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Longing for Laser -- 5 Laser printers tested

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Choosing the right corporate colour printer requires looking at a lot more than just price and print speed. We examine the factors that are crucial to making the right choice.

You have probably heard the saying that you need to spend more to save more. This may well be the case with colour laser printers. If you regularly need to produce colour training manuals, brochures, flyers, newsletters, and reports and are quite sick of paying print shops huge amounts of money, why not consider doing all your colour printing in house?

We looked at five colour laser printers from leading vendors; we also invited Canon, Hewlett-Packard, Lexmark, Panasonic and Ricoh to submit products, but they were not able to submit products in time or were between model releases. In addition to price, speed and print quality for each printer, we also evaluated the total cost of ownership.

To work out the total cost of owning a colour printer, we asked each of the vendors to supply us with all the service intervals that would need to be carried out if you were to print 60,000 pages per year over three years. This included the replacement of toners, drums, fusers, rollers, belts, waste bottles, and any other components that you would have to replace during this time.

Manufacturers claim that the cost of a typical colour page is 20 cents. This figure is based on 15 percent coverage, which is the standard calculation used by many manufacturers, although it is not entirely realistic. (Printing a typical black page costs about two cents per page at five percent coverage.)

Page coverage is an interesting issue. Industry sources tell us they have found through extensive research that the average colour coverage per page is between 10 and 12 percent. This research took into account all types of printing requirements including business and graphics users. Typically this coverage is made up of 5-6 percent black (K) and 5-6 percent colour (CMY) because colour printers use a certain amount of black toner to darken colours. This also makes black the highest single consumed colour on a colour page.

Replacement toners are relatively inexpensive, ranging from $150 for a black cartridge, to around $500 for a full set of colour cartridges. Fuji-Xerox has made an interesting deal on its 860N printer—black toner cartridges are free for the life of the printer. Toner life also varies from a few thousand pages up to 25,000 or more. The type of paper you use will also affect how long certain components in your printer last. If you use coarse or recycled paper then chances are the drum will not last as long. Some printers come with starter toner cartridges, which don't hold as much toner as standard cartridges. While we don't like the idea of starter toners, one of the main reasons vendors use them is to reduce the upfront cost of the printer.

Another interesting area of discussion is the way in which manufacturers quote the duty cycles of their printers. For example, a manufacturer may claim a duty cycle of 50,000 pages per month. However, if this level of activity was sustained for a whole year, it would come to 600,000 pages, which is the entire life expectancy of many of the printers tested in this feature. Aside from the Kyocera, we don't think any of the printers in this feature would actually be able to print 50,000 pages per month for 12 consecutive months. These claimed figures are most likely for a maximum one-off run and not sustained usage.

Features

Most of the printers we looked at could have a hard disk fitted as an option, although none of the vendors included this option in the printers we looked at. By adding a hard disk, the printer doesn't need to wait for data from the network to start processing the print job. All the printers we received shipped with a 10/100 internal Ethernet card, which will enable you to connect your printer via TCP, IPX/SPX, NetBEUI, EtherTalk, NDS, IPP, and SNMP. Most printers also feature bi-directional parallel, serial, and USB ports.

At this level, printers can also come with paper handling accessories such as extra paper trays, output bins, and duplexers. Some printers come with a multi-purpose tray as standard, which can handle a variety of different paper and envelope sizes. All the printers we looked at could handle A4, A5, A6, B5, Letter, Legal, and Executive paper sizes as well as COM-9, COM-10, C4, and C5 envelopes.

Speed and Output Quality

A typical laser printer can only print colour pages at a quarter the rate of a black and white printer. This is because the

page has to go through four passes—one for each colour. However, considering that most of these printers can handle between five and 12ppm in colour, this is suitable even for large workgroups.

Manufacturers are usually spot on with their estimates of print speeds in black and white; using a 20-page document and ignoring the time it took to print the first page, we were able to prove this by replicating the manufacturers' claims.

