PRINTING DURABILITY TESTING OF CHINESE CONTINUOUS INK SUPPLY SYSTEMS FOR INK JET PRINTERS

SUMMARY REPORT (EXCERPTS)

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This report provides excerpts of part of the "PRINTING DURABILITY TESTING OF CHINESE CONTINUOUS INK SUPPLY SYSTEMS FOR CANON INK JET PRINTERS, SUMMARY REPORT" prepared by Allion Japan Inc.

1 Introduction

At our company, Allion Japan Inc., we began with a gas resistance comparison test using 3 mixed gases between genuine ink and refill ink for ink jet printers conducted in June 2007, and from October 2007 to February 2008, we have conducted gas resistance comparison tests and printing quality comparison tests, focusing primarily on ink cartridges sold in the Japanese and Chinese markets.

This time, we report on a printing quality comparison test between genuine ink cartridges and continuous ink supply systems actually sold in the Chinese market.

Products which automatically supply ink into the ink cartridge from an external tank are currently being sold in the Chinese market. If these products are used, the printer can be used continuously without replacing the ink cartridge, simply by continually refilling the external tank with ink, and the product outer packaging and manual state that cost performance is superior to buying ink cartridges. What ordinary users want from printer ink is quality of prints made with the ink, and cost performance commensurate with the quality. For example, if problems tend to occur when printing with the ink, then it likely will not be acceptable to ordinary users, even in the price is cheap.

Therefore, our company selected continuous ink supply systems actually sold in the Chinese market by 3 companies (Company A, B and C), conducted printing quality comparison tests by repeatedly printing photographic images and text using the continuous ink supply systems of each company and genuine ink cartridges, and checked whether the prints made using the continuous ink supply systems achieved the same level of reliability as prints made using genuine ink cartridges.

In the main text below, genuine ink cartridges are referred to as Canon ink cartridges or Canon genuine (for short), and continuous ink supply systems are referred to using the acronym CISS. Systems from each manufacturer are referred to as Company A's CISS, Company B's CISS and Company C's CISS, or Company A, Company B and Company C (for short).

2 Conclusions

Durability testing was conducted by printing 1000 images and 1500 sheets of text using genuine ink cartridges and continuous ink supply systems. The results showed that, when printing was done continuously using the continuous ink supply systems of the 3 companies evaluated here, the following major problems occurred, which can be disadvantages for ordinary users.

① When using continuous ink supply systems, a number of problems could occur: sudden failure of ink to come out, fouling of prints due to ink leakage after ink filling, and a change from the original color with failure to recover when used continuously.

② When continuous ink supply systems are used, there is a possibility that the amount of ink used will be greater than with Canon genuine ink cartridges due to the effects of ① above, and this may have an impact on running costs, depending on the frequency and state of the problems.

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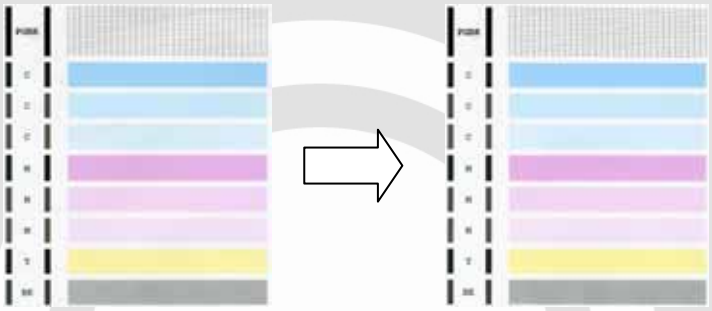
3 Test results

3.1 Problems during printing test

3.1.1 Sudden failure of ink to come out during continuous text printing

A phenomenon occurred where, during continuous printing, a specific ink suddenly failed to come out from the CISS, even though the ink cartridge was filled with ink. Failure of ink to come out tended to occur immediately after recovery when there were streaks or smudges, or immediately after filling with ink. When this problem occurred, it was not possible to recover simply by performing the recovery operations (head cleaning, strong cleaning, head position adjustment) described in the printer manual. Recovery was only possible by removing the part of the ink cartridge attached to the printer head, moving ink from the external tank side to the ink cartridge side by using the head differential, and then letting the printer sit for at least 1 day. This problem occurred with Company B and Company C, and did not occur with the Canon genuine ink cartridge or Company A.

