



QualityLogic Reliability/User Experience Test Report

- HP Color LaserJet 4700n Printer vs. Kyocera FS-C5030N -

QualityLogic Inc., an independent test firm, recently performed a reliability test comparing the HP Color LaserJet 4700n printer model with the Kyocera FS-C5030N. The test included three printers of each model and involved printing 100,000 images on each printer during the test. During testing, QualityLogic monitored and documented all interactions and issues with the printers. After the test was completed, an analysis of the print quality was implemented on a sample of the output from each printer. This document summarizes the results from the testing and issues that QualityLogic encountered during initial setup of the printers, the actual reliability test and the subsequent print quality evaluation. The information is divided into the following five sections:

1. Executive Summary (which provides an overview of the next four sections)
2. Planned Interventions
3. Failures
4. Print Quality and Consistency
5. Customer Experience

Executive Summary

In all four of the areas evaluated during this testing, the HP printers performed better than the Kyocera printers as summarized in the table to the right. (A check mark in this table indicates that the model with the check did better than the other. If both models have a check mark it indicates that they had the same or very similar performance in that area.) The HP printers were easy to setup and had no initial problems while the Kyocera printers did have setup related failures. Kyocera printers required many more planned interventions than the HP printers. In addition, the HP printers had far fewer paper jams and only one failure during testing; a failed print cartridge that was replaced with limited downtime. The Kyocera printers had eight failures during initial setup and test, one of which was not covered under warranty by Kyocera. Print quality was superior and more consistent for the HP printers than the Kyocera printers. In addition, the overall customer experience was better with HP as we experienced limited downtime with the HP printers as our cartridge issue was resolved promptly and to our satisfaction with HP which cannot be said of Kyocera.

	HP Color LaserJet 4700n	Kyocera FS-C5030N
Planned Interventions	✓ Zero Only need to change toner cartridges	Required 39 cleanings and 16 waste changes per 100,000 pages
Failures (including paper jams)	✓ No setup problems Paper jams - 2 in 300,000 pages One failed toner cartridge replaced under warranty	Two setup issues Paper jams - 27 in 300,000 pages Bin sensor failed Damaged drum Pickup rollers failed
Print Quality	✓ Better print quality with higher consistency	Much lower print quality with lower consistency
Customer Experience	✓ Positive response by HP on all issues Limited down time	Drum not covered under warranty Printers were down waiting for service both before and during testing

Planned Interventions

Interventions are divided into two categories; those that occur frequently such as changing of paper and toner cartridges (referred to as Periodic), and those that are infrequent such as changing a drum assembly (referred to as Scheduled parts replacement). The HP and

	HP Color LaserJet 4700n	Kyocera FS-C5030N
Periodic (per 100,000 pages)	✓ Change toner cartridges	Change cartridges 39 drum cleanings Replace waste toner 16 times
Scheduled parts replacement	✓ None	✓ None

Kyocera printers had the same paper capacities in both of the paper drawers that were used for this test, thus the number of paper changes and the resulting time required to change paper was the same and is not included in this analysis. Note that interventions that resulted from failures during test are not covered in this section but in the next section.

Periodic – Both printers used toner cartridges that required periodic replacement. The amount of time required between the models for actual replacement of the cartridges was similar. In addition, the number of cartridges used was approximately the same and thus the overall time consumed was similar between the models. However, in order to maintain print quality, the Kyocera printer required a manual cleaning process. This procedure is recommended each time a toner cartridge is replaced. Cleaning was required approximately 39 times per 100,000 pages which is equivalent to approximately one cleaning every 2,600 pages. This procedure took between three and fifteen minutes per cleaning (depending on the experience level of the individual). In addition, the Kyocera printers also required frequent replacement of waste toner bottles. Waste toner bottle replacement was required approximately every 6,250 pages. On average we had to replace 16 of these per printer during the 100,000 page test. The time to replace the waste toner bottles was about the same as a toner cartridge. Based on this 100,000 page test the Kyocera printer required much more time and effort to maintain than the HP printer. Including toner changes and other periodic maintenance requirements, the Kyocera 5030 took almost six times longer to maintain than the HP 4700.

