

Xerox ColorQube Solid-Ink Imaging Technology vs. Competitive Laser Imaging Technologies

TEST OBJECTIVE

Buyers Laboratory Inc. (BLI) was commissioned by Xerox Corporation to conduct a comparative lab test to measure the image permanence of output from its solid-ink print technology to that of output from competitive laser imaging technologies.

TEST OVERVIEW

In evaluating the image permanence of each technology, BLI subjected print samples from each to the following four tests: abrasion/smudge resistance, offsetting, document feeding and writeability. Multiple print samples were collected for all four tests from the following devices: the Xerox ColorQube 9203, which is a color MFP employing Xerox's solid-ink technology, and the Canon imageRUNNER C5180, HP CM6040f and the Ricoh MP C5000, which are color laser MFPs.

All printing was done on Georgia-Pacific Spectrum Printing Paper (22-lb. bond with 95% brightness), and the print samples were evaluated in BLI's 10,000-square-foot laboratory located at 20 Railroad Avenue, Hackensack, NJ (www.buyerslab.com) under ambient conditions of 72°F (+/-5°F) and 45% RH (+/-10% RH) that were monitored daily by an Extech RH S20 Digital RH/Temperature Recorder and Honeywell Model 61 Seven-Day Temperature/Humidity Chart Recorder.

PERFORMANCE OVERVIEW

Throughout each of the image permanence/durability tests conducted by Buyers Laboratory, the Xerox ColorQube imaging technology gave an image permanence performance that was comparable to that of the laser technology. In fact, the print samples from each of the imaging devices earned the same performance ratings in each test and composite performance ratings of Very Good. Consequently, with respect to these four test categories, BLI believes its test findings clearly demonstrate that Xerox's solid-ink imaging technology provides image permanence that is comparable to that of color laser imaging technology and is as well suited to standard office use.

Performance Ratings

Technology	Solid Ink	Color Laser	Color Laser	Color Laser
Device	Xerox ColorQube 9203	Canon iR C5180	HP CM6040f	Ricoh MP C5000
Abrasion and Smudge Resistance	5	5	5	5
Offsetting	5	5	5	5
Document Feeding	5	5	5	5
Writeability	3.7	3.7	3.7	3.7
COMPOSITE	4.7	4.7	4.7	4.7

Excellent = 5; Very Good = 4; Good = 3; Fair = 2; Poor = 1

TESTS RESULTS/PERFORMANCE SUMMARY

Abrasion and Smudge Resistance

TEST OBJECTIVE AND PROCEDURE

Using the ASTM Designation F1571-95, BLI technicians evaluated print samples from each device to determine if routine handling would damage printed output and whether images would be smeared, removed and/or transferred from one document to another. A Sutherland Ink Rub Tester was utilized to assess resistance to abrasion at cycles of five, 40 and 160 rotations, and an X-Rite 500 Series Densitometer was employed to measure loss of image density (indicating wear, smudging and image removal due to abrasion) following each cycle. Assessments of image smudging and transference were made visually. (See Exhibit A on page 6 for an example of the Abrasion and Smudge Resistance Test Target.)

(Note: Abrasion resistance, as defined by ASTM, is the ability of an image to withstand the frictional force attempting to remove the surface material. Smudge resistance, also as defined by ASTM, is the ability of an image to withstand smearing or streaking onto an adjacent area when rubbed. Smudge involves the redeposition of abraded material.)

BLI'S OBSERVATIONS

After being subjected to the three Sutherland rub cycles, each of the print samples proved to have excellent abrasion and smudge resistance, with no smudging or smearing, and no loss in density observed (which indicates no image degradation due to frictional wear). As can be seen in the table below, the density readings remained virtually consistent throughout this test for each of the devices, with only a few negligible changes in density readings observed.

Performance Ratings

Technology	Solid Ink	Color Laser	Color Laser	Color Laser
Device	Xerox ColorQube 9203	Canon iR C5180	HP CM6040f	Ricoh MP C5000
Abrasion and Smudge Resistance	Excellent	Excellent	Excellent	Excellent

Abrasion and Smudge Resistance Readings*

Device	Start Reading	End Reading (5 Cycle)	End Reading (40 Cycle)	End Reading (160 Cycle)
Xerox ColorQube 9203	0.06	0.06	0.07	0.07
Canon iR C5180	0.07	0.07	0.07	0.07
HP CM6040f	0.07	0.07	0.07	0.07
Ricoh MP C5000	0.05	0.05	0.05	0.05

* Each reading represents the average of four readings taken per print sample. The closer the number is to the "start reading", the greater the resistance to abrasion and smudging.

Offsetting

TEST OBJECTIVE AND PROCEDURE

This test was designed to determine if ink from the printed samples would transfer to an adjacent sheet under “normal” filing or storage conditions. BLI technicians printed sets of five-, 25- and 50-page documents using each technology and evaluated output immediately following removal from each device’s exit tray and after a 24-hour period, during which every set was stored horizontally.

BLI’S OBSERVATIONS

No evidence of ink transference (offsetting) was observed on any of the sheets from each printed set, both immediately after printing and after the 24-hour storage period. Consequently, each print technology was rated Excellent for resistance to offsetting.