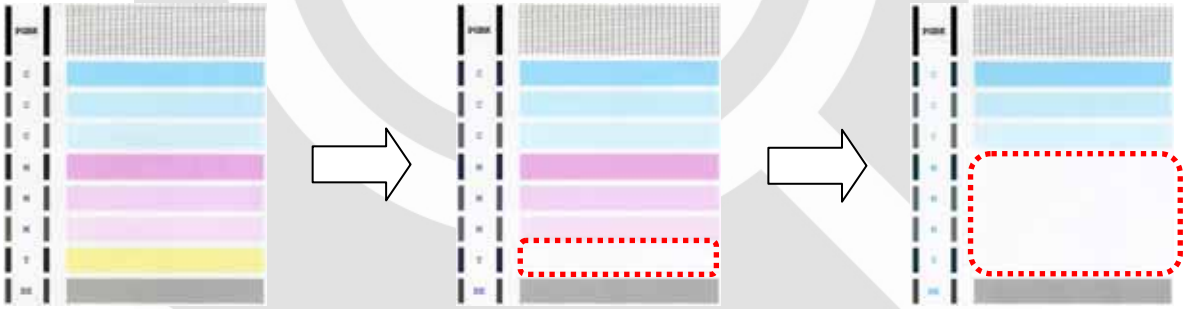
Canon genuine　Nozzle check comparison



<Initial print>　　<After 1500 prints>

No change was evident between initial print and state after continuous printing of 1500 prints

Company B　Nozzle check comparison

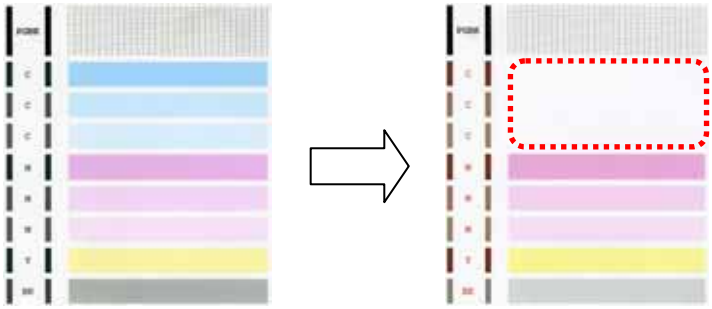


<Initial print>　　<After 400 prints >　　<After 600 prints>

After about 200 prints, Y ink gradually stopped coming out, and after 400 prints it stopped coming out completely.

Even after recovery operation and movement of ink using the head differential, M ink and Y ink did not come out after a total of 600 prints.

Company C　Nozzle check comparison



<Initial print>　　<After 500 prints>

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C ink stopped coming out after 500 prints.

Printing conditions:
● Printer used: PIXMA iP4500, Driver version: Ver. 2.11 ● Paper used: Canon SW-101A4 (Canon ordinary paper, White)
● Data used: Data printed when performing "nozzle check pattern printing" with the driver (Ver. 2.11) for PIXMA iP4500
● Printing settings: Paper setting=Plain Paper, Printing quality=Normal, Color/Density: Auto ● Page layout: Normal-size Printing

3.1.2 Sudden failure of ink to come out during continuous photo printing

A phenomenon occurred where, during continuous printing, M ink and C ink suddenly failed to come out, even though the ink cartridge was filled with ink. When this problem occurred, recovery was only possible by removing the part of the ink cartridge attached to the printer head, moving ink from the external tank side to the ink cartridge side by using the head differential, and then letting the printer sit for at least 1 day. This problem occurred with Company A and Company C, and did not occur with the Canon genuine ink cartridge or Company B.

