

# HP Indigo Industrial Web Presses: Technology and Applications

*Hart Yoram and Tal Riesenfeld*

*HP Indigo  
Rehovot, Israel*

## Abstract

The HP Indigo ws4050 is a high-speed, narrow-web digital press. It provides cost-effective on-demand printing for industrial web applications such as prime labels and flexible packaging in short- to medium-runs. The HP Indigo ws4050 offers a unique combination – digital printing with offset print quality for wide variety of applications. The Offset print quality is achieved by HP Indigo's unique printing process technology. This paper describes the fundamentals of HP Indigo process focusing on “one-shot” technology that enables the offset print quality for web application. It explains as well the fundamentals of the web handling system, which enables the use of the press in a wide variety of applications such as labels, flexible packaging, shrink sleeve, pharmaceutical applications and more.

## Introduction

The HP Indigo industrial digital web presses are based on the HP Indigo printing process; the printing process was discussed in detail prior to this paper (See reference 1-3) and therefore will not be reviewed. The HP Indigo printing engine is configured in two formations, multi-shot printing process used for sheet-fed substrates and “one-shot” printing. The “one-shot” is used for web-fed and non-flexible substrates.

The HP Indigo industrial printing engine supports a wide range of substrates with many diverse properties:

- Paper and non paper substrates
- Conductive and isolative materials
- Opaque and transparent
- Handling of flexible substrate to stiff substrate
- Handling 12 to 350 micron thickness

This article covers the unique technology that is implemented in HP Indigo industrial web presses; elaborating on the printed applications, existing products, markets, and market trends.

The following chapters will be covered in this article:

- The HP Indigo process
- The “one-shot” printing technology
- The HP Indigo web handling system.
- HP Indigo industrial web presses
- Applications range
- Markets and market trends.

## The HP Indigo Process

Every HP Indigo press has a laser imaging head exposing the Photo Imaging Plate (PIP) with a resolution of 812 x 2400 dpi (for the HP Indigo ws4050). Each of the seven predefined colors is selectively applied in his turn to the latent image previously impressed on the PIP. The development process is called Binary Ink Development (BID).

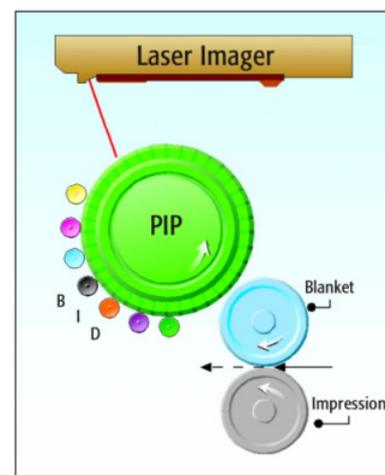


Figure 1. Binary ink development (BID)

The HP ElectroInk™ layer is created as a uniform ink film on an elastomeric roller within a BID unit. The ink is electrically transferred from the BID to the imaging surface on the PIP as an image. Negatively charged ink transfers to discharged areas on the PIP, while the negatively charged background areas on the PIP remain free of ink.

The development or process speed in these presses is 73 m/min (240 ft/min). This high speed process enabled by the use of liquid ink contains small ink particles.

The image is electro statically transferred from the PIP to the blanket. On this heated blanket, the particles partially melt and blend together until the image becomes cohesive and tacky. The images are accumulated on the blanket one by one and are ready to be transferred to the substrate using the unique “one-shot” technology.

### “one-shot” Technology

The unique “one-shot” process enables to print on the web media by accumulating all the images on the blanket and then transferring the entire registered image in “one-shot” to the web material. The transfer is done from the hot blanket to the substrate by using a release force. The unique properties of ElectroInk™ assures a 100% image transfer from the blanket to the substrate, moreover the image is fully fixed and dry as it touches the substrate. The color registration due to this process is not substrate dependent and therefore an excellent color to color register is obtained. With this exclusive process, the image is transferred all at once, enabling to print on wide gamut of substrates from thick and non flexible media to thin flexible films, temperature sensitive materials (used for flexible packaging)- fully covering the whole range needed for label market. The flexibility of this process enables a printing with up to 16 different color layers (from the same engine). The process enables high uniform gloss that matches the substrate gloss. The transfer to the web substrate is done via the web handling system.

### Web Handling System

The distinctive web handling system of the ws4050 has two major functions, transferring the image using “one-shot” process and controlling the image position on the substrate.

The unwind and rewind units supply and collect the substrate to and from the printing engine. The substrate speed at those units is the average production speed. The image transfer and image position control is done inside the printing engine (figure 2).

### Printing Engine - Image Transfer

The image transfer is being done during the last layer of color build up on the blanket. The substrate accelerates to the process speed (73 m/min) and then the ink transfer is completed at once. The ink transfer is based on the blanket temperature (keeping the ink layer tacky) and the mechanical pressure, between the substrate to the blanket.

