

### Canon imagePROGRAF iPF770 vs. HP Designjet T520 36"



Canon imagePROGRAF iPF770



HP Designjet T520 36"

Advantage ✓	Canon imagePROGRAF iPF770	HP Designjet T520 36"
Colour Image Quality	✓	
Black Image Quality	✓	
Print Productivity	✓	
Direct PDF Submission Functionality	=	=
Banner Printing	✓	
Poster Printing	✓	
Ink Consumption	✓	
Device Feature Set	✓	
Print Driver Feature Set	✓	

## 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 iPF770 and the HP Designjet T520 36", and produce a report comparing the relative strengths and weaknesses of the two products in terms of image quality, productivity, ink consumption, direct PDF submission, device feature set, driver functionality, and banner and poster printing. All testing was performed in BLI's test facility in Wokingham, UK.

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## Executive Summary

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Delivering significantly higher productivity in both colour and black modes, particularly in High/Best quality mode, and richer device and driver feature sets, the Canon imagePROGRAF iPF770 model was a superb performer in BLI's evaluation and outshone its HP Designjet 520 36" competitor in most areas of testing. The Canon model also had the overall advantage in ink consumption, using less ink for two of the three document types used in the test; notably, the Canon model is capable of handling ink and paper outages without having an impact on user productivity or causing unnecessary waste. When the HP model runs out of ink or paper, it stops and cancels the entire job in progress, even if it is in the middle of a 50-page print run. Users are forced to set up the job again once ink or paper is replenished and resume the job from the page on which it was interrupted. The Canon iPF770, in contrast, continues to print when ink needs replacing, while alerting the user to replace the cartridge, which can be done while printing is in progress. When it is out of paper, the Canon unit pauses and alerts the operator. After a new roll is installed, it prompts the operator to confirm the paper type and then it continues to print the interrupted page in full followed by all successive pages, thus reducing waste.

In terms of image quality, the Canon iPF770 emerges as the stronger, more consistent performer, with a number of image quality advantages over the HP model in both colour and black modes. The Canon model delivered higher colour optical densities overall and larger colour gamuts in all but one of the tests. This advantage was particularly noteworthy when printing on photo-quality paper, when its colour gamut was 40.1% larger than that of the HP unit (with a CIE volume of 624,576 compared with 445,672 for the HP unit). It also delivered a finer level of detail in colour AEC graphics, more natural-looking skin tones, and smoother circles; in black mode, the Canon device produced crisp, dark fonts and distinct fine lines that were unmatched by the HP model in all modes.

Whilst the Canon unit's image quality was better overall, the HP device offers some pluses in this regard, including a higher optical density for black across all modes and a higher optical density for yellow in Best mode, and a larger colour gamut when printing on plain paper in Best mode. However, output produced by the HP model with its bidirectional printhead exhibited banding across output in every mode except Best, while the Canon iPF770 had the advantage of using its unidirectional printing option to eliminate any banding.

The HP Designjet T520 offers some notable strengths: it offers a 1-GB non-upgradeable RAM (compared with Canon's 256 MB), plus Wi-Fi connectivity and it consumes less energy while printing—less than 35 watts compared with 140 watts with the Canon model. However, this is balanced by energy consumption in standby mode (where it is likely to spend more time) in which the Canon unit only uses 0.5 watts compared with 4.5 watts for the HP device. In addition, while both models support direct PDF submission without the need to open an application and both allow files to be retrieved from cloud storage for printing, HP's ePrint & Share offers some functionality not offered by Canon in some respects, including automatic saving to the cloud of all printing tasks. However, BLI analysts found the process for registering for ePrint & Share to be a more tedious and time-consuming process than with iPF Direct Print & Share. Canon users who are registered with Google Drive will have instant access to its hierarchical folder system, in contrast to the flat file structure of HP's ePrint & Share.

In conclusion, the Canon imagePROGRAF iPF770 delivered a superior performance to that of the HP T520 model in nearly all categories tested, with greater productivity in all quality modes, superior image quality overall, the ability to handle BLI's banner test successfully (which the HP failed to output) and a more feature-rich driver while also offering several unique advantages, such as its unidirectional print capabilities and hot swap ink tanks.

## Colour Image Quality

Advantage ✓	Canon imagePROGRAF iPF770	HP Designjet T520 36"
Text	✓	
Fine Lines		✓
Halftone Range	=	=
Halftone Fill	=	=
Solid Density	✓	
AEC Graphics	✓	
GIS Graphics (plain paper)	=	=
Business Graphics	=	=
Photographic Images	✓	
Colour Gamut (plain paper, Fast)	✓	
Colour Gamut (plain paper, Standard/Normal)	✓	
Colour Gamut (plain paper, High/Best)		✓
Colour Gamut (photo paper, High/Best)	✓	

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

- One factor influencing overall image quality is the Canon model's option of using unidirectional printing. The HP model offers only bidirectional printing, which means that the printhead travels in both directions when creating the image, which can create a noticeable pattern of banding across the full width of the image in all modes, except Best quality mode. Output produced by the Canon model in the colour image quality evaluation did not exhibit any banding.
- + Overall, the Canon iPF770 delivered the higher optical densities for cyan and magenta across all modes, and higher optical density for yellow in Fast and Standard modes. The HP model delivered higher optical density for yellow in Best mode.
- + When printing on plain paper using Fast settings, the Canon model delivered a colour gamut 6.3% larger than that of the HP unit, with a CIE volume of 196,671 versus a CIE volume of 184,939 for the HP device.
- + The Canon model produced a larger colour gamut when printing on plain paper using Standard/Normal settings—with a 228,330 CIE volume versus 220,244 for the HP device.
- When printing on plain paper in High/Best settings, the HP Designjet T520 delivered a larger colour gamut than that produced by the Canon iPF770, with a CIE volume of 243,589 versus 236,769 for the Canon model.
- + When printing on photo-quality paper using Canon's High quality setting and the HP Designjet T520's Best setting, the Canon model delivered a colour gamut 40.1% larger than that of the HP unit, with a CIE volume of 624,576 compared with 445,672 for the HP unit.
- + BLI technicians noted some clear differences in the text output of the two models in colour mode. Fonts pro-

duced by the Canon iPF770 were legible down to the 3-pt. level in High quality mode; in Fast mode, serif and sans serif fonts were legible down to the 4-pt. level and 3-pt. level, respectively; and in Standard mode, fonts were legible down to the 5-pt. level (serif) and 4-pt. level (sans serif). In contrast, the HP model produced serif fonts that were legible only down to the 6-pt. level, but its sans serif fonts were legible down to the 3-pt. level in Normal and in Best modes. There was no breakup evident in output from either model across all tested modes.

- Text output produced by the Canon model on plain paper exhibited minimal ink bleed in all modes, but only when viewed under magnification, whereas no bleed was detected with the HP model.
- Fine lines produced by both devices remained distinct down to the 0.1-pt. level (black on white) and the 0.25-pt. level (white on black) in all modes. However, the fine lines produced by the HP model were rated slightly more distinct in Fast and Normal modes than those of the Canon device.
- Both devices delivered halftone output across the full range—from the 10% to 100% dot-fill levels in all modes, with distinct transitions between all levels.
- The Canon iPF770 delivered good and consistent halftone fills in all modes, as did the HP model.
- + When evaluating Architectural, Engineering and Construction (AEC) graphics in Standard/Normal and High/Best modes, the Canon unit delivered better detail than the HP device.
- When evaluating Geographic Information Systems (GIS) graphics in High/Best mode on plain paper, both units delivered a fine level of detail and showed an equally good depth of field—a critical factor in delivering a more realistic three-dimensional rendering of topographical features.
- Colour business graphics produced by both the HP and Canon devices exhibited sharp details and very good colour saturation.
- When comparing photographic images in High/Best mode, there was little difference between the output produced by the two models, with both producing excellent detail in dark contrast areas, and good saturation.
- + Both devices produced circles which were distinct down to the 0.1-pt. level, but the Canon device has the advantage, with smoother circles (particularly in High quality mode) than those delivered by the HP device, which displayed some slight stair-stepping.
- + Skin tones produced by the Canon model were more natural-looking, while those produced by the HP device were distinctly reddish.
- The Canon iPF770 produced the 1x1 pixel grid in CMY with no quality issues, and coverage was excellent and consistent across all colours. The HP T520 delivered comparable coverage to that of the Canon unit.
- + Overall, the Canon model emerges as the stronger and more consistent performer in BLI's assessment of colour image quality. It delivered a finer level of detail in colour AEC graphics, more natural-looking skin tones, smoother circles and larger colour gamuts in all but one of the gamut tests when compared with the performance of the HP model. Whilst the HP device offers higher optical density for yellow, more distinct fine lines and a larger colour gamut on plain paper in High/Best mode, the Canon iPF770 had the advantage in density for cyan and magenta, plus the option of using unidirectional printing to avoid the banding that was clearly present across all HP output except in Best mode.

