

## BLI Comparative Lab Test Report

DECEMBER 2016

**Canon imagePROGRAF PRO-6000S  
vs. HP DesignJet Z6800**

Canon imagePROGRAF PRO-6000S



HP DesignJet Z6800

| Advantage ✓                             | Canon imagePROGRAF PRO-6000S | HP DesignJet Z6800 |
|---|------------------------------|--------------------|
| Image Quality                           | ✓                            |                    |
| Print Productivity                      | ✓                            |                    |
| Ink Consumption                         | ✓                            |                    |
| Device Feature Set                      | ✓                            |                    |
| Print Driver Feature Set                | ✓                            |                    |
| Printhead Reliability/Cleaning Routines | =                            | =                  |

## TEST OBJECTIVE

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Buyers Laboratory LLC (BLI) was commissioned by Canon Europe to conduct confidential document imaging device performance testing on the Canon imagePROGRAF PRO-6000S and the HP DesignJet Z6800, and produce a report comparing the relative strengths and weaknesses of the two products in terms of image quality, productivity, ink consumption, device feature set, driver functionality, and printhead reliability and cleaning routines. All testing was performed in BLI's test facility in Wokingham, UK.

## EXECUTIVE SUMMARY

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During BLI's testing, the Canon imagePROGRAF PRO-6000S performed better in more categories than did the HP DesignJet Z6800. While both models produced excellent image quality, as would be expected of models aimed at the Graphics Arts (GA) marketplace, with highly accurate colour reproduction and excellent colour stability, the Canon model had the edge overall. The Canon PRO-6000S produced a larger colour gamut on photo media (43.1% higher), delivered more vibrant colour business graphics and provided much higher optical density for cyan, magenta, yellow and black, the latter of which is a vital attribute for photographic applications. BLI analysts noted that the HP model's much lower cyan density (0.37) is likely attributable to it having only a light cyan cartridge, and not cyan. The HP Z6800 also exhibited more colour drift when FOGRA39 colour patches were compared before and after the ink consumption test, with a Delta E of 3.6 compared with 1.8 for the Canon unit.

In BLI's productivity tests, results were also clear; with the Canon PRO-6000S showing a clear speed advantage in all poster tests when printing on coated media, and delivering faster output than the HP model in the majority of photo printing tests on glossy media. This makes the Canon model a more productive choice both for medium-resolution targets such as signs and posters and for most high-resolution targets such as photographic portraits.

For the ink consumption evaluation in which three different document types were printed in Standard/Normal mode on three different media, the Canon model used less ink for two of the three document types, whilst the HP model used less ink for the other one.

In terms of feature set, the HP model has a few advantages over the Canon model. For example, HP's Professional PANTONE Emulation allows users to create and print a swatchbook of multiple PANTONE colours and see how accurately the printer will reproduce them on selected media. Another significant advantage of the HP model is its standard embedded spectrophotometer, which allows for fast single-step media profiling, a feature not offered with the Canon model. While the Canon PRO-6000S does not offer a spectrophotometer as an option, the device comes with standard calibration features that enable users to calibrate the printer not only with the manufacturer's own-brand of genuine paper, but also with other media brands, as well as letting administrators control colour remotely across multiple PRO-4000S/6000S series devices to ensure colour consistency.

Overall, however, the Canon model offers a stronger device and driver feature set. Both models include a standard 320-GB hard drive, but the Canon model delivers a smaller ink-drop size, and has lower power consumption (113 W when active compared with 270 W for the HP model, and 1.8 W as opposed to 5.3 W in standby mode), and offers higher-capacity starter cartridges. Loading media in both models was equally easy, but only the Canon model accommodates a dual-roll option, which allows users more flexibility in swapping between different media types or sizes. Borderless printing—an essential feature in the GA market—is not supported by the HP model. It also lacks support for cut-sheet media, which could also be critical in the Photo/Poster market. In addition, the Canon PRO-6000S's SG Raster driver offers security watermark options, poster print capability and more colour adjustment options than the HP device. The Canon unit also offers hot-swap ink tanks, whereby users can replace empty ink cartridges while the device is actively printing, thus reducing downtime. The HP model does not offer this capability. The Canon model's more compact footprint (431 mm less wide than the HP device) may be a key decision driver in offices where space is constrained.

Canon's software bundle includes Photoshop and Lightroom plug-ins which allow users to print 16-bit files directly from Adobe RGB with a wide gamut and clear tonal gradation, and a plug-in for DPP (Digital Photo Professional) that includes a 'Digital Lens Optimizer' to improve photographic image quality and enhance depth of field. The Canon model also includes PosterArtist Lite, Canon's software for creating posters and signage in simple steps. (This software bundle was not included in BLI's testing). Although HP offers Serif PosterDesigner Pro, a similar solution that enables poster and banner creation on HP large-format printers, it is an extra-cost option.

In summary, the Canon imagePROGRAF PRO-6000S is judged to be the stronger performer in BLI's evaluation, thanks to its excellent overall image quality and superior driver and device feature sets.

## Image Quality

| Advantage ✓                            | Canon imagePROGRAF PRO-6000S | HP DesignJet Z6800 |
|--|------------------------------|--------------------|
| <b>Text</b>                            | =                            | =                  |
| <b>Fine Lines</b>                      | ✓                            |                    |
| <b>1x1 pixel grid</b>                  | ✓                            |                    |
| <b>Halftone Range</b>                  | =                            | =                  |
| <b>Halftone Fill</b>                   | =                            | =                  |
| <b>Solid Density</b>                   | ✓                            |                    |
| <b>Colour Drift across FOGRA39</b>     | ✓                            |                    |
| <b>Consistency of three skin tones</b> |                              | ✓                  |
| <b>Consistency of neutral grey</b>     |                              | ✓                  |
| <b>Business Graphics</b>               | ✓                            |                    |
| <b>Photographic Images</b>             | =                            | =                  |
| <b>Colour Gamut (photo media)</b>      | ✓                            |                    |

+, – and ○ represent positive, negative and neutral attributes, respectively.

- All image quality testing, with the exception of colour gamut and density measurement, was done with Canon's 280-gsm Semi-Gloss media, and HP's proofing Semi-gloss Satin media, with print priority set to Proof and quality set to Highest on the Canon model (2400 x 1200 dpi), and Best (2400 x 1200 dpi) on the HP model.
- Both models produced clearly formed fonts in colour and black mode down to 5-point type size, although characters showed some slight breakup at 3-point and 4-point sizes with both units. There was no ink overspray visible in output produced by either model, even when viewed under magnification.
- + The Canon PRO-6000S produced the 1x1 pixel grid in CMY with no quality issues, whilst the HP Z6800 produced poor quality cyan and yellow pixel grids; the 1x1 pixel grid in magenta exhibited no issues.
- Both models produced a consistent dot laydown in black across all 1x1 and 2x2 pixel grids.
- + While both devices delivered excellent horizontal fine lines down to 0.1-point size, vertical lines produced by the HP model displayed considerable fuzziness. Neither models' output exhibited any stair-stepping in diagonal

lines, while circles were well formed with no line break-up. White-on-black circles and fine lines produced by the HP unit were deemed poor by BLI analysts, while those from the Canon unit were rated good.

- Both models delivered an impressive range of halftone fills in all colour and black modes, with no banding or graininess, and with distinct transitions between all levels.
- + The Canon device produced a much higher optical density for black (an important attribute for the photography market), as well as cyan, magenta and yellow compared with the HP unit. BLI analysts attributed the HP unit's much lower cyan (0.37) density to the fact that only light cyan is available with this model and not cyan.
- Both Canon and HP models exhibited very good natural-looking skin tones in photographic images, with good definition in light contrast areas.
  - In the three skin tone tests, output produced by the Canon model displayed greater variance with all three skin shades when compared with the HP model. However, these low Delta E values would not be discernible to the naked eye.
  - Neutral grey consistency varied between both models, with a Delta E variance of 1.4 registered by the Canon PRO-6000S versus 0.2 for the HP Z6800. Again these low Delta E differences would not be visible to the naked eye.
- + During BLI's colour drift analysis, in which the FOGRA39 media wedge is submitted to print before and after productivity and ink consumption tests, and measured using EFI Colour Verifier software, the Canon PRO-6000S displayed a lower mean Delta E drift than the HP device (1.8 versus 3.6 for the HP unit).
- + The Canon device delivered a larger colour gamut than the HP model when printing on 260-gsm Pearl photo media in highest quality settings—43.1% larger, with a CIE volume of 682,635 versus 476,982 for the HP model.
- BLI analysed a wide range of colour and greyscale output in photographic images output by both devices and found them to be comparable overall, with excellent fine detail in light and dark contrast areas.
- + When printing business graphics, BLI analysts gave the overall edge to the Canon PRO-6000S for the vibrancy and depth of colour in its output.