Canon genuine N1A image comparison


<Initial print> <After 1000 prints>

No change was evident between initial print and state after continuous printing of 1000 prints

Company A N1A image comparison


<Initial print> <After 909 prints>

After 909 prints, a specific color (thought to be M ink) suddenly failed to come out

Company C N1A image comparison

<Initial print> <After 765 prints>

After 765 prints, a specific color (thought be C ink) suddenly failed to come out

Printing conditions:

● Printer used PIXMA iP4500, Driver version: Ver. 2.11 ● Paper used: Canon GL-101 A4(Canon photo paper, glossy gold)

● Image used: SCID image N1A.tif, For printing N1A.tif was converted to RGB data and then used.

● Printing settings Paper setting=Photo Paper Glossy II, Printing quality=Normal, Color/Density: Auto ● Page layout: Normal-size Printing

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3.1.3 Color changes when used continuously

When the initial print and prints after the 1000th print using CISS were visually compared, it was confirmed that changes in color occurred in the latter. This problem was confirmed for Company A, Company B and Company C. Although the degree of these color changes varied depending on the CISS manufacturer, the changes were distinctly visible. When printing was done using genuine ink, no changes in color were visible even after 1000 prints. The above results showed that, when CISS is used continuously, there is a possibility that color will change from the original prints when the system was adopted.

Canon genuine Initial print	Canon genuine After 1000 prints
	
No change in color is evident compared to the initial print.	
Company A Initial print	**Company A After 1000 prints**
	
Print is reddish compared to the initial print.	

Company B Initial print	Company B After 1000 prints
	
Colors are faded compared to initial print.	
Company C Initial print	**Company C After 1000 prints**
	
Print is reddish compared to the initial print.	

Printing conditions:

● Printer used: PIXMA iP4500, Driver version: Ver. 2.11 ● Paper used: Canon GL-101 A4 (Canon photo paper, glossy gold)

● Image used: SCID image N1A.tif, For printing N1A.tif was converted to RGB data and then used.

● Printing settings Paper setting=Photo Paper Glossy II, Printing quality=Normal, Color/Density: Auto ● Page layout: Normal-size Printing

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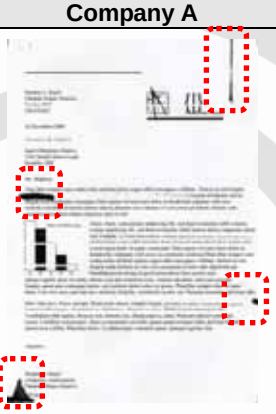
3.1.4 Prints are fouled due to leakage of ink after ink filling

When the amount of ink in a CISS system ran low (visually 5 mm or less), refill ink was supplied to the CISS system according to the manual which came with the CISS and similar precautions etc. Then, when testing was resumed, ink leaked from the print head and fouled the prints. It is thought that ink leakage occurred during printing because ink moved from the external tank to the print head side when ink filling was done. This problem occurred with CISS from all companies, and ink leakage did not occur in the Canon genuine case.

When this problem occurred, it also had effects on the printing results such as worsening of color. However, in most cases the problem disappeared if printing was continued in the same state after the problem occurred, although this varied depending on the number of prints.

<Cases of ink leakage during text printing>

*This problem did not occur during text printing with Company C.

Canon genuine	Company A	Company B
		
No leakage evident	Leakage at a few points	Considerable leakage

Printing conditions:
● Printer used: PIXMA iP4500, Driver version: Ver. 2.11 ● Paper used: Canon SW-101A4 (Canon ordinary paper, White)
● Image used: ISO/IEC 24712 data, Page 1 – Business Letter 0.1.pdf
● Printing settings: Paper setting=Plain Paper, Printing quality=Normal, Color/Density: Auto ● Page layout: Normal-size Printing

<Cases of ink leakage during image printing>

*This problem did not occur during image printing with Company B.

Canon genuine	Company A	Company C
		
No leakage evident	Leakage at a few points	Considerable leakage

Printing conditions:
● Printer used: PIXMA iP4500, Driver version: Ver. 2.11 ● Paper used: Canon GL-101 A4 (Canon photo paper, glossy gold)
● Image used: SCID image N1A.tif, For printing N1A.tif was converted to RGB data and then used.

