HP LATEX INKS BACKGROUNDER

WHAT DO YOU HAVE TO SAY?

HP Latex Printing Technologies

Print with the environment in mind

A small drop with a big impact.

Introducing revolutionary new large-format printing technologies from HP.
Designed with the environment in mind, HP Latex Printing Technologies offer print service providers a compelling new alternative. Together, HP Latex Inks and HP Thermal Inkjet Technology provide durable output, sharp, vivid image quality, broad outdoor and indoor application versatility, high-productivity, and a set of technologies that reduce the total impact of printing on the environment. A whole new era of large-format printing starts now.

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Ink composition

HP Latex Inks are pigmented, water-based inks designed for commercial and industrial printing applications. These new inks use HP's innovative aqueous-dispersed polymer ("Latex") technology to provide print durability and display permanence comparable to solvent inks. The water-based formulation provides clear advantages over solvent inks by reducing the total impact of printing on the environment and facilitating an improved print production environment.

HP Latex Inks consist of a liquid ink vehicle that carries latex polymer and pigment particles to the surface of the print media. Physical and chemical properties of the ink vehicle are critical both for drop ejection performance and control of ink-media interactions. These properties are obtained by formulating the ink vehicle with a combination of water (~70%), co-solvents for aqueous inks (~30%), and additives.

High water content gives HP Latex Inks the high surface tension and low viscosity that are ideal for use in HP Thermal Inkjet printheads. As the major component of HP Latex Inks, water offers important benefits to commercial and industrial production environments: it produces no VOCs, requires no special handling, and is non-toxic, non-flammable, and non-combustible. And, unlike printers using solvent inks, HP printers using HP Latex Printing Technologies do not require daily manual maintenance of printheads and service station components.[1]

Water alone is not a practical ink vehicle for printing on the wide variety of media used in commercial and industrial applications: co-solvents and additives must be added to obtain the required performance characteristics. The co-solvents in HP Latex Inks are similar in type and concentration to co-solvents used in HP's water-based Designjet inks, which are used in office-like environments and produce extremely low VOC emissions.

Co-solvents and additives play an important role in drop ejection and ink-media interactions. They lower surface tension to wet the internal surfaces of the drop generators to keep them primed with ink and ready to print. They keep the surface of the thermal inkjet heater resistor and orifice plate clean for consistent drop ejection performance, minimize viscous plugs in the nozzles that can cause missing or misdirected drops, and affect how the ink droplet wets the surface of the print media to control dot formation. Co-solvents soften uncoated vinyl for better adhesion to the latex polymer film, and they evaporate in the printer to produce a completely dry and odorless print[2] that can be immediately handled, stored, shipped, or displayed indoors.

A key innovation in HP Latex Inks is the incorporation of latex polymer particles. "Latex" is a term that describes a stable, aqueous dispersion of microscopic polymer particles. It is important not to confuse the polymers used in HP Latex Inks with those found in natural materials, such as latex rubber. While some individuals experience skin irritation from contact with natural latex compounds, the synthetic polymers used in HP Latex Inks are non-allergenic.

[1] Printers using HP Wide Scan Printing Technology employ fully-automatic printhead testing and maintenance systems.

[2] Printers using HP Latex Inks use internal heaters to dry and cure the latex polymer film. Some substrates may have an inherent odor.

Image Formation Process

Inside the printer, a liquid film of HP Latex Ink on the print media is exposed to radiant heaters and airflow in the Print Zone and Curing Zone. No connection to special ventilation equipment,[3] such as a vapor extraction or air purification system, is required because HP Latex Inks emit extremely low levels of VOCs. This process evaporates the ink vehicle and causes the latex polymer particles to coalesce forming a continuous polymer layer that adheres to print media and encapsulates the pigment to form a durable colorant film.

Some solvent ink printers use in-line high-speed dryers or off-line print storage to evaporate ink solvents from the print to dry it for handling and display. This also helps to minimize the release of objectionable solvent odors at the point of display. But, completely drying solvent-ink prints in the print shop releases additional VOCs into the work area, and this process may require special ventilation to meet occupational exposure requirements.

The image formation process for HP Latex Inks is described in more detail in Figures 1-3.