## Print Productivity

| Advantage ✓  | Canon imagePROGRAF PRO-6000S | HP DesignJet Z6800 |
|--|------------------------------|--------------------|
| <b>First Print Out from Ready State Portrait Printing (Fast mode)</b>                    | ✓                            |                    |
| <b>First Print Out from Ready State Portrait Printing (Standard/Normal mode)</b>         |                              | ✓                  |
| <b>First Print Out From Ready State Poster Printing (Fast and Standard/Normal modes)</b> | ✓                            |                    |
| <b>Throughput Speed Portrait Printing (Fast and Standard/Normal modes)</b>               | ✓                            |                    |
| <b>Throughput Speed Poster (Fast and Standard/Normal modes)</b>                          | ✓                            |                    |

- When printing a single high-resolution portrait on glossy photo paper, the Canon model was 23.0% slower than the HP unit in terms of speed of the first-print-out from ready state in Standard/Normal mode.
- + However, the Canon PRO-6000S was slightly faster (by 1.5%) when printing a high-resolution portrait in Fast mode.
- + The Canon PRO-6000S surpassed the performance of the HP model with a faster (by 19.6%) first-print-out time from ready state in Fast mode when printing a single medium-resolution retail poster on matte coated media. The Canon unit also delivered its output in a speed that was 31.6% faster in Standard/Normal mode.
- When printing five copies of a single-page A1-size high-resolution portrait test document in both Fast and Standard/Normal modes, the Canon model displayed an overall speed disadvantage compared with the HP model, with per-page speeds that were 5.5% faster in Fast mode but 17.4% slower in Standard/Normal mode.
- + When printing five copies of a single-page A1-size medium-resolution retail poster test document, the Canon model delivered output with speeds that were 30.4% faster in Fast mode, and 42.3% faster compared with the HP Z6800 in Standard/Normal mode.
- + In the A0-size high-resolution portrait test run, the Canon produced five copies of a single-page test document in both Fast and Standard/Normal modes with per-page speeds that were 50.7% and 47.7% faster, respectively, compared with the HP model.
- + In the A0-size medium-resolution retail poster test, the Canon model's per-page speeds were 18.8% faster than the HP device in Fast mode, and 27.1% faster in Standard/Normal mode.
- + BLI's overall conclusion is that the Canon PRO-6000S surpasses the productivity of the HP Z6800 in environments where high volumes of medium-resolution posters and signs are printed. In addition, in the majority of the photographic portrait tests, the Canon model had the performance edge.

## Ink Consumption

BLI analysts observed that, owing to the vagaries of inkjet technology (for example, head flushing and calibration routines can occur at any time during testing), the same test can produce different results at different times. Although BLI makes every effort to ensure that devices are tested on a level playing field, the test results should be regarded as an indicator of likely performance and not as a prediction of actual ink consumption in a real-world environment.

| Average weight of ink used (grams): Results averaged across three 50-page A1 print jobs in Standard/Normal Mode | Canon imagePROGRAF PRO-6000S | HP DesignJet Z6800 |
|---|------------------------------|--------------------|
| PACKAGING PROOF   | 130.5                        | 134.4              |
| RETAIL POSTER   | 90.6                         | 107.0              |
| STUDIO PORTRAIT   | 125.9                        | 121.2              |

- + In the BLI Packaging Proof ink consumption print runs using Standard/Normal mode on 195-gsm Glossy proofing media, the Canon imagePROGRAF PRO-6000S used slightly less ink (3.0%) in terms of net weight than the HP DesignJet Z6800.
- + In the BLI Retail Poster print runs on matte coated media, the Canon unit used 15.3% less ink than the HP model.
- In the BLI Studio Portrait print runs on 260-gsm Pearl Photo media, the Canon model used 3.9% more ink than the HP DesignJet Z6800.

## Device Feature Set

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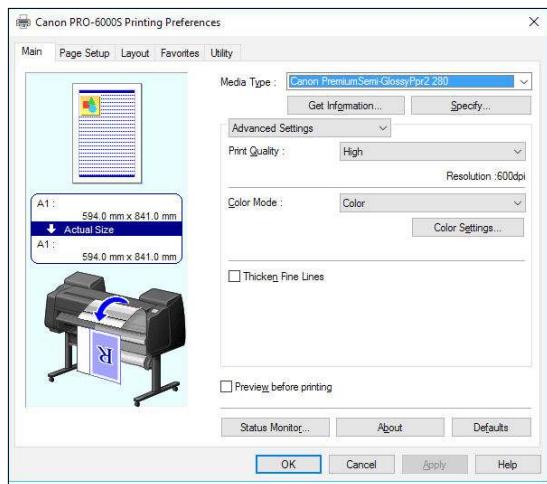
- + The Canon PRO-6000S has a more compact footprint than the HP DesignJet Z6800, measuring just 1,999 mm across compared with 2,430 mm for the HP unit—a great advantage in offices where space is constrained.
- + Owing to the unit's ink sub-tank system, the Canon PRO-6000S's ink cartridges can be replaced during operation, which helps to facilitate longer, uninterrupted print runs.
- + The Canon model offers a larger total capacity of starter ink cartridges (330 ml for matte black and CMY, 190 ml for the other four colours) than the HP model (225 ml for all colours).
- Both models employ eight inks, which include two black inks and one grey.
- + Canon's two printheads contain more nozzles per colour—18,432 in total—than the HP unit's four printheads, which contain 16,896 nozzles in total.
- + The Canon unit's ink delivery system dispenses a 4-picoliter drop size for all colours, while HP's dispenses two drop sizes: 4-picoliter (LC, LM, LG, PK) and a slightly larger 6-picoliter drop size for red, magenta, yellow and matte black.
- + The Canon model offers borderless printing (an important feature for the GA market), which is not supported by the HP unit.
- The Canon unit supports the ability to print directly from USB flash drives, including multi-page PDF files, a capability matched by the HP device.
- + The HP device offers a smaller standard RAM (1 GB) than the Canon unit, which offers 3 GB.
- Both models offer a standard 320-GB hard drive that allows for the storage of commonly used documents and aids spooling workflow.
- + The Canon model has a lower advertised operational peak energy value (113 W) than the HP model (270 W).
- + In standby mode (the operating mode most in use), the Canon PRO-6000S's energy consumption is just 1.8 W compared with 5.3 W for the HP device.
- Both the Canon PRO-6000S and the HP Z6800 offer user-friendly media loading options from the front of the units.
- + The Canon PRO-6000S offers an optional 'Multifunction Roll system' where the second roll can either be used as

a take-up roll or as a second media roll for users who want the added flexibility of swapping between different media types or sizes, helping them to reduce downtime. Although the HP model has a built-in take-up roll there is no option to install a second media roll.

