



All About Paper



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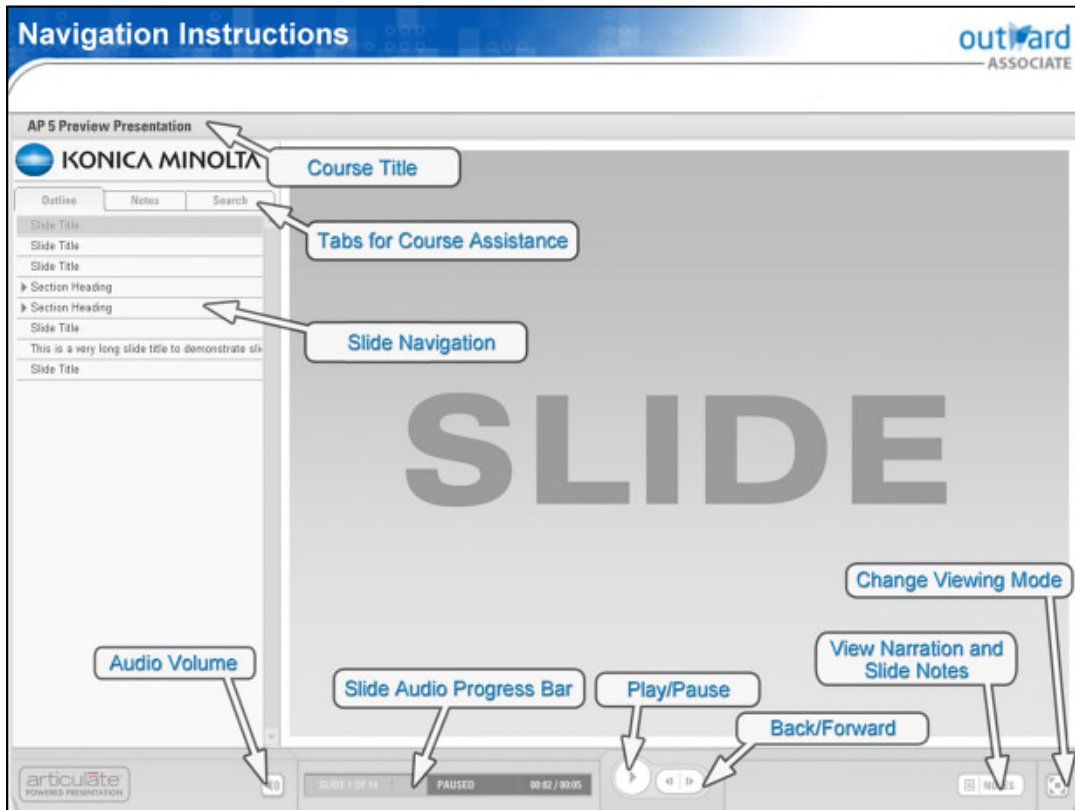
All About Paper

The objectives for this course are:

- To understand the paper process and the potential issues that can affect performance.
- To identify different kinds of paper and weights.
- To understand how the care for storage and handling can affect performance.

Please Note: Estimated time completion of this module is 30 – 40 minutes

These are the objectives for the course.



Here are the instructions on how to navigate through this course.

■ Paper

Paper is an important part of the copy process. Printers and copiers are designed to perform well with a variety of papers. Understanding paper and the potential issues related to various papers should help you identify issues earlier.

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Lessons

The following lessons are covered in this course:

- Lesson 1: Paper Manufacturing Basics
- Lesson 2: Paper Characteristics
- Lesson 3: Paper Specifications
- Lesson 4: Types of Paper
- Lesson 5: Troubleshooting

The following lessons are covered in this course.

Paper Manufacturing Basics

The topics of discussion are:

- General Statement
- Basic Structure
- Wood Types
- Combining Fibers
- Basic Materials
- Manufacturing Process
- Forming Paper
- Recycled Paper
- Coated Paper

The following topics of Paper Manufacturing Basics will be covered in this lesson.

