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PRINtips

How to Select the Right Paper for the Job

MacMillan Graphics, Ltd.
Park 50 TechneCenter
2002 Ford Circle
Milford, OH 45150
(513) 248-2121
Fax (513) 248-5141

Web site:
www.macgra.com

FTP site:
ftp.macgra.com

Email:
info@macgra.com

Inside

As printers, we love paper. Paper adds a design element, influences the impression, and contributes to the overall appeal of a printed piece. Paper is also a critical variable in how well a job runs on press, in a high-speed copier or digital printer, or through the laser printer on your desktop.

For most printing jobs, there is a paper whose characteristics are best for the application. For example, if the printed piece is a trifold brochure, a sheet with good folding characteristics will be best. If the piece has significant ink coverage, then a paper with superior ink holdout will perform best.

Here at MacMillan Graphics, it is our job to guide you through the many possibilities in order to match the paper to your printing project. This will be easier if you understand how the characteristics of paper affect the appropriateness for a specific printed piece.

Finish

The finish or surface of the paper has a significant effect on the final appearance of a printed piece. During manufacturing, paper fibers align themselves in an arrangement of peaks and valleys on the surface of the paper. The height of the peaks and depth of the valleys affect how the ink film lies on the surface. Ink film is approximately one micron thick; on a paper with little difference between the peaks and valleys, the ink density will be even, making the image appear sharp.

During the papermaking process, the paper surface can be altered by a process called *calendaring*. The paper is pressed between two rollers called *calendars* that smooth the surface. The greater the amount of calendaring, the smoother the surface.

Paper surface can also be altered by *sizing* or *coating*. Sizing is a solution added to paper to make it less absorbent. Sizing (rosin, glue, gelatin, starch, or modified cellulose) added to paper pulp is called *internal sizing*, while *external* or *surface* sizing treats the surface of the paper after it has dried. Sizing improves ink holdout.

Coating the surface of paper makes it smoother, imparts a sheen or gloss, and improves ink holdout. Kaolin clay is used as both filler and coating to impart gloss to paper. The gloss of the paper also affects the gloss of the ink – the glossier the paper, the glossier the ink. Depending on how much light the coating reflects, it will be termed *gloss* (high reflectivity) or *matte* (low reflectivity).

Writing, text, and cover papers may be given a finish either during the papermaking process or

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"Papers in different grades vary in content, appearance, end use, and original purpose."

after it is completed. Popular finishes include smooth, vellum, cockle, felt, laid, and linen.

Brightness, Whiteness, and Color

The brightness of a sheet of paper measures the percentage of a wavelength of blue light it reflects.

Most papers reflect 60-90% of light; the closer to 100, the brighter the paper. The brightness of a paper affects readability, the perception of ink color, and the contrast between light and dark hues.

Brightness is not related to either color or whiteness. Although there are many papers called *white*, all have a definite hue. Most have a blue white tint though there is a wide shade variety. Like brightness, the hue of the white affects the perception of ink color and contrast. Off-white sheets produce less glare.

Paper color is determined during the papermaking process by adding pigment to the pulp. The perception of ink color can be altered depending on the color of the paper.

Grain

The fibers in paper lie in a single direction. As paper pulp moves forward on the papermaking machine's wire screen, the fibers tend to align themselves in the direction of movement. When the grain runs the length of the paper, it is said to be *long*; when the grain is across the width of the paper, it is said to be *short*.

Grain direction directly affects paper strength and flexibility and therefore is important when a printed piece will be folded or made into a booklet. Folding long grain stresses paper fibers; folding short grain actually breaks them. When a fold must be made on the short grain, it is customary to *score* the sheet first to evenly break the fibers.

Grade

There are five basic categories of paper, called *grades*: bond, offset or uncoated book, coated book, text, and cover. Papers in different grades vary in content, appearance, end use, and original purpose. For example, the name *bond* was originally given to paper that was used to print bond and stock certificates. Today it is used to refer to paper used for letterheads, duplicating, and photocopying. Similarly, book paper was originally used to print books, and cover paper was used for book covers.

Within each grade there are other distinctions depending on the brightness, opacity, and fiber content of the paper. Uncoated writing, bond, offset, duplicating, and photocopying papers can also be referred to as *fine papers*.

Basis Weight, Caliper, and Bulk

The basis weight of paper is the weight in pounds of a ream (500 sheets) of paper cut to the basic size of its category. The basic size for bond paper is 17"x22"; for text, offset and coated papers 25"x38"; and 20"x26" for cover paper. A ream of bond in its basic size weighs 20 pounds; the equivalent weight for offset paper is 50 pounds and for cover is 27 pounds. *Pounds* is often indicated by using the # sign, as in 20# bond. Basis weight is also called *substance*.