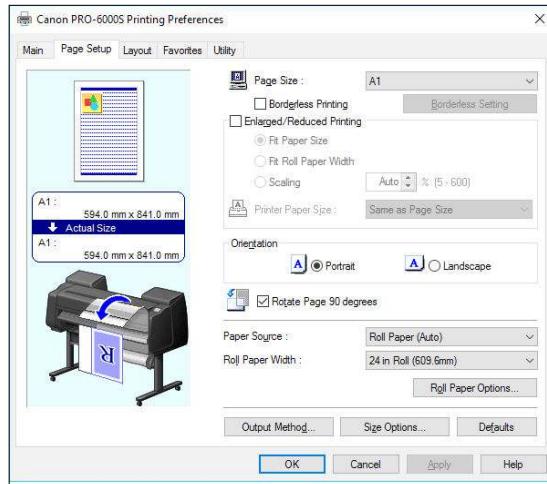
- + The Canon model offers both 2" and 3" core adaptors, which help to minimize paper curling towards the end of the life of a roll; the HP model supports only 3" core media.
- The Canon model includes a plug-in for Microsoft Office, which provides a wizard that walks users through the process of creating posters from Word, Excel or PowerPoint, avoiding the need for complex resizing. A similar poster creation feature is offered with the HP device; its Instant Printing Pro utility (available as a free download) enables users to click on a file name and, without opening the application, set individual options such as print size, rotation, print quality and number of copies before printing. Supported file formats include PDF, TIFF, JPEG and PPT. A free download plug-in provides compatibility with other MS Office applications.
- The Canon model includes PosterArtist Lite, Canon's software for creating posters and signage in simple steps. The full version of Canon PosterArtist, available as an option, offers more advanced features such as auto design, variable data printing, in-application editing features, plus additional templates, photos and clip art. HP offers Serif PosterDesigner Pro as an extra-cost option, which enables poster and banner creation on HP large-format printers.
- The Canon device includes a media mismatch option, which holds jobs that can't be printed due to incorrect media being loaded, while jobs that can be completed are printed; the queued jobs are printed once the required paper is loaded. Conversely, the HP device does not let users choose media from the driver but only displays the media loaded in the device, thus eliminating any potential for a media mismatch.
- Canon offers a Print Studio PRO plug-in which offers support for a variety of software options designed to appeal to specific segments of the Graphic Arts market such as photography and fine art display. These include a print plug-in for Photoshop, which, according to Canon, allows users to print 16-bit files directly from Adobe RGB with a wide gamut and clear tonal gradation, and a plug-in for DPP (Digital Photo Professional) that includes a 'Digital Lens Optimizer' to improve photographic image quality and enhance depth of field; Adobe Lightroom is also supported. Print Studio PRO has additional functions allowing users to add text to their photos; choose black and white photo mode, and save favourite settings, among others.
- Canon's Accounting Manager, accessed via the Status Monitor, offers comprehensive accounting management for all print jobs. Users enter the actual costs for individual inks and media types, and the cost per job is calculated automatically and displayed. For each job, the media type, area, ink used and total print time are listed, and more detailed cost and consumption information can be obtained by double-clicking on an individual job name or by highlighting a range of different jobs. Job cost information can then be saved in .CSV format and opened in Excel. HP offers similar accounting management and tracking capabilities via the Accounting tab on the embedded web server page, or via its HP Utility.
- The HP Z6800 includes a standard built-in spectrophotometer that can be used to conduct colour calibrations for all HP and third-party media to ensure colour consistency, while the Canon PRO-6000S does not offer this option.
- + However, the PRO-6000S's standard calibration features allow users to calibrate the printer not only with the manufacturer's own-brand of genuine paper, but other media brands as well. Conveniently, administrators can control colour and monitor the calibration status across the PRO-4000S/6000S series via Canon's free Device Management Console utility to ensure colour consistency.

## Driver Feature Set

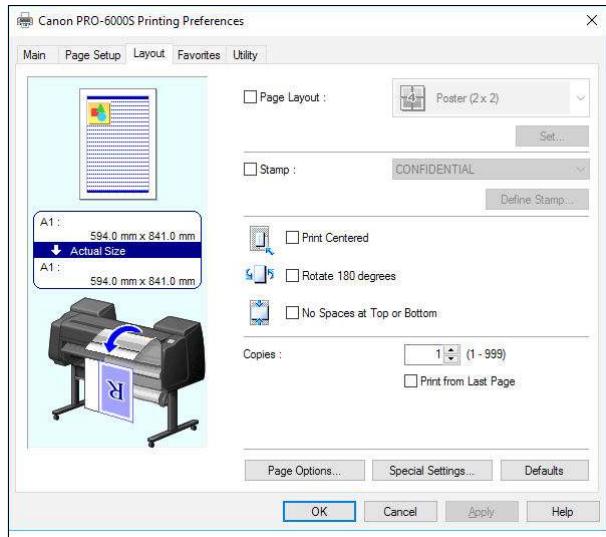
- + The Canon driver includes 49 media profiles versus 20 for the HP driver, although both units permit users to build a library of custom media profiles.
- + The Canon driver includes a watermark capability; the HP driver does not.
- + The Canon driver also includes a Thick Fine Lines image enhancement option, which is not available with the HP model.
- + The Canon driver offers N-up printing (up to 16) which is not supported by the HP device.
- + The Canon model offers poster printing capability (2 x 2), as well as page-stamping (date, time, user-name and page number); neither feature is available with the HP driver.
- The Canon model's device status monitor can be accessed directly from the first tab of the driver, but HP users are required to perform an extra click to access device status via an icon on the Services tab.
- + The Canon driver features a wider selection of simple colour adjustment options, which include brightness, contrast, saturation and sliding scale adjustments for cyan, magenta, yellow and black. The HP driver has adjustment options for cyan, magenta and yellow, but not black. The HP driver allows only brightness to be adjusted, not contrast or saturation.
- The driver for the HP model provides a handy thumbnail preview for users to check the effects on their image as they make colour adjustments.
- The Canon driver includes advanced colour-matching capabilities, including the ability to match ICC profiles and select the rendering intent based on different elements in the document. The HP Utility Color Center offers 'Paper Preset Management,' which offers users the ability to create, install and export media ICC profiles using the unit's embedded spectrophotometer.
- HP Professional PANTONE Emulation is a noteworthy feature that allows users to create and print a swatchbook of multiple PANTONE colours and see how accurately the printer will reproduce them on selected media.
- + The Canon driver includes a unidirectional print selection that helps to avoid any banding across output, whereas the HP driver does not.



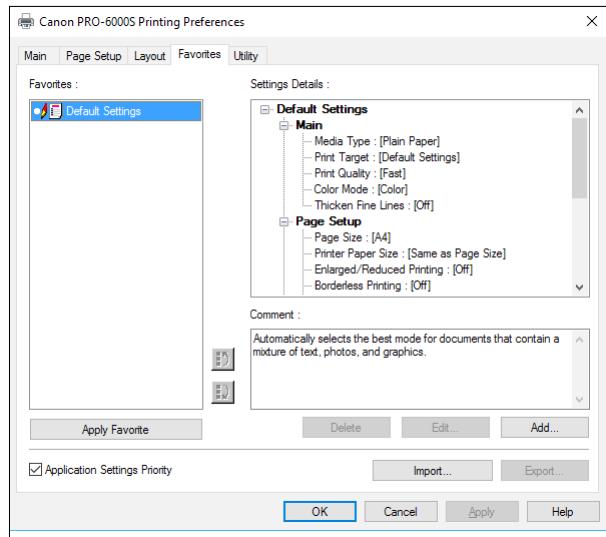
Canon PRO-6000S Print Driver Main Tab



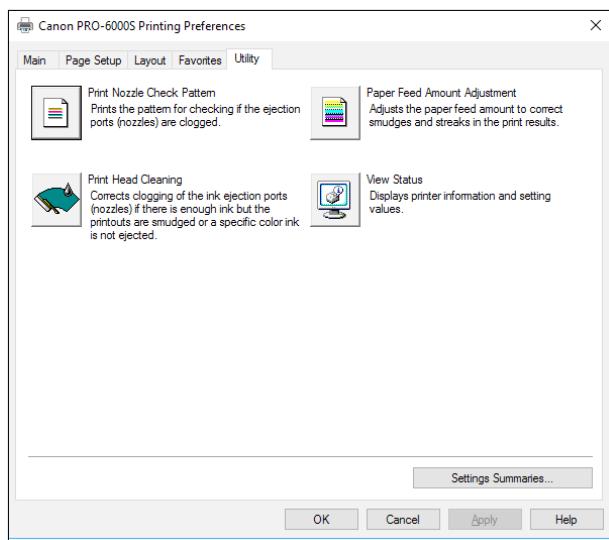
Canon PRO-6000S Print Driver Page Setup Tab



