What is Pad Printing

Mechanics of Pad Printing | Considerations for this Process | Benefits | Links

History of Pad Printing:

Pad printing has been in use since the 1700's but until recently was used mostly for ceramics and watches. The first application was imprinting small intricate watch faces. Animal bladders were overfilled with oil, and the image was transferred to the watch face by an inked, engraved metal plate. Printing pads were initially made from gelatin. Flatter substrates were chosen because the gelatin lacked the elasticity of silicone rubber, which is widely used today. By the 1990's, the number of pad printing suppliers, manufacturers and distributors in the North American Hemisphere doubled. The 1990's also saw the Screen Printing Association International expand to include the pad printing process. The new umbrella organization became known as the Screenprinting and Graphic Imaging Association International.

Mechanics of Pad Printing

Pad printing is a indirect or offset gravure printing process that uses a roller or pad to transfer the ink image onto an item or "substrate." Whether you are a graphic designer preparing artwork especially for pad printing or the print buyer charged with acquiring the next best advertising novelty for the company, the following steps will aid in achieving the optimum results from this versatile process.

Pre-press:

The first step in the pre-press production is for the graphic artist to prepare the image using a graphics program such as Macro Media Freehand, CorelDraw, Adobe Illustrator, or Quark Express. It is important to point out that communication between the artist and the client is essential so that the client's goal is met. For a detailed description of the graphic design process see the Graphic Design section.

The image is now ready to be made into a plate otherwise known as a

cliché. A laser printer can be used to produce an image on semi-transparent or transparent sheets of paper. A light emitting system, usually an ultraviolet light exposure table is required. The transparency paper, hand in hand with a linescreen film are put through the exposure process to set the image into the plate. For an in depth look at the imaging process see the Preparing Image for Plate section.

[Top]

Printing Process:

The functionality of pad printing can be attributed to these four components: cliche', pad, ink and substrate. (Click each link for further details.)

First, the clich&#65533; is mounted upon the machine, and it is then flooded with ink. The top surface of the cliché is "doctored" or cleaned with a blade, leaving ink only in the etched image area.

Then, the pad positions over the cliché and presses upon it with an even rolling action pushing air out of the way as it compresses. As the pad lifts away, the solvents in the ink evaporate causing the ink on the pad to become tacky.

Back | Home | Next

As the pad compresses, it rolls against the substrate to prevent air from becoming trapped between the

surfaces. The ink touching the substrate is tackier than the ink touching the pad, thus all of the ink comes off of the pad and onto the substrate, leaving the pad completely clean.

[Top]

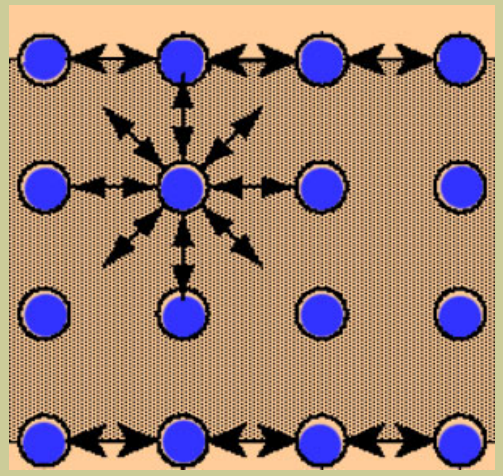
Considerations for This Process

It is essential for the customer to have a basic understanding of the pad printing process and the variables involved. This will help to communicate an idea to the printer and achieve a high quality outcome.

Choosing a Substrate:

Color, surface tension and texture are very

important in determining what substrate to utilize. When printing with bright colors such as white, yellow, pink, and orange, a white base needs to be applied to the substrate first. With black, cyan and magenta inks, a white background should be used.



