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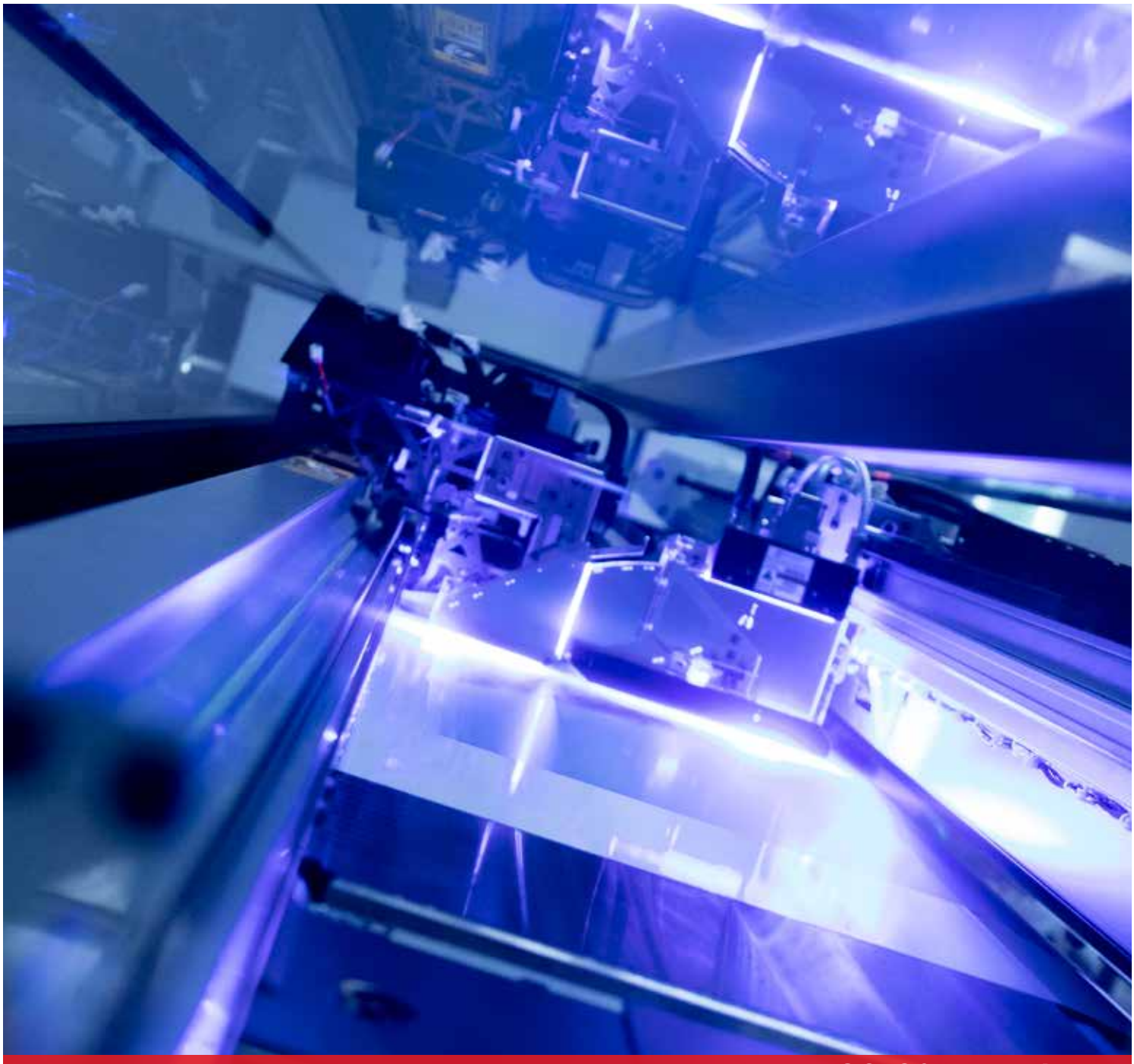


VERSION 2.0 - WHITE PAPER

UV GEL TECHNOLOGY

SMART CHANGE STARTS HERE.

Version history

Version	Date	Revision details
1.0	May 2017	-
2.0	November 2019	Market data update Addition of BLI ink consumption test reports Colorado 1640 Addition of BLI ink consumption test data Colorado 1650 Layout changes

1 TABLE OF CONTENTS

1 TABLE OF CONTENTS

2 THE MARKET NEED

The large format graphics market is a dynamic and exciting market. Change is constant and occurring faster than ever before.

Within this market we see two undeniable trends: volumes are growing, and pressure on turnaround times is rising.

2.1 Market Trends

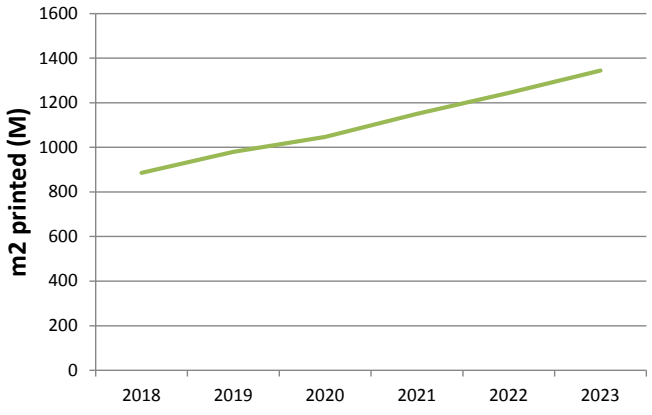
2.1.1 Market growth

Volumes in the roll-to-roll market continue to grow. Printing and decorating are on the rise, and new applications are continuously being developed. Research into large format trends conducted by Keypoint Intelligence[1] found 70% of respondents expected their large format print volumes to increase in the coming 12 months. The top three current applications were posters, banners, and signs. However, when they asked which applications they expected to increase in the coming years, wallpaper and interior decoration was clearly the leading answer.

Looking at the large format sector as a whole, IT Strategies[2] expects worldwide eco-solvent, latex, and UV roll-to-roll print volumes to see a compound annual growth rate of about 9% between 2018 and 2023. This continued growth is the result of increased adoption, new technologies, and an expanding range of applications, as well as more efficient workflow solutions.

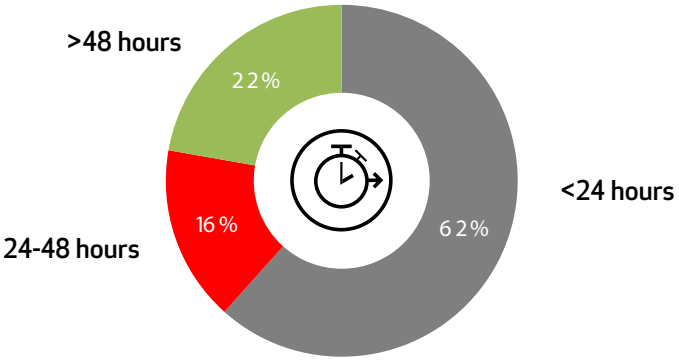
As a result, the worldwide growth of combined large format print volumes across latex, eco-solvent, and UV roll-to-roll printing technologies is expected to increase from 886 million m^2 in 2018 to over 1.3 billion m^2 in 2023.

Forecasted worldwide ES/LX/UV print volumes



2.1.2 Pressure on job turnaround

Turnaround times for customers are becoming shorter and shorter. According to Keypoint Intelligence research, more than 60% of large format print jobs need to be turned around within 24 hours.



Source: Looking for BIG Opportunity in Graphic Communications & Specialty Printing; InfoTrends 2017

Both these trends are expected to continue. This makes increased productivity a key driver for large format print service providers (PSPs) to invest in technology. Market Analyst PRIMIR US comments: "Demand for higher service levels drives investment in faster printers, with instant drying."[3]

[1] *Keypoint Intelligence, Looking for BIG Opportunity in Graphic Communications & Specialty Printing, 2017*
[2] *IT Strategies WF Graphics Print Forecast & Analysis 2019*
[3] *PRIMIR Large format Inkjet Printing Trends, June 2015*

2 THE MARKET NEED

Existing large format technologies do not address all Print Service Providers' needs regarding productivity, quality at adequate speed, and media versatility.

2.2 Limitations of current technology offering

In considering the parameters of greatest value to customers from an innovative large format printing technology, Canon conducted in-depth discussions with a variety of PSPs—large and small—in Europe, the US and Asia.

All had multiple printers: the ten European PSPs had between two and six printers, the 13 Asian PSPs (in China and Japan) ran from three to 40 devices, and the ten US customers had between four and 14 printers.

The aim of the qualitative research was to understand these PSPs' day-to-day operational frustrations, and how technology innovation could support their business growth and development. This customer insight is the foundation of Canon's R&D philosophy of Outcome Driven Innovation.

The PSPs' feedback demonstrated clearly that, with the current output technologies in the market, there is a gap in today's product offerings. Most of the products available to PSPs today are low-volume 64" (1.6m) latex and eco-solvent systems.

These printers have the advantages of requiring a relatively low initial investment and being easy to use. However, they have three key limitations which mean that they do not fully address the needs of PSPs today.

Productivity

Quality at adequate speed

Media versatility

2 THE MARKET NEED

Existing large format technologies do not address all Print Service Providers' needs regarding productivity, quality at adequate speed, and media versatility.

2.2.1 Productivity

Canon's own qualitative research among PSPs highlighted production speed as the key limitation of prevailing roll-to-roll technologies.

According to the customers surveyed, the 64" latex and eco-solvent devices available in the market today are not adequate for the demands of higher and peak volume production.

While developers of 64" latex and eco-solvent printers have improved output speed with later iterations of these technologies, gains have been incremental rather than radical, due to the inherent limitations of the technologies, namely:

- The high degree of dot gain/coalescence of 64" latex and eco-solvent inks limits the volume of ink that can be laid down without compromising image quality.
- This means that 64" latex and eco-solvent technologies require a high number of passes to achieve desired image quality over a given area.
- This slows printing down, or forces PSPs to compromise quality for higher output speeds.
- 64" latex and eco-solvent processes require a drying stage to evaporate the water/solvent.

In practice, PSPs using prevailing technologies reported that they typically find themselves managing production bottlenecks. This means that they cannot actively pursue increased job volumes, and may indeed be reluctant to accept certain jobs—especially for large volume jobs or applications where the PSP perceives an element of risk associated with delivery to a fixed deadline or working with an unfamiliar substrate.

PSPs currently address this challenge in several ways:

Multiple printing machines

PSPs may seek to resolve this productivity challenge by running multiple printing machines side by side.

- This approach requires significant space, as well as increasing staffing levels and complicating maintenance requirements. Extended shifts are another pragmatic solution, but also come with increased operator costs. In regions where labour costs are high, this may fundamentally limit the growth potential of PSPs, because business owners are reluctant to increase staffing commitments and will therefore restrict technology investment plans involving multiple engines.
- Use of multiple printers is often cited as a benefit in terms of production flexibility. However, Canon customer research indicates that, in practice, even PSPs running multiple roll-to-roll printers often have individual devices set up to print on their most popular media types, and are reluctant to incur the time delays associated with switching media and amending profiles. Thus they do not really obtain the expected flexibility gains, and still lack the true production capacity to take on larger job volumes and diversify their applications offering.

Outsourcing

Another pragmatic solution used by PSPs today is to outsource support with large volume or perceived "high-risk" jobs. However, there is reluctance to do this as the PSP sacrifices margin, quality control, and control over delivery. Most PSPs would prefer to enhance their in-house capabilities to service most customer print requirements.

Closing the gap

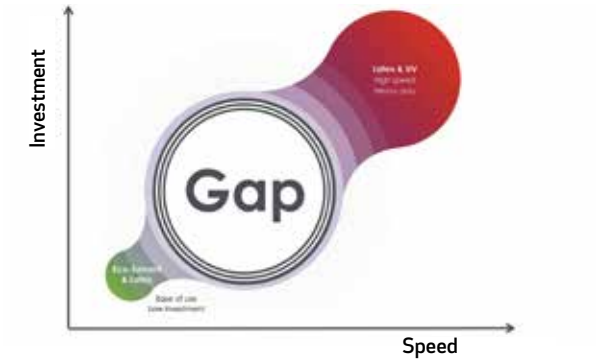
Until the development of UVgel there was no technology alternative between these two extremes of productivity and investment. There is a substantial gap in the middle, which clearly points to the need for a breakthrough new technology to meet the needs of PSPs for a better balance of productivity and investment.

