



Ink vs. Toner: Which is the Best Choice?

“The pen is mightier than the sword as long as it doesn’t run out of ink.”

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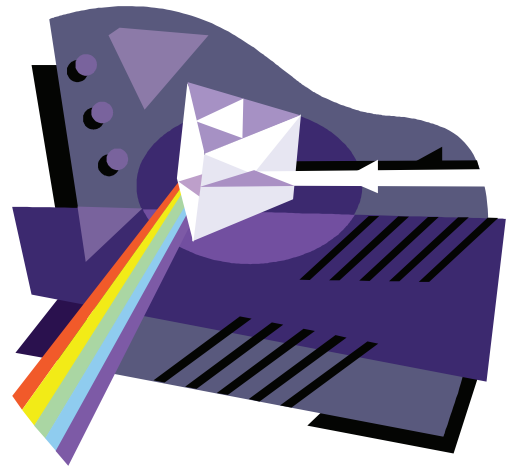
Except for deciding about color, you probably haven’t given much thought to the ink or toner that creates the image on your printed piece. Yet there are some technical facts about each one that have an effect on the finished look of your document. When you are placing your order, be sure to let us know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

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 onto 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. 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, and making toner particles that are smaller is not economically practical. So even though seven microns is a very small size, it is substantially larger than printing ink film and therefore cannot yet match offset printing resolution. However, toner manufacturers are developing new technologies (such as chemically “growing” toner particles to the required size and shape) which eventually will result in toner particles measuring 4-5 microns.

To help you determine whether offset or digital printing is best for your project, we've developed an overview of the benefits of each process. Consider this:

- **Offset printing allows more options for color management.** Adjustments to colors printed on a digital copier are hard to make and much more limited than adjustments on press. In addition, there is more chance of variation in color from the beginning to the end of the run on a digital copier than on press.
- **The range of paper stocks is greater with offset printing.** Digital copiers typically use three paper

sizes – letter, legal, and ledger – and cannot feed any others. Enamel or cast coatings on paper can be a problem for digital copiers because of the fusing temperature. Finally, the paper path or the paper pickup system limits the thickness of paper.

- **In general, offset presses run faster than digital copiers.** At high quantities, a digital copier may be too slow to produce the job in the desired turnaround time.
- **Photographs and screens can be printed at a higher resolution on press.** Press plates can be imaged at a high resolution capable of printing fine dots for photographs and screens, thus avoiding the banding and streaking that can appear in digital printing.
- **Digital printing has less make-ready than process color on press.** Because digital color printing requires no plates and only a few sheets to attain good color, it is less expensive in short runs (generally 1000 copies or less) and can be produced faster than making plates and printing on an offset press.
- **Digital printing does not require color separations.** This means that a file created in a program that does not support color separations (like Microsoft Word or PowerPoint) can be printed on a digital copier but cannot be printed on an offset press.
- **Digital printing supports variable data printing and versioning.** Because there are no press plates, each print from a digital copier is an original and can be unique.
- **A digitally printed job can proceed straight to bindery.** Because there is no need for ink drying time, a job printed on a digital copier can be folded or cut immediately after imaging.

The best time to use digital color printing is when the project is a short run (up to about 1000 copies printed one side), there are no unusual requirements for the paper, and turnaround time may be a factor. Use offset printing if the quality requirements are premium or showcase, if the job has specific paper requirements, or if the run length is 2000 or greater.

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 for an appointment.

a vocabulary of the graphic arts

worlds

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 the 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 reference system for selecting, specifying, matching, and controlling ink colors.

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

Just for Fun... Invisible Ink

For fun, make invisible ink out of lemon juice or baking soda.

You'll need:

- Lemon or lemon juice or baking soda and water
- Paper
- Toothpick, cotton swab, or paintbrush
- Paper
- Sunlight or heat source (such as a light bulb)

1. *If using lemon juice*, squeeze lemons (or use bottled lemon juice).

If using baking soda, mix equal parts of water and baking soda.

2. With a toothpick, cotton swab or paintbrush, write a message on white paper using the lemon juice or baking soda as ink.

T H E I D E A

3. Allow the ink to dry.

To read the message, hold the paper up to sunlight (for lemon juice) or a heat source (a light bulb is a good choice). The heat will cause the writing to darken to a brown shade.

The writing turns brown because the acid in the lemon juice weakens the paper, causing the weakened portion to burn before the rest of the paper. Be sure not to overdo your heating and ignite the paper!

An alternate method to reading the baking soda ink is to paint the paper with purple grape juice. The baking soda and grape juice create an acid-base reaction, producing a color change in the paper.

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Metallic Ink

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, 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.



What is a PMS Color?



PMS is an acronym for Pantone Matching System, a book of standardized color 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 determined by 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 are 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 Reps 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.

questions and answers