## Black Image Quality

Advantage ✓	Canon imagePROGRAF iPF770	HP Designjet T520 36"
Text	✓	
Fine Lines	✓	
Halftone Range	=	=
Halftone Fill	✓	
Solid density		✓
Business Graphics	=	=

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

- + The HP model delivered superior optical density for black across all tested modes.
- + Fonts produced by the iPF770 were crisp and legible down to the 3-pt level across all modes—a consistent performance unmatched by the HP device. HP’s fonts were legible only down to the 5-pt. level in Fast, Normal and Best mode.
- + Fine lines in BLI’s line art test target remained distinct down to the 0.1-pt. level in all modes in the output of both devices, with no evidence of stair-stepping in diagonal lines. However, BLI analysts gave a higher rating to the distinctness of Canon’s fine lines in High/Best mode.
- Whilst both devices delivered white-on-black fine lines at the 0.25-pt. level in all quality modes, the Canon output was rated as poor in Fast mode and only fair in Standard and High Quality modes, compared with the good ratings for the HP device.
- + Circles produced by both models were fully formed in all modes; the iPF770’s circles were slighter smoother than those produced by the HP in Fast mode.
- Both models delivered an excellent halftone range—from the 10% to 100% dot-fill levels in all modes, with distinct transitions between all levels.
- + The Canon device’s output was rated good in all modes for halftone fills, whilst the HP unit’s was rated only fair as some banding was visible across output in the direction of the printhead.
- + In black AEC graphics output in Standard/Normal and High/Best modes, the Canon unit delivered superior detail and more distinct fine lines than the HP model.
- Monochrome business graphics output in High/Best mode on plain paper were produced very accurately by both models, with smooth halftone gradations and crisp text.
- + The Canon model produced better overall black image quality than did the HP model, with crisper text, superior halftone fills, better detail in AEC graphics and smoother circles. The HP model was unable to match the Canon in delivering consistently legible fonts, and it displayed some banding in its halftone fills. The HP unit, however, produced darker solids and a higher optical density in all modes.

## Print Productivity

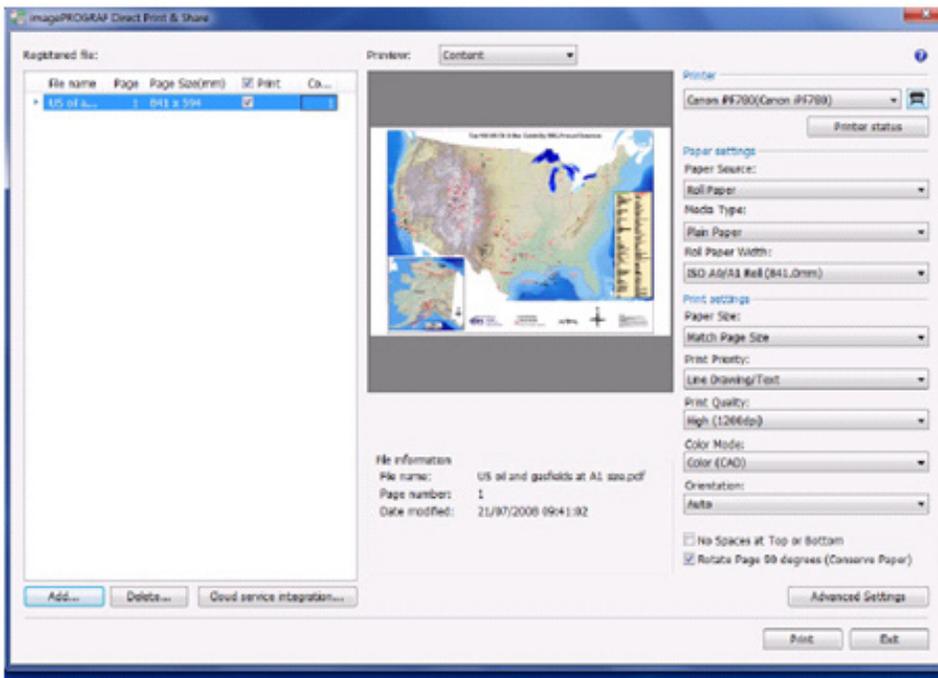
Advantage ✓	Canon imagePROGRAF iPF770	HP Designjet T520 36"
First Page Out	✓	
Throughput Speed (fastest mode)	✓	
Throughput Speed (default mode)	✓	
Throughput Speed (highest-quality mode)	✓	
Job Stream (multiple jobs submitted to device in fast succession simulating busy network environment)	✓	

- + The Canon iPF770 delivered a faster first-page-out time of 84.87 seconds after a weekend of non-use, compared with 113.85 seconds for the HP device. Start-up time before printing commenced was 41.82 seconds for the Canon model, slower than the 25.52 seconds for the HP unit.
- + The Canon iPF770 delivered a much faster first-page-out time of just 38.98 seconds from its ready state, compared with 93.45 seconds for the HP device. Start-up time before printing commenced was 13.91 seconds for the Canon model, slightly slower than the 10.42 seconds for the HP unit.
- + When printing BLI's job stream, designed to simulate a typical mixed workflow for a large-format unit, the Canon iPF770 was 45.2% faster than the HP model in Fast mode, 29.2% faster in Standard/Normal mode, and 75.6% faster in High quality/Best mode.
- + When printing BLI's 12-page DWF test file in colour, the Canon unit was 37.8% faster in Fast mode, 76.9% faster in Standard/Normal mode, and 79.7% faster in High quality/Best mode when compared with the HP unit.
- + When printing BLI's 12-page DWF test file in monochrome, the Canon unit was 39.1% faster than the HP model in Fast mode, 12.9% slower in Standard/Normal mode and 79.3% faster in High quality/Best mode.
- + In BLI's single-page A0-size test, the Canon iPF770 delivered a first-page-out time (92.84 seconds) that was 40.2% faster than that of the HP unit (155.26 seconds). The Canon model was also faster (39.4%) than the HP 520 when printing five A0-size pages (459.50 seconds versus 758.87 seconds).
- + When the HP model runs out of ink or paper, it stops and cancels the entire job in progress, even in the middle of a multi-page print run, forcing users to resubmit the job once ink or paper is replenished. This has a negative impact on productivity, since the operator must determine the last page printed and then resubmit the job from that point. The Canon model, in contrast, will continue to print (drawing ink from its sub tank) when ink needs replacing, and the control panel conveniently alerts the user to replace ink, a procedure that can be carried out while printing is in progress. When the Canon unit runs out of paper, it pauses and alerts the operator. After a new roll is installed, the operator is prompted to confirm the paper type, after which the job will continue printing from the beginning of the interrupted page.
- + Since printing is not interrupted when a Canon cartridge is depleted, it is expected that less ink and paper will be wasted by the Canon model than the HP device.

## Direct PDF Print Submission Functionality

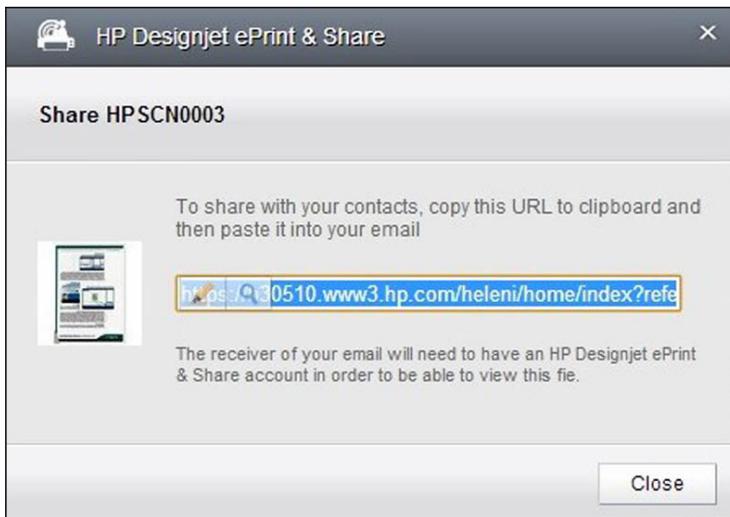
Advantage ✓	Canon imagePROGRAF iPF770	HP Designjet T520 36"
Ease of Use	✓	
Functionality	=	=

- A free download from Canon’s website, the iPF Direct Print & Share utility enables printing of PDFs without having to open Adobe Acrobat and it also allows users to retrieve files from cloud storage for printing.
- + The latest version (v2.0) of iPF Direct Print & Share supports “Shortcut Print” functionality, which defines several print settings represented by a desktop icon. Files are automatically printed with the predefined settings when users drag-and-drop them to the icon. Multiple desktop icons can be created for different print settings.