2 THE MARKET NEED

Existing large format technologies do not address all Print Service Providers' needs regarding productivity, quality at adequate speed, and media versatility.

High-end industrial systems

Customers looking for a more "industrial" production solution may also turn to high-end 3.2 meter UV and latex systems. These technologies offer high output speed and the scope to work in dual-roll mode, and are therefore able to cope with industrial production volumes. However, they represent significant capital investment (> Euros 120,000), which may be beyond the scope of small- to medium-sized PSPs. To invest in this type of printing device, the PSP requires clear visibility of consistently high production volumes to assure them of an acceptable ROI. Usability for short runs is questionable with these systems. They also occupy a large physical footprint, which may not be suitable for certain businesses.



2.2.2 Quality

The available technologies today mean that PSPs must compromise productivity for quality, or vice versa.

Indoor applications—advertising and POS for example, or décor products such as wallcoverings—are subject to close scrutiny and require precision image reproduction, smooth output with no banding, excellent repeatable color, and consistency from print to print, across the printed image, multiple printers, and multiple locations.

Existing technologies may deliver an acceptable range of quality for many applications, but higher-quality print modes force a dramatic slowdown in output speed, exacerbating the productivity frustrations described above.

For example, a latex printer producing backlit applications in highest-quality mode may only be able to print at a working output speed of approximately 69 ft^2/hr.

2.2.3 Media versatility

While the opportunity for PSPs to diversify into new application areas continues to grow, the prevailing printer technologies limit PSPs' ability to produce multiple applications with a single device.

Latex and eco-solvent printers are suitable for a broad range of media types and applications. However there are some limitations due to the need for heat drying to evaporate the water/solvent.

The evaporative process makes these technologies fundamentally unsuitable for heat-sensitive media, creating challenges with certain applications—using film, for example.

Depending on application, performance qualities such as abrasion resistance and lightfastness must also be taken into consideration.

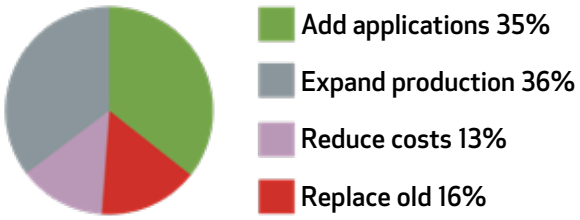
2 THE MARKET NEED

Existing large format technologies do not address all Print Service Providers' needs regarding productivity, quality at adequate speed, and media versatility.

2.3 Market dynamics & evolution

The large format graphics market is a very dynamic market, mainly catering to the retail and advertisement industries, with volumes continuing to increase year over year.

The drivers for this growth are the changing nature of marketing itself and the rise and search for new applications.



Factors driving investment in digital large format devices

2.4 Interior décor market

Answering to the meta trend of individualizing and mass personalization, large format graphics printing technology is increasingly being used for producing work outside the traditional advertising and sign and display segments. Both professional as well as personal interiors are being customized by means of digital print.

The interior décor market requires additional requirements of the printed output, such as a strict size and color consistency when paneling large surfaces both within one job run, as well as providing a reliable and repeatable color reproduction over time.

2.5 Conclusion

The prevailing technologies have their individual advantages, but also their limitations.

For PSPs looking for the optimal combination of productivity, quality, and media—and therefore applications—versatility, there is no single choice twoday. The reality is that PSPs must compromise one attribute for another.

Productivity is one of the most important technology factors limiting business growth for small- to medium-sized PSPs today.

The growing opportunities in the intérior decor market bring new requirements to technology: the ability to print matte besides gloss with strict size and color consistency within one job run as well as repeatable color reproduction over time.

The fundamental technical properties of evaporative latex and eco-solvent technologies mean that, despite ongoing R&D efforts, it will be much more difficult to fulfill the growing productivity requirements of PSPs in the near future.

There is a clear opportunity for radical innovation in the roll-to-roll market to match customers' productivity requirements, while also meeting or exceeding their expectations of quality and application diversity.

3 INTRODUCING UVGEL TECHNOLOGY

UVgel technology combines the best of three worlds: the color gamut and light fastness of eco-solvent, the fit for indoor use and quick drying time of latex, and the productivity and low-temperature printing process of UV.

Introduction

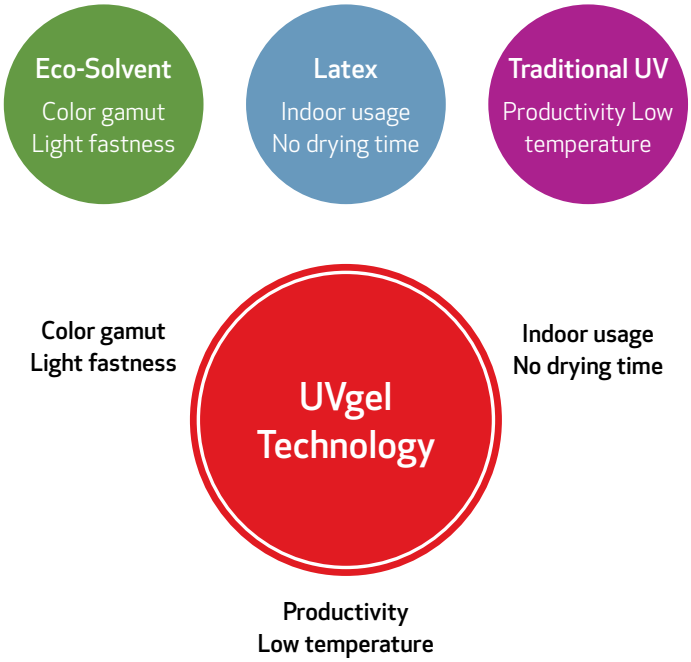
Having identified this technology gap, Canon set out to create a more comprehensive technology solution that would put an end to the compromises PSPs must make today when choosing from latex, eco-solvent, or conventional UV solutions.

Canon's objective was to develop a technology that would offer:

- Industrial speed and end-to-end productivity, for growing volumes of fast turnaround jobs.
- High output quality, suitable for a wide application spectrum including demanding indoor and décor applications.
- Maximum media versatility, to enable PSPs to produce multiple applications using a single device.

Canon also focused on controlling Total Cost of Ownership (TCO), to assure PSPs of rapid return on their capital investment and low ongoing running costs.

The result is UVgel technology and the Canon Colorado series—the first family of printers to feature UVgel technology.



3 INTRODUCING UVGEL TECHNOLOGY

UVgel technology consists of several specially developed elements that retain the advantages of prevailing printing technologies, while eliminating many of the compromises.

3.1 What is UVgel technology?

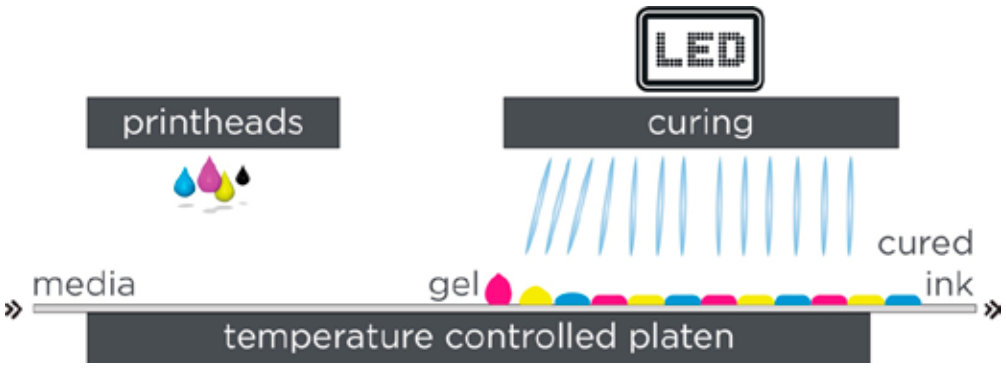
UVgel technology comprises several specially developed elements that combine to achieve a process that retain the advantages of prevailing printing technologies, while eliminating many of the compromises.

- UVgel piezo-electric print heads with automated nozzle failure compensation.
- UVgel ink.
- Low-heat media platen LED-curing concept.

The key to UVgel technology is the fact that the ink is essentially a gel, developed according to UV curing principles.

The simplified stages of the UVgel printing process are as follows:

- Inside the printheads, UVgel ink is heated and turns from gel into liquid.
- The temperature controlled platen maintains the substrate at a constant temperature regardless of environmental factors.
- On contact with the media, the liquefied ink drops return immediately to their gel state.
- In their gel state, the ink droplets are "pinned" instantly to the media, assisted by a partial LED "precure" process.
- Full LED curing takes place at a later stage, after the image swathe is completely formed and gelled on the media.



3 INTRODUCING UVGEL TECHNOLOGY

The UVgel process results in high-quality print output thanks to optimal dot gain control at productive speeds. Prints can be finished with a matte or glossy look without changing the ink or the media. UVgel prints are very robust; lamination is not always required. If to be laminated, lamination can happen immediately thanks to instant dry prints.

3.2 Key benefits of the UVgel process

The gel ink enables this innovative, instant dry, "print-then-cure" process. The UVgel technology concept delivers multiple productivity and quality benefits:

- The gel state of the UVgel ink droplet prevents coalescence (merging) between individual and adjacent ink drops, delivering optimal control over the dot to prevent spread (dot gain).
- By controlling dot gain, much more ink can be deposited in fewer passes, improving productivity and speed.
- The highly controlled and stable dot gain due to the gel state of the ink, irrespective of ambient conditions creates a unique stable color accuracy and repeatability.
- UVgel ink makes it possible to separate the image build up process (jetting the ink onto the media) from the curing process (fixating the ink layer sufficiently before the next ink layer is added). This enables the option of influencing the printed output with a high gloss or matte finish.
- By eliminating the need for immediate curing, productivity is substantially increased compared with conventional UV because curing no longer limits print speed.
- Prints are instantly dry, requiring no evaporative drying process.
- Prints are very robust, eliminating the need to laminate for a vast range of applications.
- UVgel output also complies with the strictest global health and safety requirements such as full GREENGUARD Gold, AgBB, and Type II, and is odorless.

The print head, the ink, the platen and the curing concept are all Canon developed technologies. They combine to create the UVgel technology, which is unique and disruptive to the large format graphics market.

The result is that we see UVgel and the Colorado family quickly gaining market share as it answers to these trends by enabling a high capacity output at an affordable investment level through a product design focused integral productivity and with a proven and unique application versatility.

3 INTRODUCING UVGEL TECHNOLOGY

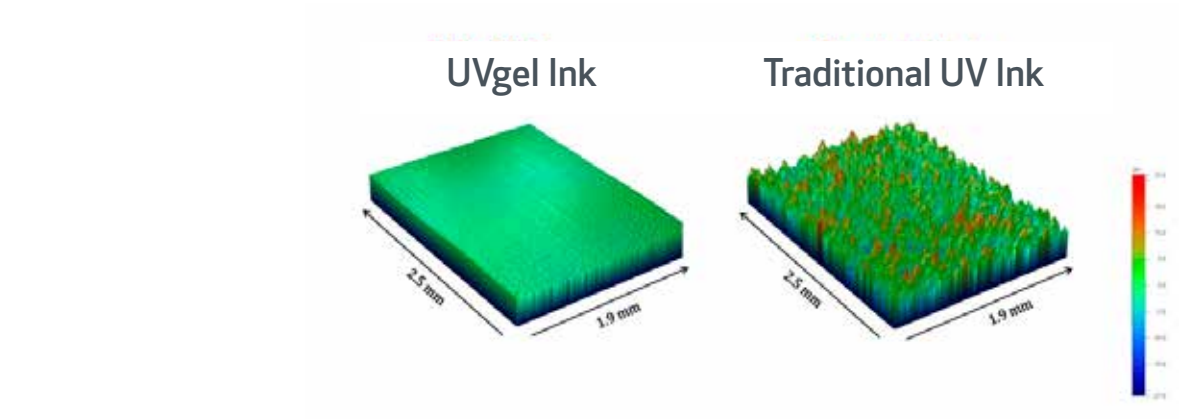
UVgel technology separates the printing from the curing process, resulting in a smooth ink layer and image build-up.