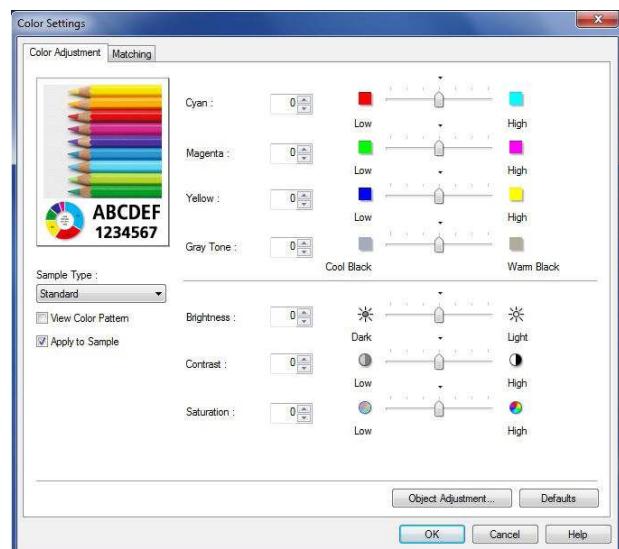
Canon PRO-6000S Print Driver Layout Tab



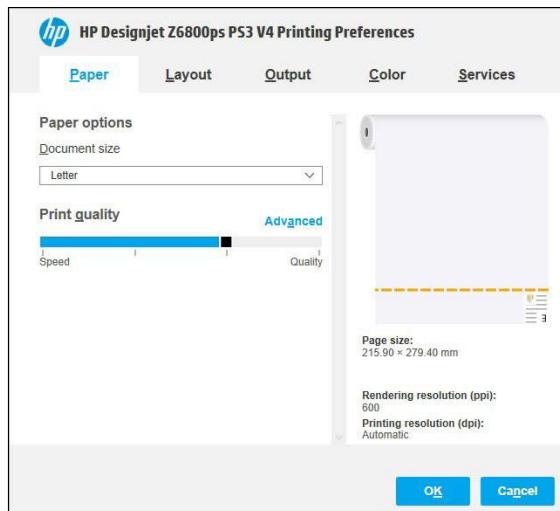
Canon PRO-6000S Print Driver Favourites Tab



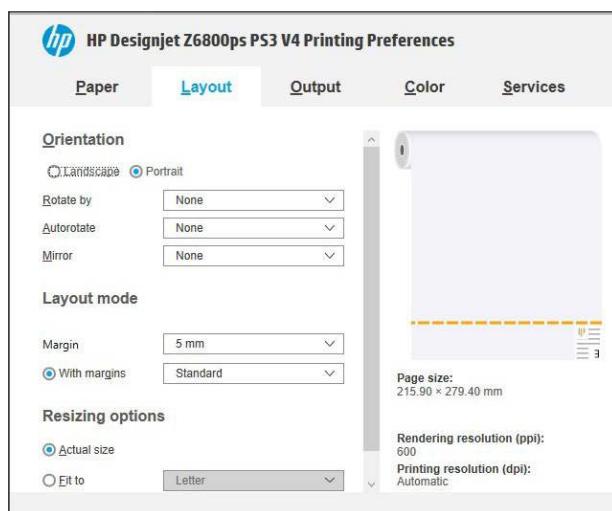
Canon PRO-6000S Print Driver Utility Tab



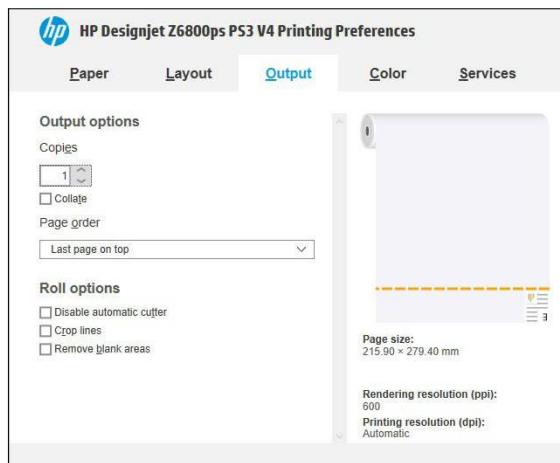
Canon PRO-6000S Colour Adjustment Settings



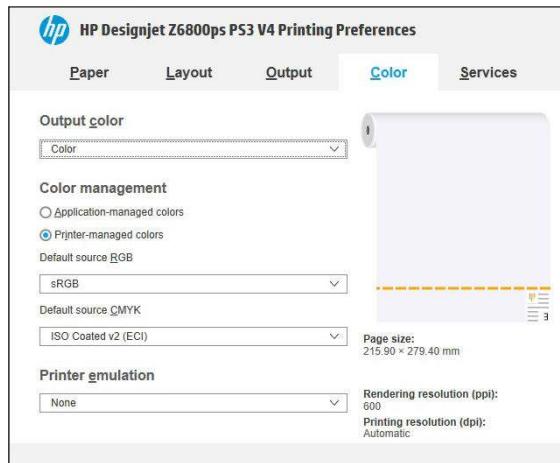
HP DesignJet Z6800 PS3 Print Driver Paper Tab



HP DesignJet Z6800 PS3 Print Driver Layout Tab



HP DesignJet Z6800 PS3 Print Driver Output Tab



HP DesignJet Z6800 PS3 Print Driver Colour Tab



HP DesignJet Z6800 PS3 Print Driver Services Tab

## Printhead Reliability / Cleaning Routines

- The Canon PRO-6000S offers various nozzle check settings at the control panel. The default setting is “Auto Nozzle Check”. Additional settings include “after one page”, “after 10 pages” or “disabled”. The HP DesignJet Z6800 does not offer this capability on its control panel.
- When it comes to replacing the printhead, both models offer flexibility with their user-friendly replacement procedure.
- + When a clogged printhead nozzle is detected on the Canon unit, it pauses during operation and automatically runs a cleaning cycle to maintain image quality and consistency; it resumes printing once the cleaning cycle is completed, with no user intervention required. The HP model does not offer any indication that it conducts automatic printhead maintenance.
- After both devices were shut down completely over the course of a weekend, neither had any problems with nozzles clogging.
- + A standard cleaning cycle performed on the Canon model takes approximately four minutes, 30 seconds on average to complete, whilst on the HP model, a cleaning cycle takes approximately seven minutes.

## SUPPORTING TEST DATA

### Productivity

#### First-Print-Out Time from Ready State – High-Resolution Portrait Printing

| Canon imagePROGRAF PRO-6000S (time in seconds) |        |          | HP DesignJet Z6800 (time in seconds) |        |
|--|--------|----------|--------------------------------------|--------|
|  | Fast   | Standard | Fast                                 | Normal |
| <b>Time before printing commences</b>          | 19.39  | 19.43    | 24.15                                | 32.42  |
| <b>First page out</b>                          | 125.07 | 217.36   | 126.97                               | 164.92 |

First-page-out times are determined by sending an A1 high-resolution portrait PDF file to print, timed from job release to page out, with both Canon and HP drivers set to semi-gloss photo paper. Both devices were loaded with 44/42" rolls, with each job set to auto-rotate to save media.

#### First-Print-Out Time from Ready State – Medium-Resolution Retail Poster Printing

| Canon imagePROGRAF PRO-6000S (time in seconds) |       |          | HP DesignJet Z6800 (time in seconds) |        |
|--|-------|----------|--------------------------------------|--------|
|  | Fast  | Standard | Fast                                 | Normal |
| <b>Time before printing commences</b>          | 20.15 | 20.50    | 22.43                                | 20.98  |
| <b>First page out</b>                          | 74.16 | 121.56   | 92.25                                | 177.63 |

First-print-out times are achieved by sending an A1 medium-resolution retail poster PDF file to print, timed from job release to page out with both Canon and HP drivers set to matte coated media. Both devices were loaded with 44/42" rolls, with each job set to auto-rotate to save media.