With colour it wasn't quite the same story. Some of the printers were not able to live up to the manufacturers' speed claims.

Another factor that affects the speed at which a page is produced is resolution. Typical colour laser printers can achieve a resolution of 600 x 600dpi. The Fuji-Xerox was able to print at 1000dpi and the Brother and Epson used interpolation to print at up to 2400dpi.

Software

All the printers typically ship with PCL and Postscript drivers. Updates are usually found on the vendors' respective Web sites. Some printers ship proprietary software, which allows clients and administrators to view the status and set the settings of the device. Many also allow the option to check the status or set the properties using a Web browser. It's good to see that the drivers cater to almost all versions of Windows, as well as Mac OS and Linux.

Let's take a look at how each of the printers fared.

Brother HL2600N

The Brother HL2600N offers a number of accessories and product enhancements that can speed up your printing. It comes with a standard 64MB of RAM, but this can be expanded to 384MB. The Brother was also the only other printer to feature a Compact Flash card reader, allowing you to print directly from a digital camera. You also have the option of installing a hard disk drive. You can increase the paper capacity to 750 sheets by adding up a 500-sheet lower paper tray and you can also add a duplexing unit.

The Brother was the second-fastest printer in monochrome. It lived up to its 24 pages per minute and in colour it also lived up to its claimed six pages per minute.

This is an excellent printer for printing plain text. Text was very sharp despite the fast printing times.

We couldn't print our A4 page colour photo at the printer's highest resolution of 2400dpi. We kept getting an error saying that the memory was full and that we should add more. We were quite surprised we couldn't print this test file considering it only spooled to a 49MB file and the Brother was fitted with 64MB of RAM.

At 600dpi the overall image quality was poor. Our photo appeared very grainy and the colours quite flat and dull.

The TCO for the Brother is relatively high. On our graph the Brother sits higher than the Fuji-Xerox and Kyocera and lower than the Oki and Epson. What it all means is that if you're printing low volumes this printer works out to be quite cost effective, since the initial outlay of the printer is small.

Product: Brother HL2600N

	Stars
Interoperability: Parallel, 10/100 Ethernet, USB, and CompactFlash ports.	3½
Futureproofing: You'll need to increase the memory to print at the highest resolution.	3
ROI: Despite its low upfront cost, it's one of the more expensive printers to own in the long run.	3
Service: 1-year RTB warranty.	2½
Rating: Very fast in black and white.	3

Epson AL-C2000

The Epson was the only four-pass printer we received, which made it considerably slower when it came to printing multiple pages. It also didn't ship with as much memory as the other printers, which could have affected its performance.

The Epson comes standard with a 500-page paper cassette tray and a 150 page multipurpose tray. You can also buy an extra 500-page cassette as well as a duplexing unit for double-sided printing, a hard disk, additional memory, and an Adobe PostScript 3 kit.

Epson claims this printer can print 20 pages per minute in monochrome. We found this to be the case at 300dpi but at 600dpi it could only manage 13 pages per minute. In colour it managed five pages per minute, which is exactly what the manufacturer claimed. We found the Epson to be the noisiest printer. It made some very strange noises while warming up and printing, which could be a distraction in the workplace.

The print quality of this printer was outstanding, especially in colour. Epson uses a number of exclusive technologies, including AcuLaser Multiple-screen Printing, Colour RIT (Resolution Improvement Technology), and Colour Stabilising. In addition, AcuLaser Colour Halftoning provides print resolution equivalent to 2400dpi.

The Epson produced the sharpest looking text at 600dpi and the reproduction of the colour photo could not be matched by any of the other printers. We were so impressed by its photo quality that we could go out and say this printer could match it with some of the best inkjet printers that are out on the market. It took less than a minute to print our A4 page colour photo, which would take up to 20 minutes on an inkjet.