3.3 How is UVgel different to traditional UV?

Although based on UV curing principles, the main disadvantages of traditional UV do not apply to UVgel technology.

Traditional UV printing creates by default an uneven surface, due to the multiple ink layers being individually cured, resulting in a relief effect.

In contrast, the LED UV curing system employed in UVgel technology can move independently from the printing carriage. This means that UVgel ink does not have to be cured intermediately and thus giving the individual ink drops the opportunity to settle. This allows the ink to create a flat, smooth profile, perfectly suited for lamination in case this is required.



3 INTRODUCING UVGEL TECHNOLOGY

FLXfinish is a unique technology that enables the printing of glossy or matte prints without changing the ink or the media.

3.4 FLXfinish: one printer, two finishes

The Colorado 1650's FLXfinish option enables the engine for both the production of gloss and matte prints, with a single printing system, without having to change ink or media.

The Colorado family of printers is characterized by having two separate carriages:

1. The print head carriage.
2. The curing carriage.

The two carriages each ride on their own dedicated beam. The unprinted media is transported to the print head carriage first. After the image has been jetted onto the media, the wet media passes on to the curing carriage which is located approximately 30 cm/1 foot behind the beam with the print head carriage. During the curing stage, the look of the printed output is influenced to create either a glossy or matte finish.

Unlike traditional UV inks, the matte finish created with UVgel has a smoother, softer texture. The gel state of the ink droplets allows for a more constant 3D build up of the ink layer, whereas traditional liquid UV often struggles with a coarser, more "sparkling" texture.

Achieving both a matte or gloss finish with the same ink set, independent of media structure, is a unique technology concept.

Being able to fixate the gel ink droplets immediately after jetting onto the media also creates the ability to print onto an even wider range of media, including more porous and absorbent ones like soft signage textiles and even uncoated paper.

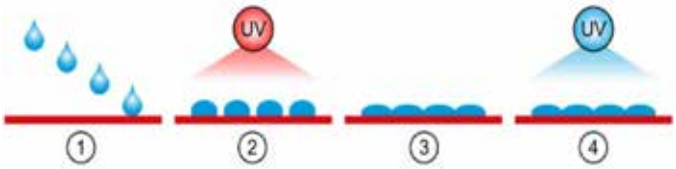
Creation of a gloss finish

First, the media is transported under the printhead carriage, where the ink is jetted onto the media and the image formed. At this stage, no curing energy reaches the ink and the image is completely being built up while the ink and image remains completely uncured.

Although not exposed to any curing energy, the image is built up at full density with all its details and sharpness. The gel state of the ink prevents the ink from flowing and mixing into each other, but it does allow for the ink layer to settle and create a smooth, high gloss ink layer.

By the time the image reaches the curing beam the wet ink layer is completely cured with high energy LED UV-light.

Creation of a matte finish



Similar to creating a gloss print, the unprinted media is transported under the printhead head carriage, where the image is being built up by jetting the gel droplets onto the substrate. In contrast to printing in gloss mode, that wet ink layer is being flashed intermediately with a low dose of LED UV-light.

This low dose of LED UV-light halts the ink spreading immediately after the droplet has hit the media and thus maintaining the ink droplet shape, resulting in an even, matte finish.

3 INTRODUCING UVGEL TECHNOLOGY

With UVgel technology dot gain is highly controlled, which means fewer passes are needed to put the image on the media, reducing the time required to produce the finished print. Smart automation features maximize printer uptime and minimize operator intervention. And UVgel prints can be processed right after printing.

3.5 How does UVgel technology influence print speed and overall productivity?

UVgel technology is completely different to evaporative ink technologies such as latex, eco-solvent, and aqueous. UVgel ink is "pinned" to the substrate by virtue of the physical gel characteristic of the ink itself.

Highly controlled dot gain
Every droplet of UVgel ink is pinned instantly upon contact with the media. Once pinned, the UVgel ink drop is fixed to the substrate and dot gain is highly controlled.

This is in sharp contrast to evaporative ink technologies, in which the ink drops naturally flow on the media, growing in size and coalescing with adjacent drops in an uncontrolled way until dried by evaporation of the water or solvent vehicle.

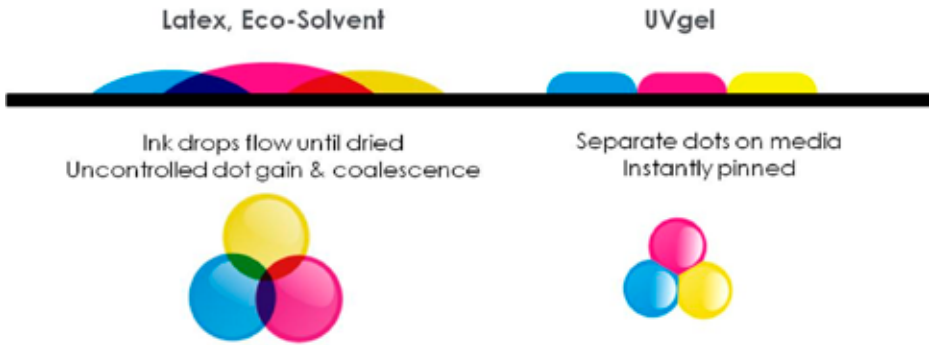
Consequently, evaporative technologies—e.g. 64" latex and eco-solvent technologies—exhibit substantial dot gain and uncontrolled growth on the media.

To overcome the challenges of this characteristic, it is necessary to build the printed image gradually, in multiple passes, to minimize the effect of ink coalescence. This has a substantial impact on productivity in higher-quality modes.

The natural behaviour of UVgel technology delivers unprecedented control of dot gain or coalescence of the ink between jetting and curing.

Therefore, with UVgel, the appropriate amount of ink can be laid down in fewer passes, reducing the time required to produce the finished print.

Reduced dot gain/coalescence UVgel vs. evaporative technologies
The diagram below depicts the print quality difference between evaporative digital ink technologies and UVgel.



Evaporative process (64" latex/eco-solvent)
You can see evaporative ink droplets immediately beginning to grow when reaching the substrate. This spread of the ink on the media results in uncontrolled dot gain and undesirable coalescence of the ink droplets, filling the print area with poorly focused, erratically spaced, and overlapping ink droplets, all contributing to lower print quality.

The limitations of evaporative ink technologies actually get worse at higher print speeds and/or on media with higher rates of absorption.

UVgel
UVgel ink drops are deposited on the media and immediately form a gel on contact with the temperature-controlled substrate, preventing uncontrolled dot gain or unintended coalescence. The ink is effectively "pinned" to the media on a drop-by-drop basis, delivering more accurate area coverage and drop position. The result is superior print quality compared to evaporative ink technologies.

3 INTRODUCING UVGEL TECHNOLOGY

With UVgel technology dot gain is highly controlled, which means fewer passes are needed to put the image on the media, reducing the time required to produce the finished print. Smart automation features maximize printer uptime and minimize operator intervention. And UVgel prints can be processed right after printing.

Other aspects, such as smart automated maintenance features, are another important factor in taking the Colorado's end-to-end productivity to a next level compared to existing technologies.

Automatic maintenance
Automatic maintenance routines make sure the printer is in optimal condition and uptime is maximised. Operator intervention is thereby minimized.

"On the fly" ink replenishment
In case ink replenishment is required, this can be done conveniently "on the fly." Colorado printers have large ink reservoirs that can be refilled while printing. The printer will indicate when one or all UVgel inks can be replenished by means of a green light. Inks can be added during printing, ensuring no downtime for ink refills.

Immediate post-processing
Being instantly dry and cured, the UVgel print is suitable for immediate post-processing and lamination, further improving end-to-end productivity.

3 INTRODUCING UVGEL TECHNOLOGY

The gel property of UVgel ink—the fact that it is instantly pinned to the substrate with controlled dot gain—results in superior drop geometry, giving inherently higher print quality. The Canon developed UVgel inks deliver a high color gamut. Nozzle performance is continuously measured for optimal output. And the unique FLXfinish technology gives you the choice of a glossy or matte finish.

3.6 How does UVgel technology influence print quality?

Print quality is the result of many interacting parameters such as:

- Ink drop volume
- Dot gain on the media
- Coalescence with adjacent drops
- Spatial resolution
- Dot placement accuracy
- Number of ink colors
- Number of printing passes
- Ink film thickness
- Media used
- Color management

Many of these are characteristics of the piezo-electric printhead system (e.g. native resolution, drop placement accuracy, control over drop volume, number of ink colors, etc.).

However, when assessing real-world print quality, the determining factor is how the final ink layer is formed on the media.

Controlled dot gain
The relationship between how the ink is jetted and the resulting ink layer on the media is strongly dependent on the technology used. The gel property of UVgel ink—the fact that it is instantly pinned to the substrate with controlled dot gain—results in superior drop geometry, giving inherently higher print quality, whatever the target media. By controlling dot gain, UVgel also delivers excellent color consistency, over the full area of the print, and from print to print.

Extended color gamut
UVgel ink has been developed specifically to deliver extended color gamut, beyond that of prevailing roll-to-roll technologies.

Controlled texture: Gloss
The gel property of the ink means that each dot has a flatter profile than other UV cured technologies. Combined with the separate LED curing process, this gives the UVgel printed image a smooth, untextured surface, creating rich, glossy prints with no lamination limitations.

Controlled texture: Matte
UVgel with FLXfinish technology uses a split curing sequence to create a printed image with an even, balanced texture that results in velvety, deep matte prints without sparkle or sheen, irrespective of the media used, ideal for indoor applications across a wide variety of different print substrates.

Nozzle performance management
Continuous nozzle performance management is critical to inkjet productivity and image quality. Temporary failure of print head nozzles is a well-known problem in inkjet printing that can be caused by dust, for instance. This may result in white lines appearing in the printed output where the faulty nozzle has failed to fire ink, particularly with eco-solvent.

UVgel technology deploys on-the-fly quality control called “Piezo Acoustic Integrated Nozzle Technology” (PAINT). In the print heads, the nozzle status is continuously monitored acoustically (by sending a small, electro-acoustic pulse to each nozzle and listening for an uninterrupted "echo"). This monitoring occurs without the need to fire droplets, thus eliminating the need to waste ink to check nozzle function.

When a malfunctioning nozzle is detected, the affected nozzle is (temporarily) switched off and replaced by neighbouring nozzles. This whole process is fully automated, requiring no operator intervention.

Media step control
Although the Colorado is built for reliable media handling, it features an automatic media step control system to prevent even the smallest chance of banding. An optical device reads the practically invisible marks in the margin of the print and sends continuous media step feedback to the media handler to be ensured of flawless print output.

3 INTRODUCING UVGEL TECHNOLOGY

UVgel printing uses a low-heat process, allowing you to print on a wide range of heat-sensitive and cost-efficient, thin media. UVgel prints are dimensionally stable due to the fact that they do not contain water. UVgel prints are durable and thereby suited for outdoor use. UVgel 460 inks are flexible enough for application around curves and edges and FLXfinish offers a unique choice of a matte or glossy finish as well as good printing quality on porous media. Last but not least, UVgel inks are certified for indoor use.

3.7 How does UVgel technology influence application versatility?

Low heat process
UVgel technology uses a low-heat process. UVgel ink drops are deposited on the substrate at 24-28°C[4], controlled by the media platen. Furthermore, UVgel technology uses LED-curing so that no heat is required for drying; the ink and print are instantly dry when cured. Consequently, with UVgel, media distortion is negligible, even with highly heat sensitive media.

By contrast, evaporative technologies may heat the media to temperatures as high as 100°C, leading to media deformation and distortion.

This fundamental difference in technology makes UVgel ideal for applications requiring high geometric accuracy, such as wallcoverings. It is also well suited to lower-cost applications on inexpensive, thin media.

No water content
UVgel ink does not contain water. Compared with other technologies, this ensures improved dimensional consistency, by eliminating the problems associated with swelling of media.