Scheduled parts replacement – Except as noted above, neither of these printer models required any scheduled parts replacement during the test.

Failures

There are three areas that are covered under failures; initial issues encountered before testing began (initial set-up), failures during the actual test and paper jam rates for each model.

Initial Setup – During initial setup, the HP printers encountered no issues. The Kyocera printers had two issues that both required service calls to resolve. One issue was a

faulty bin full sensor that gave false indications of the output bin being full and thus the printer would stop printing. The second issue was an inability of the printer to print yellow toner on the backside of pages printed in duplex. Both of these problems happened on one printer and were identified in the first 100 pages of testing. The second issue required two service calls and was resolved with new firmware. We lost four days of usage of the Kyocera printers waiting to resolve these two problems.

Failures during test – The HP printer had one failure involving a toner cartridge. The cartridge began having a print defect about half way through its life. After calling HP support the cartridge was replaced at no cost. The Kyocera printers had three issues, two of which required service calls and down time for the printers involved. First the bin full sensor problem that was first seen during initial setup recurred during testing at a page count of 13,650. This was resolved by a service call, but the printer was offline for a day. The second issue was a damaged drum that resulted from a cleaning wand that broke during the normal and required cleanings at cartridge changes. This also required a service call and resulted in a repair charge as the damage was not covered under warranty. This printer was not usable while waiting for repair, which resulted in one day of downtime. The third issue was a failure of the pickup rollers in the paper feed trays. Two printers exhibited the issue. The failure resulted when the feed rollers came apart and stopped further printing. The issue was resolved by the QualityLogic technicians running the test rather than through a service call. A service call might be required by some users to resolve this type of problem. HP printers were found to be more reliable in this test when compared to the Kyocera printers.

Jam rates - When comparing the paper jam rates of the two printer models during testing, the HP clearly outperformed the Kyocera printers by a significant margin. The HP printers had 2 jams in 300,000 total images both of which occurred during duplex printing. The Kyocera had 27 jams in the same 300,000 images printed and of the 27 jams, 19 occurred during duplex printing.

	HP Color LaserJet 4700n	Kyocera FS-C5030N
Acquisition & Initial setup	✓ No issues	Bin full sensor bad Would not print yellow in duplex
Failures during test	✓ One defective cartridge encountered	Bin full sensor Damaged drum Four instances of failed paper feed rollers
Printer Jams	✓ 2 in 300,000 pages Jam rate 1/150,000 Duplex rate 1/7,500	27 jams in 300,000 pages Jam rate 1/10,556 Duplex rate 1/789

