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PRINTtips

Getting It Onto The Paper: How Ink and Toner Work



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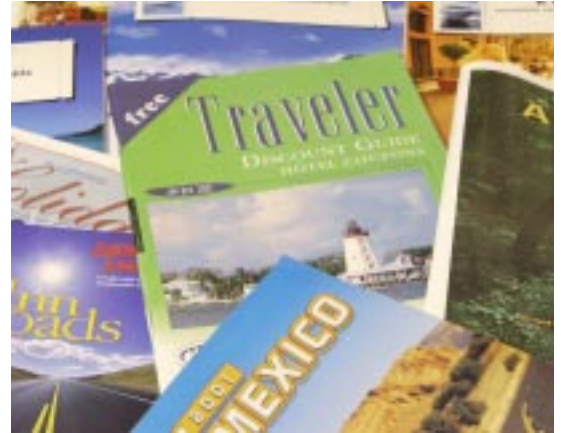
Except for deciding about color, you probably haven't given much thought to the ink or toner that creates the image on your printed piece. Yet there are some technical facts about each one that have an effect on the finished look of your document.

Ink

Printing ink consists of pigment to impart color; a vehicle to hold and disperse the pigment and bind it to the paper; and additives to control body, drying, and performance characteristics. Offset printing inks are paste inks, are applied in a thin film, and dry by oxidation.

Printing ink has four working properties:

- **Color, opacity, and transparency** are optical properties of ink that are imparted by the pigment. Pigments are finely ground solid material that is usually an insoluble derivative of an organic dye. The strength of the ink's color is determined by how much pigment is used and by how efficiently it is dispersed in the vehicle.
- **Body** describes the ink's viscosity –its ability to flow. Offset printing inks are stiff and viscous in the can, but when worked with an ink knife and with the ink roller train on the press, they become soft and more fluid. Temperature affects ink viscosity: when the press is cold, the ink is



stiffer. Also, as the speed of the press increases, the ink viscosity must also increase.

- **Tack** refers to the stickiness of the ink and is important in how the ink is transferred from the ink rollers to the plate, to the blanket, and finally to the sheet of paper. When printing more than one ink color, the first color needs the most tack so the second ink will not transfer on to the first color. In four-color process printing, each successive color must have less tack. Tack also determines whether the ink will pick the surface of the paper (lift fibers and coating off its surface).
- **Length** describes the ability of the ink to flow and form filaments. Think of the way honey behaves if you lift a knife from its surface. **Long ink** flows smoothly and forms long filaments; **short ink** is thicker and forms short filaments.

Getting It Onto The Paper: How Ink and Toner Work (Continued)

The best ink is neither long nor short, as long ink has a tendency to mist while short ink can pile on rollers, plate, or blanket.

Offset printing inks do not dry by evaporation. Rather, they dry by a chemical reaction called oxidative polymerization. Simply stated, the drying agent in the ink reacts with oxygen in the air to form a chemical, which in turn reacts with other agents in the ink to cause the ink to gel and harden. Ink is considered dry when it converts to solid state and is absolutely dry to the touch. However, since ink sets before it dries, printed sheets can be handled after the ink has set but before it has completely dried.

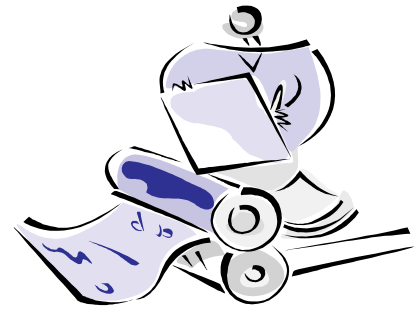
If there were no drying agents in ink, the oxidative polymerization process would proceed very slowly, if at all. Therefore, the drying agent is a very important part of the ink. And despite the presence of drying agents, some inks (such as reflex blue) are known for not always drying properly or for taking a long time to dry.

Toner

Although toner is sometimes called dry ink, it actually is an electrically charged powder with two main ingredients: pigment and plastic. The pigment imparts color to the toner and is blended into the plastic during manufacturing. The purpose of the plastic is to ensure that the toner melts when it passes through the heat of the fuser.

Because toner is set with heat, it has several advantages over printing ink. It binds firmly to paper fibers, reducing the chance of smudging or bleeding. It also can be handled immediately after fusing, since no setting or drying is required.