The TCO was extraordinary high for colour. Based on a volume of 60,000 pages per year, it would cost you approximately $52,000 compared with $24,000 for the Fuji-Xerox. The high cost is due to the price of colour toner, and the fact that you have to buy a colour transfer kit every 30,000 pages. In black this printer works out cheaper than the Fuji-Xerox if you are only going to print 2500 black pages per month.

Product: Epson AL-C2000

	Stars
Interoperability: Parallel and 10/100 Ethernet ports.	2½
Futureproofing: Limited memory, but didn't have the same problem as the Brother with large files.	3
ROI: The most expensive to run, especially in colour and high volumes.	2
Service: 1-year RTB warranty.	2½
Rating: Would get four stars if all you were after was awesome photo-quality printing.	3

Fuji-Xerox Phaser 860N

The Fuji-Xerox Phaser 860N uses solid ink technology. The solid-ink sticks are similar to crayons and to install them, all you have to do isdrop then into the shape-coded slot at any time, even while you're printing. Inside the printer the ink is melted to a liquid and used for printing.
One of the amazing things about this printer is that you will not ever have to pay for black solid ink because Fuji-Xerox provides it free. This will significantly reduce your running costs. The Phaser was also the easiest printer to get up and running.

The Phaser has a number of upgrade options such as additional memory. It comes with 64MB of memory as standard, with a maximum of 256MB. The Phaser 860N comes with a 200-sheet paper tray as standard, but we received an additional 500-sheet paper tray (extra $1212.20). You can even buy an additional 500-sheet paper tray to take your total capacity up to 1200 sheets. There is a duplexing unit available for this printer.

Unlike all the other printers the Phaser featured a large LCD screen which is backlit and includes a list of help topics. The front panel also includes an "i" button that when pressed pops up a help message to explain whatever menu function is being displayed.

The Phaser was the slowest at printing in monochrome. Despite using single-pass technology and being able to print a very quick first page, it still wasn't able to match the other printers in speed. It was a similar story for colour.

The print quality on the other hand was quite good overall, but if you're after razor-sharp output you should look elsewhere. This printer wasn't as sharp as any of the other printers. Pages generally appeared a little grainy. Our A4 size photo in particular was rather coarse. On a better note, the Phaser produced some of the nicest colours.

The TCO is exceptionally low, considering you don't have to pay for black toner. You have to replace the colour sticks every 7000 pages and buy a maintenance kit every 40,000 pages. The Phaser ended up being the most cost-effective if you were to print 6000 pages per month over three years in either black or colour.

Product: Fuji-Xerox Phaser 860N

	Stars
Interoperability: Parallel, 10/100 Ethernet, and USB ports.	3
Futureproofing: Print speed may be a concern in the future.	2.5
ROI: Lowest running cost of all the printers tested.	5
Service: 1-year onsite warranty.	3
Rating: Slightly better print quality would make this a truly great printer.	4.5

Kyocera FS 8000C

The Kyocera FS 8000C was the most expensive colour laser printer we looked at, but it was also the most flexible. It came standard with two 500-sheet paper trays and was the only printer that could print in A3.
The 8000C shipped with 128MB of RAM, which can be expanded to 256MB. You can also buy additional 500-sheet paper trays as well as a hard disk. What really impressed us is that it comes with a vast range of paper handling options such as sorting, stacking, stapling, and doubled sided printing.

The 8000C was also the fastest printer in monochrome at 30 pages per minute. In colour it manages eight pages per minute. However, it was realtively slow printing a single page or the first page of a multi-page document.

The print quality was varied. It was very good at printing text, and blacks appeared rich and saturated. It did well with our standard colour documents, but let itself down printing colour photos. Our A4 page colour photo appeared very coarse and took the longest time to print.

Despite this printer's high initial cost, it becomes the most cost-effective if you print high volumes because of its impressively low running costs. If your requirements exceed 6000 pages per month, this printer becomes more cost effective than any of the other printers we looked at.