Figure 1 shows a schematic drawing (not to scale) of a liquid film of HP Latex Ink in the Print Zone on the surface of nonabsorbent media, such as uncoated vinyl. The Print Zone is the region of the printer platen where ink drops are jetted onto the print media, and it is located immediately under the scanning printheads. The liquid film is created from an ink droplet after co-solvents and additives in the ink vehicle aid in wetting the surface to allow the drop to spread. The layer is composed of a mixture of ink vehicle, latex polymer particles, and pigment particles.

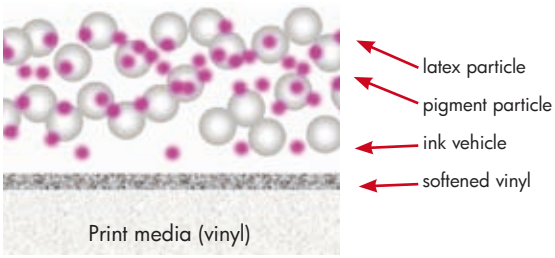

Figure 1. Liquid Film of HP Latex Ink on the Surface of Print Media – Before Drying and Curing Processes
(Schematic representation is not to scale)

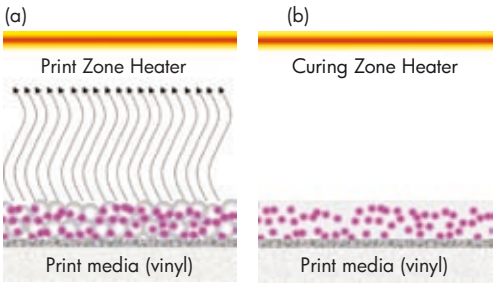

Figure 2. HP Latex Ink Curing Process: (a) Print Zone Heating; (b) Curing Zone Heating

[3] Special ventilation is not required to meet US OSHA requirements on occupational exposure to VOCs from HP Latex Inks. Ventilation equipment installation is at the discretion of the customer—no specific HP recommendation is intended. Typically no air discharge permitting required with inks that emit extremely low levels of VOCs. Customers should consult state and local requirements and regulations.

In the Print Zone, the co-solvents begin to soften the vinyl surface to prepare it for chemical interaction with the latex polymers.[4]

In Figure 2, radiant heaters and airflow evaporate the ink vehicle and cure the latex film.

Figure 2a shows the effect of the Print Zone Heater. In the Print Zone, radiant heat and forced airflow evaporates most of the water and the liquid film condenses to a viscous mixture of co-solvents, latex polymer particles, and pigment particles. High viscosity in the ink film now immobilizes the polymers and colorant to set the dot size and to minimize coalescence and bleed with dots in neighboring print locations.

In Figure 2b, the printed media has been advanced out of the Print Zone into the Curing Zone. Here, a second dryer evaporates the co-solvents. The latex polymer particles now coalesce into a continuous polymer film that encapsulates the pigments.

This process of film formation is called "curing", and it occurs during and after the co-solvents evaporate ("drying"). The dense film of latex particles now chemically bonds to the softened vinyl surface.

In Figure 3, a continuous latex film encapsulating the pigments has formed on the vinyl surface as the print leaves the Curing Zone. No additional drying of the print is needed because virtually all of the ink vehicle has evaporated.

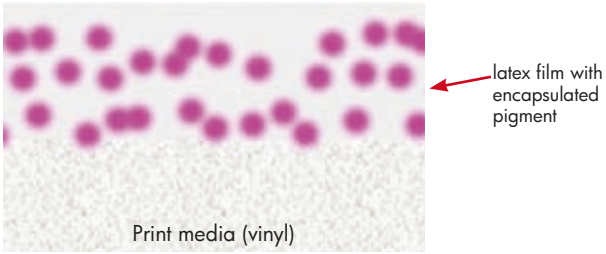

Figure 3. Cured Film of HP Latex Ink

[4] This chemical interaction occurs between the surface (molecules) of the media and so-called functional groups (of atoms) placed on the outside of the latex polymer chain during the production of these polymers. These functional groups give the latex polymer some of its chemical properties, for example the ability to bond to other materials such as polyvinyl chloride (vinyl).

Performance

Durability and display permanence are two important characteristics for prints produced for commercial and industrial applications.