**Colour Throughput Time – A1 High-Resolution Portrait Printing**

| Canon imagePROGRAF PRO-6000S (time in seconds) |          | HP DesignJet Z6800 (time in seconds) |        |
|--|----------|--------------------------------------|--------|
| Fast   | Standard | Fast                                 | Normal |
| 124.69   | 190.10   | 131.91                               | 161.94 |

A single-page high-resolution A1 portrait was printed as a five-page job using the device driver set to the semi-gloss photo paper/colour setting. Both devices were loaded with 44/42" rolls, with each job set to auto-rotate to save media. The time indicated is the average number of seconds (based on timing from the cutting of the first page to the cutting of the final page and dividing by four to exclude the initial processing time).

**Colour Throughput Time – A1 Medium-Resolution Retail Poster Printing**

| Canon imagePROGRAF PRO-6000S (time in seconds) |          | HP DesignJet Z6800 (time in seconds) |        |
|--|----------|--------------------------------------|--------|
| Fast   | Standard | Fast                                 | Normal |
| 70.06  | 111.91   | 100.70                               | 193.97 |

A single-page medium-resolution A1 portrait was printed as a 5-page job using the device driver set to the matte coated paper/colour setting. Both devices were loaded with 44/42" rolls, with each job set to auto-rotate to save media. The time indicated is the average number of seconds (based on timing the cutting of the first page to the cutting of the final page and dividing by four to exclude the initial processing time).

**Colour Throughput Time – A0 High-Resolution Portrait Printing**

| Canon imagePROGRAF PRO-6000S (time in seconds) |          | HP DesignJet Z6800 (time in seconds) |        |
|--|----------|--------------------------------------|--------|
| Fast   | Standard | Fast                                 | Normal |
| 274.79   | 556.95   | 556.95                               | 817.22 |

A single-page high-resolution A0 retail poster was printed as a 5-page job using the device driver set to the glossy paper/colour setting. Both devices were loaded with 44/42" rolls, with each job set to auto-rotate to save media. The time indicated is the average number of seconds per page (based on timing the cutting of the first page to the cutting of the final page and dividing by four to exclude the initial processing time).

**Colour Throughput Time – A0 Medium-Resolution Retail Poster Printing**

| Canon imagePROGRAF PRO-6000S (time in seconds) |          | HP DesignJet Z6800 (time in seconds) |        |
|--|----------|--------------------------------------|--------|
| Fast   | Standard | Fast                                 | Normal |
| 143.16   | 264.43   | 176.31                               | 362.66 |

A single-page medium-resolution A0 retail poster was printed as a 5-page job using the device driver set to the matte coated paper/colour setting. Both devices were loaded with 44/42" rolls, with each job set to auto-rotate to save media. The time indicated is the average number of seconds (based on timing the cutting of the first page to the cutting of the final page and dividing by four to exclude the initial processing time).

## Colour Print Quality

### Colour Optical Density Evaluation

| Canon imagePROGRAF PRO-6000S                             |      |      |      |      |      |      |
|--|------|------|------|------|------|------|
| 195 gsm Glossy Proofing Paper: Highest (2400 x 1200 dpi) |      |      |      |      |      |      |
|  | 1    | 2    | 3    | 4    | Max. | Min. |
| Cyan   | 1.75 | 1.77 | 1.74 | 1.77 | 1.77 | 1.74 |
| Magenta  | 1.41 | 1.43 | 1.43 | 1.45 | 1.45 | 1.41 |
| Yellow   | 1.31 | 1.31 | 1.31 | 1.31 | 1.31 | 1.31 |
| Black  | 2.49 | 2.48 | 2.47 | 2.47 | 2.49 | 2.47 |

| HP DesignJet Z6800                                    |      |      |      |      |      |      |
|---|------|------|------|------|------|------|
| 195 gsm Glossy Proofing Paper: Best (2400 x 1200 dpi) |      |      |      |      |      |      |
|   | 1    | 2    | 3    | 4    | Max. | Min. |
| Cyan  | 0.36 | 0.37 | 0.36 | 0.37 | 0.37 | 0.36 |
| Magenta   | 0.91 | 0.92 | 0.90 | 0.91 | 0.92 | 0.90 |
| Yellow  | 0.78 | 0.78 | 0.71 | 0.78 | 0.78 | 0.71 |
| Black   | 2.38 | 2.39 | 2.38 | 2.39 | 2.39 | 2.38 |

Note: Colour density readings were assessed by printing a BLI test file on proofing paper in high-quality colour settings and measuring the density of 100% dot fill using an X-Rite 508 densitometer.

### Skin Tone and Neutral Grey Consistency

| Skin Tone 1 (C=6, M=15, Y=16, K=0) |                              |                    |
|------------------------------------|------------------------------|--------------------|
|                                    | Canon imagePROGRAF PRO-6000S | HP DesignJet Z6800 |
| Colour block                       |                              |                    |
| 2                                  | 0.6                          | 0.2                |
| 3                                  | 0.9                          | 0.3                |
| 4                                  | 0.1                          | 0.2                |
| 5                                  | 0.2                          | 0.1                |
| 6                                  | 1.2                          | 0.0                |
| 7                                  | 0.2                          | 0.2                |
| 8                                  | 0.4                          | 0.1                |
| 9                                  | 0.6                          | 0.3                |
| Max. Delta E Variance              | 1.1                          | 0.3                |

**Skin Tone 2 (C=30, M=63, Y=75, K=0)**

|                              |  | Canon imagePROGRAF PRO-6000S | HP DesignJet Z6800 |
|------------------------------|--|------------------------------|--------------------|
| Colour block                 |  |                              |                    |
| 2                            |  | 0.5                          | 0.3                |
| 3                            |  | 2.5                          | 0.1                |
| 4                            |  | 0.2                          | 0.2                |
| 5                            |  | 0.8                          | 0.2                |
| 6                            |  | 1.8                          | 0.2                |
| 7                            |  | 0.3                          | 0.3                |
| 8                            |  | 0.2                          | 0.3                |
| 9                            |  | 1.3                          | 0.3                |
| <b>Max. Delta E Variance</b> |  | 2.3                          | 0.2                |

**Skin Tone 3 (C=19, M=33, Y=50, K=0)**

|                              |  | Canon imagePROGRAF PRO-6000S | HP DesignJet Z6800 |
|------------------------------|--|------------------------------|--------------------|
| Colour block                 |  |                              |                    |
| 2                            |  | 0.2                          | 0.4                |
| 3                            |  | 0.4                          | 0.3                |
| 4                            |  | 0.4                          | 0.4                |
| 5                            |  | 0.4                          | 0.3                |
| 6                            |  | 0.4                          | 0.2                |
| 7                            |  | 0.9                          | 0.4                |
| 8                            |  | 0.6                          | 0.5                |
| 9                            |  | 0.7                          | 0.5                |
| <b>Max. Delta E Variance</b> |  | 0.7                          | 0.3                |

**Neutral Grey**

|                              |  | Canon imagePROGRAF PRO-6000S | HP DesignJet Z6800 |
|------------------------------|--|------------------------------|--------------------|
| Colour block                 |  |                              |                    |
| 2                            |  | 0.4                          | 0.2                |
| 3                            |  | 1.6                          | 0.1                |
| 4                            |  | 0.2                          | 0.1                |
| 5                            |  | 0.8                          | 0.3                |
| 6                            |  | 1.6                          | 0.1                |
| 7                            |  | 0.4                          | 0.2                |
| 8                            |  | 0.5                          | 0.3                |
| 9                            |  | 1.5                          | 0.2                |
| <b>Max. Delta E Variance</b> |  | 1.4                          | 0.2                |