Most toner is made by melt mixing the plastic and pigment into strands that are then pulverized into small particles. The smaller the toner particles and the more uniform their size and shape, the better the particles will transfer from



the developing station to the drum and finally to the paper. But the pulverizing process does not allow precise control over particle size – some are too big and others too fine – so the particles must be mechanically sorted to a uniform size. It's a little like sifting dust.

Melt mixing produces toner with an average size greater than seven microns in diameter. Making toner particles that are smaller is not as yet economically practical. So even though seven microns is a very small size, it is substantially larger than printing ink film and so cannot match offset printing resolution. However, toner manufacturers are developing new technologies (such as chemically "growing" toner particles to the required size and shape) that eventually will result in toner particles measuring 4-5 microns.

Ink or toner: which is best?

The decision to use an ink- or toner-based printing system for your printing project depends on a number of considerations such as quantity, time to produce the project, type of paper required, the nature of the images, color space, and finishing processes. We will be glad to discuss the options with you at any time during the planning process. Please call us at (513) 248-2121 or via e-mail at info@macgra.com for an appointment.

One final word on ink: When you are placing your order, be sure to let us know whether you have a special need such as heat resistance (because the printed sheet will be going through a laser printer or copier) or resistance to fading.

“Ink is considered dry when it converts to solid state...”

“Because toner is set with heat, it has several advantages over printing ink.”



Characteristics of Metallic Inks

Metallic ink is a popular way to add a distinctive touch to printed materials. Metallic inks are formulated by suspending metal powders such as aluminum, copper, brass, or bronze in the ink vehicle. Silver metallic ink is created with aluminum powder; gold is a mixture of brass, copper, and other metals.

The metallic particles float or "leaf" to the surface, producing the metallic luster. The amount of luster is affected by the size of the metallic particles – the larger the particles, the more leafing and sheen. Drying time also affects

leafing. If the ink dries too quickly, maximum leafing may not occur.

Metallic appearance is also dependent on the type of paper used. Coated papers produce the best results of brilliance and metallic sheen. If the paper is uncoated, or has a rough finish, or is absorbent, it may be necessary to print a base ink or varnish first, then overprint with the metallic ink.

Using metallic ink for a screen tint is not recommended. At lower screen values, a decrease in metallic luster is common while at higher values, the screens may fill in.



“If the ink dries too quickly, maximum leafing may not occur.”

Q. *What is a PMS color?*



A. PMS is an acronym for Pantone Matching System, a printed book of standardized color swatches in fan format. In 1963, Lawrence Herbert, Pantone's founder, created this innovative system to identify and match colors. The system solved problems associated with producing accurate color matches in printing and graphic arts.

The Pantone Matching System begins with a base of 14 colors (two yellows, orange, four reds, purple, four blues, green, and black), then creates more than 1000 colors based on combinations of the base in a process similar to the way paint stores mix paint.

Each color is numbered for easy reference and a color swatch and ink formula is printed in PMS guides – the fan format books we use to help you select colors for your printing projects. We keep a PMS guide for our customer service representatives to use and also provide one to each of our press operators. In addition, we replace our books approximately once a year to ensure that color swatches have not changed due to fading or exposure to light.



“...an innovative system to identify and match colors.”

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Words

*“...strength of color
is determined by the
amount of
pigment...”*

A Vocabulary of the Graphic Arts

Color pigments: finely ground solid materials that impart color to ink. The strength of color is determined by the amount of pigment and how efficiently it is dispersed.

Electrophotography: image transfer systems used in copiers to produce images using electrostatic forces and toner.

Ink holdout: the property of paper to resist penetration of the ink vehicle.

Ink wash charge: a charge imposed to cover the amount of time it takes for the press operator to clean the form rollers, blanket, and ink fountain of a colored ink.

Ink fountain: a part of a printing press that stores and supplies ink to the inking rollers.

Leafing: the result of metallic particles floating to the surface of the ink, creating a metallic sheen.

Melt mixing: the manufacturing process for toner consisting of blending pigment and plastic into strands, then pulverizing the strands to create toner particles.

Pick: the process of a tacky ink lifting fibers or coating from the surface of paper.

PMS: Pantone Matching System. A generally accepted reference for selecting, specifying, matching, and controlling ink colors.

Xerography: an electrophotographic copying process that uses a corona wire (charged photoconductor surface), electrostatic forces, and dry or liquid toner to form an image.