FILM CARRIERS, PROOFS & PLATES

There are many products manufactured specifically to assist the film assembly technician and to check the quality and accuracy of the technician's work. These include film carrier materials, masking materials and proofing materials. In addition, a wide-range of printing plates are available to meet various requirements.

FILM CARRIERS AND MASKING MATERIALS

The choice of a film carrier material, commonly called a *flat*, by a film assembly technician is based upon two major considerations. First, the technician must consider if the plates that are to be used for the job are *positive*- or *negative-acting*. Many lithographic plates (especially those used in Europe), screen-printing plates and gravure plates are positive-acting. The emulsion on a positive acting plate creates an image identical to the film from which it is exposed – a negative image from a negative or a positive image from a positive. In most cases, positive-acting plates will be exposed from positive films (the only exception would be *reverse* images that are, in fact, negative images). Exposed areas of positive-acting plates become *non-image* areas while unexposed areas become *image* areas. The positive films must be mounted to a transparent material so that all non-printing areas of the plates are exposed. The choice in this case is clear polyester.

Most lithographic work in the United States uses *negative-acting* plates. Exposed areas of negative-acting plates become *image* areas while non-exposed areas become *non-image* areas. Negatives must be masked with a material that will not allow *actinic* light (the chemically-active light that exposes an emulsion) to reach the plate so that all non-printing areas of the plate are *not* exposed. Because most plates have a *monochromatic* emulsion and are sensitive only to blue light, the material used to mount the negatives may be red, green, or any combination of those two colors, including orange and yellow. These materials may be paper- or plastic-based. The choice of paper- or plastic-based materials depends upon the quality and accuracy required by the job.

GOLDENROD PAPER

Goldenrod[1] paper is a popular and inexpensive material for mounting negatives to be used on jobs that do not require critical registration. It is a sheet of regular paper that has been coated on both sides with a yellow or orange material. Because paper is not a *dimensionally-stable* material, it changes size when subjected to variations in temperature or if the relative humidity changes more than twenty percent. Thus, films mounted to it can "move" in relation to each other after the layout has been completed.

[1] Even though this material is called *goldenrod*, it is usually yellow or orange in color.

Goldenrod paper is used both as a film carrier and as a masking material. Positioning lines are drawn directly onto the paper. Then each negative is mounted, using tape, to the paper in the correct position as shown by the positioning lines. In this way, the paper acts as a film carrier. Then, openings or "windows" are cut into the paper to expose the image areas. The remainder of the paper acts as a "mask" to prevent actinic light from reaching the *non-image* areas of the plate.

Goldenrod should not be used to mount individual halftones (i.e. halftones that have not been exposed into a larger sheet of film, such as those produced by imagesetters or as a result of *composition)* because *halation* will occur. See diagram one below.

Because goldenrod paper lacks dimensional stability, it should only be used for lower-quality jobs.

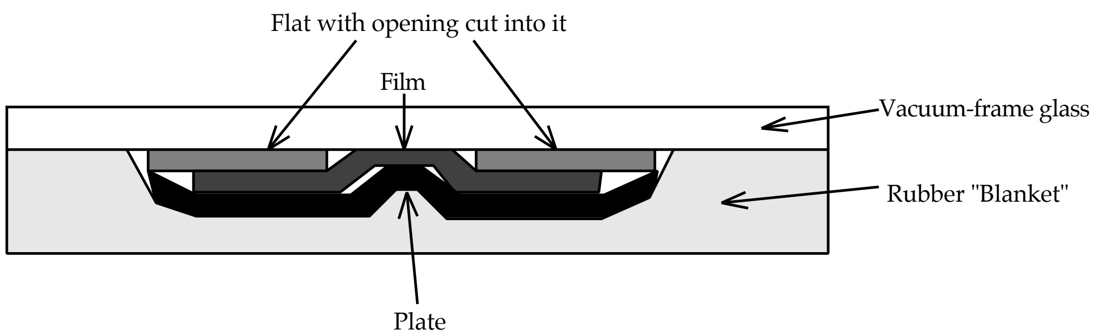

Diagram one: Halation caused by "windows" in flats. All elements inside the vacuum frame are drawn up to the rigid glass by the vacuum. The film tries to touch the glass, but the thickness of the flat material surrounding the "window" prevents the film from completely touching the glass. Similarly, the plate cannot come into complete contact with the film. Thus, light strikes the plate from various angles causing *halation.*

RIGID VINYL

Rigid vinyl is a plastic-based version of goldenrod paper. It can be used in much the same way as goldenrod. However, vinyl is much more dimensionally-stable than paper and can be used for jobs in which register is more critical. Unfortunately, vinyl is a rather soft material and, when exposed for long periods of time to hot high-intensity lamps, it can stretch and change shape (which destroys registration).