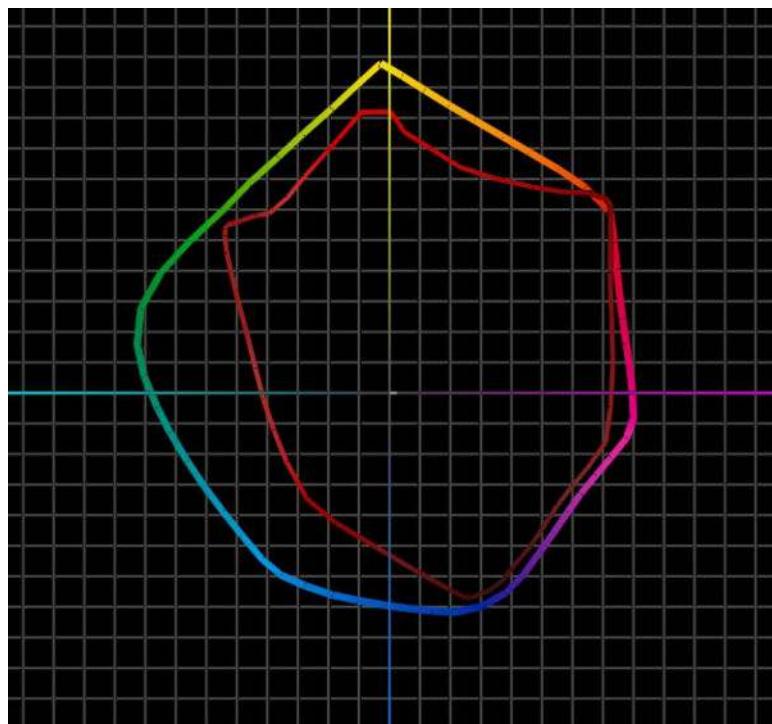
Note: Skin tone and neutral grey consistency measurements are based on nine readings taken from a BLI proprietary PDF test target file comprising four A1-sized solid coverage documents of three skin tones and a neutral grey, with the High/Best print driver setting selected in the driver and the target printed on the manufacturer's own brand of proofing gloss media. Colour differences across the A1 image were measured comparing eight locations to that of the colour measured at the top left of the page, using an EFI ES1000 colour spectrophotometer and Gretag MacBeth EyeOne Share colour comparison software.

**FOGRA 39 DRIFT TEST: Comparison of FOGRA39 colour patches before and after ink consumption test**

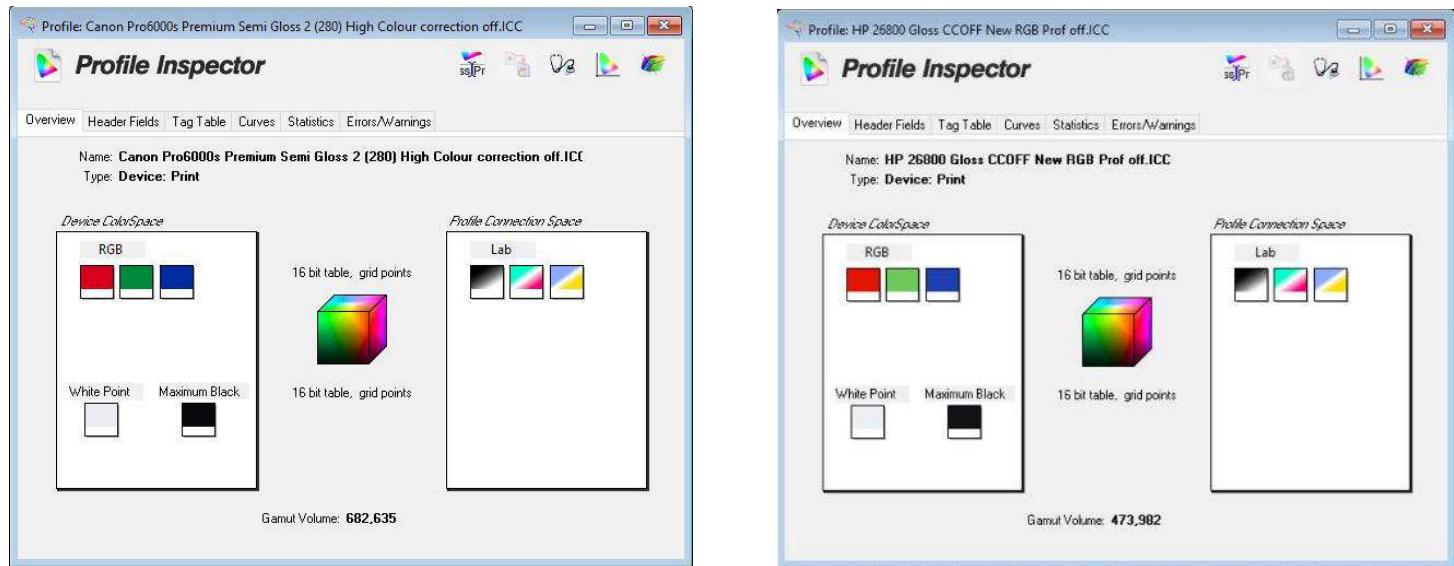
|               | Canon imagePROGRAF PRO-6000S | HP DesignJet Z6800 |
|---------------|------------------------------|--------------------|
| Delta E Drift | 1.8                          | 3.6                |

**Colour Gamut Comparison**

| Media Type/Settings             | Canon imagePROGRAF PRO-6000S | HP DesignJet Z6800 | Canon % larger/smaller (-) |
|---------------------------------|------------------------------|--------------------|----------------------------|
| Photo Paper Highest/Max Quality | 682,635                      | 476,982            | 43.1                       |



Canon imagePROGRAF PRO-6000S colour gamut (shown chromatically) on photo paper in highest quality settings versus HP DesignJet Z6800 colour gamut on photo paper in highest quality settings (red).



Colour gamut profiles for the Canon imagePROGRAF PRO-6000S (left) and HP DesignJet Z6800 (right) on photo paper in highest quality settings.

## Device Feature Set

|  | Canon imagePROGRAF PRO-6000S                                 | Advantage | HP DesignJet Z6800   |
|--|--|-----------|--|
| <b>Max. print resolution</b>                         | 2400 x 1200 dpi  |           | 2400 x 1200 dpi  |
| <b>Number of inks</b>                                | 8  |           | 8  |
| <b>Ink tanks replaceable during operation</b>        | Yes  | ✓         | No   |
| <b>Ink-drop size</b>                                 | 4 picoliter  | ✓         | 4 picoliter (LC, LM, LG, PK), 6 picoliter (Red, M, Y, MK)        |
| <b>Starter cartridge capacity</b>                    | 330 ml (MBk,C,M,Y); 190 ml (PC, PM, Bk, G)                   | ✓         | 225 ml for all 8 colours   |
| <b>Ink cartridge capacity</b>                        | 700 ml   | ✓         | 775 ml   |
| <b>Number of nozzles</b>                             | 18,432 (2,304 per colour)                                    | ✓         | 16,896 (2,112 per colour)  |
| <b>Number of printheads</b>                          | 1  |           | 4  |
| <b>Line accuracy</b>                                 | +/-0.1%  |           | +/-0.1%  |
| <b>Minimum line width</b>                            | INA  |           | 0.02 mm  |
| <b>Minimum print margins</b>                         | Borderless   | ✓         | 5 mm   |
| <b>Borderless (0 mm) printing</b>                    | Yes  | ✓         | Not supported  |
| <b>Maximum outside diameter of roll paper</b>        | 170 mm   |           | 170 mm   |
| <b>Maximum printable paper roll length</b>           | 18 m (varies according to the OS and application)            | ✓         | 15.24 m  |
| <b>Maximum cut-sheet media length</b>                | 203.2 mm   | ✓         | Not supported  |
| <b>Maximum media thickness</b>                       | 0.8 mm   | ✓         | Up to 0.56mm   |
| <b>Maximum media width</b>                           | 60 inches  |           | 60 inches  |
| <b>Media loading</b>                                 | Front  |           | Front  |
| <b>Optional media handling</b>                       | Roll holder spindle and adapter                              |           | Roll holder  |
| <b>Standard RAM</b>                                  | 3 GB   | ✓         | 1 GB (including virtual memory)                                  |
| <b>Hard drive</b>                                    | Standard 320-GB  |           | Standard 320-GB  |
| <b>Interface</b>                                     | 10/100/1000Base-TX Ethernet, 802.11b/g/n, USB 2.0 High Speed | ✓         | 1000Base-T Ethernet, USB 2.0 High Speed                          |
| <b>PDL</b>   | SG Raster  | ✓         | HP GL/2, HP RTL, PostScript, optional PostScript/PDF upgrade kit |
| <b>Net weight (unpacked)</b>                         | 137 kg   | ✓         | 190 kg   |
| <b>Power consumption when in standby</b>             | 1.8 W  | ✓         | 5.3 W  |
| <b>Power consumption when active</b>                 | 113 W  | ✓         | 270 W  |
| <b>Acoustic pressure</b>                             | Operation: 49 dB (A) or less; Standby: 35 dB (A) or less     | ✓         | Operation: 53 dB (A); Standby: 38 dB (A)                         |
| <b>Acoustic power</b>                                | Operation: 6.7 Bels or less                                  | ✓         | Operation: 7.0 Bels  |
| <b>Option to integrate with a spectrophotometer?</b> | No   | ✓         | Embedded spectrophotometer                                       |