Canon’s iPF Direct Print & Share utility gives operators an image preview.

- HP’s ePrint & Share Web services software provides the same direct PDF submission and cloud storage retrieval functionality for the HP device and also supports printing from Apple or Android smartphones or tablets, and automatically saves copies of work to the cloud. The Canon model also supports an app which enables PDF printing from Apple iPad devices to facilitate workflows for mobile workers.



- + HP's ePrint & Share requires users to register as users of the ePrint & Share Library and the HP ePrint & Share Printing tool by creating a separate account for each on HP's ePrint & Share Web Center (server), each with their own passwords, which BLI analysts found to be a more tedious and time-consuming process than with iPF Direct Print & Share. Canon users who are registered with Google Drive will have instant access to its hierarchical folder system, in contrast to the flat file structure of HP's ePrint & Share.

## Banner Printing

Advantage ✓	Canon imagePROGRAF iPF770	HP Designjet T520 36"
Banner printing capability	✓	
Productivity	✓	

- + The Canon imagePROFGRAF iPF770 successfully printed BLI's 36" x 105" banner (a 4,955-KB PDF file) in Fast mode, taking 32.7 seconds to generate a preview, and a further 3 minutes, 26.06 seconds from preview to final paper cut.
- + The HP Designjet T520 36" was unable to print any portion of the banner, with an error message appearing on the display saying 'Out of memory... the printer cannot complete this job.'

## Poster Printing

Advantage ✓	Canon imagePROGRAF iPF770	HP Designjet T520 36"
Image Quality (Fast mode)	✓	
Image Quality (Standard/Normal mode)	✓	
Image Quality (High/Best mode)	✓	
Productivity (Fast mode)	✓	
Productivity (Standard/Normal mode)	✓	
Productivity (High/Best mode)	✓	

- + When printing a poster in Fast mode at 300 dpi, the Canon model took 32.15 seconds to complete the job and the HP unit took 51.72 seconds. Banding was slightly evident with the Canon iPF770 in Fast mode, while there was some banding evident with the HP model in virtually all modes apart from Best. When unidirectional printing was selected in the Canon print driver, it took 47.53 seconds to print and the banding was eliminated.
- + When printing a poster in Standard/Normal mode at 600 dpi, the Canon model took 54.08 seconds and there were no quality issues. The HP unit took 89.88 seconds, and there was some banding evident in one particular dark area on the poster.
- + Printing a poster in High quality (600 dpi) mode on the Canon model took 1 minute, 32.22 seconds, while the HP model in Best quality (1200 dpi) mode took 5 minutes, 35.22 seconds—a 72.5% faster print time for the Canon model.
- + At these High/Best quality settings, the Canon model delivered superior image quality to that of the HP device, with more vibrant reds; definition was equally good on output from each model.

## Ink Consumption

RESULTS		
Results averaged across three sets of 50-page A1 printing in various modes (specified below)	Canon imagePROGRAF iPF770	HP Designjet T520 36"
<b>COTTAGE ARCHITECTURAL PLAN (Fast mode)</b>		
Overall weight of ink used (grams)	22.1 g	17.7 g
<b>COTTAGE ARCHITECTURAL PLAN (Standard/Normal mode)</b>		
Overall weight of ink used (grams)	23.8 g	21.5 g
<b>RETAIL POSTER (Standard/Normal mode)</b>		
Overall weight of ink used	66.2 g	75.0 g
<b>GIS MAP (Standard/Normal mode)</b>		
Overall weight of ink used	40.4 g	52.6 g

- When producing 50 prints of a Cottage Architectural Plan in Fast mode, the Canon unit used 24.9% more ink than the HP T520.
- When producing 50 prints of a Cottage Architectural Plan in Standard/Normal mode, the Canon unit used 10.7% more ink than the HP T520.
- + When printing a Retail Poster in Standard/Normal mode, the Canon unit used 11.7% less ink than did the HP T520.
- + When printing a GIS Map in Standard/Normal mode, the Canon iPF770 used 23.2% less ink compared with the HP device.
- + As noted earlier, the fact that the Canon cartridges can be run to exhaustion without interrupting the print process means that less ink and paper are likely to be wasted by the Canon model than by the HP T520.

## Device Feature Set

- + The Canon black, cyan, magenta and yellow cartridges are all available in 130-ml capacities, which is a much higher capacity than those for the HP model's cartridges (29 ml for cyan, magenta and yellow; 38ml (starter) and 80 ml for black). Consequently, they will need replacing much less frequently than with the HP device.
- + If the Canon device detects that printhead nozzles are in danger of clogging, it automatically starts a cleaning routine. This task would have to be done manually with the HP unit, although BLI analysts did not encounter any nozzle clogging issues during testing.

- + Canon's ink cartridges are replaceable during operation (unlike with the HP model), which helps to reduce downtime for Canon users.
- + The Canon unit supports a larger diameter of roll paper (150 mm as opposed to 100 mm with the HP device), a higher maximum cut-sheet media length of 1.6 m compared with 914 mm for the HP unit, and a higher maximum media thickness (0.8 mm compared with HP's 0.3 mm).
- Both models offer USB 2.0.
- Unlike the Canon device, the HP model is WiFi-enabled.
- The catch trays of both models enable most printed sheets to be stacked neatly, with the Canon model offering the advantage of flat stacking. However, there was little to distinguish between the two models when the end of media rolls approached, as the tightly curled output from both models had a tendency to spill out of the basket.
- The Canon model offers a standard, non-upgradable RAM of 256 MB, while the HP unit has a standard RAM of 1 GB.
- The HP T520 is a more compact, lightweight device than the Canon model, weighing in at just 39.2 kg versus 64.6 kg for the Canon unit.
- The HP model includes a colour touchscreen, while the Canon model has a monochrome non-touchscreen LCD display.
- The HP T520's power consumption (less than 35 W) is much lower than the Canon model's (140 W) while active.
- + However, in standby mode (where the devices are likely to spend more of their time) the Canon model's power consumption (0.5 W) is much lower than the HP device (5 W).
- Rated noise emissions are comparable (48 dB).

