss



HP CLJ 2600n



Samsung CLP-300N

Magnification at approx. 350%

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Print Quality Analysis — Results (cont'd)

Tints

HP CLJ 2600n

- *Tints are vibrant and smooth compared to Samsung CLP-300N*
- *Free from banding, mottle, and grain*
- *Black Tints have good differentiation at varying percentages (10%-90%)*

Samsung CLP-300N

- *Tints exhibit noticeable screening patterns*
- *Solid Tints appear less saturated when compared to HP CLJ 2600n*
- *Black Tints (10%-90%) are uneven and inconsistent, with an overextended highlight area*

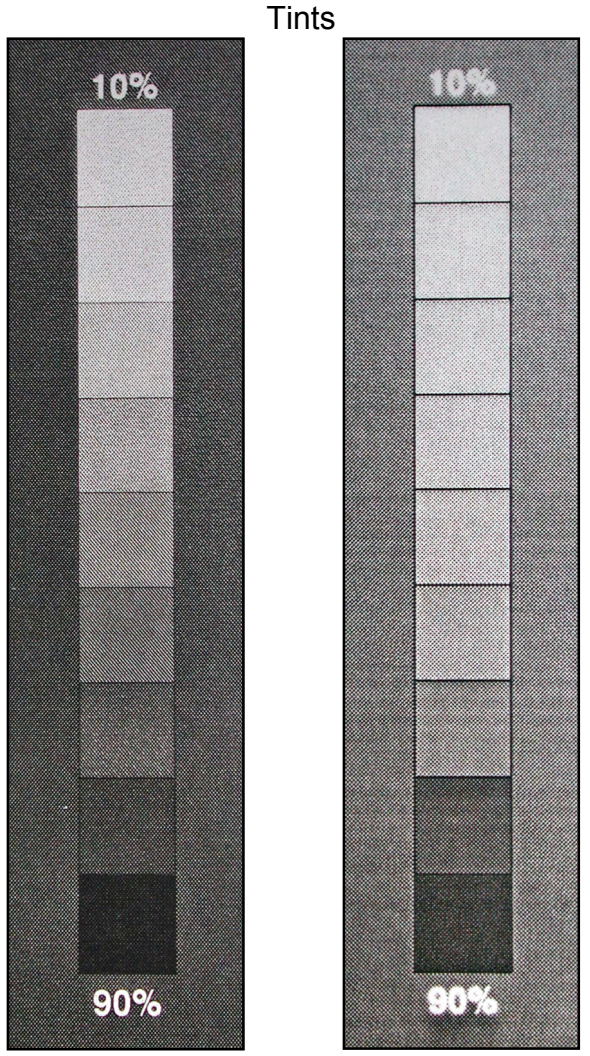
Blends

HP CLJ 2600n

- *Overall, Blends have smooth, consistent transitions*
- *Highlight areas appear a bit blown-out and shadow areas overly dark*
- *Minor screening patterns visible*

Samsung CLP-300N

- *Blends are comparably smooth*
- *Shadow Blends appear plugged and highlights washed out*
- *Harsh transitions and non-linearities present*



HP CLJ 2600n *Samsung CLP-300N*

Magnification at approx. 210%

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Print Quality Analysis — Results (cont'd)

Images

HP CLJ 2600n

- *Overall Image quality is superior to Samsung CLP-300N*
- *Images produced with excellent richness and high color differentiation, resulting in pleasing output*
  - Skintones are a rendered with a magenta cast, but are pleasing
  - Images can sometimes appear too saturated, resulting in loss of fine shadow detail
- *Images are smooth in comparison to the Samsung*
  - No visible banding, mottle, grain
- *Highest quality image rendition when printing on "HP Color Laser Photo Paper, Matte" media*
  - Images were realistic and vibrant, without being overly saturated

Samsung CLP-300N

- *Images lack richness and contrast*
  - Colors produced are flat, resulting in dull and lifeless prints
  - Lack of detail, depth, and clarity
- *Images have noticeable print artifacts*
  - Horizontal and vertical banding visible
  - Machine streaks noticeable in large blue (sky) regions
- *Images have acceptable color fidelity*
  - Skintones and grass areas are a rendered with a yellow cast

HP CLJ 2600n

Samsung CLP-300N

Magnification at approx. 100%

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Ease-of-Use/Functionality Findings

Installation & Set-Up

- *Easy installation of both HP CLJ 2600n and Samsung CLP-300N printers*
  - The HP CLJ 2600n printer is ready to be used out-of-box, with toner and consumables factory installed
  - During Samsung CLP-300N initial toner cartridge installation, user failed to seat one of the toner cartridges properly
    - *This resulted in disturbing machine noises; the control panel failed to generate an error signal*
    - *Problem was fixed after powering down the printer and re-seating the toner cartridges*
  - Samsung CLP-300N is lightweight with a small footprint, and can be lifted and moved by one person
  - HP and Samsung ship with easy-to-understand setup poster and CD-ROM containing all required printer drivers/software
  - Simple, easy to follow on-screen installation instructions
    - *HP CLJ 2600n and Samsung CLP-300N ship with CD-ROM based User Guide, not printed hardcopies*
    - *Samsung CLP-300N ships with a printed 'Network Printer Quick Guide'*

Control Panel

- *HP CLJ 2600n control panel consists of a 2-line LCD display*
  - Provides text information, including but not limited to, Toner Low, Paper Jams, Paper Out, Printer Errors, and Printer Status
  - Advanced functions such as Paper Setup, Service/Maintenance, Network Configuration, Print Quality, etc. can be performed directly from the control panel
- *Samsung CLP-300N has no text display*
  - Control panel has LED lights that provide basic information on Toner Low, Paper Jams, Paper Out, Printer Errors, and Printer Status
  - Relies on printer driver interface for advanced printer monitoring and troubleshooting

Findings based upon evaluators' experiences during testing of single HP CLJ 2600n and Samsung CLP-300N printers, assumed to be representative. Some information based upon respective printer User/Owner's Manual.