Rigid vinyl can be used both as a film carrier and as a mask. However, it should not be used as a film carrier for jobs that are to be exposed on step-and-repeat machines because the accumulated heat from multiple exposures will cause the vinyl to soften and change shape. In such cases, films should be mounted to clear polyester (see below) with a separate sheet of rigid vinyl used to mask the non-image areas. In addition, individual halftones should not be mounted to rigid vinyl because halation will occur (see diagram one).

CLEAR POLYESTER FILM

Clear polyester sheets are the most dimensionally stable materials available to the film assembly technician. Virtually all films that require close registration, including process-color work, are mounted to clear polyester. In addition, most films prepared for positive-acting plates are mounted to these sheets.

Positioning lines are not drawn on clear polyester because ink does not adhere well to the material and because inked lines could interfere with the proper transmission of light though the plastic. Instead, positioning lines are prepared on a sheet of rigid vinyl, commonly called the *master-marks* flat. Then, a sheet of clear polyester is placed over the rigid vinyl and the films are positioned on it using the lines previously drawn on the vinyl.

If negative-acting plates are to be used, the non-image areas must be masked. Obviously the clear polyester cannot be used as a mask in this case. So, masks are prepared using rigid vinyl or *peelable masking film* (see below). If individual halftones are assembled on clear polyester, *peelable masking film* is the preferred masking material because it will result in the least possibility for *halation.*

PEELABLE MASKING FILM

Peelable masking films consist of a membrane of extremely thin red or orange material laminated to a clear polyester base sheet. These films are commonly referred to by Ulano's trade names *Rubylith (red)* or *Amberlith (orange).* To make a mask, a sheet of peelable masking film is placed over the film carrier or *master-marks* flat. The film-assembly technician uses very light pressure on a knife to cut windows through the membrane, but not through the base. The membrane is then gently peeled away, leaving the base in tact (see diagram two). Peelable masking films are the preferred materials to create masks because windows cut into the extremely thin membranes virtually eliminate *halation* in the vacuum frame.

PHOTOGRAPHIC MASKING MATERIALS

In some cases, masks are extremely complicated. Such masks may require intricate cuts that might take the film assembly technician hours to complete. To decrease mask-cutting time, some peelable masking films can be exposed to a master film. After exposure, the image areas are washed away using a developing solution. The remaining non-image areas may be peeled away as necessary.