Surface tension is created by the attraction of the molecules to each other. A substrate with high surface tension has molecules that are tightly packed together. In order for ink to adhere to a substrate it must be able to wet the material — meaning the molecules must be loosely packed, so that a liquid is able to spread across the surface. A dyne pen can then be utilized to decide if a substrate needs to be pre-treated, exposing more molecules to to the surface to improve ink adhesion.

[Top]

Turnaround Time:

Turnaround time refers to the duration of time from when the customer first requests a print order until the printer produces the finished product for the customer. The pad printing process is impacted by variables associated with substrates and production. For an explanation on substrates, see Choosing a Substrate. Aspects of production that affect turnaround time include labor, logistics, curing time (vary with substrate) and quantity (run length).

[Top]

Graphic Design:

During the graphic design process the customer must provide all native files, including all fonts

and artwork, which can either be images and/or type. Materials should be submitted to the printer either in hard copy format or as digital files.

When submitting hard copy format, art can be placed on a copy board and photographed producing a film positive or negative. Film should be sent at actual size.

When submitting digital files, make sure to include:

• Fonts: The Font File must be included in the packaged files for the jobs, or the fonts need to be converted to outlines or curves.

• Images: Artwork can be scanned or generated from scratch. Adjacent files of pictures included within the job need to be included when the art is sent. The size of the original artwork should be two times larger than the desired outcome. This allows for cleaner and sharper edges on the final film positive.

• Supported File Format: It is extremely important to have good graphic manipulation software programs that can import a variety of file formats without having to modify the files. Adobe Illustrator, CorelDraw, Quark Xpress and Macromedia Freehand are most commonly used to make image adjustments in preparation for pad printing. The ability to restrict a single feature or dimension of pre-press art is essential to take advantage of pad printing. Cases arise where only a portion of the art may need to bend, fold or be distorted around corners, curves, compound angles, raised surfaces, up side-walls and even over edges. Layout software must be able to make ready images that have never before been applied by printing.

[Top]

Preparing Image for Plate:

Outputting the pre-press image to the Cliché requires the following:

• Halftoning: Converting an image containing gradation of tone to a halftone.

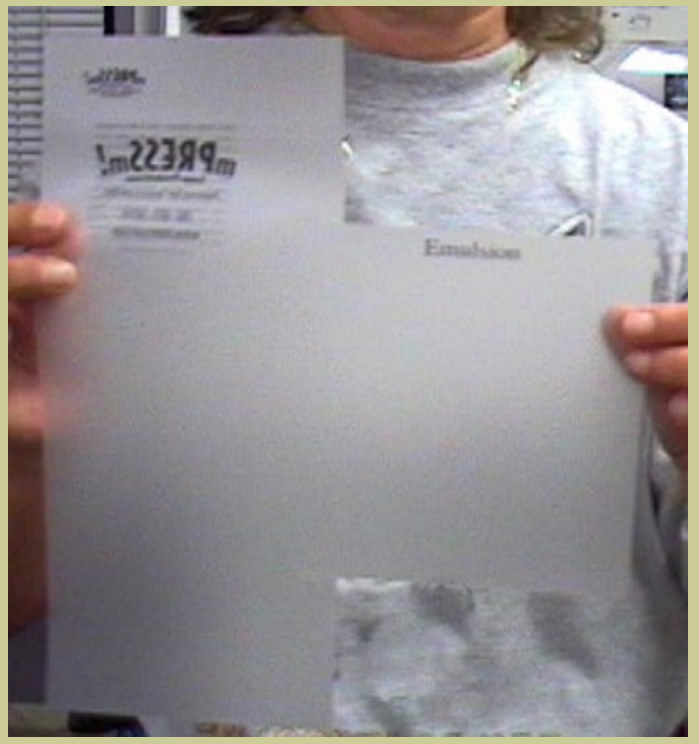
• Dpi & Lpi: An imagesetter that can achieve a stable and predictable opacity is essential. An output of 650 dots per inch is acceptable for solid areas of art, but for detailed art, at least 1200 dpi is necessary to achieve line screen in the imaging steps. Often, the use of products that can darken up an available imagesetter's capabilities may be used to assure that during exposure an image area promising acceptable screening is produced. If not, when the pad goes to pick up ink, areas with insufficient screen WILL NOT TRANSFER. Imagesetters output film using a standard resolution of up to 2540 dpi and a line screen between 90 and 120 lines per inch are acceptable, depending on substrate. For a flat pressing with two separated image contexts, one in the forefront and one in the background for instance, an Lpi of 100 at 1200 dpi will suffice. In general, more texture requires more dpi and a softer pad.