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Ease-of-Use Findings/Functionality (cont'd)

Consumables

- *HP CLJ 2600n*
  - The HP ships with full-size toner cartridges: page yields of 2,500 Black and 2,000 Cyan, Magenta, and Yellow Print Cartridges (yields at 5% coverage)
  - HP CLJ 2600n Print Cartridges are the only user-replaceable part
  - Eliminates frequent human interventions due to simple and easy maintenance
  - HP SureSupply™ allows toner re-ordering, with ease and real-time availability
- *Samsung CLP-300N*
  - Samsung CLP-300N ships with starter-size toner cartridges: page yields of 1,500 Black, and 700 Cyan, Magenta, and Yellow at 5% coverage (as opposed to full-size replacement cartridges that have page yields of 2,000 Black, and 1,000 Cyan, Magenta, and Yellow)
  - Samsung CLP-300N has additional user-replaceable components, in addition to the four toner cartridges
    - *Imaging Drum Cartridge (manufacturer rated life of approx 20,000 pages)*
    - *Waste Toner Powder Collection Bottle (manufacturer rated life of approx 5,000 pages)*
  - Supply re-ordering through printer driver directs user to third-party websites; real-time data not always available

Operating Systems

- *HP CLJ 2600n currently supports OS versions of Windows and Mac*
- *Samsung supports OS versions of Windows, Mac, and various flavors of Linux*

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Ease-of-Use Findings/Functionality (cont'd)

Media support

- *HP CLJ 2600N supports glossy and matte varieties of Photo, Brochure, and Presentation media types, in addition to plain paper, envelopes, transparencies, labels, and cardstock*
  - Not all supported media types are listed in the printer driver
- *Samsung CLP-300N does not support glossy media; only supports plain envelopes, transparencies, labels, and cardstock*

Paper Input Capacity

- *HP CLJ 2600N has 500-page input capacity*
  - Standard 250-sheet input is expandable with an optional 250-sheet tray
- *Samsung CLP-300N has 150-sheet non-expandable input capacity*

Technical Support

- *HP Telephone Support was knowledgeable and helpful*
  - Identified print driver settings for printing on new specialty HP glossy and matte photo laser media without difficulty or hesitation
  - HP Instant Support Professional Edition not supported for HP CLJ 2600n printer
- *Samsung Telephone Support was unable to provide consistent, factual assistance on Sales and Technical issues*
  - During the period from September 2006 through November 2006, Samsung CLP-300N printers were unavailable and subsequently, backordered at most retailers. Calls were placed to Samsung regarding availability, however Samsung support personnel were unable to provide detailed retailer (online and brick-and-mortar) locations, stock inventory information, or provide an expected 'ship date'
  - In the absence of satisfactory online support and documentation, calls were placed to Samsung Technical Support regarding printing on glossy and specialty media. Samsung staff were unable to recommend or advise on media alternatives or print driver settings; it was only during subsequent phone calls that user was cautioned against using any type of glossy media
- *Observations based on multiple calls, at various times, to both manufacturers*

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Ease-of-Use/Functionality Findings

General Observations

- *HP's Instant-On technology allows for faster First Page Out times*
  - Irrespective of 'sleep' time (i.e. 5 min, 15 mins, 30 min, or overnight), the HP CLJ 2600N produced consistent Fist Page Out times
- *HP accommodates a variety of media weights and finishes*
  - Handles up to 220 g/m^2 weight paper
  - Able to print on glossy and matte photo media
- *Samsung CLP-300N has restricted recommended media choices*
  - Maximum basis paper weight restriction of 163 g/m^2
  - Inability to print on glossy laser media is a significant disadvantage
- *Samsung CLP-300N not readily available in the marketplace*
  - At time of test (9/06 -11/06), printer was on not available and was on back-order at most retailers
  - Samsung sales support was unable to provide accurate and satisfactory information on printer availability
- *HP CLJ 2600n and Samsung CLP-300N displayed machine issues, on tested printers*
  - The HP CLJ 2600n output had discernable toner splatter throughout the page, especially at right vertical edge
  - The Samsung CLP-300N exhibited excessive banding
- *HP CLJ 2600n and Samsung CLP-300N experienced no failures or paper jams during the tests*

This research was conducted by *SpencerLab* Digital Color Laboratory, under commission by the Hewlett-Packard Company. Research results and analysis represent our best knowledge at the time of publication, and are based upon testing procedures developed and implemented by *SpencerLab* in our continuing commitment to accuracy, integrity, and our broad base of industry clients. Usage of derivative works requires permission from *SpencerLab* prior to distribution.