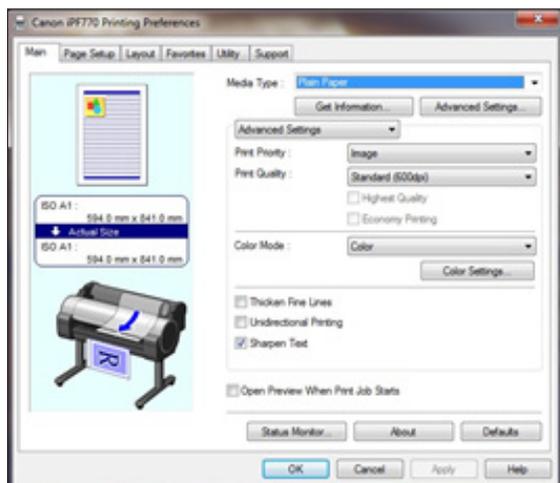
## Driver Feature Set

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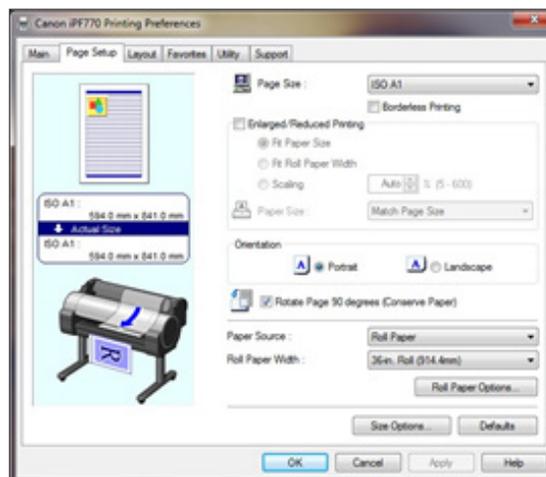
- + The Canon iPF770 has five speed settings (Fast 300, Standard 600, Fast 600, High 600 and 1200), as opposed to three with the HP device (Fast, Normal and Best). Note: not all speed settings are available with all media types.
- + Seven predefined profiles are available with the Canon driver, while the HP driver offers a range of five.
- + The Canon GARO driver provides an overview of the settings for predefined profiles, unlike HP's HP-GL/2 driver.
- + The Canon driver supports multi-up (2 to 16) printing, which the HP driver doesn't support.
- + The Canon GARO driver has a poster mode (2 by 2) that is not available from the HP driver.
- + Unlike the HP driver, the Canon driver offers page stamping (Date, Time, Name and Page Number).
- + The Canon GARO driver offers a wider range of built-in adjustments for CMYK balance, brightness, contrast and saturation than the HP-GL/2 driver. ICC profile settings are also available in the GARO driver's matching tab under Advanced Settings. Operators can select four matching modes (driver, ICC, driver ICM and host ICM matching) and choose one of four rendering methods (auto, perceptual, colorimetric or saturation). Note that a wide range

of colour management profiles are available when the HP driver and colour management tools (from the Printing Preferences menu) are downloaded from HP’s website (as of March 2014), plus the ability to preview images before printing—features which were not included in the Startup driver disk supplied to BLI with the device.

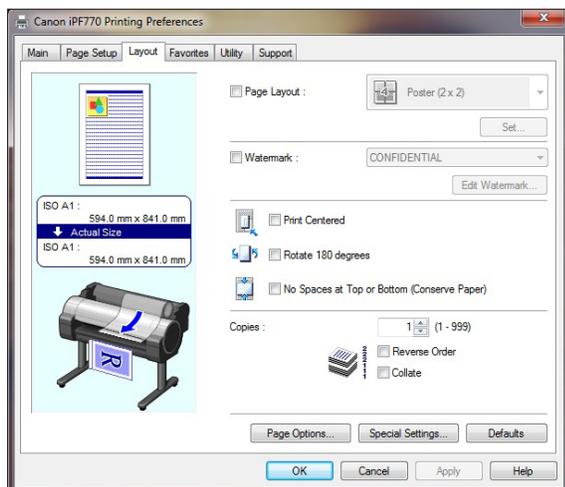
- + The Canon driver offers the choice of unidirectional printing, even in Fast mode. This means that the printhead travels in only one direction to create the desired image, helping it to avoid the banding that’s evident across the full width of the image when using the HP device’s bidirectional printhead in every mode except Best.
- + The Canon driver Extra Kit (a free download from Canon’s website) includes the Colour imageRUNNER Enlarge-ment Copy Mode utility, which enables users to integrate a Canon small-format MFP device with the iPF770. Documents scanned by the Canon MFP are automatically routed to a hot folder that is monitored by the driver of the iPF770. The image is then resized and printed, offering a fast, easy-to-use poster creation tool for office users.
- + The Canon driver Extra Kit also includes a Free Layout nesting tool that enables files—even files created with different applications—to be scaled, resized, or grouped together as a single job from the printer driver. Images can be dragged and dropped to their desired locations and printed together on a single page to save on paper.
- + A plug-in for printing from Microsoft Office applications offered by the Canon driver includes useful tools for automatic media resizing, nesting and borderless printing.