Print Quality and Consistency

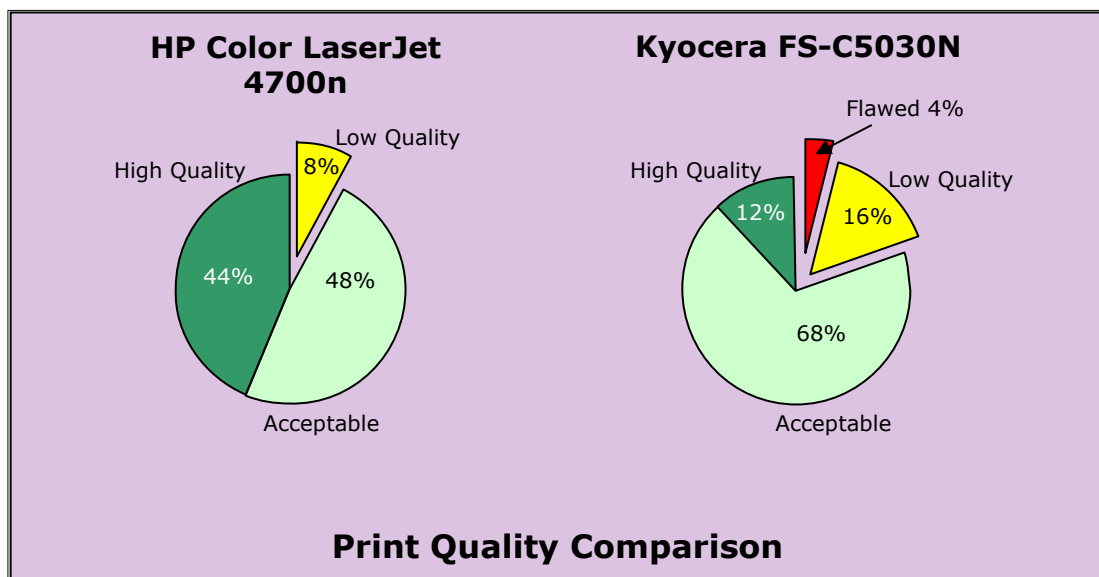
After all testing was completed two separate aspects of print quality were evaluated. The first evaluation compared the output of the HP and Kyocera printers directly. The second compared output consistency over the test period.

	HP Color LaserJet 4700n	Kyocera FS-C5030N
Print Quality	✓ Clear winner almost 4X more high quality pages	Graded well below the HP
Print Quality Consistency	✓ High and consistent	Poor and somewhat declining

Print Quality - A direct print quality comparison of output from the Kyocera and HP printers was performed. A selection of pages from the print quality suite was compared by evaluators and ranked on a scale of 1 to 10 representing pages from "Flawed" to "High Quality". The HP printers showed a clear print quality advantage over the Kyocera printers.

Quality Level	Print Quality Description	HP Color LaserJet 4700n	Kyocera FS-C5030N
High Quality	Page has no apparent artifacts and a user would put this page in his or her resume. These pages are defined as "High Quality" pages.	44%	12%
Acceptable	Pages are still acceptable but they have noticeable differences from those above. The average user would still use it in a typical business document.	48%	68%
Low Quality	Page is sufficiently flawed that it would not be circulated to others as a business document and would only be acceptable as a draft page. These pages are defined as "Low Quality" pages.	8%	16%
Flawed	Page has lost some to a significant amount of legibility and is considered severely flawed and would need to be re-printed or corrective action taken.	0%	4%
Average (based on 1 worst – 10 best scale)		8.2	6.5

The following side by side pie charts compare the above information in a graphic form.