• Distort: Three-dimensional parts may have all sorts of contours and radii. Pad printing on a true radius, such as a golf ball or a can, necessitates wrapping the image around the shape. A wrap between 90° and a 120° may be utilized in circumstances of extreme shape variables.

It is sometimes necessary to distort artwork for

the pad to form about surfaces at times. In such instances, it is essential to distort or force the artwork to conform, in areas such as compound angles, raised surfaces, and up side-walls and over edges. Some stretching of the image may occur as the pad compresses around the radius.

It is important to consider different pad shapes and sizes to determine which distorts the least. Once you have the best-printed result, you can use that part as a guide, distorting the art and applying to small areas of the substrate, completing small portions at a time.



[Top]

Image Setting

Outputting the image onto semi-transparent or vellum paper, and then exposing that image to the cliché is considered the first exposure. The film paper can be fed through a laser printer, where toner is affixed to its surface at between 650 dpi and 2540 dpi, depending on the artwork and the substrate.

The film is placed with the toner on the film facing the emulsion coated side of the plate. When pad printing the toner should be oriented so that it will be directly contacting the emulsion coating of the cliché during exposure. The film should be secured to the face of the plate and introduced to the exposure system.

A UV (ultraviolet) light creates a negative on the face of the cliché. The exposed cliché is removed from the exposure system. A second film with a emulsion is then affixed to the plate. Exposing the plate a second time creates a linescreen effect. The film is angled to create a variable line screen

angle to prevent moire'.

[Top]

Cliché:

Influential factors taken into account when choosing a Cliché are:

• Form and composition of substrate.

• Family of machine used (Sealed or Open Ink Cup).

• Costs (type/material and in relation to run length).

• Performance requirements (run length and time constraints).

• In-house production (having the ability to utilize a variety of clichés allows for more flexibility and process control throughout production).

• Print design (opacity of ink, detail, etc.)

• Image quality requirements (consideration of amount of coverage of smallest and largest printable areas).

Cliché: Material composition

Nylon photo polymer coating on a metal backing
a. Intended for short print runs; up to 10,000 impressions.

Aluminum with an anodized coating
a. Up to 250,000 impressions per plate.

Hardened steel
a. *Thin steel/Flexible* (approximately .020" thick)

May last anywhere from 35,000 to 150,000 impressions or more, depending upon variables.
b. *Thick steel* (Between .25" to approximately .5") Commonly used by open inkwell machines taking advantage of the amount of usable surface area on the Cliché.

[Top]

Ink:

Inks and substrates are interdependent and must be considered in tandem. Important characteristics to consider when choosing pad printing inks are:

Drying time
Very little ink is used when the ink is contained in the etched image area of the cliché. The exposed surface of the ink goes through a physical change of evaporation.

Composition
Typical components of solvent-based pad printing inks are:
pigments (or dyes) - pass on the opacity color to the finished print.
solvents- permit the pigment-resin mix to transfer to the substrate during printing.
resins- carry the colorant and form the ink film.
minor additives-stability, flexibility.

Stability
The solvents evaporating from the ink are the main device that makes the process possible. Considerations must be made in the case of ink for the method of delivery, open or closed cup, etc., as exposure to ambient air can cause some inks to dry, or as in the case of a closed system the lack of agitation may cause the ink to become overly viscous.

Consistency
Inks can be found or formulated for almost any substrate, yet no one ink is ideal for all applications. The wide variation and variables associated with ink allow for greater flexibility of process but may require much fine tuning.