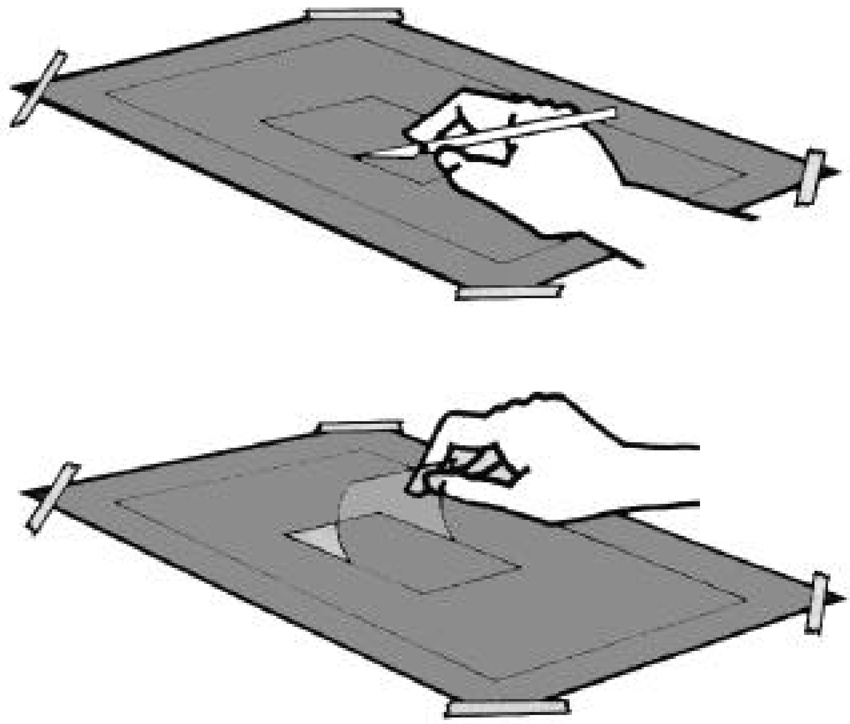

Diagram two: Cutting and peeling peelable masking film

PROOFING MATERIALS

Errors discovered when a job is being printed on a press are very time-consuming and costly to correct. To catch errors before the job reaches the press, films and flats are generally proofed a number of times before the plates are made. Proofs generally have two major functions: *internal proofing,* so technicians and supervisors may check the job's color, image accuracy and registration, and *external proofing* for submittal to the client for approval.

Internal proofing is done to check that all necessary images are in the correct place on every page of the job. Many a job has been ruined because a page number, a caption, or some other image was inadvertently left off a page. Internal proofing is also done to check pagination and to be sure the job matches the client's comprehensive – are the images the correct color? are the fonts correct? are all the images where they are supposed to be?

External proofs are presented to the client for approval. If the proof matches the customer's expectations, the customer indicates approval by signing it. This proof becomes a binding contract between the printer and the client: if an error is discovered in the final printed job and the job matches the signed proof, the customer is a fault. If, however, the printed job and signed proof do not match, the printer is responsible.

There are many types of proofs available to printer and client. They may be single- or multi-color, may be viewed as "hard-" or "soft-" copies, may be multi-layer or laminated, and may or may not provide an opportunity to examine the effect of varying paper stocks on the printed image. In addition, they may be positive- or negative-acting (printers use the same for both plates and proofs).

SINGLE-COLOR PROOFS

Single color proofs are used for one color jobs and for internal proofing to check film content, pagination, etc. They are generally provided to the client as an external proof only if the job is to be printed in one color or, perhaps, a color and a spot color or two.

The content of computer files is often proofed by printing out the file using a laser printer. These proofs, often called *lasers,* may be used for internal proofing before film is made. Once film is made, proofs must show the content of the film, not the computer file. *Lasers* should also be provided by the client if the client delivers an electronic file to the printer rather than a *comprehensive* layout or paste-up.

Once the job has been converted from a paste-up or computer file to film, proofs are generally made on *polymer papers,* generally referred to as *bluelines* or by the DuPont trade name *Dylux.* Polymer papers are either positive- or negative-acting and are prepared by placing the film or flat over the material in a vacuum frame and exposing the material to intense ultraviolet (UV) light. The UV light causes the exposed areas (if negative-acting) to darken. After exposure to UV light, the film or flat is removed and the blueline is exposed to a "white" deactivation light. The proof is now stable and will no longer darken if exposed to UV light. Diagram three illustrates the exposure and deactivation steps.

Polymer papers can simulate *color breaks* (identifying the color that each image is to be printed) by exposing a series of registered flats to the material. Shorter exposure is given to light colors and longer exposure to dark colors. Images exposed less time will be lighter than those exposed longer, so color breaks can be identified.

Polymer papers require no processing, so they are not exposed to additional heat or moisture. As a result, they are relatively dimensionally stable.

The single color proof category includes other materials such as *Diazo* and *Brownprint* papers that are seldom used today. In addition, photographic papers and diffusion-transfer materials are sometimes used as single color proofs.