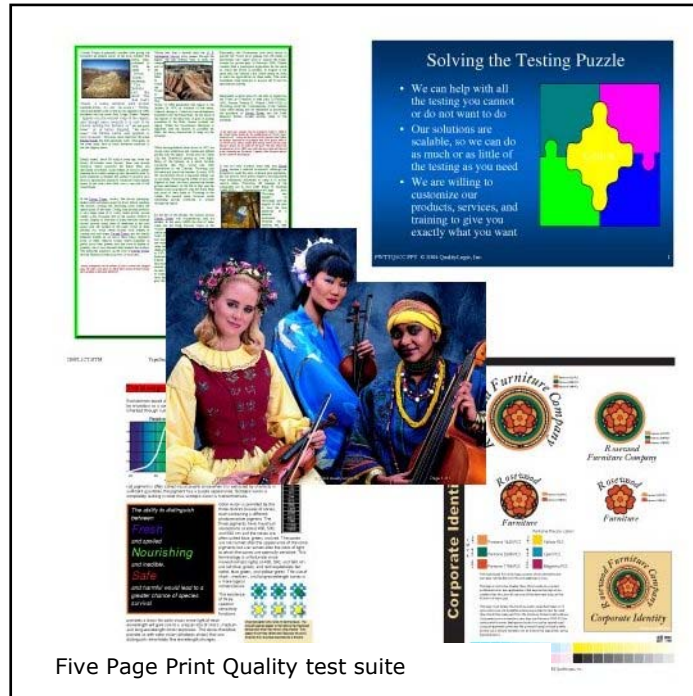


The table above shows that the Kyocera printers received a wider range of grades from the reviewers and a significantly lower average. Kyocera had 20% of their pages graded as “Low Quality” or below compared to 8% for HP. In addition, Kyocera had 4% of their pages considered to be “Flawed” compared to none for HP. HP printed almost 4 times as many high quality pages as Kyocera. The HP average of 8.2 (based on a 1 – 10 scale) was significantly higher than the Kyocera average of 6.5.

Consistency – In addition to the print quality test above, a separate consistency evaluation specific to each individual printer was also completed. This test showed how much each individual printer’s output varied throughout the test. No comparison between models was done during this evaluation only for the given printer being graded.

In the consistency test, similar to the print quality comparison test, the HP printers had higher overall quality grades and printed higher quality pages more consistently. The Kyocera printers were less consistent with overall lower grades that were more spread out. Comparing the grades for the first 50,000 pages versus the last 50,000, the Kyocera’s had a downward print quality trend during the test while the HP printers improved slightly. All maintenance procedures were followed during this testing and printing did not exceed monthly recommended duty cycles. The Kyocera printers required frequent cleanings and these cleanings were rigorously followed on schedule during the testing and performed by a trained technician.

Summary - In summary the HP printers showed clearly better consistency and print quality compared to the output from the Kyocera printers.



Customer Experience

There are three areas considered under customer experience; equipment acquisition, testing and downtime. We will cover interactions with the printer vendor or their support infrastructure and how effective those interactions were at resolving any issues that arose.

	HP Color LaserJet 4700n	Kyocera FS-C5030N
Equipment Acquisition	✓ No issues.	Persistence required to resolve yellow duplex issue
During test	✓ One call that was resolved to our satisfaction.	Kyocera refused to cover drum under warranty
Downtime	✓ Limited down time	6 days lost before and during test

In the first area under equipment acquisition we will cover the initial and subsequent acquisition of printers and consumables along with any initial setup problems. In the second area we will cover any interactions required during the test.

Equipment Acquisition – Both the HP and Kyocera printers were easy to order and arrived promptly. The HP printers and consumables were ordered through a large well known online merchant. The Kyocera printers were purchased through a local retailer which is Kyocera’s method of distribution. As noted earlier, the HP printers did not have any initial setup issues while the Kyocera printers did have issues that were summarized previously. The local service provider for Kyocera did provide prompt service on the issues that were encountered, although their preliminary proposal to change printer drivers to resolve the yellow duplex issue was rejected by QualityLogic. They did resolve the problem but it required some persistence on QualityLogic’s part and a second service call.

During Test – During testing, the HP printer had one issue with a print quality problem that was quickly resolved by HP to our satisfaction. The cartridge was replaced free of charge by HP. The Kyocera printer had one failure that recurred during testing which had been seen during initial setup (the false bin full error). In addition, the drum that was damaged during testing was not covered under warranty. Even with a trained technician performing all maintenance according to the schedule and procedures provided by Kyocera, they believed we had not used proper procedure.

Downtime – The HP printer had very limited downtime during testing due to one failed cartridge while the Kyocera printers lost two days due to printer failures during testing and four days prior to testing.

Summary – During this test the HP printers had one problem and the subsequent interaction was positive. The Kyocera printer had issues that resulted in lost printing time and extra expense. Kyocera was responsive on most issues but extra time was required on our part. In addition the damaged drum incurred extra expense.

