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PRINTtips



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Printing Paper and the Environment

As printers, we have a special relationship to paper. Far more than appreciating its beauty, we understand its physical properties so we know how it will react to a specific set of production conditions. We know the latest trends in colors and finishes and whether new papers are being manufactured in response to new printing devices. We know the price of paper, and whether it is scarce or readily available.

Because paper is so integral to what we do, many of us learn its history and manufacturing process. And lately we've also been learning about paper's impact on the environment.

A brief history of paper

The word *paper* is from the Latin word *papyrus*, the Nile Delta plant from which Egyptians made their writing material. Known as a wetland sedge, papyrus-based writing material was abundant but fragile and susceptible to damage. It gradually gave way to parchment, a writing material made from animal hides.

What we know today as paper - writing material made of pulp, rags, and plant fibers - was invented by the Chinese almost 2000 years ago. The plant material they used was bark, primarily from the paper mulberry tree. (Today's paper is made from the tree's wood fibers which are more plentiful than bark but require more processing.)

For thousands of years after its invention, paper was made by hand and relied heavily on rags as the main fiber ingredient. It wasn't until the 19th century that steam-driven papermaking



machines were developed and wood became the main source of fiber.

How paper is made

The basic process of making paper is the same, whether done by hand or with machinery: the material containing the wood or plant fibers is soaked in liquid to separate the individual fibers; a screen is passed through the slurry to catch and orient the fibers; the liquid is removed from the fibers on the screen through pressing and drying; and the formed sheets are removed from the screen.

Today the two main sources of cellulose fiber for paper is wood pulp (a dry fibrous material made by separating fibers from wood); recycled paper; and vegetable fiber such as cotton and

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cereal crops such as straw. Wood pulp comes from both softwood trees (spruce, pine, fir, larch, hemlock) and hardwood trees (eucalyptus, aspen, birch) which are grown in pulpwood forests specifically for paper making. Thus paper is a natural, renewable resource that is biodegradable, recyclable, and a source of energy after use.

The ecology of pulpwood forests

There was a time in the past when pulpwood came from cutting mature forests. Today pulpwood comes from the parts of a tree (such as wood chips and sawdust) that are left after using the tree for other commercial purposes; from thinning a forest of trees; or from forests grown solely for paper making. In addition, several certifying bodies have become active to encourage sustainable forestry initiatives for trees used for paper as well as other products such as furniture or construction. Like all forests, pulpwood forests act as a “sink” for carbon dioxide because they take in more carbon dioxide from the atmosphere as part of the photosynthesis process than they give up through respiration and decomposition. And the younger the forest, the greater amount of carbon dioxide is sequestered in the trees.

The role of water in paper making

Because it is used in almost every stage of the pulping and paper making process, water is an important part of the paper manufacturing process. Almost all early paper mills were located next to rivers to ensure a dependable source of water.

Unfortunately, early mills contributed to water pollution by discharging waste water contaminated by solid matter, nitrogen, phosphorus, and organic substances back into the rivers. In response to stricter environmental controls, paper mills now recycle water and collect contaminated water for treatment prior to being returned to its source.

Energy used for paper making

Manufacturing paper is energy intensive. In fact, up to 25% of the total manufacturing cost can be attributed to energy consumption, providing

an economic incentive for paper mills to practice energy efficiency.

Modern paper making plants produce biomass fuels as a byproduct of the manufacturing process, which in turn are used as a source of energy during manufacturing. (Biomass is organic material made from plants and animals and contains stored energy from the sun. Some examples of biomass fuels are wood, crops, manure, and some garbage.) Since the most common form of biomass is wood, many paper mills use wood waste to produce the energy needed to power their operations. In fact, the pulp and paper industry is the single largest producer and user of biomass fuels.

Recycled paper

About 30% of the raw material for making paper today is paper that has been recovered during recycling, called *post consumer waste*. Paper mills have always recycled scraps, called *mill broke*, which is *pre consumer waste* and so doesn't really count as recycled paper.