The only real big price spike with this printer is at 200,000 pages when you have to replace the drum and a few other components.

Product: Kyocera FS 8000C

	Stars
Interoperability: Parallel, serial, and KU10 slot 2.	3.5
Futureproofing: Comes with a vast range of paper handling options.	5
ROI: Fast with very low running costs.	4.5
Service: 2-year onsite warranty.	4
Rating: The Kyocera is a very fast printer with low running costs.	4.5

OKI C7200N

The Oki C7200N makes use of single-pass technology and has quite a few options for expansion. The C7200DN includes additional memory, hard disk drive and duplex unit. You can also buy a second or third paper tray.
Oki claims this printer can print 20ppm in black and white and 12ppm in colour. We managed to print 20 pages per minute in black and white, and in colour the Oki handled our 16-page complex document at a little under 11 pages per minute. It was also very fast at printing the first page of our 20-page document, which is an advantage especially if you're only printing single pages.

The Oki printer was good at printing plain black text, but had a bit of trouble with some of the more complex test documents. It is a very good photo printer, and it managed to print very smooth gradients, as well as colours that were rich and stood out.

The TCO of the Oki, however, was quite high. In monochrome this printer worked out to be the most expensive to run. In colour only the Epson worked out to be more expensive. Colour toners for this printer were expensive, but the drums on this printer also don't last as long as some of the other printers.

Product: OKI C7200N

	Stars
Interoperability: Parallel, 10/100 Ethernet, and USB ports.	3
Futureproofing: Good array of accessories available, memory can be increased to 1GB.	3.5
ROI: Very expensive to run, especially in black and white.	2.5
Service: 1-year onsite warranty.	3
Rating: Very good print quality; running costs could be lower.	4

What to look for when buying a laser printer

Print Speed: Should be based upon the number of users that will be using the printer as well as the volume of pages they will be printing.
Total Cost of Ownership: Look at the cost of replacing toner as well as the initial cost. It's also worth comparing the cost per page between various printers.
Paper Capacity: Check to see the number of pages it can hold and the paper sizes it supports.
Expansion Potential: What's the maximum amount of memory that the printer can hold? Can you fit a hard disk or duplexer to the printer? Can you add paper trays and output bins?

Scenario 1:
Company: Bodine Pharmaceuticals This company wants to deploy colour laser printers for each workgroup of 15-20 people. Printing volumes are estimated at 60,000 pages/year (expected lifetime of the printer is three years. This comprises approximately 4000 colour pages at 12 percent total coverage and 1000 black and white pages at five percent coverage.
Budget: $6000 per printer.
Requires: Five colour laser printers.
Concerns: Upfront cost is not as important as long-term running costs; the company is very concerned about the cost of consumables. Print speed and quality will also be taken into account.
Best Solution: The Fuji-Xerox might have the lowest running cost, but the Kyocera-FS 8000C (though it might break your initial budget) was extremely cost-effective and fast. It also features the longest overall life expectancy of all the printers we looked at.

Scenario 2:
Company: Zone Real Estate This real estate company wants to buy a single colour printer for printing flyers and brochures. It expects to print 12,000 pages per year over three years. This comprises 550 colour pages with 50 percent coverage and 450 black and white pages at 15 percent coverage.
Budget: $6000.
Requires: One colour laser printer.
Concerns: Because flyers and brochures include large colour photos, picture quality is very important. Cost of consumables is also a big issue for the same reason.
Best Solution: The best solution here would be the Epson AL-C2000. It's great for printing full-colour photographs, and if you're not going to be printing more than 1000 colour pages per month then this is the printer for you. In addition, if you're not going to be printing more than 2500 black pages per month then this printer works out to be the least expensive to own over three years.

How do colour lasers work?