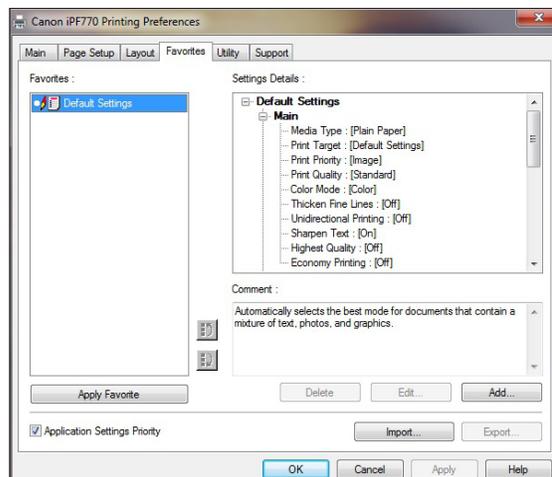
**Canon Print Driver Main Tab**



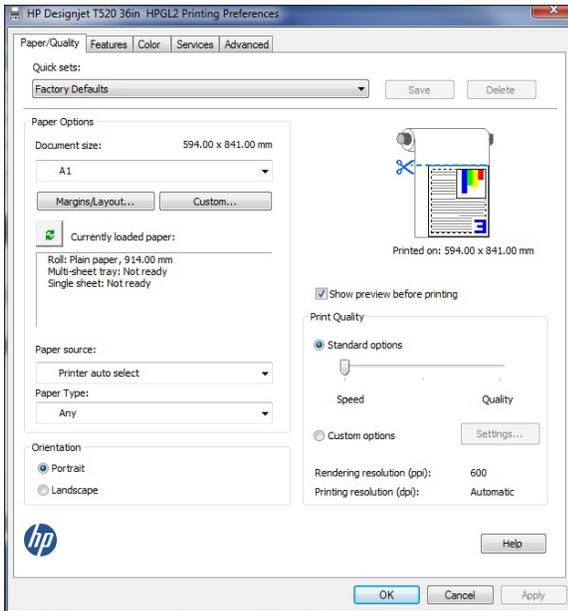
**Canon Print Driver Page Setup Tab**



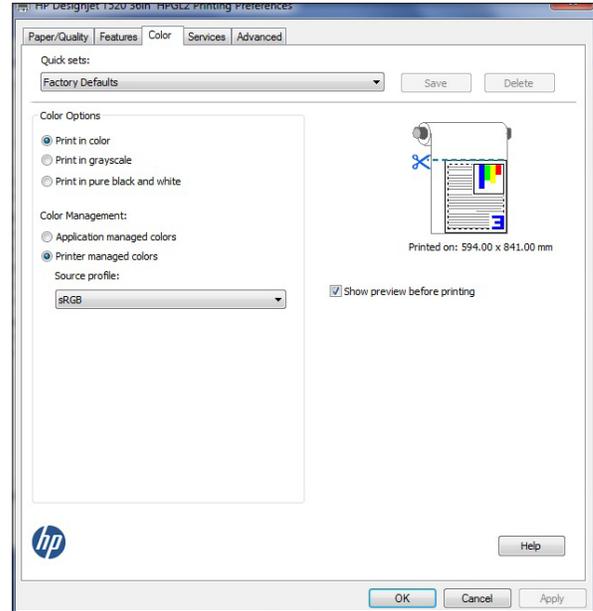
**Canon Print Driver Layout Tab**



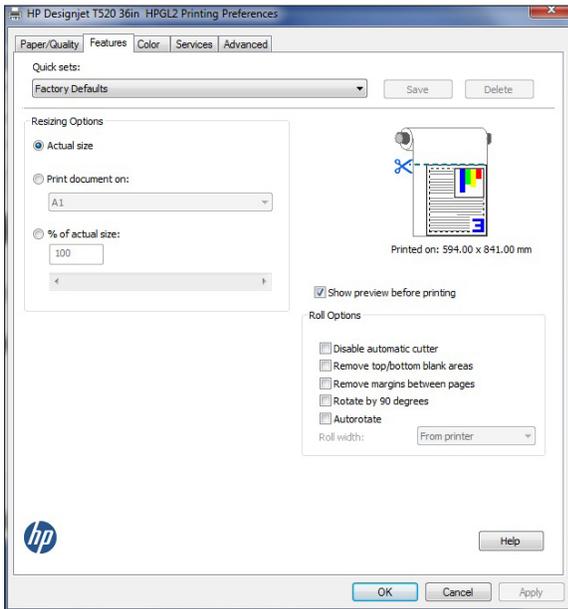
**Canon Print Driver Favourites Tab**



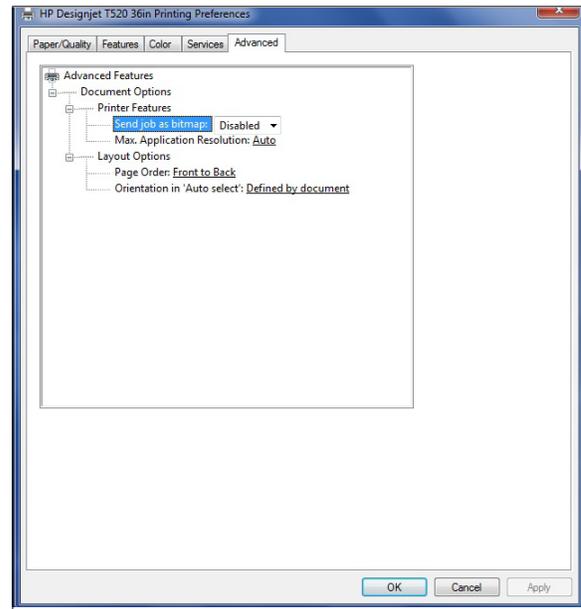
HP Print Driver Paper Quality Tab



HP Print Driver Colour Settings Tab



HP Print Driver Features Settings Tab



HP Print Driver Advanced Settings Tab

## SUPPORTING TEST DATA

### Job Stream Productivity

#### Mixed File Types, Same Size

Canon imagePROGRAF iPF770 (time in seconds)			HP Designjet T520 36" (time in seconds)		
Fast	Standard	High	Speed	Quality	Max Quality
650.84	1,176.97	1,804.76	1,188.68	1,662.14	7,386.95

BLI's job stream consists of nine files, including PDF, TIFF and DWF files totalling 19 pages, all at Arch D-size. This test replicates the type of traffic a typical wide-format device might experience in a real-world, multi-user environment. All of the files are submitted to the controller in a specific order and sent to the printer as a group, at which time the stopwatch begins; timing ends when the last page of the last file exits the device. Both devices were loaded with 914 mm rolls, with each file set to auto-rotate to save media.

#### Colour Productivity

Canon imagePROGRAF iPF770 (time in seconds)			HP Designjet T520 36" (time in seconds)		
Fast	Standard	High	Fast	Normal	Best
407.13	757.81	1,094.83	654.03	1,114.14	5,391.03

The 12-page DWF test file was printed using the device driver set to the plain paper/colour setting. Both devices were loaded with 914-mm rolls with each file set to auto-rotate to save media. The actual time indicated is the time it took to RIP, image and deliver all pages of the test document to the collection bin.

#### Monochrome Productivity

Canon imagePROGRAF iPF770 (time in seconds)			HP Designjet T520 36" (time in seconds)		
Fast	Standard	High	Fast	Normal	Best
398.53	767.17	1,111.56	654.28	679.47	5,372.42

The 12-page DWF test file was printed with the Canon driver set to the plain paper/monochrome setting and the HP driver set to plain paper, black mode. Both devices were loaded with 914-mm rolls, with each file set to auto-rotate to save media. The actual time indicated is the time it took to RIP, image and deliver all pages of the test document to the collection bin.

#### First-Page-Out Productivity after a Weekend of Non-Use

	Canon imagePROGRAF iPF770 (time in seconds)	HP Designjet T520 36" (time in seconds)
Time Before Printing Commences	41.82	25.52
First Page Out	84.87	113.85

### First-Page-Out Productivity from Ready State

	Canon imagePROGRAF iPF770 (time in seconds)	HP Designjet T520 36" (time in seconds)
Time Before Printing Commences	13.91	10.42
First Page Out	38.98	93.45

First-page-out times are achieved by sending an Arch D-size PDF file to print, timed from release to page out with the Canon driver set to the plain paper/monochrome setting and the HP driver set to plain paper, black mode. Both devices were loaded with 914-mm rolls, with each file set to auto-rotate to save media.

### A0 First-Page-Out and Throughput Productivity

	Canon imagePROGRAF iPF770 (time in seconds)	HP Designjet T520 36" (time in seconds)
First Page Out	92.84	155.26
Five Pages Out	459.50	758.87

The single-page A0-size PDF test file was printed using the device driver with the plain paper/colour setting in default speed mode. The actual time indicated is the time it took to RIP, image and deliver all pages of the test document to the collection bin.

## Colour Image Quality

### Colour Optical Density Evaluation

	Canon imagePROGRAF iPF770 Plain Paper					
	Fast		Standard		High	
	50%	100%	50%	100%	50%	100%
Cyan	0.59	1.06	0.66	1.15	0.64	1.14
Magenta	0.57	0.99	0.63	1.12	0.63	1.14
Yellow	0.46	0.78	0.53	0.88	0.52	0.89
Black	0.57	1.31	0.69	1.44	0.67	1.44

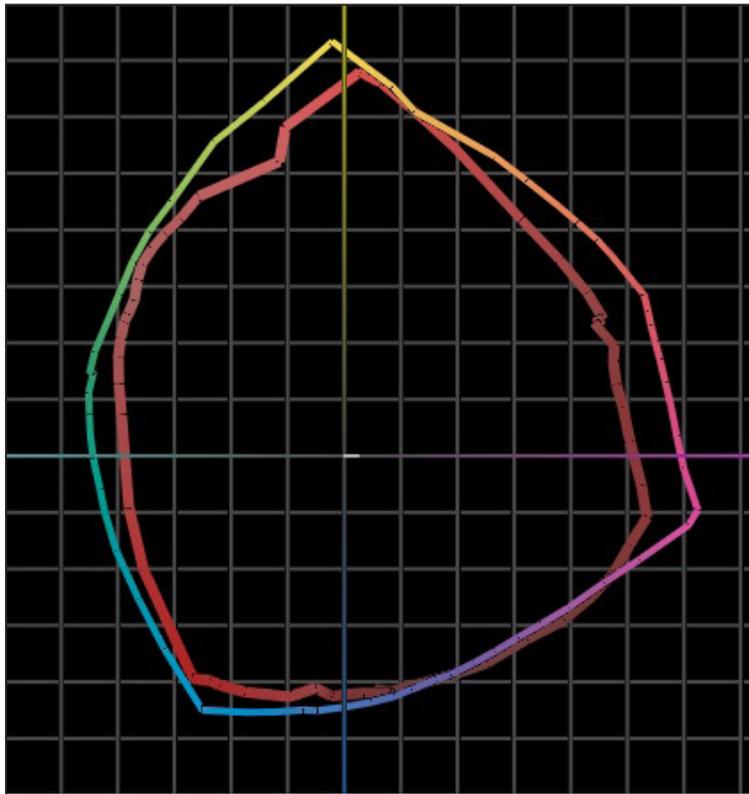
HP Designjet T520 36" Plain Paper						
	Fast		Standard		High	
	50%	100%	50%	100%	50%	100%
<b>Cyan</b>	0.41	0.75	0.45	0.85	0.52	0.97
<b>Magenta</b>	0.54	0.82	0.59	0.84	0.59	0.98
<b>Yellow</b>	0.57	0.76	0.62	0.85	0.61	0.96
<b>Black</b>	0.56	1.46	0.61	1.50	0.60	1.37

Note: Colour density readings were assessed by printing a BLI proprietary PDF test target file on plain pa-per in default colour settings at all quality settings available and measuring the density of 100% dot fill and 50% dot fill using an XRite 508 densitometer.