Each paper grade has a range of basis weights: 16#-24# for bond; 50#-70# for offset; 50#-100# for coated book; 60#-100# for text; and 60#-100# for cover.

The thickness of paper is called the *caliper*; it is measured in thousands of an inch and referred to as *point size*. The caliper of paper is not related to basis weight – a smaller-sized, thick sheet may have the same basis weight as a thinner paper in a larger basic size.

Paper bulk defines thickness relative to basis weight. A paper may be bulkier than another grade while still having the same basis weight.

What it all means

From this description, we hope you can see that selecting paper means more than choosing a color and grade. Our knowledgeable customer service staff will guide you toward the grade that is best for your project. Call us at (513) 248-2121 for more information.

Q. *How does a tree become paper?*

A. Two types of trees are used to make paper: hardwood trees such as cottonwood and softwood trees such as Douglas fir and Ponderosa pine. Softwood trees provide long fibers that add strength to paper; hardwood trees provide shorter fibers that improve the ability of the paper to take a finish.

Paper mills often own forests from which trees are harvested. After cutting, trees are transported to the mill and converted to wood chips. The chips are sorted by size, then sent to a digester where they are cooked at high pressure to dissolve *lignin*, a substance in wood that holds the cellulose fibers together.

Because lignin is brown in color, the pulp that emerges from the digester is brown. It can be used for paper products such as cardboard, but for other purposes, the pulp must be bleached using a combination of chemicals and heat.

After bleaching, the pulp is moved to a papermaking machine called a Fourdrinier. The pulp or *stock* is sprayed onto a continuous screen called a *wire* that moves in an endless belt. Water is drained and sucked out of the porous wire; the pulp, which is about 3% solids when placed on the wire, is about 7% solids at the end of the wire.

From the wire, the stock is picked off the screen by a *felt* moving at the same speed. The stock goes through a series of rollers to squeeze out more water. At the end of this process, called the *press section*, the stock is 40-50% solids.

Next, the stock moves to the *dryer* that is composed of a series of rollers that are heated from the inside by dry steam and from the outside by hot air. After drying is complete, the stock is about 95% solids.

To improve the ability of the paper to take ink, a special coating called *sizing* is applied to the paper, then it is once again dried before being collected on a large roll at the end of the paper machine. From start to finish the paper travels approximately a quarter of a mile.

Q & A
questions and answers

"The stock goes through a series of rollers to squeeze out more water."

Add Impact with Embossing

Embossing is a way to add impact and appeal to business stationery, presentation folders, invitations, annual reports, personal stationery, or other printed products. Embossing raises the surface of selected areas of paper to create a dimensional effect. Many things can be embossed – type, a border, a logo or other image, for example. If the embossed area has not been printed, it is said to be *blind embossed*.

Embossing requires that paper be subjected to heat and pressure between two dies – one right-reading and one reversed. The force and heat causes the paper to assume the form of the dies.

Embossing can be as high as 1/8 inch, and the area around the embossing can become smooth and shiny, known an *ironing*.

Paper to be embossed must be carefully selected so it will assume the shape of the die without breaking or tearing. In general, the best paper for embossing is soft and uncoated with a high cotton content. Papers that are hard or have coating are more at risk for cracking and breaking during the embossing process. The critical factor is not bulk or thickness but tensile strength.

Ask us to see samples of embossed materials – you will quickly see how important the paper selection is.

TRICKS & tips

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Please Route to the Printing Buyer

Add Prestige with a Watermark

IDEA CORNER

"The watermark design displaces the fibers, which alters the thickness and opacity of the paper in those areas."

A *watermark* is a translucent image that is added to the fibers of paper during the papermaking process. Fine writing papers such as those used for business stationery are characterized by watermarks. Hold a sheet of Crane's or Strathmore paper up to the light, and you will see the watermark clearly. When watermarked paper is used to print letterheads and envelopes, it conveys a subtle sense of prestige.

A watermark can also provide a security feature. Since genuine watermarked paper cannot be duplicated, documents printed on it are protected by the watermark. For example, when United States currency was redesigned in 1995, a watermark of Benjamin Franklin was added to the $100 bill.

A genuine watermark is made while paper is still wet and moving through the wire portion of the Fourdrinier papermaking machine. The pulp or stock passes under a cylinder called a *dandy roll* on which the watermark design is located. The watermark design displaces the fibers, which alters the thickness and opacity of the paper in those areas. It is the variation in opacity that is seen as the watermark.

There are three positions for a watermark: *localized* meaning that the mark falls in the same position on every sheet (within a tolerance of one-half inch); *centralized* meaning the mark appears in the same vertical line on the sheet, though its top-to-bottom location may vary; and *random* meaning the watermark falls anywhere on the sheet. In this instance, the watermark may appear more than once on a single sheet.