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● Printing settings Paper setting=Photo Paper Glossy II, Printing quality=Normal, Color/Density: Auto ● Page layout: Normal-size Printing

3.2 Comparison of ink used

The amount of ink used by the Canon genuine system and CISS of each company were compared in printing durability tests of a total of 2500 prints (1000 image prints + 1500 text prints). CISS from all companies used more total ink than Canon genuine. This is thought to be because work to restore the normal condition when the problems in Section 3.1 occurred (head cleaning, strong cleaning, head position adjustment and movement of ink by using the head differential etc.) had an effect on the amount of ink used. In this evaluation, the differences were as indicated in the following "Comparison of total ink usage for each ink color", but if printing is continued for more than the number of prints in this evaluation using a CISS intended for high-volume printing, there is a possibility that the difference in ink usage with the Canon genuine system will increase, and that may have some impact on running costs.

Work to restore the CISS to normal condition when a problem occurs not only uses excess ink. It may also require a lot of trouble and time, and place a burden on the user.

<Comparison of total ink usage for each ink color>

Ink color	Canon genuine	Company A	Company B	Company C
PGBK ink	**104 ml**	**240 ml**	**230 ml**	**320 ml**
BK ink	**91 ml**	**130 ml**	**140 ml**	**110 ml**
C ink	**143 ml**	**180 ml**	**220 ml**	**230 ml**
M ink	**208 ml**	**270 ml**	**240 ml**	**230 ml**
Y ink	**169 ml**	**180 ml**	**230 ml**	**200 ml**

*The above table compares ink usage after a total of 2500 prints (1000 image prints + 1500 text prints).
*The above usage amounts include the original ink contained in the CISS when it was opened.

<Details of ink usage for each manufacturer>

Manufacturer	Ink color	Initial amount of ink	Consumed amount of ink, Units: ml		
			Image printing	Text printing	Total
Canon genuine	PGBK ink	26 ml / cartridge	26 ml	78 ml	104 ml
	BK ink	13 ml / cartridge	78 ml	13 ml	91 ml
	C ink	13 ml / cartridge	130 ml	13 ml	143 ml
	M ink	13 ml / cartridge	182 ml	26 ml	208 ml
	Y ink	13 ml / cartridge	143 ml	26 ml	169 ml
Company A	PGBK ink	80 ml / when opened	60 ml	180 ml	240 ml
	BK ink	80 ml / when opened	80 ml	50 ml	130 ml
	C ink	80 ml / when opened	130 ml	50 ml	180 ml
	M ink	80 ml / when opened	180 ml	90 ml	270 ml
	Y ink	80 ml / when opened	120 ml	60 ml	180 ml
Company B	PGBK ink	60 ml / when opened	70 ml	160 ml	230 ml
	BK ink	60 ml / when opened	90 ml	50 ml	140 ml
	C ink	60 ml / when opened	120 ml	100 ml	220 ml
	M ink	60 ml / when opened	170 ml	70 ml	240 ml

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	Y ink	60 ml / when opened	140 ml	60 ml	200 ml
Company C	PGBK ink	30 ml / when opened	100 ml	220 ml	320 ml
	BK ink	30 ml / when opened	40 ml	70 ml	110 ml
	C ink	30 ml / when opened	180 ml	50 ml	230 ml
	M ink	30 ml / when opened	190 ml	40 ml	230 ml
	Y ink	30 ml / when opened	150 ml	50 ml	200 ml

*The above table compares ink usage and total ink usage after printing 1000 image prints and 1500 text prints.

*The above usage amounts include the original ink contained in the CISS when it was opened.

*Usage for the Canon genuine system was calculated based on the values 13 ml (BK, C, M, Y ink) and 26 ml (PGBK ink) listed on the outer packaging.

*The calculated value is given for CISS ink usage. For the Canon genuine system, the value was calculated based on the number of ink cartridges used.

4. Important: Notes on This Report

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