1.1 General Statement

Before we can get into the details of paper, we need to get a basic understanding and appreciation for how paper is made. This will give us the information necessary to delve into the program and see how paper can be a factor in machine reliability.

In this section, we will be looking at **Paper Manufacturing Basics** along with the **Basic Materials**, as well as the **Process of Manufacturing**.

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1.2 Basic Structure

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Trunk

Just look at a tree trunk. The bark protects the inner wood from weather, insects and other dangers. Just inside the bark is a thin layer called the cambium, whose cells become both bark and inner wood.

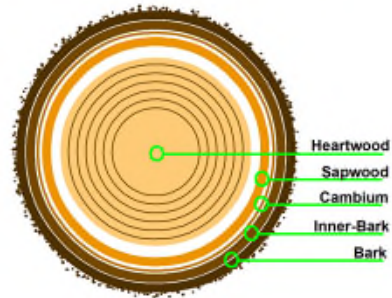
Sapwood

Sapwood carries sap throughout the tree.

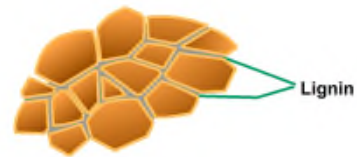
Heartwood

Heartwood is the innermost part of the trunk, and even though it isn't alive, it provides the tree with strength and structure.

All that wood material is comprised of fibers. Those fibers are tiny cellulose strands. The strands are bound together with a natural adhesive called lignin. Paper is made by separating and reorganizing those fibers.



Tree trunk cross-section



Plant Fibers

If you really want to know about paper and papermaking, you've got to get to know trees. Trees are all around you. However, have you ever really thought about how they're put together? They're pretty cool.

These are the parts of trees that relate to paper composition.

1.3 Wood Types (1/2)

Foresters divide trees into 2 categories: Hardwood and Softwood species.

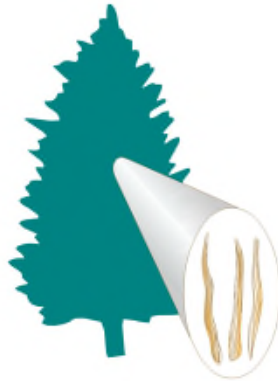
Hardwood trees are identified by the broad leaves they produce during the growing season.



Hardwood trees such as oak, maple, poplar, birch, and beech have wood with very short fibers. Paper made from these species is weaker than that made from softwoods, but its surface is smoother. Therefore, paper made from hardwood trees is better to write and print on.

Wood is wood? Yes, but its not that simple. Each tree species grows a certain way, and that affects the way its wood looks and performs. Foresters divide trees into two categories: hardwood and softwood species. Hardwood trees are identified by their broad leaves and short wood fibers.

Softwood trees—such as the many varieties of pine, spruce, hemlock, and fir, are identified by their needles.



These trees have wood with long fibers, and paper made from this type of wood is much stronger. Softwood fibers are twice as long as the hardwoods, ranging from about 3 to more than 5 mm in length. The longer fibers add strength to the finished paper.

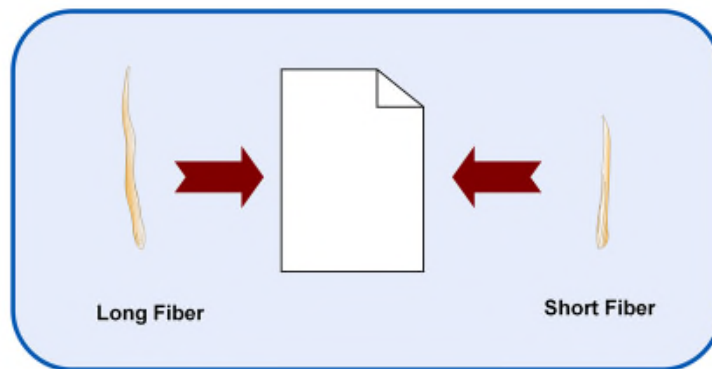
Paper made from softwood is ideal for making products like shipping containers that require superior strength. However, the finish is rougher, and that's not as good for writing, printing and many other uses.