Due to its excellent interaction with a variety of substrates, including heat-sensitive media, UVgel is inherently versatile for a wide range of indoor and outdoor applications.

Durability
UVgel technology's suitability for outdoor work is enhanced by the high durability of the LED-cured image. The finished prints offer improved levels of outdoor UV light fastness, abrasion resistance, and washability/scrubbability compared with prevailing technology inks.

Flexibility
In combination with an exceptional mechanical and chemical resistance, the UVgel 460 inks are also flexible and have stretch for easy application and removal around curves and edges.

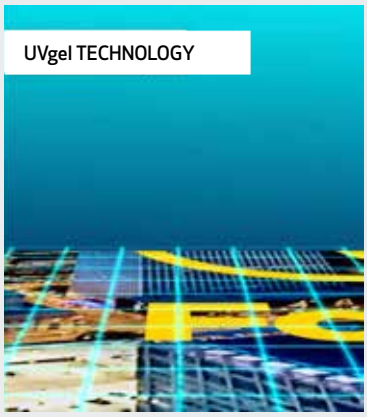
FLXfinish
With the ability to choose between a high gloss finish or a velvety smooth matte look, the Colorado 1650 allows you to offer a multitude of applications with different requirements without having to change inks or media.

Porous media
Printing on porous media, such as soft signage textile as well as uncoated papers or Tyvek, are now possible.

Odorless
UVgel technology has been developed to be odorless so it can be used for high-margin indoor applications, including prints used in health sensitive environments.

[4] *The platen temperature can be changed from the default temperature if this is advantageous for the specific customer's applications and media*

Evaporative process with high heat



Non-evaporative process with low heat

3 INTRODUCING UVGEL TECHNOLOGY

With its high productivity and low ink consumption, the ability to print on inexpensive media, and a high level of automation, an advantageous TCO can be achieved.

3.8 How does UVgel technology influence Total Cost of Ownership (TCO)?

Improved productivity
The productivity gains offered by UVgel technology enable PSPs to deliver more finished jobs from a single printer without increasing staffing costs, resulting in accelerated return on their capital investment.

Reduced ink consumption and wastage
Benchmarking tests validated by Buyers Lab Inc. (BLI) have shown that UVgel technology can save customers 40% on average on ink usage (including wastage) when compared with 64" latex or eco-solvent systems. This saving is achieved thanks to UVgel technology's highly efficient use of four color inks, which deliver as wide a color gamut as other roll-to-roll technologies that use a higher number of colors, and because the acoustic nozzle monitoring technology, PAINT, fires an electro-acoustic pulse rather than ink droplets to test the printhead nozzles, significantly reducing ink wastage.

Option to use less expensive media
The low-heat UVgel technology enables PSPs to work with thin and heat-sensitive media. This gives PSPs the option to choose less expensive substrates when appropriate to the application and customer expectation, potentially reducing consumable costs.

Nozzle compensation and preemptive quality control
The Colorado's automatic nozzle compensation technology ensures that prints remain at saleable quality, even when nozzles are malfunctioning, reducing waste. The system pre-empts quality defects by testing the nozzles continually. This enables the operator to be proactive about print head maintenance, rather than being alerted to issues by poor quality output.

Reduced routine maintenance
Automated nozzle compensation on the fly reduces the need for routine operator print head maintenance, freeing up operator time for other tasks.

"ONYX test chart" Test File

"Ink Consumption" Test File

"Outdoor Banner" Test File

3 INTRODUCING UVGEL TECHNOLOGY

The Colorado family comprises a series of 64" roll-to-roll printers that utilize the patented UVgel technology and produce highly durable, odorless, and instantly dry prints of high quality with a wide color gamut. The UVgel inks offer rich, colorful, and razor sharp images that will wow your customers. Two printer models, Colorado 1640 and Colorado 1650, with unique advantages offer the customer a choice that will fit their business.

3.9 The Colorado family

Canon's new UVgel technology is at the core of what will be a whole family of roll-to-roll printing products.

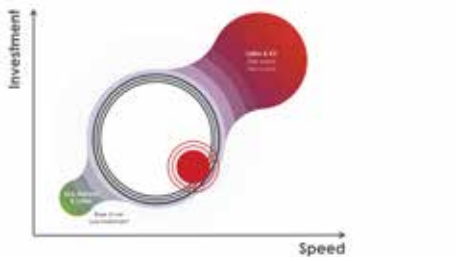
Launched in 2017, the Colorado 1640 is a 64" roll-to-roll printer developed to deliver unprecedented productivity, minimal maintenance, and excellent output quality on a broad range of media.

The Colorado 1650 was introduced in 2019 and features the same unrivalled speed and print quality, together with a flexible ink set and FLXfinish technology, allowing for optimum application versatility.

The Colorado family exploits all the advantages of UVgel and adds automation features that make the printer even more productive. With a top speed of 159 m^2/hr for applications such as billboards or outdoor banners, the Colorado series is faster than any other printer in this segment.

The printer's automation features reduce operator handling time by up to a third compared to competitive technologies. The dual-roll configuration of the Colorado family further enhances productivity, not only decreasing the time required to load media, but also enabling users to switch media quickly when producing mixed applications.

The heavy-duty drawer holds two rolls of media of the same or different substrate types. Both rolls can be fed into the print engine without operator assistance. The media height can be added to the media profile, and upon loading the



media and profile, the printer then automatically adjusts the settings accordingly, ensuring the best possible quality print and preventing printhead crashes. The new parameters are then stored into the media library for future use.

As with all roll-to-roll printers, an important factor in print quality and application range is the accuracy with which the printer advances the media. The printer's heavy, robust frame, class-leading rigidity, and industrial components ensure stability of media handling. The printer also features a Media Step Control system, which uses an optical feedback loop that continuously monitors media advance to automatically correct the subsequent step size as needed.

The continuous nozzle monitoring feature of the UVgel print heads allows for unattended printing and reduces waste prints.

Engineered to the highest industrial standards, the Colorado 1640 and 1650 therefore meet the peak production requirements of businesses of all sizes, producing high volumes of large format graphics—including posters, banners, signage, POS, billboards, window graphics, decals, and bespoke wallcoverings—within the short turnaround times demanded by customers.

Colorado 1640 - Rock Solid Productivity
64-inch roll-to-roll printer that won over many customers with its high output speed, rapid job turnaround, and excellent economics. Produce jaw-dropping oderless and durable prints, perfect for posters, banners, and floor graphics.

Colorado 1650 - The Flexible Choice
The next-gen Colorado with flexible inks and FLXfinish offers you a choice between matte and gloss. Explore new business horizons with an astonishing application range from economical posters up to high value interior décor.

4 MEASURING UVGEL PERFORMANCE

Both the Colorado 1640 and 1650 fulfill the Fogra39 color space requirement.

The value of the color volume is not the only factor affecting print quality. A second indicator of color performance is how much of the color space—of Fogra 39, for example—can be simulated by a printer.

Introduction

Canon has conducted stringent tests to evaluate the performance of UVgel technology under a wide range of conditions. The results confirm that the Colorado series with UVgel technology sets new standards for quality, productivity, automation, application range, and operating costs.

The tests covered six critical performance parameters:

- Color gamut
- Color accuracy
- Color uniformity
- Repeatability and color consistency
- Surface tackiness and susceptibility to smudging
- Print durability

4.1 Color gamut

Why it matters

The color gamut of a printer is the range of colors that can be printed on this specific device. Usually, the bigger the color gamut, the better the output can be matched to the viewer's expectations.

The tests

There are multiple ways to show the size of the gamut. For UVgel we have measured:

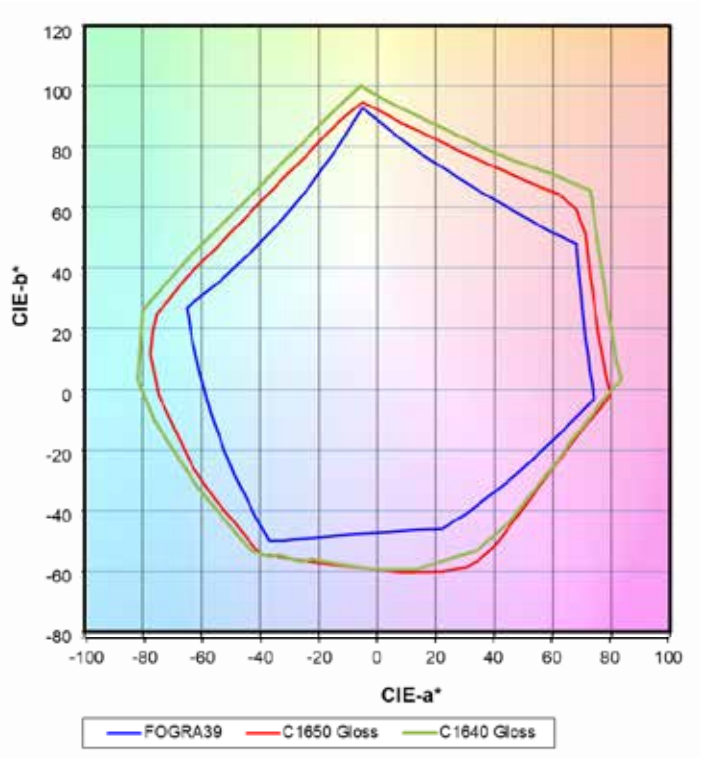
- The maximum volume of the color space.
- The fraction of Pantone coated colors that can be addressed with the color space of the printer.

The printer gamut was measured in the high-quality print mode at a speed of 40 m^2/hr. All measurements were made using a colorimeter using D50/2degree and M1 lighting conditions. Specification printer gamut > Fogra 39.

The results

The gamut of the UVgel technology is large enough to simulate most relevant industry standards, as is shown in the graph:

Color Gamut Contour of maximum Chroma Colors
Tone Curves for primary and secondary colors
Comparison to Reference Printing Condition
Colorado 1650 UVgel



4 MEASURING UVGEL PERFORMANCE

UVgel technology color accuracy is well within the Fogra target.

4.2 Color accuracy

Why it matters
When the color to be reproduced does reside in the color gamut of the printer, the next step is to check if the color accuracy of the system (controller, RIP, printer) is good enough to reproduce a color correctly. Color accuracy is a measure of how accurately a color can be reproduced.

The tests
We evaluated the color accuracy of UVgel and the Colorado 1640 and 1650 against the Fogra39 input profile.

Measurements were taken directly after profiling the printer.

Input profile	Fogra39
Intent	Absolute
Printer profile	"Enhanced colors" and no color boost
Media	MPI2000 Avery Gloss White Vinyl
Measurement	D50, 2degr, M1 lighting

Patches are compared with the Fogra39 reference file.

The results
95% of all 1485 patches can be reproduced with an accuracy 2.9 dE00. This fulfills the requirement of 95% <4 dE00.

4 MEASURING UVGEL PERFORMANCE

UVgel color uniformity is well within the Fogra target.

4.3 Uniformity

Why it matters

When printing certain colors, they should appear the same, regardless of where they are printed—i.e. their position on the media or between two similar prints. This is most obvious when printing wallcoverings: multiple tiles are printed consecutively, but will end up next to each other on a wall. There should be no color difference between them.

This performance criterion is called color uniformity: a measure of how reproducible the color is within one print. Color is measured on patches. (Note: color variations due to banding or printhead artefacts are not considered in this analysis.)

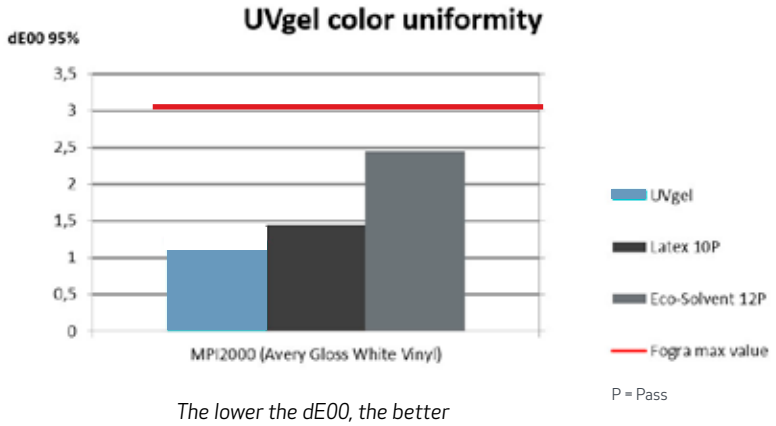
The tests

Nine targets were printed to Fogra specification on a meter-square sheet. The 90 percentile of the patches must have a dE00 of 3.0 or less.