Performance Ratings

Technology	Solid Ink	Color Laser	Color Laser	Color Laser
Device	Xerox ColorQube 9203	Canon iR C5180	HP CM6040f	Ricoh MP C5000
Offsetting	Excellent	Excellent	Excellent	Excellent

Offsetting from Exit Tray

Device	5-Page Document	25-Page Document	50-Page Document
Xerox ColorQube 9203	No image transfer	No image transfer	No image transfer
Canon iR C5180	No image transfer	No image transfer	No image transfer
HP CM6040f	No image transfer	No image transfer	No image transfer
Ricoh MP C5000	No image transfer	No image transfer	No image transfer

Offsetting after 24 Hours

Device	5-Page Document	25-Page Document	50-Page Document
Xerox ColorQube 9203	No image transfer	No image transfer	No image transfer
Canon iR C5180	No image transfer	No image transfer	No image transfer
HP CM6040f	No image transfer	No image transfer	No image transfer
Ricoh MP C5000	No image transfer	No image transfer	No image transfer

Document Feeding

TEST OBJECTIVE AND PROCEDURE

This test was designed to determine whether each of the technologies could withstand abrasion when samples of each were run through a standard imaging device document feeder. BLI technicians used four recently released copier-centric and printer-centric MFPs (Canon imageRUNNER 5050, Konica Minolta bizhub 751, Samsung CLX-8380 and Toshiba eSTUDIO 6530c) to evaluate whether images would hold up after multiple passes through their document feeders. One printed set consisting of 10 pages was run through each document feeder 10 times.

BLI'S OBSERVATIONS

No evidence of image degradation was visible on any of the documents following their run through each of the device's document feeders; consequently, each image sample earned a rating of Excellent in this performance category.

Performance Ratings

Technology	Solid Ink	Color Laser	Color Laser	Color Laser
Device	Xerox ColorQube 9203	Canon iR C5180	HP CM6040f	Ricoh MP C5000
Document Feeding	Excellent	Excellent	Excellent	Excellent

10 Cycles

Device	Xerox ColorQube 9203	Canon iR C5180	HP CM6040f	Ricoh MP C5000
Canon imageRUNNER 5050	No deleterious effects	No deleterious effects	No deleterious effects	No deleterious effects
Konica Minolta bizhub 751	No deleterious effects	No deleterious effects	No deleterious effects	No deleterious effects
Samsung CLX-8380	No deleterious effects	No deleterious effects	No deleterious effects	No deleterious effects
Toshiba e-STUDIO 6530c	No deleterious effects	No deleterious effects	No deleterious effects	No deleterious effects

Writeability

TEST OBJECTIVE AND PROCEDURE

Employing the ASTM Designation F2294-03, this test is designed to determine whether specific writing instruments (for instance, blue, black and red pens; a No. 2 pencil; an Avery Hi-Liter; and a black Sharpie marker) can be used to write legibly over each print sample, without skipping or smearing. All results were evaluated visually. (See Exhibit B on page 6 for an example of the Writeability Test Target.)

BLI'S OBSERVATIONS

The print samples produced by both imaging technologies and each of the test devices gave a comparable performance in the "writeability" test, as can be seen from the tables below. Each received a Good rating when writing was done with blue, black and red pens and with No. 2 pencil, due to slight skipping; and each received an Excellent rating when writing was done with an Avery Hi-Liter and Sharpie Marker. No smearing or smudging occurred in any of these tests.

Performance Ratings

Technology	Solid Ink	Color Laser	Color Laser	Color Laser
Device	Xerox ColorQube 9203	Canon iR C5180	HP CM6040f	Ricoh MP C5000
Writeability	Good	Good	Good	Good

Writeability

Device	Blue Pen	Black Pen	Red Pen	No. 2 Pencil	Avery Hi-Liter	Sharpie Marker
Xerox ColorQube 9203	Good	Good	Good	Good	Excellent	Excellent
Canon iR C5180	Good	Good	Good	Good	Excellent	Excellent
HP CM6040f	Good	Good	Good	Good	Excellent	Excellent
Ricoh MP C5000	Good	Good	Good	Good	Excellent	Excellent

Exhibits

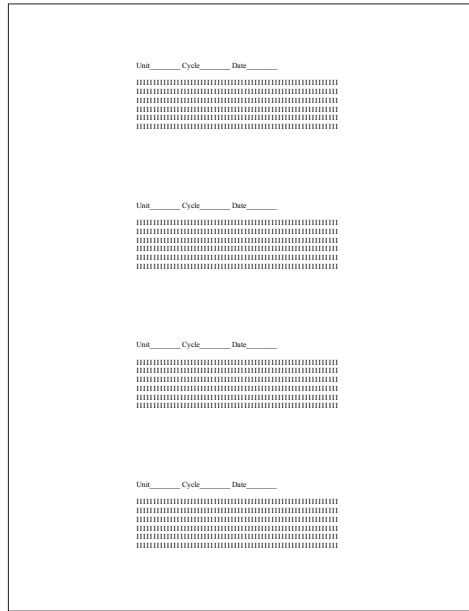


Exhibit A: Abrasion and Smudge Resistance Test Target

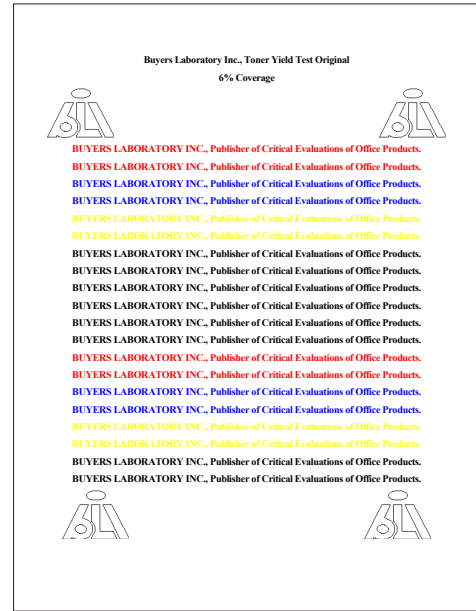


Exhibit B: Writeability Test Target