Softwood trees are identified by their needles and long wood fibers.

1.4 Combining Fibers

While softwood and hardwood pulp are both utilized in papermaking, softwood pulp is used to a much greater extent. Softwood fibers add strength to a sheet of paper, while the short fibered hardwoods fill the gaps and give a tighter mesh to the paper.

- We can blend fiber from hardwoods and softwoods into a single paper, achieving the correct combination of strength, whiteness, writing surface and other characteristics that we want.
- Most of the paper you see today is made from hardwoods and softwoods; a special blend for each purpose.



Paper is typically composed of a combination of long and short fibers of wood.

1.5 Basic Materials

Some paper is made brand-new from trees: either small trees harvested just for that purpose, or from sawmill scraps left over when larger trees are made into lumber. A second source of papermaking material is recycled fiber. Each year, more and more paper is recycled - its fibers used a second, third or fourth time. Every year, about 50% of the paper Americans use is recovered for recycling and other uses. Another source of the raw material is recovered paper. Although some papers contain 100 percent recycled fiber, papermakers often combine various amounts of recycled and new fiber to produce the desired quality and grade of paper.

Only about one-third of the fiber used to make paper in the U.S. is from whole trees, which the industry calls round wood. It is not considered economical to use large logs for paper when they could instead be used for lumber. For this reason, only trees smaller than 8 inches in diameter, or larger trees not suitable for solid wood products, are typically harvested for papermaking.

Almost all of the paper you use today is made of wood fibers, although some specialty papers, like stationery and money, are made from linen, cotton, or other plants. Other papers contain a combination of cellulose fibers and synthetics such as latex.

The basic recipe - wood, water and energy - is adjusted to make just the paper that's needed.

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1.6 Manufacturing Process (1/2)

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Papermaking starts with the pulping process.

In the pulping stage, the individual wood fibers in the chips must be separated from one another. This can be accomplished using one or more pulping techniques. The type of paper that's being made determines the pulping process that is used.

The finished pulp looks like a mushy, watery solution. But if you look at it under a microscope, you will see that the individual wood fibers have all been separated.

There are two methods of pulping, **mechanical** and **chemical**.

The mechanical process involves grinding the whole log to a pulpy mass by abrasion.

The chemical method requires that wood chips be fed into a digester and cooked to remove resins, gums and other undesirable components.

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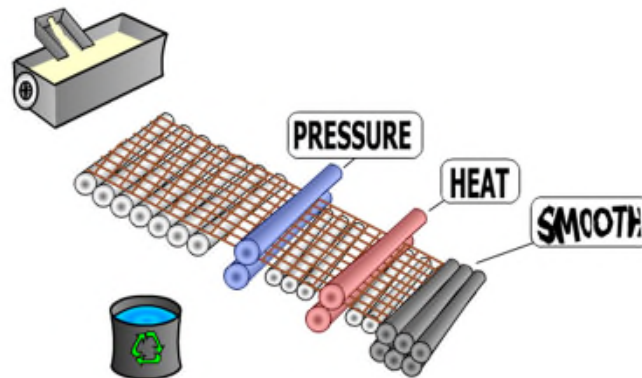
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1.7 Forming Paper (1/6)

Now it's time to make paper out of our pulp. The preparations have already been made including bleaching, washing, refining, and adding required chemicals to the mixture. That means getting the water out of the wood-fiber soup. Since this papermaking stock is about 95% water, how the fibers are forming have an effect on the curl, opacity, porosity and stiffness of the paper. This is an important process. The first area in which this takes place is called the **wet end** of the papermaking machine (Fourdrinier) referred as a head box or distribution unit.