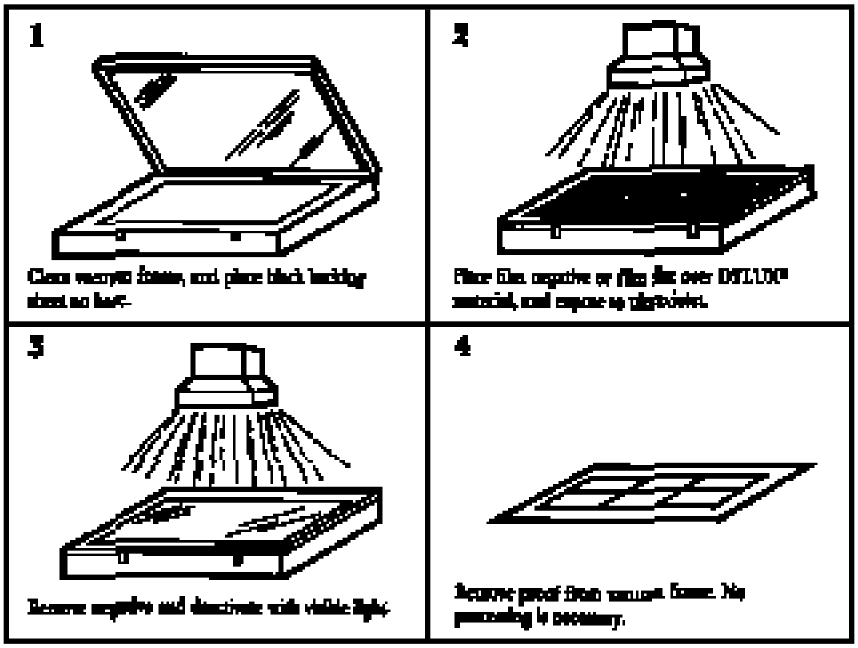

Diagram three: The production of a DuPont Dylux® proof

"SOFT" COLOR PROOFS FROM COMPUTER FILES

Perhaps the simplest, and least accurate, color proof is the *soft proof.* A *soft proof* is an image that appears on a computer screen. These proofs are very inaccurate and are not to be trusted. Monitors may or may not be WYSIWYG (what you see is what you get), so images may not be the same size on the screen as they will ultimately print. In addition, monitors may be adjusted for brightness and contrast. These adjustments alter the way an image looks on the screen, but not the image held in the computer's memory. Also, the colors on a monitor are formed using transmitted beams of red, green and blue light, whereas printed colors are made from light reflecting from white paper through layers of yellow, cyan, magenta and black ink. Monitors may or may not be "color" corrected. And, monitors (driven by graphics software) may or may not consider "dot gain" that occurs during any commercial printing process. Use this type of proof with extreme caution.

"HARD" COLOR PROOFS FROM COMPUTER FILES

A number of manufacturers provide color printers that can print a "proof" from electronic color files. These machines use a variety of imaging technologies including thermal wax, dye-sublimination, ink-jet, solid ink or laser. Of all these technologies, only dye-sublimination and solid-ink processes are appropriate for graphic artists – the others are better suited to an office user who wishes an occasional "splash" of color on a page. The best looking result comes from dye-sublimination technology. Unfortunately, it produces continuous-tone prints that do not resemble the halftone dot patterns that are used to print color photographs on printing presses.

Dye-sublimination printers use a ribbon containing page-sized panels of cyan, magenta, yellow and (sometimes) black dyes. The ribbon is moved across a tightly focused heat source that is capable of precise temperature variations. As the dyes heat up, they evaporate from the ribbon and diffuse into specially coated paper. The resultant colors differ according to the intensity of the heat.

Solid ink printers use pellets of crayonlike wax – cyan, magenta, yellow and black. The pellets are heated until they're liquid and then sprayed through tiny nozzles onto the page. The wax cools on contact, solidifying into dots of color.

Because these color "prints" do not use the same ink colorants and do not necessarily build in the variations that are inherent in the printing process, these proofs should be used with caution.

COLOR PROOFS FROM FILMS

Proofs made from films, called *photo-mechanical proofs,* have distinct advantages over those made from computer files. Primarily, these proofs are made from the same films that will be used to expose the plates. Secondly, special techniques can be used to simulate press variations, such as dot gain. So, these proofs more closely resemble an actual printed sheet than computer-based prints. These types of color proofs are the *minimum* that should be provided to a client for approval.

When viewing color proofs two important points must be remembered. First, room lighting affects perceived color! All proofs must be viewed under standardized lighting (5000˚K) lighting. Second, the colorants used in photo-mechanical proofs are not *identical* to printing inks. So, printers and clients need to use these proofs with caution.

OVERLAY COLOR PROOFING SYSTEMS

A number of firms manufacture overlay color proofing systems. These proofs, often called by the 3M brand name *Color Keys*, have thin colored emulsions laminated to thin polyester bases. A separate sheet is necessary for each color to be proofed. Sheets are manufactured in the basic process colors (YMCK) as well as PMS colors.

In use, the technician places a film over a sheet of proofing material that corresponds to the color of the image recorded on the film. The proof is exposed, like a sheet of contact film, in a vacuum frame. After exposure, the proof is developed. A separate colored proof is made for each color required by the job.