FOUR-PASS
Traditional colour laser printers have four cartridges (cyan, magenta, yellow, and black, or CMYK) that are mounted to a rotating cylinder. Each contains a coloured powder or toner that is transferred first onto the imaging drum, where it is held by an electrostatic charge, and then onto the paper. To print a colour document, the paper must cycle around the imaging drum four times—once for each colour. This is why rated colour speeds (in pages per minute) are generally one-quarter the claimed monochrome speeds.

IN-LINE
In an in-line print engine (also called single-pass or tandem), the four toner cartridges are lined up one after another, each with its own drum. Since colours are laid down in one pass rather than in four separate passes, print times are much improved. And, since the paper doesn't need to bend to cycle back against the drum, you can print on heavier stock as well. The downside? There is a greater chance for misregistration (where colours don't properly fall on top of each other) due to misalignment of the mechanisms.

Editor's Choice

The Kyocera FS-8000C is fast and it comes with a vast range of paper handling options like sorting, stacking, stapling and double-sided printing. It was also the only A3 printer that we tested. The Kyocera is a printer that can churn pages all day long and can accommodate a large workgroup. The most impressive part however is its low running costs. Although it works out rather expensive if you plan to print a lot of pages, for low-volume environments the Epson AL-C2000 provides excellent quality and reasonable speed. If you aim to impress, this is the printer to go for. The Fuji-Xerox also deserves a worthy mention since it had the lowest TCO of all the printers.

The two laser printers that receive the Editor's Choice are the Kyocera FS-8000C and the Epson AL-C2000.


Kyocera FS 8000C


Epson AL-C2000

How we tested

We tested each of the colour laser printers in a number of ways to gauge how well they performed in each category of test. We tested each device for its speed and print quality. We tested all the printers from our MicroArts desktop PC, which was equipped with an Intel Celeron 700 processor and 128MB of RAM running Windows 98. All the printers were tested one by one using the PCs parallel port.

The following is a breakdown of the testing methodology.

Printing

Word, Simple 20-page Test (600dpi)
This Word document test comprised 20 pages with a single font (Arial 10-point) and was used to evaluate the printer's maximum real-world throughput.

Word, Complex 16-page Test (600dpi)
This Word document test comprised 16 pages of complex word processing and included 18 different fonts, some in multiple sizes, eight images ranging from simple clip art to high-res TIFF photos, and multiple column styles.

Fontkey.PDF (600dpi)
This test confirmed the printer's ability to correctly and accurately render multiple font sizes from 4-point up to 48-point in two font styles—Times New Roman and Gaudy Handtooled.

Laserkey.PDF (600dpi)
This test exercised the printer's ability to produce smooth greyscale gradients, (both linear and greyscale,) smooth straight, oblique and radial fine lines, and smooth solid black fills.

Colorkey.PDF (600dpi)
This test was similar to the previous test, but also included smooth colour gradations, ink mixing, fine yellow grid lines on a solid green background, and a JPEG image of a small child.

Photo Realistic Graphics Test Photo (Max Resolution)
The very large 44MB (once "flattened" by Photoshop) test image was created and printed using Photoshop 5.0 LE.

The image was a composite comprising a large landscape with fine cloud, forest and wildflower detail, a sleeping baby, a vase of multicoloured flowers, a close up of purple and white irises, an island and water scene, multicoloured balloon, and finally a monochrome, but highly detailed image of a cow skull hung on a weathered wooden panel. The diversity of the graphic content allowed us to evaluate a whole range of printer abilities such as skin tones, sky colour fidelity, accuracy with fine white on colour details, accuracy of dithering (particularly in areas of low contrast), handling of low contrast shadows and overall colour or greyscale accuracy. This was also timed.

We started timing this test after the PC had processed the job first. This meant we had to pause the printer and wait for the PC.

Printing Quality Assessment
Printer output was assessed for quality by the Test Lab staff, both with the naked eye and also an 8x magnifier. Purity was also judged with the naked eye, assessing how close the output was to the actual screen image. While we acknowledge this was a largely subjective process, especially given the different technologies, we feel that most users would use similar purity criteria.