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■ Wet End

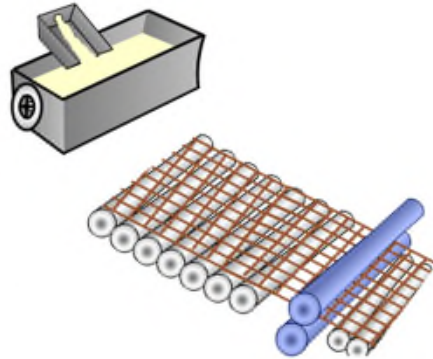
Fibers and additives are thoroughly diluted in this heavily watered slurry. The fibrous mixture pours onto a long, wide screen, called a traveling wire mesh of the Fourdrinier machine. Water immediately begins to drain out the bottom of the wire. This water is collected so that it can be reused repeatedly. Meanwhile, the pulp fibers are caught on the topside of the wire, and begin to bond together in a very thin mat. The fiber mat remaining on the wire is squeezed between felt-covered press rollers to absorb more of the water.

The WIRE or FELT side terminology is used when talking about what side of paper is up. This was from the paper manufacturing process that those terms were coined.

Another important fact is that fine paper, such as book, text, and uncoated printing paper has a "grain direction" corresponding to the direction of flow along the wire.

This is important because the grain will have a bearing in printing and folding. A sheet folds better with the grain than against it.

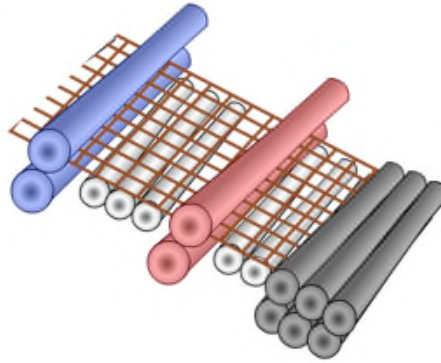
Even when this wet end work is over, the pulpy stuff on the wire is still about 60% water.



The wood fiber and water mixture is compressed during the wet end process to reduce water content and produce a grain direction.

In the **dry end**, huge metal cylinders are heated by filling them with steam. The wet paper, which can be up to 30 or 40 feet wide, passes through these hot rollers, sometimes dozens of them, and often in three to five groups. Heating and drying the wet sheet causes the fibers to bind closer and closer together, turning them gradually from pulp into paper. This process of gradual evaporation ensures that the paper achieves desired moisture content upon completion of the manufacturing process. A final moisture content of between 4% and 6% is generally reached. This figure is predetermined by the mill. The paper must not reach 100% dryness or it will become too brittle.

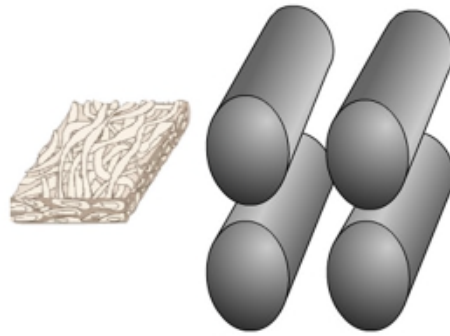
In some cases, the paper undergoes a sizing or coating process.



NOTE: The dry end can be up to 9.144 - 12.192 meters in width.

The dry end process heats, dries, and compresses the wood fibers into raw paper.

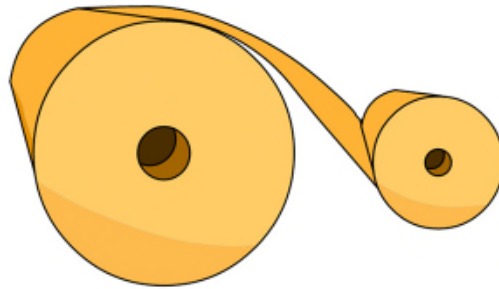
Calendered Stocks have been pressed between steel rollers in order to compress the fibers in the stock. The calendering process smooths the surface and decreases the absorbency of the paper. Super calendering will compress the stock even more, eliminating voids in the surface and decreasing the thickness of the stock as shown here.