The results

The following graph shows the results for a number of different types of media. The red line represents the Fogra specification. The lower the figure, the better the result.

The uniformity within a print is good, with 95% of all patches being reproduced with an accuracy of better than 1.07 dE00. This is also better compared to latex and eco-solvent.



The lower the dE00, the better

4 MEASURING UVGEL PERFORMANCE

The color repeatability of UVgel technology is very high, and well within ISO 12647-8 criteria.

UVgel prints printed with the UVgel 460 inks have a stretchability of up to +85%, on par with Latex and superior to most traditional UV inks.

4.4 Repeatability and color consistency

Why they matter
When a print is made it is important to know the repeatability or consistency of the color reproduction.

The tests
We measured prints both one hour and 24 hours after the reference print. Measurements were taken after profiling the printer.

Test file	1485 patch test chart ECI2002CMYK
Time interval	1 hour and 24 hours
Media	MPI2000 Avery Gloss White Vinyl
Measurement	D50, 2degr, M1 lighting

Patches were compared with the reference print.

95% of all patches fulfill dE00 < 1.53. Moreover we can deduce from the measurement data that the ISO 12647-8 criteria are also matched: max. dE00 < 2.5 for solids CMYKRGB and max. dE00 < 3 for midtones CMYK.

4.5 Flexibility

The UVgel 460 inks of the Colorado 1650 have been designed to bring extra flexibility and stretchability to the printed output, while securing the robustness that UVgel inks are known for.

Output printed with the Colorado 1650 has an elongation of up to +85%, on par with Latex technology and scoring better than most traditional UV inks found in high-end, high volume printing equipment.

A stretch figure of +85 % means a 10 cm print can be stretched up easily to 18.5 cm without breaking or damaging the print or media. This allows for self-adhesive vinyls (SAVs) and other media to be comfortably applied and removed, including stretching and bending around curves and edges. As a result it serves a wide scope of applications, including stretchable soft signage material and vehicle graphics.

4 MEASURING UVGEL PERFORMANCE

UVgel fulfills the <0.025 requirement for all supported media proving that UVgel inks are robust enough for standard post-processing.

4.6 Surface tackiness and smudge susceptibility

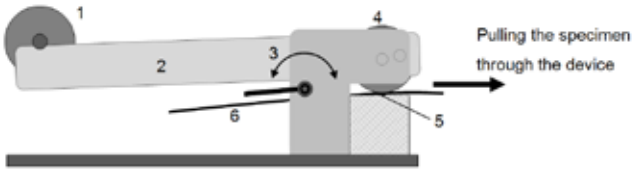
Why they matter

The sooner a freshly printed output can be handled—for example, by finishing devices—the better. Ideally any waiting time should be avoided, in order to minimize turnaround time. The goal is to ensure that media can be handled and finished without the risk of distortion of the image or smudging on the winder.

In practice, many graphics applications require the ink surface to withstand mechanical load by, for instance, rubbing, stacking, or winding.

The tests

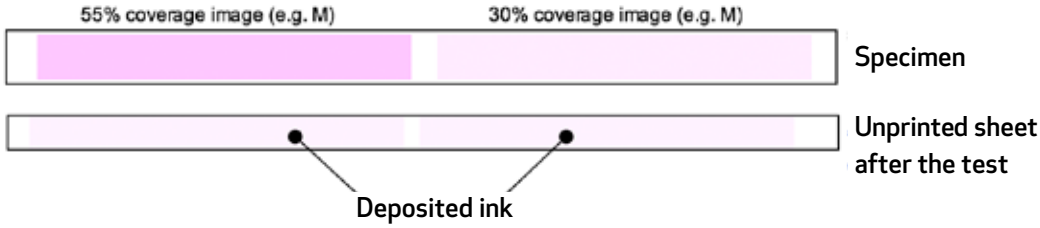
The System Michael Huber München carboning tester was used to quantify the tackiness of the ink top layer, which is an important factor in smudge resistance.



1. Weight
2. Lever arm
3. Lever for applying or removing force on specimen
4. Plastic-coated roller
5. Steel roller
6. Specimen with unprinted sheet of paper on top

Figure 1: SYSTEM MICHAEL HUBER MÜNCHEN carboning tester

The test specimen was a strip partly printed with a coverage of 30% and partly printed with a coverage of 55%. An unprinted sheet of uncoated wood-free 80 gsm office paper was placed on top of the specimen and the stack of these two strips was pulled through the two rollers.



The optical density of the ink deposited on/transferred to the unprinted sheet was measured with a spectrophotometer. The optical density is the measure for surface tack/smudge. An optical density smaller than 0.025 (i.e. hardly any transfer of ink) is considered to be sufficient to ensure post-processing and handling of the medium without risk of distortion of the image or smudging of the medium's rear surface on the winder.

The results

UVgel fulfills the <0.025 requirement for all supported media. There is potential for higher values to be measured in the case of a medium with high roughness e.g. when fabric is used in banner media. There may be specific media that suffer from smudge susceptibility, but for most media smudging will be within acceptable limits.

4 MEASURING UVGEL PERFORMANCE

UVgel prints have superior abrasion, washability, light fastness, and weather durability properties.

4.7 Print durability

Durability when subjected to external factors is critical for many applications, both indoor and outdoor, to ensure that the print is fit for purpose and maintains its quality and performance characteristics.

Durability is defined as a combination of factors:

- Abrasion resistance
- Washability/scrubbability
- Light fastness and weather ability

4.7.1 Abrasion resistance

Abrasion resistance is important in applications that are subjected to everyday contact, such as floor graphics, vehicle graphics, or wallcoverings.

The tests
To measure abrasion resistance, we apply the Prüfbau Quartant abrasion tester.

In the test, the 200% ink areas of RGB were subjected to 1,000 strokes against a defined counter paper. The abraded sample was judged on the following:

- Color transfer to the counter paper according to ISO18947:2013 "Imaging materials—Photographic reflection prints—Determination of abrasion resistance of photographic images."
- A visual assessment of the worn sample with regard to ink transfer and visible damage.

The abrasion robustness scale is 0 - 5:

0= white media visible

1= strong buff marks/scratches

2 = buff marks/scratches

3 = light buff marks/scratches

4 = visible under angle

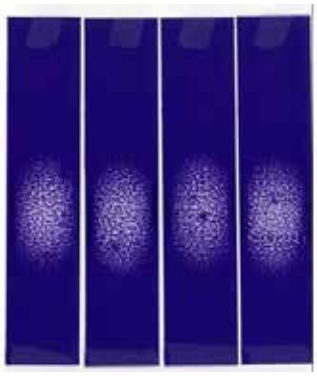
5 = nothing visible

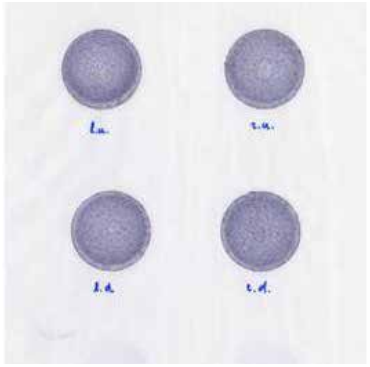
4 MEASURING UVGEL PERFORMANCE

UVgel fulfills the <0.025 requirement for all supported media, proving that UVgel inks are robust enough for standard post-processing.

The results

A bad result looks like the images below.



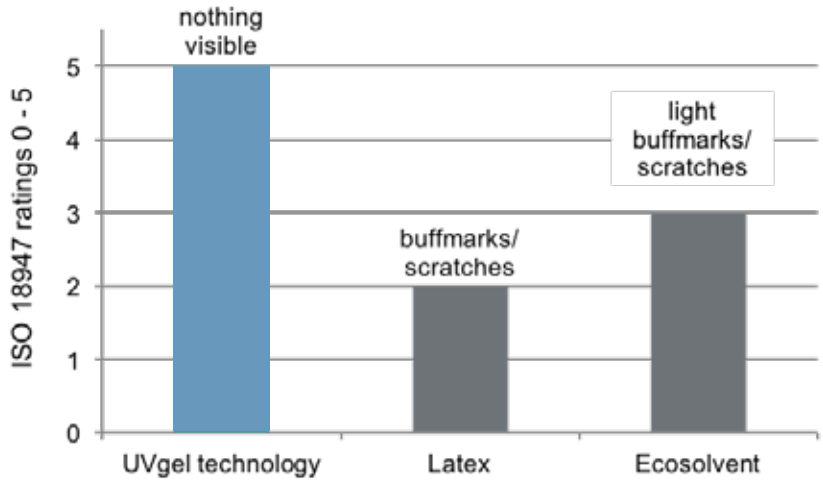


Note: abrasion robustness has an impact on ink stretchability in any ink technology. The higher the abrasion robustness, the lower the ink stretchability.

The Colorado 1640 with UVgel 356 inks produces prints with an exceptionally strong rigidity and resistance to scratching and abrasion, but a more limited stretchability of the printed output. As a consequence, vehicle wrapping around sharp edges (e.g. car mirrors) is not recommended.

The Colorado 1650 with UVgel 460 inks combines the ability to produce stretchable and flexible output that allows for vehicle graphics and soft signage, while still featuring a significantly higher abrasion resistance than competitive ink technologies.

We compared UVgel technology with latex and eco-solvent, and observed the following outcome:



Scale Abrasion Robustness: 0 - 5

0 = white media visible
1 = strong buff marks/scratches
2 = buff marks/scratches
3 = light buff marks/scratches
4 = visible under angle
5 = nothing visible

4 MEASURING UVGEL PERFORMANCE

In benchmarking tests, UVgel prints demonstrate excellent washability compared with latex and eco-solvent prints.

4.7.2 Washability/scrubbability

Printed products—wallcoverings, for example—need to be cleaned from time to time. Washability/scrubbability is also part of the EN233 classification for commercial wall covering products.

The tests

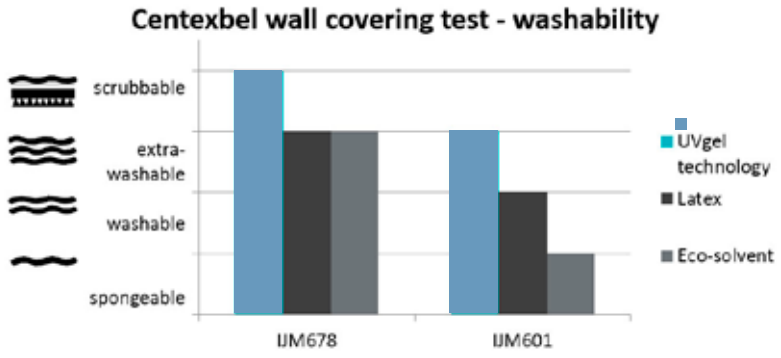
Washability/scrubbability of the ink/media combination is determined according to NEN-EN 12956/NEN-EN 259-1 including extra scrubbability using the Elcometer 1720 Washability Tester. This is also known as the Timperley test.

The following measurements were performed:

Test part	Rubbing head	Reagent	Cycles	Speed (c./min)
Spongeability	Sponge (polyether foam)	Distilled water	20	30
Washability	Felt (97% wool fiber)	Soap solution	30	120
Extra-washability	Felt (97% wool fiber)	Soap solution	100	120
Scrubbability	Brush (polyamide 6.6.)	Abrasive paste	30	30
Extra- scrubbability	Brush (polyamide 6.6.)	Abrasive paste	100	30

The results

The results are compared visually after each test on a typical test pattern as shown on the right:



IJM678 (WCVA) Self-adhesive embossed wall covering
IJM601 Durable In- & Outdoor Paper 212gsm

4 MEASURING UVGEL PERFORMANCE

UVgel shows excellent lightfastness and weather resistance.