After all the layers are exposed and developed, the layers are laid, in register, over a sheet of the paper *on which the job will be printed* and taped into position. The use of the actual printing stock helps the client and technician visualize the paper's affect on the colors.

The use of layers has benefits and drawbacks. A major benefit is to allow the press operator to see what each color should look like, as well as how each combination of colors should appear. This is useful, especially when the job is to be printed on a press that has fewer printing towers than the number of colors required by the job. One drawback is the density (darkness) of the base material. Although each layer is clear, the polyester does have density and darkens the paper upon which it is placed. Several layers of the plastic will noticeably darken the paper and, as a result, the colored images.

SINGLE-SHEET COLOR PROOFING SYSTEMS

Single-sheet color proofing systems use a single base rather than a number of layers taped together in register. Because of this characteristic, they look more like a press sheet and seem more realistic to clients.

Making a single-sheet color proof is very much like printing on a press. Each color is exposed and developed, one at a time on the same base, until all the colors are "built." If there is a flaw in any color, the entire proof must be rebuilt.

Some single-sheet color proofing systems require the use of a special base upon which the colors are built. For example, DuPont Cromalin® proofs require a special base sheet. Other color proofing systems, like DuPont WaterProof®, allow the technician to build the proof on the same paper that will be used to print the job.

PRESS PROOFS

The best way to proof a color job is to actually print a copy of the job using the same inks and the same paper on the same press that will be used for the production run. Obviously, this is the most expensive because of the time involved. However, it is the most accurate. All other types of proofs attempt to replicate press proofs.

Today, most proofs prior to the production run are made using *photo-mechanical* methods, such as the overlay or single-sheet color proofing systems. Most clients sign-off on a photo-mechanical proof. However, many clients demand to check the actual press run as well. These proofs, called *press checks,* require the client to be in the printing plant when the first copies of the job start coming off the press, no matter what the time or day. Most printers provide a customer lounge or "condo" for customers to use while they are waiting for the press to be made-ready. When the press is properly adjusted, the client will be asked to view the sheet and approve it. Like all color proofs, press checks must be made under controlled lighting. Clients must understand that any changes made at the *press check* will be extremely expensive and will delay completion of the job. Once the *press check* has been approved, it is the responsibility of the printer to print the remaining copies so that they match the signed sheet, within reasonable tolerance.

PLATES

Every printing process uses its own particular type of printing plate. This discussion will involve those plates used for offset-lithography.

Historically, lithographic platemaking was a difficult task at best. At first, slabs of limestone had to be quarried and smoothed before the platemaker hand painted the image, in reverse, on the stone. Later, limestone slabs gave way to sheets of thin metal. These metal plates had to be coated with a home-made light-sensitive emulsion that consisted of, among other things, egg albumin. Large *whirlers* were necessary to evenly coat the metal sheets with the emulsion. After the emulsion was applied, the plate was dried and then exposed, in contact with the film-flat, with high-intensity carbon-arc light. The plate was then developed by applying a coating of greasy ink to the entire plate, followed by water to dissolve the unexposed emulsion, and a final coat of a gum-arabic solution to desensitize the non-image areas. It was a nasty business.

Today's technology has made platemaking one of the simplest tasks in a printing operation. Plates generally come ready to expose. Development is usually done by machine.

Plate emulsions may be positive- or negative-acting. Positive-acting plates yield a positive image from a positive flat. Film-flats for these plates consist of positive images mounted to clear polyester sheets. Negative-acting plates produce a positive image when exposed to a negative. These plates are exposed using negatives masked with goldenrod, orange rigid vinyl or red peelable masking film.

Plate emulsions may be coated on a number of different bases. Short-run plates can be made on a paper or plastic base. Extremely long-run plates may have a stainless steel base. Typically, however, most plates used for commercial lithography are aluminum-based.

Plates are rated according to their longevity – how many impressions they can print before they wear out. Some paper-based plates last for only a few hundred or thousand impressions while some aluminum-based plates can print up to 200,000 copies. It is important to remember that very long runs may require multiple sets of plates. For example, one million copies of a single four-color sheet printed two sides will require five sets of 200,000-run plates – a total of forty plates!