When you look at a piece of paper, can you find any difference in thickness in that single sheet? Probably not, thanks to a part of the paper machine called the calender - big, heavy cast iron rollers that press the drying paper smooth and uniform in thickness.

Raw paper is rolled into large spools, or reels, for future use.

With a bit more drying, the paper is rolled onto a big spool or reel. The pulp - a miraculous mat of fibers from trees - has become paper, ready for a thousand uses.



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1.8 Recycled Paper (1/2)

Recycled paper may be composed of **pre-consumer** or **post-consumer** paper. What's the difference between pre-consumer and post-consumer paper?

Pre-consumer recovered paper consists of trimmings and scraps from printing, carton manufacturing, or other converting processes that are reused to make pulp without reaching the final consumer.

Post-consumer recovered paper (like old corrugated boxes, newspapers, magazines, and office paper), has been used by the ultimate consumer and is then returned to the mill for recycling.



Pre-consumer paper



Post-consumer paper

Pre-consumer paper comes from manufacturing, while post-consumer paper is reclaimed from final consumers of products.

The **Environmental Protection Agency (EPA)** in the U.S. issued "Paper Products Recovered Materials Advisory Notice II" on June 8 1998. It described that government purchase of all the uncoated printing and writing grades containing 30% post consumer fiber.

The nature of the post-consumer material includes foreign materials. It may contain adhesives (from window envelopes, stick-on notes, labels, etc.), which are very difficult to remove, or certain types of toner and ink. During the recycling process, the fibers are changed. Recycled papers are less uniform in content and quality than papers made entirely from virgin fibers. It tends to curl variability (resulting in jams), and it can cause contamination of machine components resulting in reduction of their life cycles.

NOTE: Please use recommended recycled papers only for the best-feed performance and image quality available.

These are things to consider when using recycled paper for printing.

1.9 Coated Paper

The definition of **coated paper** is very broad. Coated papers include: thermal paper, ink jet paper, and offset printing paper. The more popular coated papers are offset printing paper and letterpress, lithography, or gravure – coated papers.

Halftones (photographic illustrations) have more snap and sharpness than when produced on uncoated paper. Four-color process by all printing methods offers rich-appearing images because of the smooth surface on which they are printed, as well as the reflective whiteness of the paper.

The higher grades of coated paper are usually manufactured as a separate operation off the machine, sometimes with several layers of coating to ensure better quality and smoothness.

The combination of a slight contamination of the feed/transport rolls and belts and the extremely smooth surface of the coated paper, tends to increase the number of misfeed jams over time.

For copiers and printers, use recommended coated paper that provides better quality and reduced paper problems.

These are the considerations when using coated paper for printing and copying.

1.10 Quiz

Question 1 of 6 ▾

Point Value: 10

Paper made from Softwood is ideal for making writing and printing paper.

- True
- False

PROPERTIES

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Properties...



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1.11 Review

You should now have a basic understanding of how paper is manufactured and the effects that the manufacturing processes have on the characteristics of paper.

Next, we will delve more deeply into the characteristics of paper. We will also examine how the characteristics of paper affect the performance of copiers and printers.

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Paper Characteristics

The topics of discussion are:

- Copy Process Influences
- ISO Size Standards
- North American Size Standards

The following topics of Paper Characteristics will be covered in this lesson.

2.1 Copy Process Influences

When most people think of paper they see it as a tool or medium for storing and transferring information. The average person might describe a sheet of paper as being white or some other color, flat, smooth or textured and will observe it as being of some size. All are excellent observations, however, the average person will not recognize the subtle nuances of paper, nor will they recognize what impact the various characteristics of paper have on the copy/print process itself.

Let's take a look at the characteristics of paper, the nuances of each basic characteristic, and how those details impact the copy process.