4.7.3 Light fastness

Light, water, and heat are the most critical factors with respect to image degradation of outdoor prints, so it is important to determine the resistance of printed output to these influences.

The tests

We used an accelerated testing cabinet to produce faster results, as the current ink technologies have multi-year resistance.

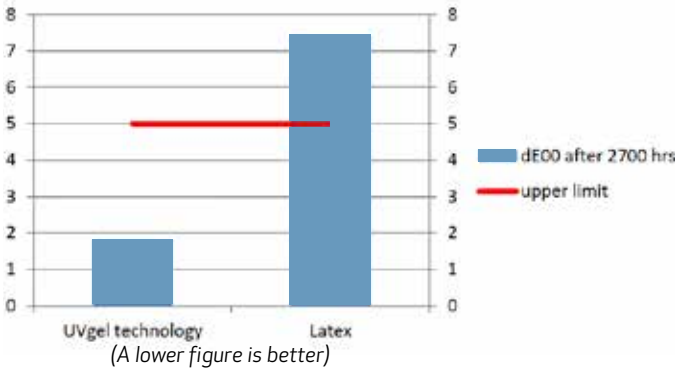
Lightfastness Testchart CMYK

The test target was measured at regular intervals using a spectrophotometer. From this data the color difference in dE was charted and judged on the visibility of color change (dE00) after 2700 hours.

The results

The chart below compares the performance of UVgel with that of latex technology. Usually a dE 5 is considered the maximum color difference acceptable.

Color Fading



(A lower figure is better)

Translation to colorfastness in years

The results are based on tests of unlaminated prints under lab conditions simulating exposure to direct sunlight. Fading time is estimated between 3800 and 6588MJ/m^2 yearly radiant energy, depending on the geographical position, latitude and climate conditions.

The table below translates the results of the dry WOM simulation test to the equivalent outdoor exposure relative to the geographical position:

Geographical Location	Outdoor*, Unlaminated
Chicago, Illinois	Up to 3.2 years
Miami, Florida	Up to 2.5 years
Ottawa, Canada	Up to 4 years
Phoenix, Arizona	Up to 2 years
Novorossiysk, Russia	Up to 3.3 years
Lochem, the Netherlands	Up to 4.4 years
Changi, Singapore	Up to 2.7 years
Melbourne, Australia	Up to 3 years
Seosan, Korea	Up to 3.5 years
Choshi, Japan	Up to 3.5 years

** Test samples were done on MP 2000 self-adhesive vinyl, unlaminated. Test results according to dry WOM procedure and geographical translation based on Outdoor Radiant Energy from AWSG Climatological Data.*

Performance may vary depending on application conditions, as well as media performance. Outdoor applications are susceptible to more than only solar energy and light fading. External factors such as mechanical impact, coarse weather conditions, and exposure to chemical or environmental influences can accelerate the aging process.

In that aspect, Canon advises to use a protective laminate for applications with a prolonged exposure in a non-protected environment.

5 ENVIRONMENTAL IMPACT & SUSTAINABILITY

UVgel prints live up to the world's most stringent environmental standards, making them perfectly safe for use in sensitive environments such as hospitals, schools, and other public places.

Introduction

Based on our philosophy of Kyosei—living and working together for the common good—Canon firmly believes in developing and manufacturing products in a sustainable way, and delivering services that support customers to reduce their environmental impact.

As signatories to the UN Global compact, Canon is committed to responsibly meeting our customers' sustainability needs and thus acting as a responsible corporate citizen.

When talking about the environmental impact and sustainability of UVgel technology and the Colorado series, we are proud to illustrate this on three levels:

- The impact of the end product: the printed output.
- The impact of the equipment and its properties while in operation.
- The impact of Canon manufacturing and recycling.

5.1 Printed output

Any new technology must clearly demonstrate sound environmental credentials. This is especially important when the technology is implemented in sensitive environments, such as hospitals, schools, and other public places. We therefore measured UVgel's performance against required standards in four key areas:

- VCL (Vinylcaprolactam)
- HAPs (Hazardous Air Pollutants)
- VOCs (volatile Organic Components)
- Odor

5.1.1 VCL-free ink

VCL (vinylcaprolactam) is a chemical compound that has traditionally been included in the production of UV inks. Recognizing the hazards of VCL and the call for its replacement, UVgel ink has been developed completely free of VCL.

5.1.2 HAPs

HAPs (Hazardous Air Pollutants) is a collective name for a group of 187 specific toxic substances, a number of which are used in printing processes.

TNO, the Netherlands-based organization for applied scientific research that certifies products and issues independent evaluations of quality, has performed extensive testing on preliminary emissions both from the UVgel print technology and from the prints produced on it.

Concluding that no HAPs are emitted by either the printer or the prints, the test results state that working with UVgel technology and handling UVgel prints under normal conditions will not expose either printer operators or customers/consumers to HAPs.

5.1.3 VOCs

VOCs (Volatile Organic Compounds) are components in the ink that contain carbon and can easily evaporate during the printing process. UVgel is an ink technology that meets the strictest standards with its very low emissions and is almost void of any VOCs. Moreover, UVgel technology also does not require the use of any maintenance fluids and solvents, nor primers to be used in its operational process.

5.1.4 Odor

For any large format print to be used for indoor applications such as wallcoverings, for example, the printed output must be odorless.

Although measuring odor is by its nature a subjective rating involving a panel of people, printed output from the Colorado has been formally evaluated according to the standard DIN EN ISO 16000-28 i. A., VDI 4302 and judged to be odorless.

5 ENVIRONMENTAL IMPACT & SUSTAINABILITY

UVgel prints live up to the world's most stringent environmental standards, making them perfectly safe for use in sensitive environments such as hospitals, schools, and other public places.

5.1.5 Indoor certifications

Meeting the major indoor emissions certifications, such as AgBB and full GREENGUARD Gold as well as certifications required in individual countries (France and Finland, for example), prints produced with UVgel technology can also be used in more sensitive environments such as schools and healthcare facilities.

ASTM F793 Type II

ASTM F793 is the standard classification for wallcovering as prescribed by the American Society of Testing and Materials, an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services.

ASTM F793 has been adopted as the norm in the North American wallcovering and interior décor industry, but is also recognized and referenced globally.

Type II signifies fit for use in commercial areas with the potential for average to above average scuffing such as waiting rooms, classrooms, and hallways.

Various characteristics are evaluated such as colorfastness, washability, scrubbability, stain resistance, crocking resistance, break- and tear strength, and other serviceability aspects as well as flame spread and smoke development.

Having been fully evaluated against the ASTM quality standards by an independent organization for emissions testing, wallpaper produced by Colorado and UVgel ink complies with the ASTM F793 Type II Category V. For this particular evaluation, a combination of UVgel ink and Royson's Dreamscape 20 oz Oznaburg Back Wallcover was used; however, as long as any alternative appropriate medium fulfills the ASTM F793 requirements, using it in combination with UVgel ink will meet the ASTM F793 criteria.

AgBB – Health-related Evaluation of Emissions of VOC from building products

Building products, including wall coverings, can be a major source of indoor air pollution by volatile organic compounds (VOC, VVOC, and SVOC). The Committee for Health-related Evaluation of Building Products in Germany (Ausschuss zur gesundheitlichen Bewertung von Bauprodukten - AgBB) has developed criteria and subsequently an evaluation scheme for testing VOC emissions from building products to confirm their suitability for indoor use.

Having been fully evaluated against the AgBB quality standards by an independent organization for emissions testing, wallpaper produced by the Colorado and UVgel ink complies with all the requirements of the AgBB scheme. For this particular evaluation, a combination of UVgel ink on IJM601 Durable In- & Outdoor paper 212 g/m² was used; however, as long as any alternative appropriate medium fulfills the AgBB requirements, using it in combination with UVgel ink will meet the AgBB criteria.

More information is available at:

Learn more

5 ENVIRONMENTAL IMPACT & SUSTAINABILITY

UVgel prints live up to the world's most stringent environmental standards, making them perfectly safe for use in sensitive environments such as hospitals, schools, and other public places.

GREENGUARD GOLD certification by UL Environment

The GREENGUARD Certification Program gives assurance that products designed for use in indoor spaces meet strict chemical emissions limits and so contribute to the creation of healthier interiors. It focuses on emissions from building materials, in this case printed wall coverings/wallpaper and signage. The maximum acceptable concentrations of VOCs are defined in a standard: UL 2818.

GREENGUARD Gold Certification sets stricter certification criteria that take account of safety factors to consider in the case of sensitive individuals (such as children and the elderly) and ensures that a product is acceptable for use in environments such as schools and healthcare facilities.

Having been thoroughly tested against the UL 2818 – 2013 Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings, UVgel ink has been awarded the GREENGUARD Gold certificate.

More information is available at:

Learn more

EN15102 – CE marking for decorative wall coverings

CE marking for wallcoverings is regulated by a European standard: EN15102:2007 Decorative wall coverings – roll and panel form products. This standard has made CE marking on all wallcoverings mandatory since 2013. To ensure conformity with the standard, wallcoverings are tested for their mechanical strength, their reaction to fire, and their sustainability, among other aspects.

Wallpaper produced on the Colorado, using UVgel ink in combination with both IJM678 Self-adhesive Embossed Wall Covering and IJM601 Durable In- & Outdoor paper 212g/m^2, fully conforms with EN15102, having successfully passed all the tests conducted by CENTEXBEL, an independent institute officially approved for CE marking certification.

5 ENVIRONMENTAL IMPACT & SUSTAINABILITY

UVgel prints live up to the world's most stringent environmental standards, making them perfectly safe for use in sensitive environments such as hospitals, schools, and other public places.

Certifications in individual countries

Finland - Emission Classification of Building Materials M1

Regarding the classification of emissions from building materials, Finland has its own voluntary certification process, which all manufacturers, importers, and exporters of building products can apply for, but must do so locally in Finland.

Certificates are granted by the Building Information Foundation (RTS, Finland's leading information service for the building and construction sector) in three categories, of which M1 is the highest and signifies the lowest emissions. To be granted a certificate, a construction product has to pass an emissions test (including for ammonia, formaldehyde, and carcinogenic compounds) and an odor test. The M1 classification does not overrule official building codes, but many developers, architects, and design engineers favour M1 classified products when selecting materials for their projects.

As the Colorado has been certified as complying with AgBB's requirements following tests conducted by an accredited testing laboratory for the M1 classification in Finland, wallcoverings produced with the same medium and ink therefore also comply with the M1 classification in Finland.

If, however, the medium required is different from those used on the Colorado in the AgBB tests, but nevertheless also complies with the AgBB requirements, using it in combination with UVgel ink will comply with the M1 classification in Finland.

Canon will support local customers, who are seeking to gain the M1 classification for their printed wallcovering, by providing all the necessary paperwork and guidance on completing it.

Certifications in individual countries

France - Émissions dans l'air intérieur

It is mandatory for any wallcovering sold on the French market to meet the requirements of the "Émissions dans l'air intérieur" classification, of which the highest category is A+. A mark indicating conformity with the classification has to be applied to the wallcovering in addition to the European CE mark.

This self-declared classification must be made locally in France by the printer supplying the wallcovering or by the wallcovering manufacturer.

As the Colorado has been certified as complying with AgBB's requirements following tests conducted by an accredited testing laboratory for the "Emissions dans l'air interieur" classification, wallcovering produced with the same medium and ink therefore also comply with the A+ category of the "Émissions dans l'air intérieur" classification.

If, however, the medium required is different from those used on the Colorado in the AgBB tests, but nevertheless also complies with the AgBB requirements, using it in combination with UVgel ink will comply with the "Émissions dans l'air intérieur" classification.

Canon will support local customers who are seeking to gain the "Émissions dans l'air intérieur" classification for their printed wallcovering, by providing all the necessary paperwork and guidance on completing it.

Details of the declaration process can be found at:

Learn more

5 ENVIRONMENTAL IMPACT & SUSTAINABILITY

Colorado printers are safe to operate and are designed to have minimal ecological and health impact during operation. Colorado printers are energy efficient and reduce the need for plastic-consuming lamination.