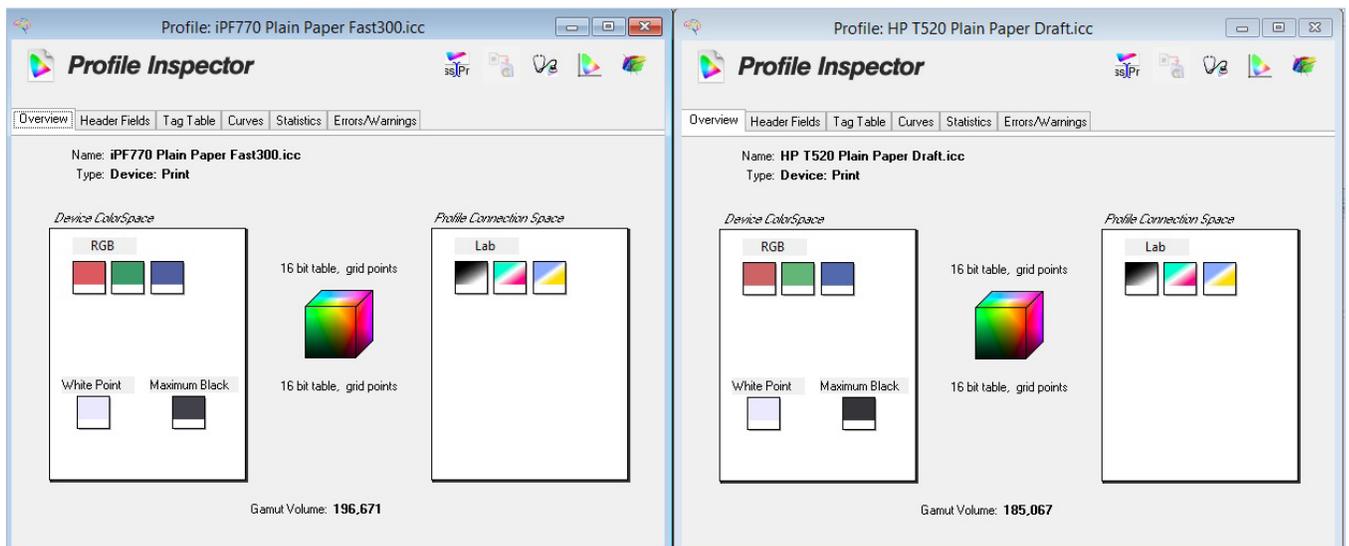
### Colour Gamut Comparison

Media Type/Settings	Canon imagePROGRAF iPF770	HP Designjet T520 36"
<b>Plain Paper Fast</b>	196,671	184,939
<b>Plain Paper Standard/Normal</b>	228,330	220,244
<b>Plain Paper High/Best</b>	236,769	243,589
<b>Glossy Photo High/Best</b>	624,576	445,672

### Colour Gamut Comparison



HP Designjet T520 36" colour gamut on plain paper in Fast settings (red) versus Canon imagePROGRAF iPF770 colour gamut (shown chromatically) on plain paper in Fast settings.

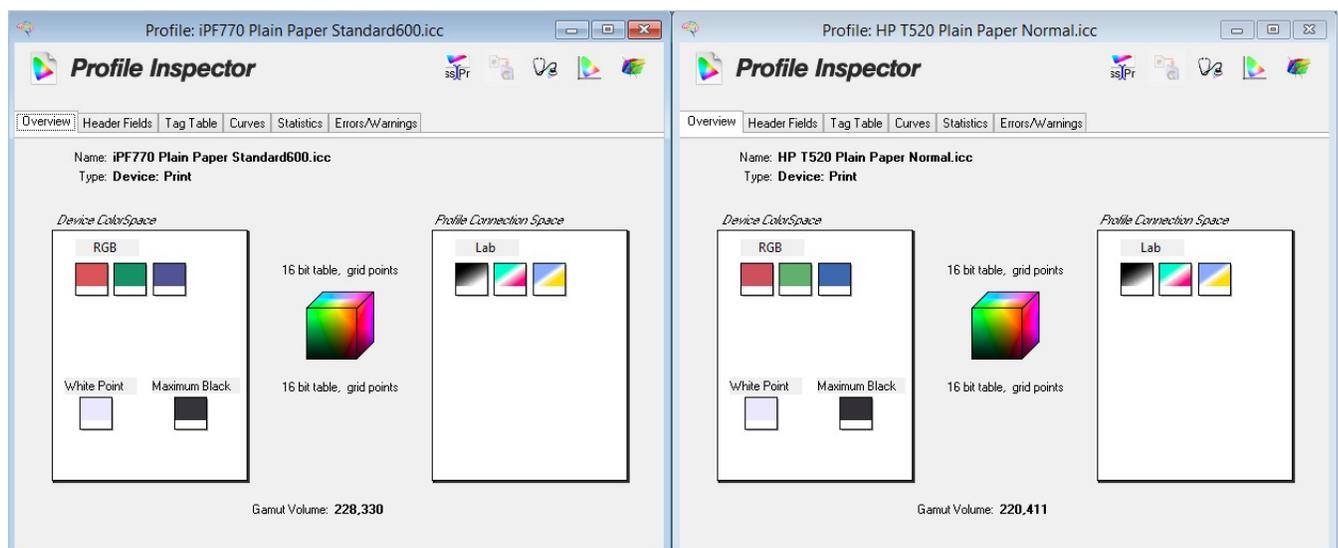


Colour gamut profiles for the Canon iPF770 (left) and HP Designjet T520 (right) on plain paper in Fast mode.

Colour Gamut Comparison



HP Designjet T520 colour gamut on plain paper in Normal settings (red) versus Canon imagePROGRAF iPF770 colour gamut (shown chromatically) on plain paper in Standard settings.

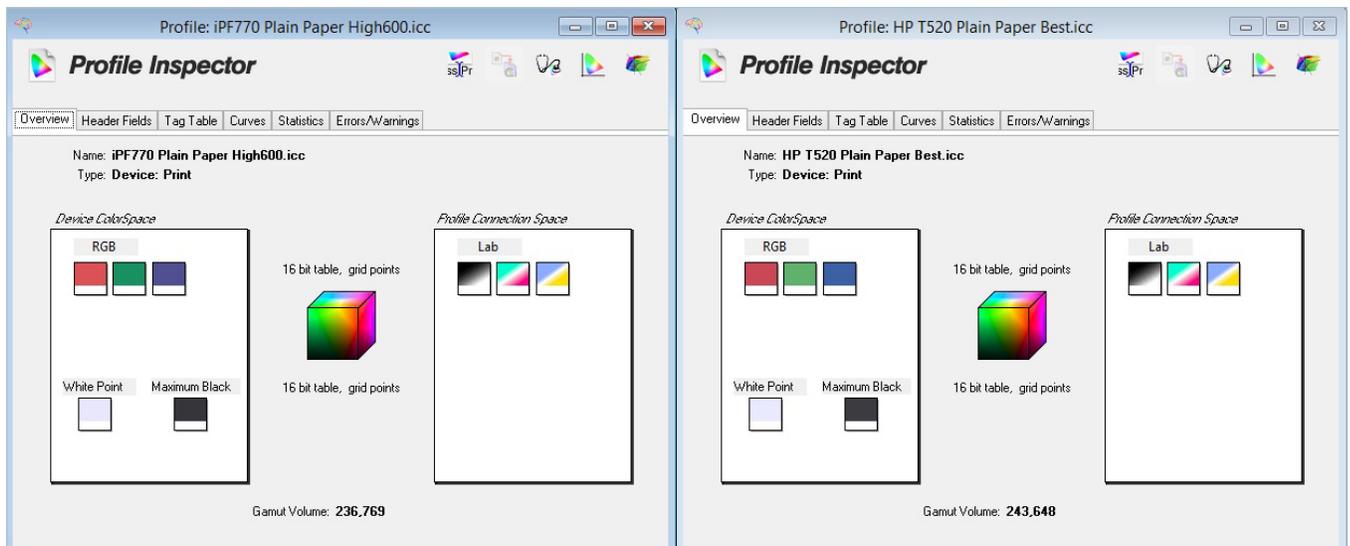


Colour gamut profiles for the Canon iPF770 (left) and HP Designjet T520 (right) on plain paper in Standard/Normal modes.