Fonts were assessed for accuracy of formation, smoothing of radial and oblique edges and any evidence of toner "spatter" particularly in the white-on-black font test. Smoothness of colour/greyscale gradations and dithering was assessed, as was the accuracy of fine radial and oblique lines.

RATINGS

We also rated each of the machines in the areas of interoperability, futureproofing, return on investment and service.

Interoperability: We looked at the interfaces supported.

Futureproofing: We were concerned with the expansion potential of each of the printers. We considered the maximum amount of RAM the printers could hold, the availability of additional paper trays, sorter bins, and duplexers, and the availability of a hard disk.

Return on Investment: We looked at the initial cost of the printer as well as the total cost of ownership. We also considered the print speed and print quality.

Service: We looked at the duration of the warranty and the support hours that were offered for each of the printers.

Benchmarks			
Simple document print speed (ppm)		Photo Print Speed (ppm)	
Brother HL2600N	23.8	Brother HL2600N	0.75
Epson AL-C2000	13.1	Epson AL-C2000	1.2
Fuji Xerox 860N	10.1	Fuji Xerox 860N	0.36
Kyocera FS-8000C	30.8	Kyocera FS-8000C	0.26
Oki C7200N	20.4	Oki C7200N	0.59
Complex document print speed (ppm)		Print quality (jury test score)	
Brother HL2600N	6.1	Brother HL2600N	75%
Epson AL-C2000	5	Epson AL-C2000	88%
Fuji Xerox 860N	5.4	Fuji Xerox 860N	72%
Kyocera FS-8000C	7.8	Kyocera FS-8000C	73%
Oki C7200N	10.8	Oki C7200N	75%

Table of Specs

	Brother HL2600N	Epson AL-C2000	Fuji Xerox 860N	Kyocera FS-8000C	OKI C7200N
Vendor	Brother	Epson	Fuji Xerox Phaser Printing	Kyocera Mita	OKI
Telephone	02 9887 4344	1300 361 054	1300 793 769	1300 364 429	02 9690 8200
	Web www.brother.com.au	www.epson.com.au	www.xeroxprinters.com.au	www.kyocermita.com.au	www.oki.com.au
Warranty	1-year RTB	1-year RTB	1-year on-site	2-year on-site	1-year on-site
Manufacturer's rated speed (mono/colour ppm)	24/6	20/5	16/10	30/8	20/12
Maximum resolution (dpi)	600x600 (2400 CAPT)	600x600 (2400)	1000x1000	600x600	600x1200
Memory (MB)	64	32	64	128	64
Input capacity (A4 sheets) 250	250	500 + 150 sheet multi-purpose	200 + multipurpose	2 x 500 + multipur-pose	530 + multipurpose
Interfaces	Parallel, 10/100 Ethernet, USB, CompactFlash	Parallel, 10/100 Ethernet	Parallel, 10/100, Ethernet, USB	Parallel, Serial, KU10 slot 2	Parallel, 10/100 Ethernet, USB
Printer languages	PCL5c, PS3	PCL5e, PS3 (option)	PCL 5c, PS3	PCL5c, KPDL3 (PS level 3)	PCL5c, PS3
Black ink cartridge (inc. GST	$299	$137.50	Free	$196.90	$152.46
Colour ink cartridge (inc. GST)	$279	$286	$470.80 (2 x CMY blocks)	$207.90	$378.13
Estimated cost per page*					
5% black coverage	NA	4.4c	1c	2.4c	4.3c
15% colour coverage	NA	22.1c	20c	22.5c	4.3c
Estimated toner life* (pages)					
5% black coverage	12,000	6000	4200	25,000	10,000
15% colour coverage	7200	6000	7000	10,000	10,000
Duty cycle* (pages per month)	35,000	30,000 (black), 7500 (colour)	65,000	100,000 (black) 25,000 (colour)	50,000
***Estimates supplied by manufacturers**					