5.2 Equipment and Operation

The UVgel ink technology and handling, as well as the Colorado family of print engines, are designed to have minimal ecological and health impact on the production environment while in operation.

The Colorado series of printers come equipped with internal filters and can be installed and operated in the foreseen space without dedicated extraction installed on or at the machines.

Radiation emitted while in operation is below the Threshold Limit Values for UV, Visible, and IR radiation according to ACGIH institute standards.

Noise emission is tested according to ISO7779/EN27779 and verified to be maximum 66dB (A) at the operator position.

Compared to other ink technologies such as latex or eco-solvent inks, UVgel requires considerably less ink to build up the same image quality and color intensity. With a saving of up to 40% less ink consumed, this is not only an economical benefit, but also a clear ecological advantage.

Printed output of the Colorado family is well tried and tested and has proven to have very strong robustness properties and performs exceptionally well in terms of both mechanical and chemical resistance.

This results in the fact that customers conclude for a multitude of applications to omit the usual process of laminating the prints before applying.

Apart from bringing economic benefits as increasing profit margins for short-term applications by eliminating the time and cost of the overlaminate, the simpler process will also take out the extra plastic layer of laminate of the end application.

Safety/EMC marks and Environmental labels

CE-mark TÜV GS CETECOM c-UL-US RCM

5 ENVIRONMENTAL IMPACT & SUSTAINABILITY

The Colorado family of printers are designed to fit in Canon's Circular Economy Manufacturing program and to be eligible for remanufacturing after its first lifetime. By reducing reliance on natural resources and by reusing existing parts and materials, we enable ourselves and our customers to maximize their own sustainability commitments.

5.3 Canon Circular Economy Manufacturing and recycling

Canon well understands the need for companies to minimize their use of natural resources and design waste out of their operating models. For Canon, this means paying attention to what happens to its products at the end of their lives and ensuring that their usefulness is prolonged wherever possible.

The average lifespan of a current 1.6m large format printer on the market could be three to five years, after which it will be replaced and disposed of as electronic waste.

Both the Colorado 1640 and Colorado 1650 are engineered for a lifespan of up to one million square meters of output. Canon is committed to reduce the reliance on natural resources by choosing long lifetime parts and using maximum recyclable materials such as steel and iron, and keeping unsustainable plastics to a minimum.

The Colorado family of printers are designed from the ground up to fit in Canon's Circular Economy Manufacturing program and to be eligible for remanufacturing after its first lifetime.

Hereby we will reduce our reliance on natural resources and by reusing existing parts and materials, we enable ourselves and our customers to maximize their own sustainability commitments.

6 BLI TEST REPORT COLORADO 1640 INK CONSUMPTION

Ink Consumption Testing Colorado 1640 vs. Roland SOLJET EJ-640 and HP Latex 570.

Introduction

With Canon Colorado 1640 customers can expect to save, on average, 40% on ink usage versus the competition (including waste). The reason is that UVgel technology has a much more constant ink usage across different media, compared to, for example, HP Latex ink. To prove the marketing claim about ink savings, we measured the actual ink usage across three technologies and asked Buyers Laboratories Inc. (BLI) to validate the process and results.

6.1 Test objective

We evaluated the ink consumption of three 64-inch wide format devices: Canon Colorado 1640, Roland's seven-color eco-solvent ink SOLJET EJ-640, and HP's six-color latex ink Latex 570. All devices were serviced by a vendor-approved service agent before testing commenced.

The evaluation comprised printing two test files (Onyx and Ink Consumption) twice on each device on Avery Dennison MPI 2000 media. The Onyx test file was configured and printed as "4-Up," which measured approximately 11.18 feet^2 (1.04 m^2), while the larger Ink Consumption file, which measured approximately 21.53 feet^2 (2.00 m^2), was printed as seen in the images on page 20. The high quality driver setting was used for printing the samples on the Colorado 1640, while two manufacturer-advised speed modes for vinyl / indoor quality were used on each of the other devices: 10 and 12 pass for the Roland unit and 10 and 6 pass for the HP unit. Each manufacturer's published 10 pass MPI 2000 media profile was used, while the published MPI 2000 Canon high quality profile was also used. However, because media profiles are not available for either the Roland EJ-640 unit 12 pass setting or the HP Latex 570 6 pass setting, their generic vinyl media profiles were used instead. Lastly, a third Banner test file was configured and printed as "2- Up," which measured approximately 30.23 feet^2 (2.81 m^2), and printed twice on each device on Starflex SFF-155 banner media. The production driver setting was used for printing on the Colorado 1640, and since there is no specific profile for the Roland device, a generic banner 10 pass media profile was used, which is the speed Roland recommends for printing on banner material. For the HP printer, the Starflex SFF-155 6 pass profile was used as was a generic banner 4 pass media profile, which are HP-recommended banner print settings.

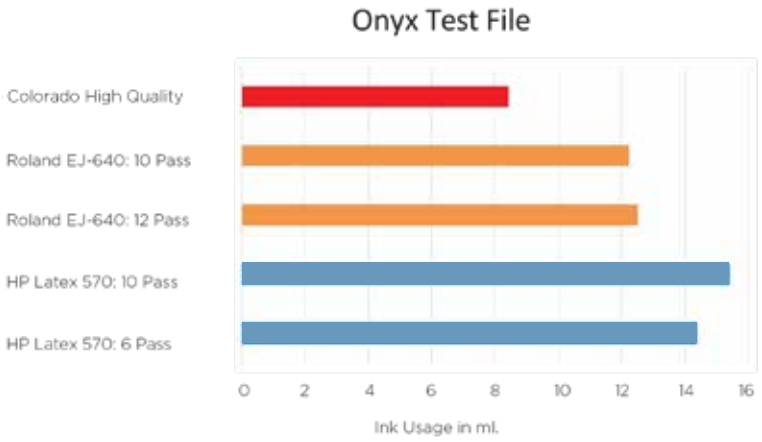
Additionally, like-for-like color management settings were utilized across all devices: in the Onyx RIP, which was used for both the Canon and HP devices, the CMYK ICC profile was set to EuroscaleCoated and the RGB profile was set to AdobeRGB1998. The rendering intent for images was set to Perceptual (images) and the rendering intent for vector was set to Relative colorimetric. For the Versaworks Dual RIP, (which is the default RIP for Roland SOLJET EJ-640), the CMYK ICC profile was likewise set to EuroscaleCoated and the RGB profile was set to AdobeRGB1998, while the rendering intent for images was set to Perceptual and the rendering intent for vector was set to Colorimetric. The subsequent ink usage results that were provided in the accounting utility supplied by each printer manufacturer in the device's web server / Job Log immediately after printing each test file are recorded below.

So, in summary the tests are performed on equal media and print settings for all three devices, each using supplier provided print profiles and supplier recommended speed modes. The above testing method and results have been validated to be correct by Buyers Laboratory Inc.

6 BLI TEST REPORT COLORADO 1640 INK CONSUMPTION

6.2 Test results

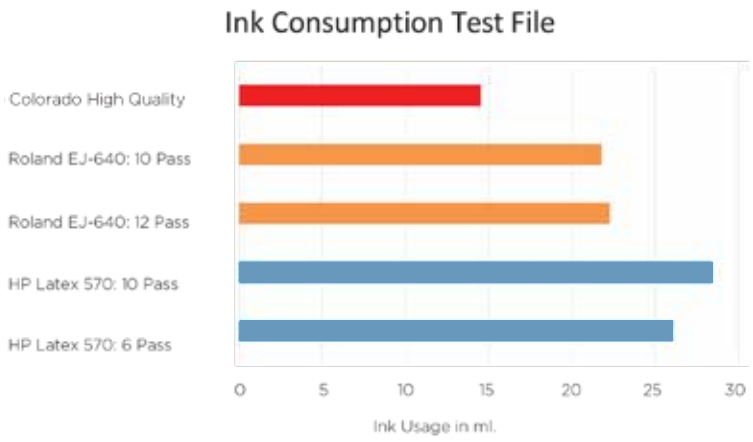
ONYX TEST FILE - Printed on Avery Dennison MPI 2000 Media					
Device	Media Profile Used	Print Driver Quality Setting	Ink Usage (in ml.)	Average Ink Usage for two print runs (in ml.)	Percentage Less Ink Used by Colorado 1640
Colorado 1640	MPI 2000	High quality	8.43	8.43	-
	"	"	8.43		
Roland EJ-640	MPI 2000	10 Pass	12.24	12.24	31.13%
	"	"	12.24		
	Generic Vinyl	12 Pass	12.50	12.50	32.56%
	"	"	12.50		
HP Latex 570	MPI 2000	10 Pass	15.39	15.41	45.30%
	"	"	15.43		
	Generic Vinyl	6 Pass	14.35	14.37	41.34
	"	"	14.39		



The above testing method and results have been validated to be correct by Buyers Laboratory Inc.

6 BLI TEST REPORT COLORADO 1640 INK CONSUMPTION

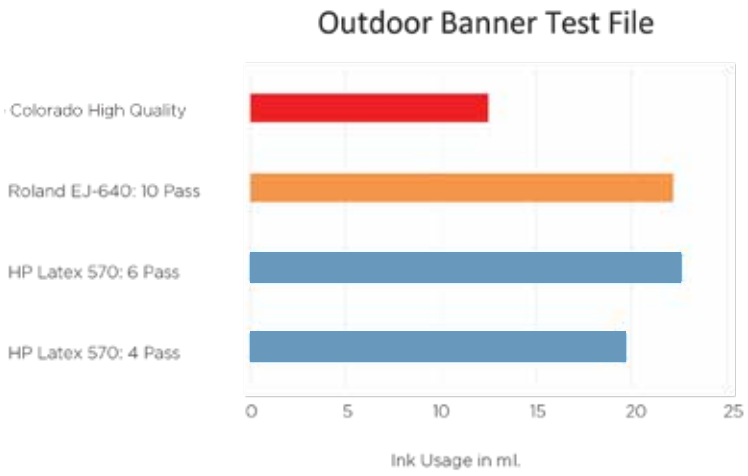
INK CONSUMPTION TEST FILE - Printed on Avery Dennison MPI 2000 Media					
Device	Media Profile Used	Print Driver Quality Setting	Ink Usage (in ml.)	Average Ink Usage for two print runs (in ml.)	Percentage Less Ink Used by Colorado 1640
Colorado 1640	MPI 2000	High quality	14.53	14.53	-
	"	"	14.53		
Roland EJ-640	MPI 2000	10 Pass	21.77	21.77	33.26%
	"	"	21.77		
	Generic Vinyl	12 Pass	22.28	22.28	34.78%
	"	"	22.28		
HP Latex 570	MPI 2000	10 Pass	28.32	28.40	48.84%
	"	"	28.47		
	Generic Vinyl	6 Pass	26.05	26.05	44.22%
	"	"	26.05		



The above testing method and results have been validated to be correct by Buyers Laboratory Inc.

6 BLI TEST REPORT COLORADO 1640 INK CONSUMPTION

OUTDOOR BANNER TEST FILE - Printed on Starflex SFF-15 Media					
Device	Media Profile Used	Print Driver Quality Setting	Ink Usage (in ml.)	Average Ink Usage for two print runs (in ml.)	Percentage Less Ink Used by Colorado 1640
Océ Colorado 1640	Starflex SFF-15	Production	12.49	12.49	-
	"	"	12.49		
Roland EJ-640	Generic Banner	10 Pass	22.19	22.19	43.71%
	"	"	22.19		
HP Latex 570	Starflex SFF-15	6 Pass	22.58	22.60	44.73%
	"	"	22.61		
	Generic Banner	4 Pass	19.63	19.71	36.63%
	"	"	19.78		



The above testing method and results have been validated to be correct by Buyers Laboratory Inc.