Durability is characterized by a print's scratch-, smudge-, and water-resistance. Display permanence is a measure of how long prints will last on outdoor and indoor display.

Prints made with HP Latex Inks on a range of media that are displayed outdoors offer display permanence comparable to prints produced with low-solvent inks: up to 3 years unlaminated and up to 5 years with lamination.[5] Indoors, prints made with HP Latex Inks on a range of media offer in-window display permanence up to 5 years unlaminated and up to 10 years with lamination.[6]

When used in a 6-ink color printing system including cyan, light cyan, magenta, light magenta, yellow, and black, HP Latex Inks produce a color gamut comparable to HP low-solvent inks as seen in Figure 4. The gamuts are projected onto the a-b plane of the CIELab color space.[7] The gamut plot for HP Latex Inks is shown in the hue associated with the (a,b)-coordinate; the HP low-solvent ink gamut is shown in gray. Overall, the CIELab gamut on uncoated vinyl[8] of HP Latex Inks is about 4% larger than the gamut for HP low-solvent inks.

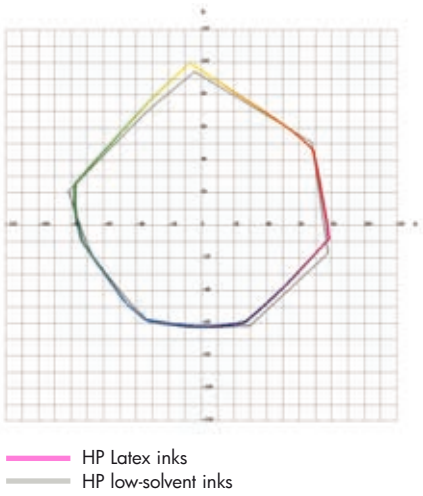

Figure 4. CIELab Color Gamuts on Uncoated Vinyl, a-b Plane – HP Latex and HP low-solvent inks, 6-ink printing systems

[5] HP image permanence and scratch, smudge, and water resistance estimates by HP Image Permanence Lab. Display permanence tested according to SAE J1960 using HP Latex and solvent inks on a range of media, including HP media; in a vertical display orientation in simulated nominal outdoor display conditions for select high and low climates, including exposure to direct sunlight and water; performance may vary as environmental conditions change. Scratch, smudge, and water resistance tested using HP Latex and solvent inks on a wide range of HP media. Laminated display permanence using Neschen Solvoprint Performance Clear 80 laminate. Results may vary based on specific media performance. For more information, see www.hp.com/go/supplies/printpermanence

[6] Interior in-window display ratings by HP Image Permanence Lab on a range of media including HP media. HP in-window predictions based on test data under Xenon-Arc illuminant. Calculation assumes 6,000 Lux/12 hr day. Laminated display permanence using Neschen Solvoprint Performance Clear 80 laminate. For details: www.hp.com/go/supplies/printpermanence

[7] Based on HP Imaging and Color Lab color gamut measurement for HP Latex Inks and HP 780 and 790 low-solvent inks on uncoated vinyl. Gamut calculations based on measurements of 943 data points of absolute colorimetric rendering using a D50 illuminant at 2 degree observer.

[8] CIELab gamut volumes on Avery uncoated vinyl are predicted to be 562,993 units with HP Latex Inks and 542,674 units with HP 780 and 790 low-solvent inks. Rendering is Absolute Colorimetric.

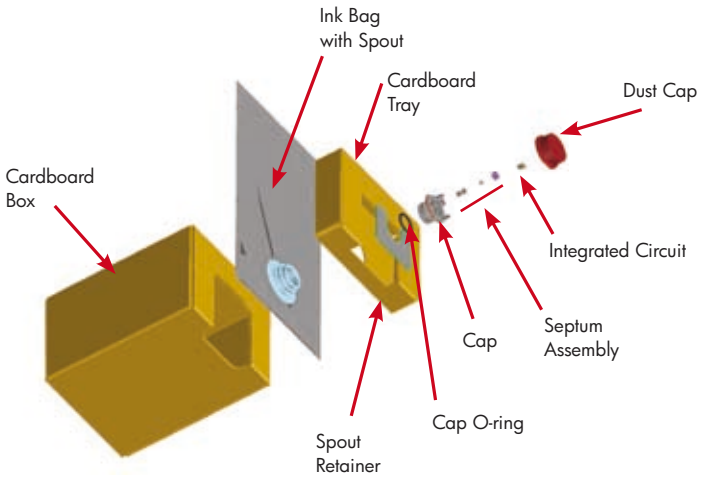

Figure 5. Ink Cartridge – Exploded View Showing Internal Components

Ink Cartridge

An ink cartridge with an innovative design was developed for use with HP Latex Inks. Its construction reduces material use and the outer shell is made of recyclable cardboard. This cartridge and its internal components are shown schematically in Figure 5.