### Control of the Image Position

After complete transfer of the image, the substrate decelerates till a complete stop, perform a motion back and accelerate to the next print cycle. The motion profile forward and backward inside the printing engine enables seamless printing in different repeat lengths without any hardware changes. The full digital solution enables changes of the repeat length or image length during printing using the state of the art servo control system.

The web buffer system connects the unwind and rewind to the printing engine – enabling this forward and backward motion while keeping constant web tension. The web handling system provides the tension level according to the substrate optimal level, thin substrates use lower tension (3 Kg) thick substrates use higher tension ( up to 8 Kg).

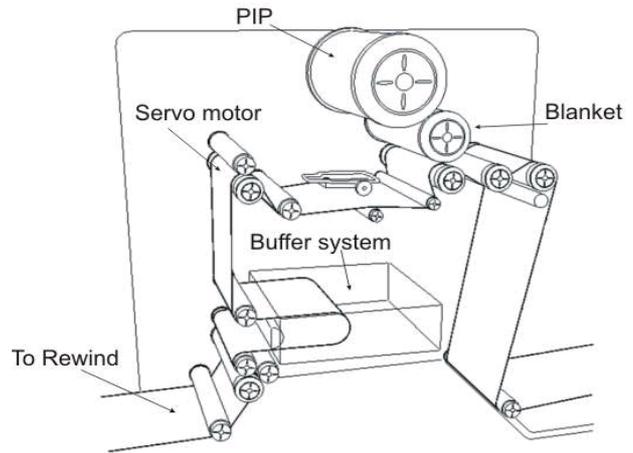


Figure 2. Web handling system inside the printing engine

### HP Indigo Industrial Web Presses

The first revolutionary HP Indigo web press- the HP Indigo ws2000 was released to the label market. This first web product later evolved to the double speed mature HP Indigo ws4000 (released in Sep 02). The latest model – the HP Indigo ws4050 (released in Sep 04) further expanded the application range enabling printing on thinner and wider substrate range.

The table below summarizes the main technical specifications for the HP Indigo industrial press.

#### Main Technical Specifications:

Print engine specifications	HP Indigo ws4050	HP Indigo ws2000
Print speed at 4 colors	16 m/min	7 m/min
Image quality	812 x 2400 dpi	812 x 1600 dpi
Image size	308 x 450 mm max	308 x 437 mm max
Substrate thickness	12-350 micron	12-250 micron



Figure 3. HP Indigo ws4050 (bottom), HP Indigo ws2000 (top)

## Application Range

The Hp-indigo technology based on the thermal transfer process enables transfer to almost any substrate where linear contact with the Blanket is achieved.

This positions the ws4050 as widest substrate ranged press in the market: printing from paper face stock, synthetics and plastics to metalized face stock, shrink sleeves, flexible packaging and folding cartoon substrates—all with outstanding image quality.

Within these products most ws4050 converters focus on the following vertical markets: pharmaceutical, food, beverage, wine and cosmetics – all these applications require a high standard of quality and consist of growing needs for short runs with fast turnaround time.

The HP Indigo ws4050 can be combined with in line or off line finishing equipment. This combination forms a streamline label production and fully integrated finishing solution. The finishing solutions includes varnishing, lamination, hot foil stamping, die-cutting, laser die – cutting slitting and rewinding all fully integrated in the HP Indigo digital workflow. For the Flexible packaging and Shrink sleeve markets off line solutions are available.

## Market and Market Trends

With the trend towards fast-turnarounds, higher quality, more colors and shorter runs, packaging printers, have a real need for the means to improve profitability while meeting these demands. The HP Indigo ws4000 product line offers a complete solution to meet the demands of the packaging printers and their end users- offering an End to End solution- with digital workflow efficiency through leading third party workflow solutions and finishing equipment.

Combining HP Indigo core technology capabilities with the arising market needs have positioned us as the obvious digital label market leader. One of the top four label market players- the HP Indigo ws4050 is now pushing digital printing into the next frontiers – entering the high quality flexible packaging industry and penetrating the folding cartoon market.

## References

1. Udi Chatow and Ronen Samuel, Digital label printing, IS&T NIP, pg. 476 to 481.
2. Haim Livne and Michael Plotkin, High-speed laser scanning, IS&T NIP19, pg. 472 to 475.
3. Gilad Tzori, Control Mechanisms for Print Quality Assurance in HP Indigo Presses, IS&T NIP20, pg. 586 (2004).

## Biographies

**Hart Yoram** received his B.Sc. degree in Mechanical engineering from the Technion – Israel Institute of Technology in 1995 and a M.E degree in System Engineering from the Technion – Israel Institute of Technology in 2001. Since 1995 he has worked on various development projects in the printing industry. In the last 3 years his work has primarily focused on the development of HP Indigo industrial digital press. Today he is the program manager of the HP Indigo ws4050.

**Tal Riesenfeld** received his B.Sc. degree in Computer Science from Ben Gurion University. Since 2004 he is a HP Indigo Product Manger of the Industrial Digital press line of products (HP Indigo ws4050, HP Indigo ws2000, HP Indigo s2000).