6 BLI TEST REPORT COLORADO 1640 INK CONSUMPTION

6.3 Summary

- The Roland SOLJET EJ-640 device used 12.24 ml. of ink on average when printing the Onyx test file at the 10 pass setting, while 12.50 ml. of ink were used on average at the 12 pass setting. In contrast, the Canon Colorado 1640 utilized 8.43 ml. ink when printing the same file at the high quality setting. In terms of percentage of ink used, the Canon device utilized 31.13% and 32.56% less ink, respectively, versus the two Roland print scenarios.
- The HP Latex 570 device used 15.41 ml. of ink on average when printing the same Onyx test file at the 10 pass setting, while 14.37 ml. of ink were used by the HP printer at the 6 pass setting. Again, this is compared with the aforementioned 8.43 ml. of ink utilized by the Canon Colorado 1640. In terms of percentage of ink used, the Canon device utilized 45.30% and 41.34% less ink, respectively, versus the two HP print scenarios.
- For the Ink Consumption test file, the Roland EJ-640 device utilized an average 21.77 ml. of ink at the 10 pass setting and 22.28 ml. of ink at the 12 pass setting, while the Canon Colorado 1640 utilized 14.53 ml. of ink when printing the same file at the high quality setting. In terms of percentage of ink used, the Canon device utilized 33.26% and 34.78% less ink, respectively, versus the two Roland print scenarios.
- Similarly, the HP Latex 570 device utilized an average 28.40 ml. of ink at the 10 pass setting and 26.05 ml. of ink at the 6 pass setting when printing the Ink Consumption test file. Again, this is compared with the 14.53 ml. of ink utilized by the Canon Colorado 1640. In terms of percentage of ink used, the Canon device utilized 48.84% and 44.22% less ink, respectively, versus the two HP print scenarios.
- For the Outdoor Banner test file, the Roland EJ-640 used an average of 22.19 ml. of ink at the 10 pass generic banner setting, while the Canon Colorado 1640 used 12.49 ml. when printing the same file at the production setting. In terms of percentage of ink used, the Canon device utilized 43.71% less ink than did the Roland EJ-640.
- Lastly, the HP Latex 570 printer utilized an average of 22.60 ml. of ink at the 6 pass setting, and 19.71 ml. of ink at the 4 pass setting when printing the Outdoor Banner test file. Again, this is compared with the 12.49 ml. of ink used by the Canon Colorado 1640. In terms of percentage of ink used, the Canon printer utilized 44.73% and 36.63% less ink, respectively, versus the two HP print scenarios.

7 ADDENDUM COLORADO 1650 INK CONSUMPTION

Colorado 1650 Addendum to Colorado 1640 benchmark test.

Introduction

With both the Canon Colorado 1640 and the Colorado 1650, customers can expect significant ink savings versus the competition (including waste). The reason is that UVgel technology has a much more constant ink usage across different media, compared to, for example, HP Latex ink. To prove that the marketing claims about ink savings made for the Colorado 1640 extend to the Colorado 1650, we have measured and assessed the actual ink usage of the Colorado 1650 according to the same procedure as used by the Buyers Laboratories Inc. (BLI) in our previous assessment. This addendum lists the measured ink consumptions for the Colorado 1650 and illustrates the ink savings compared to the same competitive technologies as the original comparison.

7.1 Test objective

We evaluated the ink consumption of the Canon Colorado 1650, and compared that to the devices in the original Colorado 1640 benchmark: Roland's seven-color ecosolvent ink SOLJET EJ-640 and HP's six-color latex ink Latex 570.

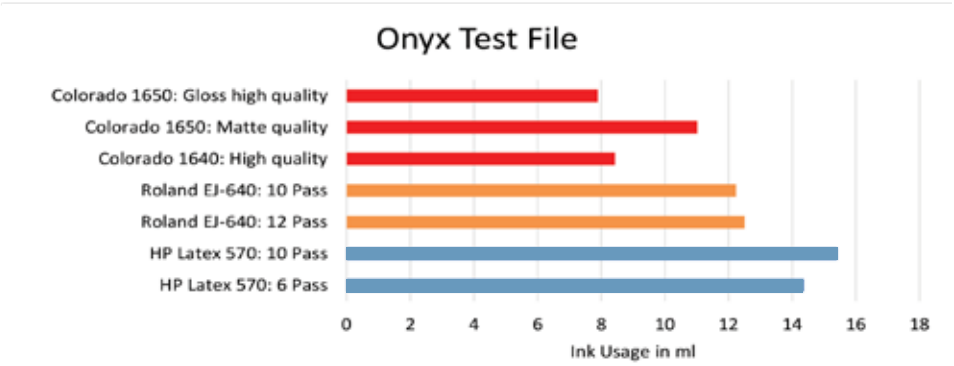
The evaluation comprised printing two test files (Onyx and Ink Consumption) twice on each device on Avery Dennison MPI 2000 media. The Onyx test file was configured and printed as "4-Up," which measured approximately 11.18 ft^2 (1.04 m^2), while the larger Ink Consumption file, which measured approximately 21.53 ft^2 (2.00 m^2), was printed as seen in the thumbnail image below. The high quality driver setting was used for printing the samples on Canon Colorado 1650, in both high quality gloss and matte quality. The most recent media profile was taken from the Canon Media Library. Lastly, a Banner test file was configured and printed as "2-Up," which measured approximately 30.23 ft^2 (2.81 m^2), and printed twice on Canon IJM650 banner media in both gloss production and matte production print modes with the IJM650 media profile. Note that this is slightly different from the original benchmark that used the Starflex SFF-15 banner material.

Additionally, like-for-like color management settings were utilized: in the Onyx RIP, the CMYK ICC profile was set to Fogra39, and the RGB profile was set to AdobeRGB1998. The rendering intent for images and vector were set to Relative colorimetric with black-point compensation. The subsequent ink usage results for the Colorado 1650 were taken from the device's web server immediately after printing each test file are recorded below.

7 ADDENDUM COLORADO 1650 INK CONSUMPTION

7.2 Test results

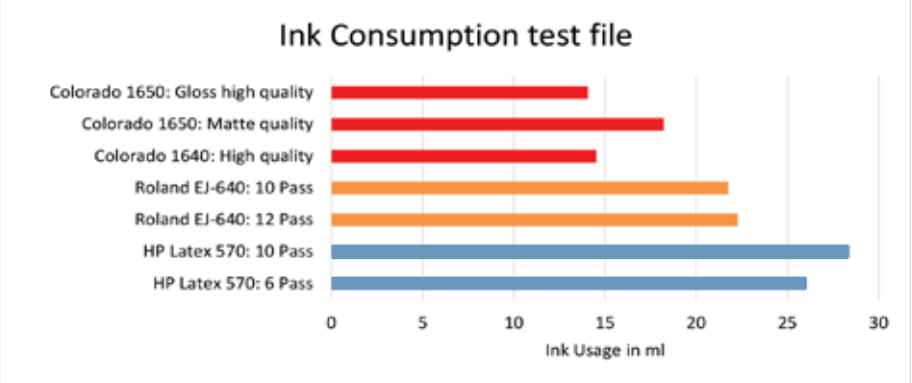
ONYX TEST FILE - Printed on Avery Dennison MPI 2000 Media				
Device	Media Profile Used	Print Driver Quality Setting	Ink Usage (in ml.)	Average Ink Usage for two print runs (in ml.)
Colorado 1650	MPI 2000	Gloss high	7.89	7.89
	"	"	7.89	
	"	Matte quality	11.02	11.02
	"	"	11.02	
Colorado 1640 (from previous benchmark)	MPI 2000	High quality	8.43	8.43
	"	"	8.43	
Roland EJ-640 (from previous benchmark)	MPI 2000	10 Pass	12.24	12.24
	"	"	12.24	
	Generic Vinyl	12 Pass	12.50	12.50
	"	"	12.50	
HP Latex 570 (from previous benchmark)	MPI 2000	10 Pass	15.39	15.41
	"	"	15.43	
	Generic Vinyl	6 Pass	14.35	14.37
	"	"	14.39	



The above testing method and results have been validated to be correct by Buyers Laboratory Inc.

7 ADDENDUM COLORADO 1650 INK CONSUMPTION

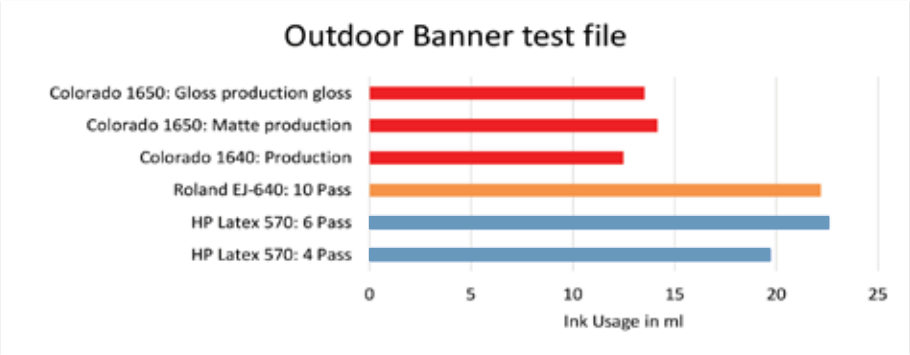
INK CONSUMPTION TEST FILE - Printed on Avery Dennison MPI 2000				
Device	Media Profile Used	Print Driver Quality Setting	Ink Usage (in ml.)	Average Ink Usage for two print runs (in ml.)
Colorado 1650	MPI 2000	Gloss high	14.05	14.05
	"	"	14.05	
	"	Matte quality	18.21	18.21
	"	"	18.21	
Colorado 1640 (from previous benchmark)	MPI 2000	High quality	14.53	14.53
	"	"	14.53	
Roland EJ-640 (from previous benchmark)	MPI 2000	10 Pass	21.77	21.77
	"	"	21.77	
	Generic Vinyl	12 Pass	22.28	22.28
	"	"	22.28	
HP Latex 570 (from previous benchmark)	MPI 2000	10 Pass	28.32	28.40
	"	"	28.47	
	Generic Vinyl	6 Pass	26.05	26.05
	"	"	26.05	



The above testing method and results have been validated to be correct by Buyers Laboratory Inc.

7 ADDENDUM COLORADO 1650 INK CONSUMPTION

OUTDOOR BANNER TEST FILE				
Device	Media Profile Used	Print Driver Quality Setting	Ink Usage (in ml.)	Average Ink Usage for two print runs (in ml.)
Colorado 1650	IJM650	Gloss	13.52	13.52
	"	"	13.52	
	"	Matte	14.16	14.16
	"	"	14.16	
Colorado 1640 [from previous benchmark]	Starflex SFF-15	Production	12.49	12.49
	"	"	12.49	
Roland EJ-640 [from previous benchmark]	Generic Banner	10 Pass	22.19	22.19
	"	"	22.19	
HP Latex 570 [from previous benchmark]	Starflex SFF-15	6 Pass	22.58	22.60
	"	"	22.61	
	Generic Banner	4 Pass	19.63	19.71
	"	"	19.78	



The above testing method and results have been validated to be correct by Buyers Laboratory Inc.

7 ADDENDUM COLORADO 1650 INK CONSUMPTION

7.3 Summary

- Low ink consumption is a core characteristic of Canon's UVgel technology and the Colorado 1650 printer has similar efficient ink consumption when compared to the Colorado 1640: The Colorado 1650 has ink savings of, on average, 40% for the three test files when compared to the Roland SOLJET EJ-640 printer and the HP Latex 570 printer for the gloss print modes.
- Ink consumption in gloss mode is, on average, the same for the Colorado 1650 as for the Colorado 1640.
- The ink consumption for the matte printing modes are more dependent on the media and media profile, and range from, on average, 5% higher compared to the gloss prints for the Outdoor Banner test print, to an additional 35% for the Onyx and Ink Consumption test prints on MPI 2000, compared to the equivalent gloss prints.
- Conclusion: For all test prints, the ink consumption of the Colorado 1650 is significantly lower than the Roland SOLJET EJ-640 and the HP Latex 570 printer, with advantages up to 40%.
- When assuming a 50-50 split between gloss and matte printing for a typical Colorado 1650 customer, the average ink savings compared to the competitive devices and technologies in the test are between 25% and 40%.

NOTES

CANON SOLUTIONS AMERICA

Large Format Solutions
100 Park Blvd., Itasca, IL 60143

1-800-842-4534 | 1-630-250-6551
us.info@csa.canon.com CSA.CANON.COM

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