### Colour Gamut Comparison

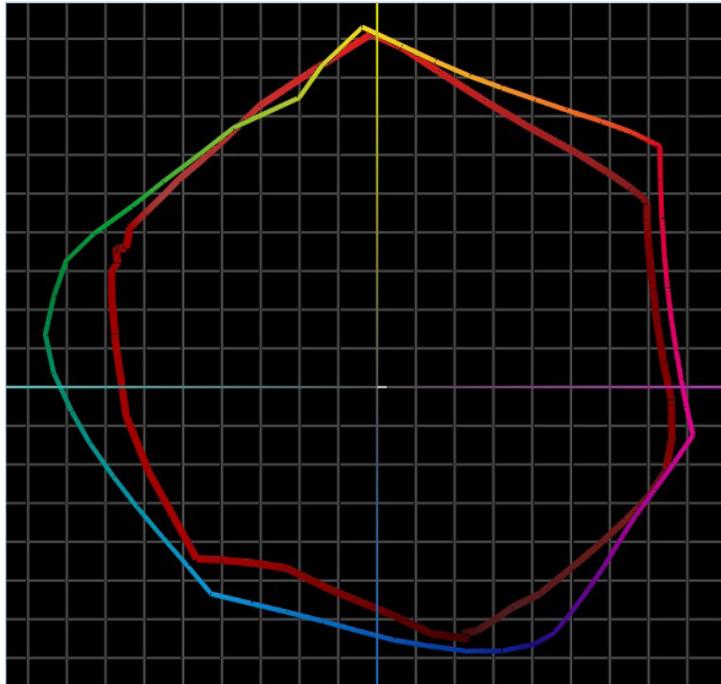


HP Designjet T520 colour gamut on plain paper in Best setting (red) versus Canon imagePROGRAF iPF770 colour gamut (shown chromatically) on plain paper in High setting.

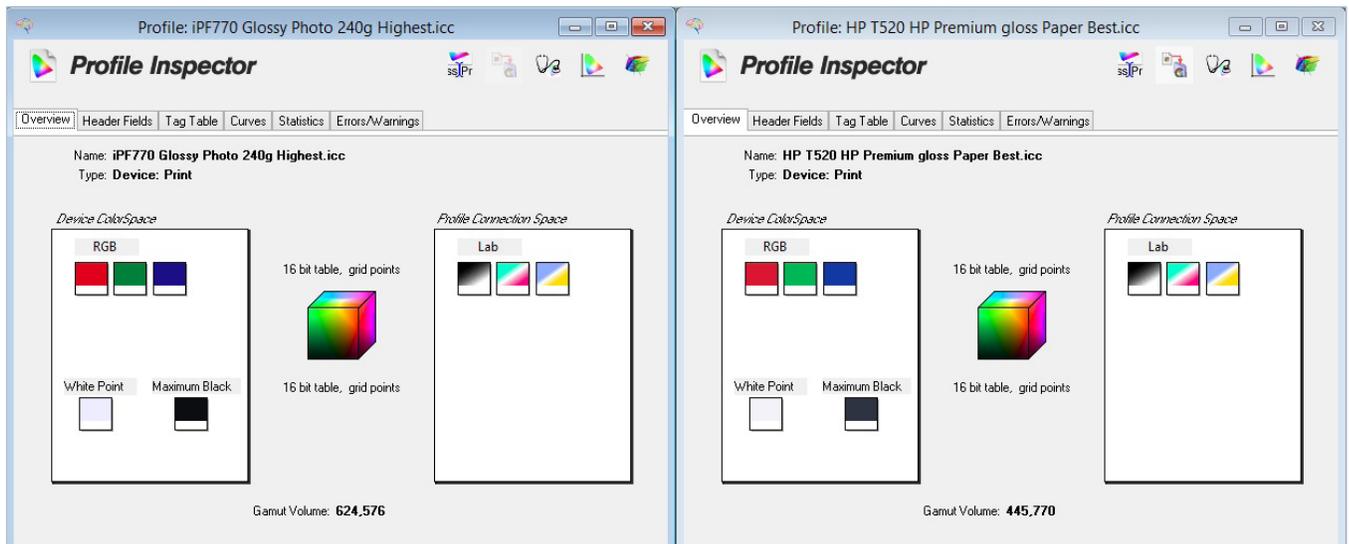


Colour gamut profiles for the Canon iPF770 (left) and HP Designjet T520 (right) on plain paper in High/Best modes.

### Colour Gamut Comparison



HP Designjet T520 colour gamut on photo quality paper in Best setting (red) versus Canon imagePROGRAF iPF770 colour gamut (shown chromatically) on photo quality paper in High quality setting.



Colour gamut profiles for the Canon iPF770 (left) and HP Designjet T520 (right) on photo quality paper in Highest/Best modes.

## Black Image Quality

	Canon imagePROGRAF iPF770			HP Designjet T520 36"		
	Fast	Standard	High	Fast	Normal	Best
<b>Density Block</b>						
<b>1</b>	1.32	1.41	1.44	1.35	1.48	1.52
<b>2</b>	1.32	1.38	1.44	1.36	1.48	1.51
<b>3</b>	1.30	1.38	1.43	1.36	1.48	1.50
<b>4</b>	1.31	1.36	1.43	1.35	1.49	1.52

Note: Solid black density measurements are based on four readings taken from a BLI proprietary PDF test target file corresponding to four different 100% solid black locations on the output. The output was assessed at all quality settings available, with the Canon driver set to plain paper/monochrome setting and the HP driver set to plain paper, black mode. Density was measured using an XRite 508 densitometer.

## Device Feature Set

	Canon imagePROGRAF iPF770	Advantage	HP Designjet T520 36"
<b>Max. print quality</b>	2400 x 1200 dpi		2400 x 1200 dpi
<b>Number of inks</b>	5	✓	4
<b>Ink tanks replaceable during operation</b>	Yes	✓	No
<b>Ink-drop size</b>	4 picoliter	✓	C,M,Y: 5.5 picoliter; K: 12 picoliter
<b>Ink cartridge capacity</b>	130 ml for all colours	✓	K: 38 ml (Starter), 80 ml; CMY: 29 ml
<b>Number of nozzles</b>	2,560 nozzles each, 15,360 in total	✓	1,376 each, 5,504 in total
<b>Number of printheads</b>	1		1
<b>Line accuracy</b>	+/-0.1%		+/-0.1%
<b>Minimum line width</b>	0.02 mm		0.02 mm
<b>Minimum print margins</b>	3 mm	✓	5 mm
<b>Borderless (0 mm) printing</b>	Yes	✓	No
<b>Maximum outside diameter of roll paper</b>	150 mm	✓	100 mm
<b>Maximum printable paper roll length</b>	18 m (varies according to the OS and the application)	✓	45.7 m
<b>Maximum cut-sheet media length</b>	1.6 m	✓	914 mm

	Canon imagePROGRAF iPF770	Advantage		HP Designjet T520 36"
Maximum media thickness for roll paper	0.8 mm	✓		0.3 mm
Maximum media width	36 inches			36 inches
Media loading	Front			Front
Optional media handling	Roll holder set	✓		None
Standard RAM	256 MB		✓	1 GB
Maximum RAM	256 MB		✓	1 GB
Hard drive	None			None
Interface	10/100/1000Base-T/TX, Ethernet, USB 2.0			10/100Base-T, USB 2.0, WiFi
PDL	GARO, HP-GL/2, HP RTL			HP-GL/2, HP RTL, HP PCL3, GUI, JPEG, CALS G4
Net weight (unpacked)	64.6 kg			39.2 Kg
Power consumption when in standby	0.5 W	✓		4.5 W
Power consumption when active	140 W		✓	<35 W
Acoustic pressure	Operation: 48 dB (A) or less; Standby: 35 dB (A) or less		✓	Operation: 48 dB (A);
Acoustic power	Operation: 6.5 Bels			Operation: 6.5 Bels

## Driver Feature Set

	Canon imagePROGRAF iPF770	Advantage		HP Designjet T520 36"
Speed settings	5 (Fast 300, Standard 600, Fast 600, High 600 and 1200)	✓		3 (Fast, Normal, Best)
Economy mode	Yes			Yes
Predefined profiles	7	✓		5 (Default, CAD, GIS, Photo, B/W Photo)
Overview of profile settings provided	Yes	✓		No
IQ optimized for options	Yes			Yes
Watermark	Yes	✓		No
Sharpen text	Yes			Yes (Max detail setting)
Thicken fine lines	Yes			Yes (Max detail setting)
Mirror image	No			No
Multi-up printing	Yes, 2 to 16	✓		No
Poster print mode	Yes (2 by 2)	✓		No
Page stamping	Yes (Date, Time, Name, Page Number)	✓		No

	Canon imagePROGRAF iPF770	Advantage		HP Designjet T520 36"
<b>Image rotation</b>	Yes, auto 180 degrees			Yes, auto 90 degrees
<b>Option to preview before print</b>	Yes			Yes*
<b>CMYK balance adjustment</b>	Yes	✓		No
<b>Brightness adjustment</b>	Yes	✓		No
<b>Contrast adjustment</b>	Yes	✓		No
<b>Saturation adjustment</b>	Yes	✓		No
<b>Advanced colour management options</b>	Yes			Yes
<b>Disable automatic cutter</b>	Yes			Yes
<b>Unidirectional printing selection option</b>	Yes	✓		No
<b>Integration with MFP</b>	Yes	✓		No

\*When driver is downloaded from HP's website.