PLATES FOR CONVENTIONAL AND WATERLESS LITHOGRAPHY

Plates may be designed for conventional or waterless lithography. Conventional lithography requires the non-image area to be desensitized (hates ink) and hydrophyllic (likes water). The image area must be the opposite, sensitized and hydrophobic. On the press, special dampening rollers place a "mist" of moisture on the non-image area. The water cannot stick to the image area because it is hydrophobic. Then, ink rollers pass over the plate. Ink cannot stick to the water-covered non-image area, but can stick to the dry image area. Waterless plates, a relatively new innovation, have sensitized images areas and desensitized non-image areas. The non-image need not be hydrophyllic because no water is used in the process.

Waterless plates use temperature-controlled inks that stick only to the sensitized image area – they are repelled by the desensitized non-image. Only one firm, *Toray*, makes these plates at present.

SURFACE PLATES

Most conventional lithographic plates are known as *surface* plates. On all surface plates, manufactured by a variety of firms, the light-sensitive coating becomes the printing surface after exposure and development. These plates may be purchased either *presensitized* or *wipe-on.* Presensitized plates are already sensitive to light – the technician merely removes a plate from its package, places it in the vacuum frame in contact with the film-flat, exposes it to light, and then develops it in a processor or by hand. Wipe-on plates do not come sensitized – raw metal sheets and bottles of prepared coating are purchased. The technician must apply the prepared coating to the plate, using a simple roller coater, before exposing it. Development is done by hand or by processor.

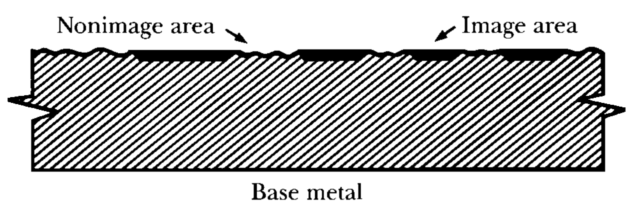

Diagram four: Cross section of a surface plate

BIMETAL PLATES

Bimetal plates are excellent for exceptionally long press runs. They consist of two different metals – one for the image and one for the non-image. The metals for the two areas are chosen based upon the receptiveness of the metal to ink or water: image areas are made from hydrophobic and sensitized metals while non-image areas are made from hydrophyllic and desensitized metals. Non-image metals include aluminum or stainless steel. Image metals include copper or brass. The plates come with the image metal electroplated onto a sheet of the non-image metal. After exposure, the unnecessary image metal is etched away leaving the non-image metal uncovered by image metal.

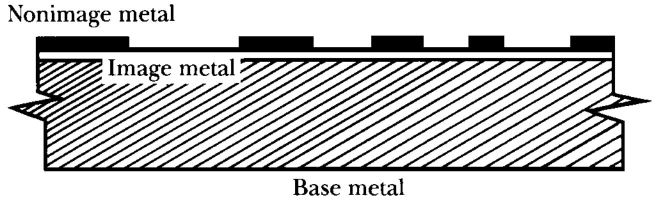

Diagram five: Cross section of a bimetal plate

DIRECT-IMAGE, PHOTO-DIRECT & ELECTROSTATIC PLATES

These plates are generally used for short runs on small offset-lithographic presses.

Direct-image plates are a specially-coated paper that can be placed into a typewriter and typed upon using a special ribbon. They only print a few copies and are declining in popularity.

Photo-direct plates are paper- or plastic-based plates made directly from the original copy using a camera or other projection device. They are often used in *Quick-Print* operations.

Electrostatic plates are made using the Xerographic process. Specially coated paper plates are placed into a special Xerographic machine. The machine copies the original image onto the plate in the same way that a Xerographic copier makes copies.

COMPUTER-TO-PLATE DEVICES

Many manufacturers are preparing special laser imaging devices that can expose a printing plate directly from digital data downloaded from a computer. Presently, there are two drawbacks to this process: it is quite time consuming to image the plates (especially when a number of plates must be made) and the equipment necessary to expose all but the smallest plates is prohibitively expensive. However, like all technology, these drawbacks will likely be overcome in the near future.

At least one machine, the *Heidelberg GTO-DI (Direct Imaging)*, exposes digital waterless plates on the press. Blank plates are mounted to each printing tower's plate cylinder. Special exposure devices, built into each tower and driven by data downloaded from a computer, burn the plate "on the fly" while the press is turning slowly. Because the plates are exposed on the press, there are virtually no registration problems. This process is being widely hailed as a "breakthrough" for short-run color work, especially advertising for realtors!

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