Viscosity/ Elasticity
The evaporation of solvents causes the surface of the ink to become tacky and the ink sticks to the pad as the pad lifts up from the etching. Solvent mix and color correctness are still an untamed science in pad print. Nevertheless processes exist that can help to assure variability control and highly predictable results.

[Top]

Types of Pad Printing Inks
• Inks cured by evaporation of a solvent (one component).

• Two components - "chemically reactive" inks require a catalyst to be added to produce a chemical reaction prior to printing.
• Oxidation curing.
• Sublimation.
• UV curable.
• Ceramic and glass.
• Baking.

For in-depth references to Pad Printing Inks please visit:

Understanding and Using Pad Printing Inks

[Top]

Pad:

The part that which transfers the image from the cliché to the substrate in pad printing is referred to as
the tampon. Performance of tampon depends on:
• Type of ink and ink shade used
• Doctoring contact pressure ("open" systems)
• Ink/doctoring cup contact pressure ("hermetic" systems)
• Transfer of lubricants or sealant

Important factors to consider in pad selection include:

Size: Image size is relative to pad size. The larger the screen is in relation to the image size, the less the image is likely to distort.

Shape: Pads are available in hundreds of shapes. Most are based on three shapes: round, rectangular, or bar. The pad is shaped so that when it squashes against the plate the printing surface of the pad rolls across the plate and

comes into contact with the tacky surface of the ink. A taller pad disperses compression over a larger area, reducing the amount by which the image area must distort in order to roll onto the substrate. The more rolling action that is achieved, the more ink that will be transferred. A pad which matches the geometry of the artwork should be chosen.

Hardness /durometer: Pad hardness is generally established by the amount of silicon oil used when the pad is molded. The less silicone oil added, the harder the pad. A harder pad usually performs better, yet at times is impractical to use due to type of substrate or equipment. Four basic pad harnesses are standard in the industry and cover most applications.

Material/composition: Silicone is the most commonly used material although urethane and gelatin ones are also used. The base on which the pad is mounted is also taken into consideration as it is relevant to the overall pad life. It isn't unusual for pads to last 50,000 prints. Poor setup or the use of inappropriately harsh solutions to break in a new pad can destroy it.

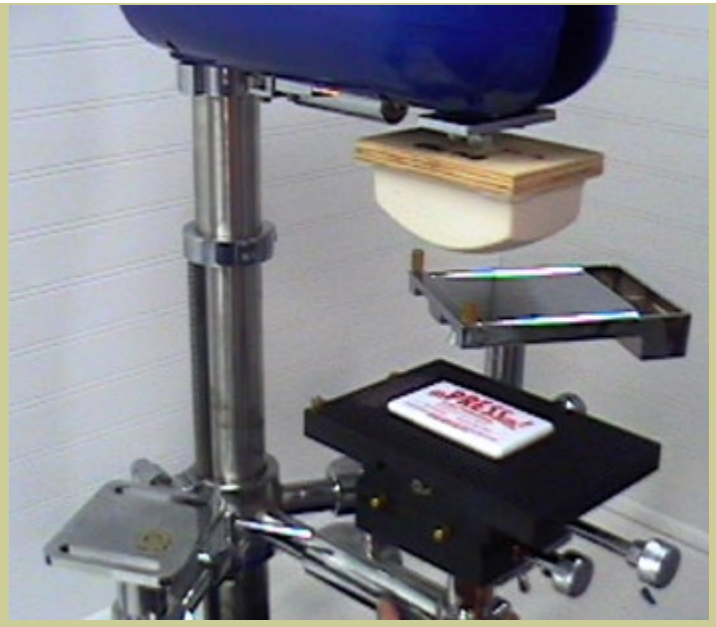
[Top]

For in-depth references to Pad Printing Tampons please visit:

TampoPrint

Machines:

Pad Printing Presses are identified and grouped by key features such as their inking systems, the rate at which they run, and the type of substrate they are able to accommodate. Groups of like systems are often referred to as families.