## Driver Feature Set

|   | Canon imagePROGRAF PRO-6000S           | Advantage | HP DesignJet Z6800                                   |
|---|--|-----------|--|
| <b>Speed settings</b>                           | Up to 5, depending on media settings   | ✓         | 3 (Fast, Normal and Best), depending on paper chosen |
| <b>Economy mode</b>                             | Yes (Fast setting)                     |           | Yes (Fast setting)                                   |
| <b>Predefined profiles</b>                      | 5 (Under Easy Settings)                | ✓         | 6  |
| <b>Overview of profile settings provided</b>    | Yes                                    |           | Yes  |
| <b>Media profiles</b>                           | 49                                     | ✓         | 20   |
| <b>IQ optimized for various types of output</b> | Yes                                    |           | Yes  |
| <b>Watermark</b>                                | Yes                                    | ✓         | No   |
| <b>Sharpen text</b>                             | No                                     | ✓         | Yes  |
| <b>Thicken fine lines</b>                       | Yes                                    | ✓         | No   |
| <b>Mirror image</b>                             | Yes                                    |           | Yes  |
| <b>Multi-up printing</b>                        | Yes, 2 to 16                           | ✓         | No   |
| <b>Poster print mode</b>                        | Yes (2 by 2)                           | ✓         | No   |
| <b>Page stamping</b>                            | Yes (Date, Time, Name, Page Number)    | ✓         | Not supported  |
| <b>Image rotation</b>                           | Yes, auto 180 degrees                  |           | Yes, auto 180 degrees                                |
| <b>Option to preview before print</b>           | Yes                                    |           | Yes  |
| <b>Link to device web server from driver</b>    | No (there is a link to Status Monitor) |           | No   |
| <b>CMYK balance adjustment</b>                  | Yes                                    |           | Yes  |
| <b>Brightness adjustment</b>                    | Yes                                    |           | Yes  |
| <b>Contrast adjustment</b>                      | Yes                                    | ✓         | No   |
| <b>Saturation adjustment</b>                    | No                                     | ✓         | Yes  |
| <b>PANTONE Emulation</b>                        | No                                     | ✓         | Yes  |
| <b>Advanced colour management options</b>       | Yes                                    |           | Yes  |
| <b>Enlargement Copy Mode</b>                    | Yes                                    |           | Yes  |
| <b>Free Layout Capability</b>                   | Yes                                    |           | Yes  |
| <b>MS Office Plug-in</b>                        | Yes                                    |           | Yes  |
| <b>Adobe Photoshop Plug-in</b>                  | Yes*                                   |           | No   |
| <b>Accounting Capability</b>                    | Yes                                    | ✓         | Yes  |
| <b>Disable automatic cutter</b>                 | Yes                                    |           | Yes  |
| <b>Unidirectional printing selection option</b> | Yes                                    |           | No   |
| <b>Unidirectional printing selection option</b> | Yes                                    | ✓         | Yes  |

\* Supports Canon's Print Studio PRO plug-in which lets users print from industry-standard editing and graphics software Adobe Lightroom, Adobe Photoshop and Canon Digital Photo Professional. It also comes bundled with PosterArtist Lite.

## Ink Consumption

Table 1: Amount of Ink in each Canon imagePROGRAF PRO-6000S Cartridge (grams)

|   | GY    | PM    | M     | MBK   | PBK   | PC    | Y     | C       |
|---|-------|-------|-------|-------|-------|-------|-------|---------|
| Weight of cartridge prior to installation | 544.9 | 560.9 | 911.3 | 923.2 | 497.1 | 573.2 | 903.5 | 907.7   |
| Weight of cartridge at end of life        | 201.3 | 201.3 | 201.3 | 201.3 | 201.3 | 201.3 | 201.3 | 201.3   |
| Net weight of ink                         | 343.6 | 359.6 | 710.0 | 721.9 | 295.8 | 371.9 | 702.2 | 706.4   |
| Total ink weight across 12 cartridges     |       |       |       |       |       |       |       | 4,211.4 |

Table 2: Amount of Ink in each HP DesignJet Z6800 Cartridge (in grams)

|   | M     | LM    | PK    | MK    | Y     | LC    | LG    | R       |
|---|-------|-------|-------|-------|-------|-------|-------|---------|
| Weight of cartridge prior to installation | 989.7 | 989.7 | 989.7 | 989.7 | 989.7 | 989.7 | 989.7 | 989.7   |
| Weight of cartridge at end of life        | 203.4 | 203.4 | 203.4 | 203.4 | 203.4 | 203.4 | 203.4 | 203.4   |
| Net weight of ink                         | 786.3 | 786.3 | 786.3 | 786.3 | 786.3 | 786.3 | 786.3 | 786.3   |
| Total ink weight across 11 cartridges     |       |       |       |       |       |       |       | 6,290.4 |

Table 3: Ink Used in Three 50-Page Runs of Packaging Proof Test Document on the Canon imagePROGRAF PRO-6000S (grams)

|   | GY   | PM   | M    | MBK | PBK  | PC   | Y    | C     |
|---|------|------|------|-----|------|------|------|-------|
| Test Run 1<br>Net weight of ink used          | 26.3 | 15.1 | 14.1 | 4.1 | 33.2 | 15.0 | 13.8 | 9.8   |
| Test Run 2<br>Net weight of ink used          | 30.5 | 18.2 | 16.6 | 7.7 | 30.9 | 11.7 | 13.5 | 8.8   |
| Test Run 3<br>Net weight of ink used          | 25.5 | 18.8 | 15.7 | 2.4 | 29.6 | 11.4 | 10.9 | 7.9   |
| Average amount of ink used across three runs  | 27.4 | 17.4 | 15.5 | 4.7 | 31.2 | 12.7 | 12.7 | 8.8   |
| Total average ink weight across 11 cartridges |      |      |      |     |      |      |      | 130.4 |

**Table 4: Ink Used in Three 50-Page Runs of Packaging Proof Test Document on the HP DesignJet Z6800 (grams)**

|  | M    | LM  | PK   | MK  | Y    | LC   | LG   | R            |
|--|------|-----|------|-----|------|------|------|--------------|
| <b>Test Run 1</b><br>Net weight of ink used          | 13.1 | 5.8 | 25.4 | 3.1 | 12.4 | 10.2 | 46.4 | 13.2         |
| <b>Test Run 2</b><br>Net weight of ink used          | 13.3 | 5.6 | 25.7 | 3.3 | 12.5 | 10.3 | 51.6 | 13.3         |
| <b>Test Run 3</b><br>Net weight of ink used          | 13.2 | 5.9 | 25.8 | 3.3 | 13.0 | 10.7 | 52.5 | 13.5         |
| <b>Average amount of ink used across three runs</b>  | 13.2 | 5.8 | 25.6 | 3.2 | 12.6 | 10.4 | 50.2 | 13.3         |
| <b>Total average ink weight across 11 cartridges</b> |      |     |      |     |      |      |      | <b>134.4</b> |