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2.2 ISO Size Standards (1/2)

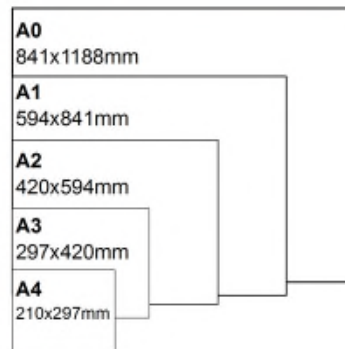
The **International Organization for Standardization (ISO)** has established standards for paper sizes based on the metric system.

The "A" series is the most commonly used with sizes ranging from A0, which is the largest, down to A8. The A-series sizes are represented as a part of the area of one square meter with a length to width ratio of 1.414.

Size A0 is equivalent to the area of one square meter with each smaller size being 50% of the size of the preceding one. A1 is 50% of the area of A0; A2 is 50% of A1, and so on.

Another way to look at it is that an A0 sheet cut in half yields two A1 sheets, and an A1 sheet cut in half yields two A2 sheets.

Shown here are some of the sizes in the A-series.



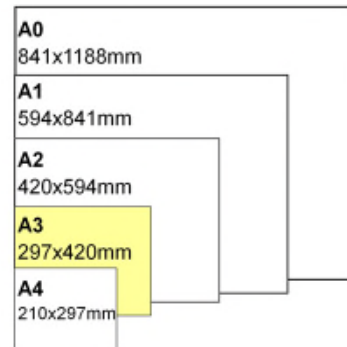
These are the established paper sizes according to the International Organization for Standardization, or ISO.

Size A3 paper plays an increasingly important role in Konica Minolta's worldwide business.

Since it is an equivalent to tabloid (11" x 17") paper, A3 paper is appropriate for printing documents such as:

- Bi-fold Brochures
- Advertising Documents
- Banners
- Databases
- Marketing/Planning Charts
- Technical Drawings

With the increased usage of color printing, A3 will play an important part as more of our customers demand it.



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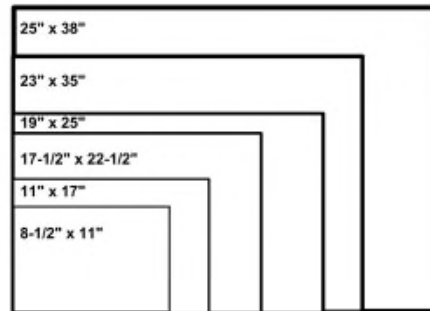
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2.3 North American Size Standards (1/2)

Although the ISO size standards are common in many parts of the world where the metric system is the established standard for measurement, North American sheet sizes are based on inches.

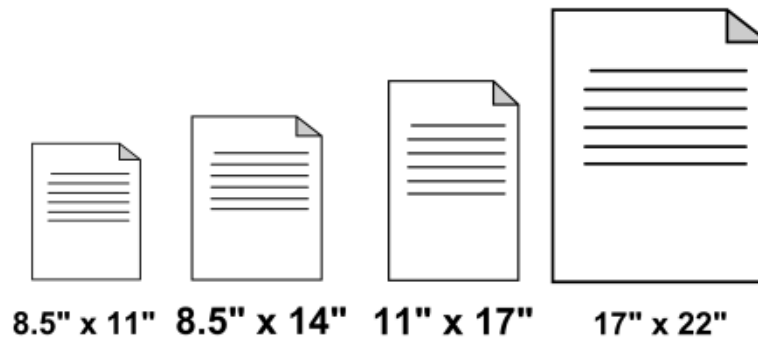
Shown here are some of the standard North American sizes.



These are examples of the North American sheet sizes.

Size of paper in the US market is based on categories of paper.

- In North America, the most common size of cut sheet for copier/printers is 8.5"x11" (Letter Size) that is based on a size of 17"x22". (Letter being a quarter of the size of the 17" x 22")
- Other popular sizes are 8.5"x14" (Legal Size), and 11"x17" (Ledger Size).
- The other sizes such as 12"x18" and 9"x12" are becoming popular for color applications.
- These paper sizes are based on paper sizes used in offset printing.
- