Ink Types

Nearly all types of ink can be placed into one of two main categories:

1. **Standard Printing Inks:** web offset ink (heatset and non-heatset), sheet-fed ink, soybean based ink, process ink for color printing, and others.
2. **Specialty Inks:** metallic, fluorescent, security, phosphorescent, and others.

Standard Ink Types

Web Offset Non-Heatset Ink

The non-heatset variety of web offset printing ink is a common type of ink used on web presses for newspaper and business forms printing. Non-Heatset ink is printed on absorbent, uncoated paper stock. Coated stocks should not be used with this type of ink because the paper will not completely absorb the ink, resulting in excess smudging and smearing.

Web Offset Heatset Ink

The heatset variety of web offset ink contains special varnishes that help the ink dry when heat is applied. Heatset presses are equipped with drier units for this purpose. Due to the varnishes, the ink printed on the paper is highly flammable, so the drying units must be specially built and properly maintained to avoid potential hazards. The main advantage of heatset ink is a printed product with a higher degree of quality.

Quickset Ink

Quickset ink contains a special varnish to speed the drying process. Unlike heatset ink, quickset ink does not require a heat source for proper drying and curing. The ink will not dry out on the press, but will dry quickly after it has been printed onto the substrate.

The are four basic processes that allows quickset ink to dry depending on the formulation: evaporation, absorption, oxidation, and polymerization. Newer types of quickset ink have a greater proportion of antioxidants and higher boiling-point distillates, which evaporate more slowly, so the absorption process plays a greater role with the newer inks. All four processes share equally in the ink curing process with older ink types.

Uncoated paper stocks are best suited for quickset ink. This is because the low viscosity distillates and antioxidants are quickly absorbed by the substrate, which leaves the remaining pigment and vehicle to dry quickly on the surface.

Sheet-fed Ink

Sheet-fed ink is manufactured specifically for sheet-fed presses and usually has a higher tack than web offset inks. The reason for this is that most sheet-fed presses run at slower speeds than web presses and a higher tack is necessary to provide the necessary quality.

Rubber-base Ink

Ink formulated with a rubber base is a good choice when flexibility in the printing process is important. Rubber-base ink can be printed on coated and uncoated paper and it dries quickly. It is most often used on small sheet-fed presses.

Soybean-base Ink

Soybean-base ink is becoming a popular alternative to petroleum-base ink because of the ease in which it is used and because it is environmentally friendly. Soy-base ink prints and handles similar to petroleum-base ink, but it is much less toxic because of the soybean oil. The soybean ink is biodegradable, meaning that it is eventually broken down and is much less hazardous to the environment. Some soy inks may contain petroleum additives, so if a client requires 100% soy-based ink for a print application, it is important to be fully informed on the type of soy ink that is used.

Water-base Ink

Water-base ink has been around for awhile, but it is still not as popular as other ink types. The usage of water-base ink may increase as environmental laws get tougher on the acceptable VOC (Volatile Organic Compounds) emissions generated from petroleum-base ink. Water-base ink emits no VOC's. It is safe to work with and the print quality is comparable to other ink types. Water-base ink is used mainly in flexography and gravure printing. It is a good choice for printers and customers who want their projects manufactured with nontoxic materials.

Laser Ink

Laser ink is specially formulated to withstand the extreme heat of the laser printer. If conventional ink is used for the preprinted portion of a document (such as an invoice or statement), the ink will melt in a laser printer because of the excessive heat produced by the laser printer. This results in damage to the preprinted document and possible damage to the laser printer because of ink adhering to the internal parts of the printer.

UV (Ultraviolet) Ink

Ultraviolet ink is formulated to cure and dry when exposed to a UV light source, unlike conventional ink, which dries through evaporation and absorption. Instead of being absorbed into the paper, the UV ink remains on the surface until it is exposed to the UV rays, which instantaneously transforms the ink into a hard film. UV ink can be applied to many types of substrates including paper, metal, vinyl, and glass.

Process Ink Colors

*Process ink colors are used in **Four Color Process Printing**. Cyan, magenta, yellow, and black are the colors necessary for this process and are formulated differently for different types of printing processes.*

High-Fidelity Ink Colors

***High-fidelity ink colors** are use in an advanced form of color printing, combining the standard four process colors of cyan, magenta, yellow, and black, with two more colors - usually orange and green. This allows for a greater color range, increased subtlety in the gradations of color, and additional vibrancy.*

Specialty Ink Types

Non-porous Ink

Non-porous ink is used for printing on substrates, such as metal or plastic, that do not allow ink to be absorbed into the material. Because the printing surface of these materials is nonabsorbent, the ink dries solely through oxidation rather than absorption.

Metallic Ink

Metallic ink provides a distinctive look to a variety of print applications. The ink is produced by blending different types of metallic powders into the ink mixture, such as aluminum powder to create a silver appearance and bronze powder to create a gold appearance. Some metallic inks can nearly duplicate the look of foil on some applications without the need to purchase the additional equipment required for foil stamping.

Metallic ink is more challenging for the press operator to control than conventional ink. One reason for this is that the metallic powder blended into the ink mixture cannot be ground as fine as other pigments because the metallic ink will lose its luster. The larger particles create problems on the press, especially with the offset lithography process. To overcome some of the special print problems, some printers do a double hit (running the piece through the press a second time to apply another coat of ink to strengthen the coverage).

Most printers require an up charge for the use of metallic ink on an application because the ink is more expensive to produce and makes the print job more time consuming. Metallic ink tends to have a much shorter shelf life than standard ink.

Magnetic Ink

Magnetic ink is comprised of a petroleum-base ink blended with magnetic iron oxide particles. The magnetic iron oxide particles allow documents printed with this type of ink to be read and sorted by electronic scanning equipment. Checks are an example of a document printed with magnetic ink. The MICR (Magnetic Ink Character Recognition) number at the bottom of the check is the only portion of the check printed with the magnetic ink. The remaining copy on the check is printed

with standard ink to ensure that no other printed area on the check interferes with the ability of the scanner to read the magnetic MICR number.

Fluorescent Ink

Fluorescent is another type of ink that can provide a distinctive look for a variety of print applications. Fluorescent ink colors are most often printed on labels, posters, and signs that are used for alerting people to hazards or attracting their attention to advertising pieces.

There are several points to consider when using fluorescent colors. The ink tends to fade quickly, so they should be kept out of direct sunlight. Because of their tendency to fade, fluorescent inks have a short shelf life. Another point to consider is that fluorescent ink is very transparent, so it may require a double hit (a second run through the press) in order to achieve the desired results. In spite of this potential problem, fluorescent ink is a good choice for creating emphasis and increased visibility.

Phosphorescent Ink

Applications printed with phosphorescent inks acquire a "glow in the dark" property after the phosphorescent area has been exposed to light. The length of time that an application will glow in the dark depends upon the ink ingredients and the length of time that the application is exposed to light. In some cases, a 10-30 minute exposure to light can yield an afterglow of up to 12 hours. The ingredients of phosphorescent ink are nontoxic and are free of radioactive additives. It is very useful for road signs, sporting goods, exit signs, safety products, toys, and novelty items.

Pearlescent Ink

Pearlescent ink is a specialty ink that is used to add highlights and depth to the printed area of an application. It is able to provide an almost 3-dimensional effect to some applications.

Edible Ink

Edible ink is used on print applications that may come into contact with food or the ink may be part of the food product and therefore it must be made of totally nontoxic ingredients. An example where edible inks are used would be in the monogramming found on some confectionery items. Because the inks are used on food items, they are strictly regulated by the government.

Scratch and Sniff Ink

Also known as a microencapsulated ink, scratch and sniff ink releases a fragrance when the microcapsules are broken. The scratch and sniff ink is commonly used in magazines for perfume advertisements. When the consumer scratches the surface of the designated area of the ad, the capsules are broken, releasing the fragrance.

Medical Device Ink

Ink used for printing on medical devices is made of nontoxic ingredients so that direct printing on noninvasive surgical and medical disposable items is possible.

Moisture Resistant Ink

Moisture resistant ink is most often used for different types of packaging or for applications that may be used outdoors.

Security Ink

There are a variety of inks that provide added security features to print applications. Some security inks allow documents to be created that are tamper proof, while the use of other types of security inks prevent documents from being copied. Security inks include the following varieties:

- Coin Reactive
- Bleeding
- Erasable
- Heat Reactive
- Visible Infrared
- Optically Variable
- Pen Reactive
- Penetrating
- Photochromic
- Solvent/Chemical Reactive
- Thermochromic
- Water Fugitive
- UV Invisible Fluorescent

Desensitizing Ink

Desensitizing ink is a transparent ink that is applied to the face of CF (Coated Front) and/or CFB (Coated Front and Back) carbonless paper in order to deactivate the CF coating. The use of desensitizing ink is important when an application requires that handwritten or imprinted data not be transferred through the various pages of a carbonless form in specific areas.

Electronic Ink

Electronic ink can be transformed from bright white to dark and then back to bright white again with a small electrical charge. The ink consists of plastic microcapsules that contain both dark dye and white ink chips. The microcapsules are sandwiched between thin layers of flexible material, which substitutes for traditional paper. When an electrical charge is applied, some of the white chips float to the top of some capsules to create a white surface and in other capsules, the white chips remain at the bottom allowing the dark fluid to remain visible. Different characters are created by applying the electrical charge under different combinations of capsules. After the initial electrical charge is applied, no further charge is required to hold the image in place, (unlike a computer monitor, which requires a constant

stream of energy in order to display an image). The content of the flexible page can be changed instantly and then be held on the page for as long as necessary. Although, this technology is still being perfected, it could be a major advancement in variable imaging and in the reduction of paper usage for some print applications.

Coating Types

When coatings are applied as an off-line process over dry ink, they create a bold effect, but when applied as an on-line process, they create a much more subtle effect over ink that is still wet. Among the most popular coatings are overprint varnishes, aqueous coatings, UV coatings, and EB coatings.

Overprint Varnish

Applied during the printing process or as an off-line process, overprint varnish is much like a solvent-based ink. The different varieties are usually colorless, but sometimes they are tinted to achieve a desired effect. Varnish can be applied as an all-over coat or in spots to highlight a specific area of a printed piece.

Overprint varnish is available in glossy, dull, or satin finishes. Gloss varnish creates a smooth surface over the paper, filling in any voids or irregularities that may be on the surface. Dull varnish also fills in irregularities to form a smooth surface, but it diffuses light that reflects back to the eyes, which creates a dull appearance. A nearly 3-D effect can be created by applying gloss varnish to a subject and dull or satin varnish to the background. The subject will appear to jump off the page. In addition to applying varnish as a solid coat, it can also be printed as a halftone (series of dots) in order to provide subtle effects and to provide printed objects with an increased dimensional appearance. The effects that can be achieved are endless when using different combinations of varnish, paper, and ink.

Besides design effects, another important aspect of varnish is the protection it provides. A coating of varnish over a printed piece protects it from the wear and tear that is part of every day handling, allowing the document to remain intact for a longer period. An all-over coat of satin varnish will protect the printed surface without drawing attention to the fact that varnish was used for protection purposes.

A disadvantage of varnish is that many of them are solvent-based. Solvent-based means that they emit VOCs while they are being applied, which can be a health hazard for the press operator unless the proper safety precautions are followed. Another disadvantage is that varnishes tend to yellow over time if they are formulated with tung or linseed oil. Varnishes with alkyd formulations will not yellow, but they are not as glossy or as hard as tung or linseed oil.

The use of varnishes on print applications should be planned early in the design process. They should not be applied as an afterthought in order to try to cover-up a poor choice in paper, ink, or design.

Aqueous Coating

An aqueous coating is usually applied during the printing process and can be applied as an all-over coat or in patterns or spot coatings. Like varnishes, an aqueous coating offers protection for the printed document and provides numerous effects for print applications. Aqueous coatings are available in gloss, matte, and satin finishes. Among the advantages that aqueous coatings have over solvent-based varnishes is that they will not yellow over time and they are less toxic and emit fewer VOCs.

UV Coating

UV coatings come in a liquid or paste form and remain as a liquid or paste until exposed to ultraviolet light. The printed page is covered with the UV coating and is then exposed to the UV light, which causes photoinitiators within the coating to immediately react, creating a hard protective finish. Ingredients called monomers give the coating its gloss and hardness characteristics. UV coating, which is also known as an Energy Curable coating, provides the best surface properties and protection for printed surfaces. Some of the benefits include:

- Greater opacity.
- Color stability.
- Deeper and more vibrant colors and color tones.
- Sharper graphics.
- Higher gloss.
- Uniform surface to give labels a more vibrant look.
- Scuff resistance.
- Instantaneous curing.
- Allows for in-line die cutting.
- Chemical resistance.
- Better outdoor endurance.
- Environmentally safe - No VOCs (Volatile Organic Compounds) are produced.

EB Ink/Coating

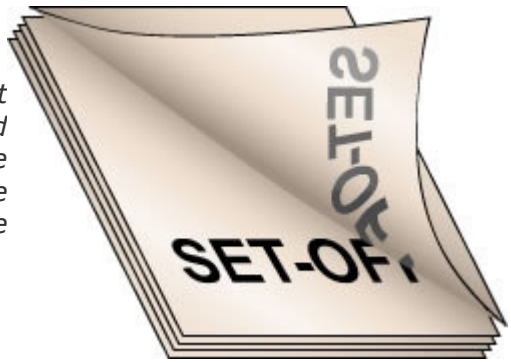
Like UV inks/coatings, EB (Electron Beam) is an energy curable coating, but it is hardened with the use of a concentrated beam of high energy electrons. EB inks/coatings do not contain photoinitiators because the high energy electron beam is all that is necessary to cure the surface.

Other Coatings

Other types of coatings include clay coatings to add strength and gloss to paper, whitewash coatings which are used as a finish coat for such items as Kraft paper, and grease resistant coatings used on applications for industrial and scientific uses.

Ink Related Printing Problems

Setoff



The transfer of ink from one sheet to the next sheet is known as setoff and is usually caused by too much ink being applied to the substrate and/or ink that is slow drying. The ink can be transferred from the front of one sheet to the back of the next and vice versa.

Slow Drying

One of the most common printing related problems is ink that dries too slowly. When ink dries slowly it may smudge and smear on the printed surface. The ink may also transfer from the front of one sheet to the back of the next one (setoff) and vice versa. Setoff is usually the result of too much ink being applied to the paper because of improper press settings. Both high humidity in the production area and high moisture content in the paper affect the ability of the ink to dry properly.

Poor Binding and Rub

This condition is sometimes confused with slow drying. With poor binding and rub, the ink is actually dry but the pigment can be easily rubbed off the surface. This can be caused by ink that does not have adequate bonding properties for the type of paper on which it is being printed. An excessive amount of the vehicle soaks into the paper leaving all of the pigment on the surface with nothing to hold it there. It is possible to salvage a print application with this problem by applying a coat of varnish to seal the pigment.

Ink Adhesion

Ink adhesion is actually the result of setoff and slow drying ink, which in turn are usually the result of poorly adjusted press settings. The quantity of ink applied to the sheet or web can be so excessive that the ink acts as an adhesive, causing the sheets stick together. A printed document with any of the printing from the front showing up on the back and/or the printing from the back showing up on the front, is a definite sign that the press settings were not adjusted correctly for the type of printing surface, the type of ink used, or the coverage area.

Mottling

Mottling is a condition referring to an uneven appearance in the solid portions of a printed document, which can be caused by uneven absorption of ink, nonabsorbent

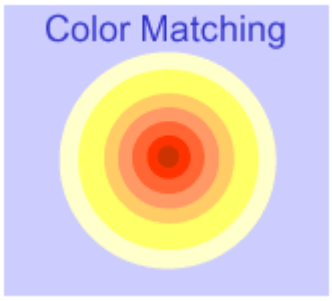
papers, the wrong ink for the particular paper used, or faulty press adjustments.

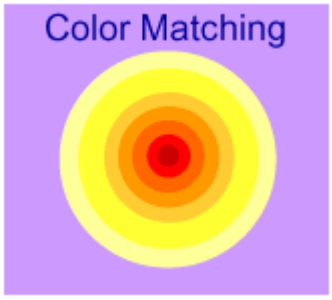
Fill-in

Fill-in can cause a muddy look in printed screens and halftones and a speckled appearance in highlight areas. Areas of detail may disappear entirely. The causes of fill-in are contamination of the ink with paper fibers, lint, dirt and dust; substandard ink; the wrong choice of ink for the job; and/or improper press settings.

Misting

Misting occurs when an ink with too much length is used on high-speed presses. Poorly adjusted ink rollers also contributes to the problem. The ink actually turns into a fine mist and if the problem is significant, the mist may create a fog in the press area. The mist makes contact with everything in the area, including the surface of the printed application. Misting can give the finished product a speckled and dirty appearance and create health hazards for press operators.





Piling

If a printed document has blotchy areas that are outlined by a non-printed line, it can be the result of piling. Piling is usually caused by faulty paper or ink. The paper may contain excessive paper dust or a poor coating. The coating may be partially removed as it passes through the press, adhering to the printing blanket and plate, causing the blotchy appearance. The vehicle in the ink may not carry the pigment properly, which allows the pigment to pile on the plate and blanket of the press.

Color Matching

Occasionally, a color that is printed does not match the color that was intended. As with many printing related problems, improper press settings can be the cause, but other variables may also contribute to the problem. Some of the variables are listed below.

- *The color and texture of the paper changes the printed colors, so the choice of paper must considered early in the planning stage of the project.*
- *Some of the ink colors can change slightly as they age, which may cause large color shifts, especially when older inks are mixed together to produce other colors.*
- *Lighting conditions influence the appearance of color, which is why it is very important for the customer and printer to have a good proof to work from.*

Trapping

Trapping refers to the alignment of colors on a printed document, such as a document printed with four-color process printing. Trapping may be required to correct the registration of colors on a print project. Successful trapping depends a

great deal on the tack of the ink. The first color printed on the sheet should have a higher tack than the second color printed, and so on. This will greatly improve the trapping abilities.

Show Through

Show through is a term used to describe when the printed area of a document shows through to the other side of the sheet. Show through is especially annoying when there is printing on both sides of the document. This is usually caused by the use of paper that is too thin or transparent or ink that is applied too heavily on the printing surface.