An internal cardboard component (Tray) is also made of recyclable cardboard.

A collapsible Ink Bag inside the box contains the ink and provides vapor and air barriers to minimize changes in ink composition during shipping, storage, and use. A Cap with a Septum Assembly is attached to the Spout on the Ink Bag. The septum is a valve that opens when the ink cartridge is connected to the printer's ink delivery system. A Dust Cap keeps the septum clean during shipping and storage.

An Integrated Circuit makes electrical contacts with the printer when the ink cartridge is installed. Bi-directional communication with the printer provides information about the status of the ink cartridge including type of ink, ink color, and remaining ink quantity. It also identifies the cartridge to the printer as an Original HP ink cartridge.

The ink cartridge features high ink utilization: as ink is extracted, the ink bag is designed to collapse in a way that maximizes the amount of usable ink that can be delivered.

HP Surface Treatment Technology

High Density Polyethylene (HDPE) fibers are used in the production of Tyvek®. HDPE has many desirable physical properties: it has high tensile strength and is lightweight, it is durable outdoors, and it is recyclable[9]. HDPE is also resistant to many solvents, and this feature gives HDPE widespread use in packaging for food and chemicals. But, it is this solvent-resistance that poses an issue for image quality and print durability. When printing HDPE materials with aqueous and low-solvent inks, the ink vehicle cannot soften or dissolve the surface. Therefore, no interface layer forms between the substrate and the colorant layer to give good adhesion and print durability.

Tyvek® is formed from HDPE fibers fused together under heat and pressure. The surface of a Tyvek® sheet is a matrix of randomly-oriented fibers with large, open pores. Pigments can be carried deep into the fiber matrix when ink penetrates the surface of untreated Tyvek®. When this happens, a print may have high color bleed and feathering, low edge sharpness, low color saturation, reduced color gamut, and low optical density.

To improve imaging characteristics of HDPE, HP developed a polymer-based, proprietary surface treatment technology for HDPE-based materials. This surface treatment offers both sharp, vivid image quality and print durability when using either HP Latex Inks or HP low-solvent inks.

On HDPE materials processed with HP Surface Treatment Technology, HP Latex Inks and HP low-solvent inks wet and dissolve the polymers to leave an integrated colorant film after the ink vehicle evaporates. Pigments are encapsulated into the polymers to achieve improved image durability, color saturation and color gamut, and edge sharpness.

[9] Recycling opportunities currently available only in limited areas. Customers should consult local recycling resources.

Printing with the environment in mind can bring in more business

HP understands that a printing solution with a smaller environmental footprint can create benefits at your printing location and for your customers. We have identified four key benefits for print service providers who move to a printing system that enables printing with the environment in mind:

- **Lower total cost** – due to factors such as fewer infrastructure requirements, faster set-up time, and location flexibility
- **Improved printing environment** – Non-hazardous inks reduce environmental, health, and safety considerations, for example.
- **New, higher value applications** – when quality and performance can be delivered with a solution that reduces the total impact of printing on the environment
- **Social reputation** – opportunity for promotion as an environmentally conscious print service provider

New HP Latex Printing Technologies offer environmental, health, and safety advantages, relative to solvent-ink technology, that facilitate simpler printer installation and operation on your business premises while providing a breakthrough in meeting the demands of your environmentally conscious customers, all without compromising outdoor durability across a range of substrates.

Easier and less expensive printer installation and operation

Odorless prints[2] produced with HP Latex Inks emit extremely low levels of volatile organic compounds (VOCs). There is no special ventilation required to meet occupational exposure limits, and there are no requirements for air discharge permitting,[3] facilitating an improved printing environment.