Conclusions

The HP Color LaserJet 4700n outperformed the Kyocera FS-C5030N in almost all tracked reliability metrics. Setup was less complex and incident free with the HP printer. Kyocera had two issues requiring service calls before we were able to start testing. During the test, the HP printer only required cartridge changes with no need for additional scheduled maintenance. Kyocera required many additional planned interventions including waste toner bottle replacement approximately every 6,250 pages and cleaning every time a toner cartridge was replaced. Kyocera had 37 unplanned interventions for paper jams, and parts failures, while HP had three unplanned interventions including two paper jams and a printer cartridge that required early replacement. In the print quality portion of the test, the HP Color LaserJet 4700n had clearly superior print quality with higher consistency. HP had over three times as many high quality pages as the Kyocera. In addition, while HP had no flawed

pages, Kyocera had four percent of its pages rate as flawed. The Kyocera printers required both phone and on site support multiple times. HP did not require any on site support. Calls to both Kyocera and HP revealed that HP support resolved issues quicker with less wasted time. In this reliability test, the HP Color LaserJet 4700n was the clear winner.

Test Approach

The objective of this reliability study was to identify any reliability and usage issues in a controlled and consistent test environment. The testing was done in a manner that attempted to simulate normal start stop printing usage in a high volume business environment. Another objective of the study was to understand and document the customer experience during the purchase, initial equipment setup and usage of the printers. The test length was set as 100,000 pages per printer with an initial burn in test that extended the test length to 102,000 pages for each printer.

Three printers of each model were purchased and tested in order to have a broad base to compare with and avoid having any single printer predominate. All equipment setup, maintenance (if required) and replacement of parts was done by trained QualityLogic test technicians unless local support was provided by the vendor. All procedures as recommended in supporting documentation provided by the manufacturer were adhered to during testing. The recommended maximum monthly duty cycle by the manufacturer was not exceeded during testing.

Print jobs were 10 pages in length and a pause was inserted between print jobs in order to simulate a work environment in a controlled manner. 90% of the pages were printed on standard 20 lb. laser paper while the remainder was divided between a 20 lb. recycled paper, a heavy 28 lb. laser grade paper and a 32 lb. glossy paper. 10% of the overall pages were printed in duplex using the standard 20 lb laser grade paper. In each group of 100 pages, 95 were using a test suite available from ISO for yield testing while five pages were a print quality grading suite. This suite was developed for this test by QualityLogic from existing QualityLogic files. All printing was done on letter size paper.

All testing was done in an environmentally controlled environment with the average temperature controlled within the range of $23.0^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and humidity $50\% \pm 10\% \text{RH}$. All materials used in testing were acclimated in this environment for at least 8 hours prior to usage.

All printers were configured with similar options. A second bin was added for the standard 20 lb. paper while the three special papers were fed from the standard tray. All printers were equipped with their duplex printing options and network connection option (which was used for delivering test files). All printers and consumables were purchased by QualityLogic on the open market. The majority of toner was purchased in one of three lots for each printer. The lots were disbursed over the test period in order to provide randomness in manufacturing lots used for the testing.

All print drivers were installed using the Plug-n-Play method and tested using the default settings. Files were initially printed and captured for later integration into the QualityLogic test environment. The captured files were then sent to the printers during testing. Logs were kept during testing regarding all issues encountered during the test.

After the test was completed, two print quality evaluations were conducted. The first comparison evaluated the consistency of output over the test period for each printer. A single grader was used for the evaluation in order to provide consistency in the process. All three printers from a single manufacturer were evaluated before proceeding to the next model. Every other print quality suite was graded and each page in the sampled suite was evaluated.

For the second portion of the study the grader removed representative samples of the suites from each model. These were graded on a one to ten scale by several evaluators.

This study was commissioned by HP.

About QualityLogic

QualityLogic is a leading Software Quality Services Company offering a variety of testing services and related tools focused on the conformance, performance, and interoperability testing needs, from low level firmware testing, to high level multi-tier application testing. QualityLogic has over 20 years' experience, both in developing specialized test tools and providing comprehensive testing services for top industry manufacturers.

Test results provided by QualityLogic. Tests were performed under laboratory conditions and your results may vary.

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