## Ink Consumption

Table 1

Amount of Ink in Each Canon iPF770 Cartridge (grams)

	Cyan	Magenta	Yellow	Matte Black 1	Matte Black 2	Black
<b>Weight of cartridge prior to installation</b>	176.2	170.0	169.9	175.0	171.4	176.5
<b>Weight of cartridge at end of life</b>	45.0	45.0	45.0	45.0	45.0	45.0
<b>Net weight of ink</b>	131.2	125.0	124.9	130.0	126.4	131.5
<b>Total ink weight across six cartridges</b>						769.0

**Table 2**
**Amount of Ink in Each HP Designjet T520 36" Cartridge (grams)**

	Cyan	Magenta	Yellow	Black
Weight of cartridge prior to installation	58.4	58.4	58.7	134.1
Weight of cartridge at end of life	28.2	28.2	28.2	49.2
Net weight of ink	30.2	30.2	30.5	84.9
<b>Total ink weight across four cartridges</b>				<b>175.8</b>

**Table 3**
**Ink Used in Three 50-Page Runs of Cottage Architectural Plan Test Document (Fast Mode) on the Canon iPF770 (grams)**

	Cyan	Magenta	Yellow	Matte Black 1	Matte Black 2	Black
Test Run 1 Net weight of ink used	3.2	3.7	2.3	6.0	6.3	1.7
Test Run 2 Net weight of ink used	3.0	3.0	1.7	6.2	6.3	1.7
Test Run 3 Net weight of ink used	3.4	2.6	1.7	6.1	6.0	1.4
Average amount of ink used across three runs	3.2	3.1	1.9	6.1	6.2	1.6
<b>Total ink weight across six cartridges for 50-page run (based on averages)</b>						<b>22.1</b>

**Table 4**
**Ink Used in Three 50-Page Runs of Cottage Architectural Plan Test Document (Fast Mode) on the HP Designjet T520 36" (grams)**

	Cyan	Magenta	Yellow	Black
Test Run 1 Net weight of ink used	4.1	2.4	1.1	11.0
Test Run 2 Net weight of ink used	3.9	2.3	0.8	10.3
Test Run 3 Net weight of ink used	3.5	2.2	0.9	10.7
Average amount of ink used across three runs	3.8	2.3	0.9	10.7
<b>Total ink weight across four cartridges for 50-page run (based on averages)</b>				<b>17.7</b>

Table 5

Ink Used in Three 50-Page Runs of Cottage Architectural Plan Test Document (Standard Mode) on the Canon iPF770 (grams)

	Cyan	Magenta	Yellow	Matte Black 1	Matte Black 2	Black
Test Run 1 Net weight of ink used	4.1	1.6	1.7	7.9	7.8	1.2
Test Run 2 Net weight of ink used	3.7	1.1	1.5	8.1	7.9	1.6
Test Run 3 Net weight of ink used	3.9	1.8	1.6	7.1	7.2	1.6
Average amount of ink used across three runs	3.9	1.5	1.6	7.7	7.6	1.5
Total ink weight across six cartridges for 50-page run (based on averages)						23.8

Table 6

Ink Used in Three 50-Page Runs of Cottage Architectural Plan Test Document (Normal Mode) on the HP Designjet T520 36" (grams)

	Cyan	Magenta	Yellow	Black
Test Run 1 Net weight of ink used	6.5	3.1	1.2	12.3
Test Run 2 Net weight of ink used	5.9	2.5	0.7	11.6
Test Run 3 Net weight of ink used	6.1	2.5	0.7	11.5
Average amount of ink used across three runs	6.2	2.7	0.9	11.8
Total ink weight across four cartridges for 50-page run (based on averages)				21.6

Table 7

Ink Used in Three 50-Page Runs of Retail Poster Test Document (Standard Mode) on the Canon iPF770 (grams)

	Cyan	Magenta	Yellow	Matte Black 1	Matte Black 2	Black
Test Run 1 Net weight of ink used	13.2	29.5	13.1	4.2	4.6	1.8
Test Run 2 Net weight of ink used	13.2	30.2	13.2	4.6	4.5	1.9
Test Run 3 Net weight of ink used	12.7	27.8	13.3	4.7	4.7	1.5
Average amount of ink used across three runs	13.0	29.2	13.2	4.5	4.6	1.7
Total ink weight across six cartridges for 50-page run (based on averages)						66.2

**Table 8**

**Ink Used in Three 50-Page runs of Retail Poster Test Document (Normal Mode) on the HP Designjet T520 36" (grams)**

	Cyan	Magenta	Yellow	Black
<b>Test Run 1 Net weight of ink used</b>	14.8	29.9	24.2	7.5
<b>Test Run 2 Net weight of ink used</b>	14.9	29.0	24.3	7.7
<b>Test Run 3 Net weight of ink used</b>	14.1	28.9	23.4	6.3
<b>Average amount of ink used across three runs</b>	14.6	29.3	24.0	7.2
<b>Total ink weight across four cartridges for 50-page run (based on averages)</b>				<b>75.1</b>

**Table 9**

**Ink Used in Three 50-Page Runs of GIS Map Test Document (Standard Mode) on the Canon iPF770 (grams)**

	Cyan	Magenta	Yellow	Matte Black 1	Matte Black 2	Black
<b>Test Run 1 Net weight of ink used</b>	14.4	9.2	7.3	3.6	3.7	1.9
<b>Test Run 2 Net weight of ink used</b>	14.4	8.6	8.2	4.4	3.9	2.2
<b>Test Run 3 Net weight of ink used</b>	14.3	7.4	7.6	4.1	3.7	2.2
<b>Average amount of ink used across three runs</b>	14.4	8.4	7.7	4.0	3.8	2.1
<b>Total ink weight across six cartridges for 50-page run (based on averages)</b>						<b>40.4</b>

**Table 10**

**Ink Used in three 50-page Runs of GIS Map Test Document (Normal Mode) on the HP Designjet T520 36" (grams)**

	Cyan	Magenta	Yellow	Black
<b>Test Run 1 Net weight of ink used</b>	20.6	10.7	15.2	4.6
<b>Test Run 2 Net weight of ink used</b>	20.7	11.0	15.3	5.9
<b>Test Run 3 Net weight of ink used</b>	20.9	12.8	16.0	4.0
<b>Average amount of ink used across three runs</b>	20.7	11.5	15.5	4.8
<b>Total ink weight across four cartridges for 50-page run (based on averages)</b>				<b>52.5</b>

## Ink Consumption Test Methodology Overview:

Buyers Lab's ink consumption analysis was conducted using three document types (architectural plan, retail poster and GIS map). Each document was formatted as a PDF (except for the Cottage Architectural Plan, which was formatted as a DWG TrueView Drawing) and sized at ISO A1.

The Canon imagePROGRAF iPF770 was installed in BLI's lab with the latest (01-00) level of firmware (as of November 2014) and connected to a Windows 7 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 with media selection set to plain paper and the image set to print at actual size. For the Cottage Architectural Plan, Print Priority settings were set to Line Drawing/Text with Quality set to Fast (600 dpi) and Standard (600 dpi). For the Retail Poster and the GIS map, Print Priority settings were set to Image with Quality set to Standard (600 dpi).

The HP Designjet T520 36" was installed in BLI's lab with the latest level of firmware (as of March 2014) and connected to a Windows 7 workstation using a 1000BaseT TCP/IP connection. The device was left in default configuration throughout testing. The Windows HP-GL2 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. Quality was set to Normal (600 dpi) mode for all document types with the exception of the Cottage Architectural Plan, which was tested in both Fast and Normal modes.

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.

With both models, one cartridge was then run to exhaustion and the weight of the empty cartridge was recorded.

The percentage of ink used per cartridge was calculated by dividing the net weight of ink used in the print run by the overall weight of ink in each cartridge and multiplying by 100.

The percentage of total ink used per printer was calculated by adding the percentages used of each of the cartridges and dividing by the number of cartridges.

## 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 7 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 and 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 LLC

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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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