Because these innovative new inks do not produce ozone emissions during printing and contain no hazardous air pollutants (HAPs) or sensitizers,[10] they are in compliance with a number of industry-leading certifications including Nordic Swan.

Non allergenic—It is important not to confuse the polymers used in HP Latex Inks with those found in natural materials, such as latex rubber. While some people experience skin irritation from contact with natural latex compounds, the synthetic polymers used in HP Latex Inks are non-allergenic.

[2] Printers using HP Latex Inks use internal heaters to dry and cure the latex polymer film. Some substrates may have an inherent odor.

[3] Special ventilation is not required to meet US OSHA requirements on occupational exposure to VOCs from HP Latex Inks. Ventilation equipment installation is at the discretion of the customer—no specific HP recommendation is intended. Typically no air discharge permitting required with inks that emit extremely low levels of VOCs. Customers should consult state and local requirements and regulations.

[10] No ozone products expected based on ink composition and printing technology; HAPs per US Environmental Protection Agency Method 311.

Easier handling and transport of supplies

HP Latex Inks are not classified as hazardous material per transportation requirements, do not carry hazard warning labels, and are not considered hazardous waste.[11] These inks are non-flammable and non-combustible.

Recyclable substrates,[9] and ink cartridge design with recyclable cardboard

Designed to reduce the total impact of printing on the environment, our innovative new ink cartridge design uses a recyclable cardboard container and reduces materials use.

HP large-format media designed specifically for new HP Latex Printing Technologies includes a range of recyclable substrates,[9] for example a woven High Density Polyethylene (HDPE).

Satisfying the demands of more of your customers

As environmental performance becomes an increasingly visible component of your customer requirements—at the printing location, and during and after the use of the print—the use of HP Latex Inks enables you to expand the services and applications you offer.

In addition, the odorless prints[2] produced by HP Latex Inks give your customers the best of both worlds: durable enough for demanding applications such as outdoor display, but without the noticeable odor of solvent-ink technology that can limit indoor applications.

Figure 6. Better environmental performance facilitates an improved printing environment and can attract more business

[2] Printers using HP Latex Inks use internal heaters to dry and cure the latex polymer film. Some substrates may have an inherent odor.

[9] Recycling opportunities currently available only in limited areas. Customers should consult local recycling resources.

[11] HP Latex Inks are generally not considered hazardous waste. Customers should consult state and local requirements and regulations

Summary table of technology attributes and benefits

Attributes	Benefits
Water-based inks emit extremely low levels of VOCs (volatile organic compounds).	No special ventilation required[3]: – Lower installation and operation costs – No requirements for air discharge permitting[3] – Easier installation and relocation
Odorless prints[2] —Prints emit no noticeable odor even right out of the printer.	– Improved printing operating environment – Enables prints to be immediately displayed indoors
Non-combustible, non-flammable inks	Simplify safety measures in operating environment and in transport of supplies
No sensitizers in inks No hazardous air pollutants (HAPs)[10]	– Improved printing operating environment – Prints are suitable for a wide variety of applications
Ink cartridge design includes recyclable cardboard container.	Reduces environmental impact
A range of recyclable substrates[9] designed specifically for HP Latex Printing Technologies	Meets increased customer demand for recyclable prints
HP Latex Inks comply with Nordic Swan.	Meet increased customer demand for environmentally compliant print production

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Designing products with the environment in mind

HP Latex Printing Technologies are fruit of HP's Design-for-Environment program, an engineering perspective that optimizes for improvements in environmental impact. The program takes into consideration the entire product life cycle: from design, manufacturing, and distribution, to customer use, reuse, and recycling. It aims to reduce the amount of energy and resources used at HP and by our customers.

The environmental performance of a printing system is in many ways linked to its ink technology. With over two decades of experience in ink design and a broad portfolio of printing technologies, HP is uniquely positioned to deliver quality and performance in new solutions designed to reduce the total impact of printing on the environment.

For more information
visit www.hp.com/go/hp_latex_printing_technologies

HP Wide Scan Printing Technology
HP Latex Inks were developed together with HP Wide Scan Printing Technology, which achieves high image quality and high speed using printheads based on HP Scalable Printing Technology and accurate media advance using HP's proprietary Optical Media Advance Sensor. For more details, see HP's backgrounder on HP Wide Scan Printing Technology.

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