**Table 5: Ink Used in Three 50-Page Runs of Retail Poster Test Document on the Canon imagePROGRAF PRO-6000S (grams)**

|  | GY  | PM  | M    | MBK  | PBK | PC  | Y    | C           |
|--|-----|-----|------|------|-----|-----|------|-------------|
| <b>Test Run 1</b><br>Net weight of ink used          | 5.1 | 4.8 | 49.7 | 10.3 | 3.3 | 5.6 | 21.7 | 18.3        |
| <b>Test Run 2</b><br>Net weight of ink used          | 5.9 | 5.4 | 50.0 | 12.0 | 4.3 | 5.2 | 21.4 | 20.0        |
| <b>Test Run 3</b><br>Net weight of ink used          | 4.6 | 3.9 | 3.6  | 3.3  | 3.4 | 3.3 | 3.0  | 3.7         |
| <b>Average amount of ink used across three runs</b>  | 5.2 | 4.7 | 34.4 | 8.5  | 3.7 | 4.7 | 15.4 | 14.0        |
| <b>Total average ink weight across 11 cartridges</b> |     |     |      |      |     |     |      | <b>90.6</b> |

**Table 6: Ink Used in Three 50-Page Runs of Retail Poster Test Document on the HP DesignJet Z6800 (grams)**

|  | M    | LM  | PK   | MK  | Y   | LC   | LG   | R            |
|--|------|-----|------|-----|-----|------|------|--------------|
| <b>Test Run 1</b><br>Net weight of ink used          | 20.6 | 5.1 | 13.9 | 6.1 | 7.9 | 10.4 | 19.5 | 21.8         |
| <b>Test Run 2</b><br>Net weight of ink used          | 22.0 | 5.2 | 14.2 | 6.1 | 7.9 | 10.3 | 19.4 | 22.0         |
| <b>Test Run 3</b><br>Net weight of ink used          | 22.5 | 5.3 | 14.0 | 6.0 | 8.3 | 10.7 | 19.6 | 22.3         |
| <b>Average amount of ink used across three runs</b>  | 21.7 | 5.2 | 14.0 | 6.1 | 8.0 | 10.5 | 19.5 | 22.0         |
| <b>Total average ink weight across 11 cartridges</b> |      |     |      |     |     |      |      | <b>107.0</b> |

**Table 7: Ink Used in Three 50-Page Runs of Studio Portrait Test Document (Standard mode) on the Canon imagePROGRAF PRO-6000S (grams)**

|  | GY   | PM   | M   | MBK | PBK  | PC   | Y    | C            |
|--|------|------|-----|-----|------|------|------|--------------|
| <b>Test Run 1<br/>Net weight of ink used</b>         | 42.6 | 31.0 | 6.8 | 6.2 | 11.6 | 26.3 | 13.8 | 4.5          |
| <b>Test Run 2<br/>Net weight of ink used</b>         | 26.5 | 26.6 | 5.4 | 1.6 | 11.5 | 24.8 | 12.1 | 4.7          |
| <b>Test Run 3<br/>Net weight of ink used</b>         | 25.3 | 33.3 | 6.2 | 5.9 | 11.6 | 23.6 | 11.3 | 4.6          |
| <b>Average amount of ink used across three runs</b>  | 31.5 | 30.3 | 6.1 | 4.6 | 11.6 | 24.9 | 12.4 | 4.6          |
| <b>Total average ink weight across 11 cartridges</b> |      |      |     |     |      |      |      | <b>126.0</b> |

**Table 8: Ink used in Three 50-Page Runs of Studio Portrait Test Document on the HP DesignJet Z6800 (grams)**

|  | M    | LM  | PK   | MK  | Y    | LC  | LG   | R            |
|--|------|-----|------|-----|------|-----|------|--------------|
| <b>Test Run 1<br/>Net weight of ink used</b>         | 10.0 | 7.9 | 12.6 | 5.2 | 12.8 | 9.1 | 62.0 | 10.7         |
| <b>Test Run 2<br/>Net weight of ink used</b>         | 7.5  | 6.9 | 12.1 | 4.5 | 11.5 | 7.8 | 60.0 | 9.6          |
| <b>Test Run 3<br/>Net weight of ink used</b>         | 6.7  | 6.0 | 11.3 | 3.4 | 10.9 | 7.0 | 59.6 | 8.4          |
| <b>Average amount of ink used across three runs</b>  | 8.1  | 6.9 | 12.0 | 4.4 | 11.7 | 8.0 | 60.5 | 9.6          |
| <b>Total average ink weight across 11 cartridges</b> |      |     |      |     |      |     |      | <b>121.2</b> |

## Ink Consumption Test Methodology Overview

Buyers Lab's ink consumption analysis was conducted using three document types (proof, retail poster and photo). The packaging proof document was formatted as a PDF, the retail poster as a JPG file and the studio portrait as a TIFF file and all three were sized at ISO A1.

The Canon imagePROGRAF PRO-6000S was installed in BLI's lab with the latest level of firmware (as of July 2016) and connected to a Windows 10 workstation using a 1000BaseT TCP/IP connection. The device was left in default configuration throughout testing. The Canon GARO driver was used for all testing and was left in default colour setting configuration. The packaging proof document was printed on 195gsm glossy proofing media in standard mode, the retail poster was printed on matte coated media in standard mode, and the studio portrait photo was printed on 250gsm glossy photo media in standard mode.

The HP DesignJet Z6800 was installed in BLI's lab with the latest level of firmware (as of July 2016) and connected to a Windows 10 workstation using a 1000BaseT TCP/IP connection. The device was left in default configuration throughout testing. The HP-GL 2 driver was used for all testing and was left in default colour setting, with media selection set to plain paper and the image set to print at actual size. The packaging proof document was printed on 195gsm glossy proofing media in quality mode, the retail poster was printed on matte coated media in quality mode, and the studio portrait photo was printed on 250gsm glossy photo media in quality mode.

Before installing the ink cartridges, BLI technicians weighed and recorded the weight of each with all packaging removed. At the end of each 50-print test run, the cartridges were weighed again and the resulting weight of ink used for the test run calculated for each colour. To ensure that the sub-tank on the Canon model did not affect results, a procedure was followed to ensure that the sub-tank level was at its maximum before the print run commenced and again after the print run was completed, thereby ensuring that ink replenishment of the sub-tanks was taken into account for each print run. Then, for each model, one cartridge was run to exhaustion and the weight of the empty cartridge was recorded.

## Test Environment

Testing was conducted in BLI's European test lab, in an atmospherically controlled environment monitored by a 24/7 Dickson Temperature/RH chart recorder, ensuring that typical office conditions were maintained. All paper used in testing was allowed to acclimatize inside the facility for a minimum of 12 hours before being used.

## Test Equipment

BLI's dedicated test network in Europe, consisting of Windows 2008 servers, Windows 10 workstations, 10/100/1000BaseTX network switches and CAT5e/6 cabling.

## Test Procedures

The test methods and procedures employed by BLI in its lab testing include BLI's proprietary procedures and industry-standard test procedures. In addition to a number of proprietary test documents, BLI uses industry standard files including a BLI test file and an ASTM monochrome test document for evaluating black image quality. In addition to a visual observation, colour print quality and gamut size are evaluated using a profile software tool from Colour Confidence that was read using an EFI ES-1000 colour spectrophotometer and analysed using Chromix ColorThink Pro 3.0 software. Density of black and colour output was measured using an X-Rite 508 densitometer.

## About Buyers Laboratory Inc.

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Buyers Laboratory LLC (BLI) is the world's leading independent provider of analytical information and services to the digital imaging and document management industry. For more than 50 years, buyers have relied on BLI to help them differentiate products' strengths and weaknesses and make the best purchasing decisions, while industry sales, marketing and product professionals have turned to BLI for insightful competitive intelligence and valued guidance on product development, competitive positioning and sales channel and marketing support. Using BLI's web-based bliQ and Solutions Center services, 40,000 professionals worldwide create extensive side-by-side comparisons of hardware and software solutions for more than 15,000 products globally, including comprehensive specifications and the performance results and ratings from BLI's unparalleled Lab, Solutions and Environmental Test Reports, the result of months of hands-on evaluation in its US and UK labs. The services, also available via mobile devices, include a comprehensive library of BLI's test reports, an image gallery, hard to find manufacturers' literature and valuable tools for configuring products, calculating total cost of ownership (TCO) and annual power usage. BLI also offers consulting and private, for-hire testing services that help manufacturers develop and market better products and consumables.

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