Open Inking Systems

• Because ink is exposed directly to air, thinner or solvent must be added during the print run periodically to maintain consistency.
• Short runs.

Closed Inking Systems

• Ink not exposed to air, contained in closed container (ink cup).
• Longer runs.
• Excellent control of ink consistency.
• Cup holds ink and acts as doctor blade.
• Used in partially and fully automated production.
• Minimal solvent ink evaporation into environment.

Manually operated machines can be found in many configurations. Automated operated machines come in just as many variations as manual and more.

• Rotary Pad-printing Systems
• Carousel Machines
• Electromechanical Machines
• Reciprocating-plate Machines

Automated systems have appeal for several reasons:

• Used for multicolor short runs.
• Accommodates various pad shapes.
• Many combination of registration tables and padding units.

[Top]

Doctor Blade Ink Cup:

In an open system, doctor blades are considered to be the least important part of the pad printing process. In actuality, their characteristics determine print quality and plate life. Blades are manufactured out of steel with very specific specifications concerning thickness. A flexible doctor blade will tend to dip easily into image areas that lie parallel to the blade or larger areas on the plate holding ink, causing images with interrupted areas. This is commonly referred to as *scooping.* A firmer blade may be used if the attempt to remark the substrate fails to improve the transfer. If a firmer blade is chosen a more durable plate may need to be used, such as steel, to make sure the halftone area does not get scooped and to make sure the layer of ink remains even.

[Top]

Choosing a Pad Printer:

Variables to consider when selecting a pad printer:

• A basic knowledge of the pad printing process is necessary to know what questions to ask and how to communicate effectively.
• Price and compare printers to find one that can produce high quality work that is within planned budget.
• Make sure the printer is ISO 9001:2000 certified.
• Ask if the company is experienced and able to troubleshoot problems onsite.
• Ensure that the printer has the capability to run numerous jobs.
• Ask if the printer has equipment that can be customized to suit your goal.
• Request a tour of the facility.
• Ask the printer if the equipment is set up properly onsite, observable for inspection and in good working order.
• Ask if the equipment is environmentally friendly and efficient.

[Top]

Back | Home | Next

Benefits

Pad printing has several benefits that are well-known in the print industry today. One reason this process is in high demand is because it produces an image on a wide range of substrates like no other printing process can. Meaning, it is possible to print on objects that are uneven, irregular, cylindrical, flat, etc., as well as objects made of polypropylene, santoprene, silicone, engineering grade plastics, ceramics and glass.

Another benefit is that this process can produce very fine details without distorting an image using little ink and space unlike screen printing and hot stamping, which both require high processing speeds to heat transfer. The result to the customer is a more cost effective, rapid turnaround time compared to that of the conventional machine etched gravure plate used in lithography. Finally, this process is perfect for large or small quantity printing because the results will be the same -- consistent quality that meets industry standards.

Pad Printing Links

For more on pad printing advantages:

Pad Flex

Technical Library

Pad printing machines:

Pad Printing Network

Trans Tech

Hermetic/Closed Inking Systems

Open Inking Systems

Open Rotary Inking Systems

Large-Format Pad Printing

Choosing a pad printing press:

Spinks India

Pad printing basics:
(Open Inkwell, Sealed Ink Cup
and Rotary Gravure)

Information about pad printing ink:

Screen Web

Information on pads:

Innovative Marking Systems

Tampon/Pads:

Silicon Transfer Pads

Pad Print Machinery of Vermont:

Cylindrical Pads

Square and Rectangular Pads

Linear Pads

Special and Compound Pads

Information on ink cups:

ITWImtran

For information about the cliché:

Pad Printing Plates

Screen Web

For video clips of pad printing equipment and applications click here:

Printex

For pad printing standards:

P D S Consulting

Extra Special Thanks to:

Back | Home

[Top]