Not all paper that has been collected for recycling can be used in all paper grades. Every time a paper fiber is recycled, it loses some of its length, and therefore some of its strength. So recovered paper must be mixed with some virgin fibers, and cannot be used indefinitely. Some recovered paper must be deinked before it can be reused

The first step in using recovered paper is to sort it according to grade:

- *Low grades* consisting of mixed papers, old corrugated containers, board, etc.) are used to produce packaging papers and boards. Most recovered paper is used in low grade applications.
- *Deinking grades* such as newspapers and magazines are also considered to be low grades and are used for graphics and sanitary papers.
- *High grades* consisting of mill broke and other scrap can be used as a pulp substitute.

After the recovered paper is sorted and graded, it is delivered to a paper mill where it is made into

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pulp. Contaminants such as staples, plastic, and glass are removed, then the fibers progressively cleaned. The pulp is filtered and screened as the final step before being made into paper.

Paper and the carbon cycle

As a forest product, paper is part of a carbon cycle that begins with photosynthesis and produces a biomass fuel as a byproduct. After use, many paper products can be collected and recovered, to be re-used as a raw material to make more paper or paper products.

As you might surmise from the topic of this issue of Printips, we are committed to doing our part to conserve, reuse, recycle, and be responsible for the paper we purchase and use in your printing projects. Here are some of the ways we carry out that responsibility:

- We encourage press operators to minimize the use of paper. Each printing job requires *makeready* – an amount of paper going through

the press to get the image in the correct location on the sheet, to register the parts of the image, and get up to color. When possible, press operators use scrap paper that would otherwise be discarded. We have set standards for the amount of extra sheets to print to allow for post-press operations. There are sheet counters on all presses so there is no guessing about how much paper has been printed.

- We encourage you to use the paper we stock as house sheets. When you let us use our house sheet for your job instead of a special-order paper, you keep us from having to order more than we need for the job. We must purchase paper in a minimum quantity of 500 sheets, and sometimes in a minimum quantity of 4000 or 5000 sheets in a carton. If your job needs 1235 sheets and you are using a house sheet, we will use 1235 sheets. If we must order, the job will require 1500 sheets.

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Basis or Substance Weight Defined

 One confusing aspect of paper is its *basis* or *substance* weight, the number that refers to the weight of a ream of paper (500 sheets) in its parent size (*i.e.*, the size the sheet was originally made in). Each category of paper has a different parent size, ranging from 17 x 22 inches for bond papers, to 23 x 35 inches for writing papers, and 25 x 38 inches for text papers. For bond papers, a ream in the parent size weighs 20#, while a ream of writing paper weighs 24# and text paper weighs 70#.

Moreover, the basis weight isn't a particularly useful thing to know. Most often what you are interested in is the thickness of the paper, and that is not defined by the basis or substance weight. To compare thicknesses, you must know the micrometer measurement of the paper. But don't worry too much about basis weight and micrometer measurement. We can guide you through paper selection and will be happy to provide a sample sheet for you to inspect.



“Most often what you are interested in is the thickness of the paper...”

Consider using Watermarked Paper



“A watermark is a translucent image that is added to the fibers of paper”

To add an elegant touch to your business letterheads, consider using a water marked paper. A *watermark* is a translucent image that is added to the fibers of paper during the papermaking process. Hold a fine writing paper such those made by Crane’s or Strathmore up to the light and you’ll see the watermark clearly.

Besides beauty, a watermark also provides 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.



“When exposed to light and oxygen, lignin reacts and turns paper yellow.”

Q. What is archival paper?

A. Archival paper, also called *acid-free paper*, is paper with a neutral or basic pH (7 or slightly greater) that is used for preserving documents. Paper made from wood pulp can contain a significant amount of aluminum sulfate salts, called *alum*, which

are acidic. The cellulose fibers in paper are hydrolyzed by acid, making them degrade. Other papers may contain a significant amount of lignin, a major component of wood. When exposed to light and oxygen, lignin reacts and turns paper yellow.

If you are printing an important document that you want to last for a long time, ask us to order an acid-free paper for you. The extra cost is minimal compared to shortening the life of your document.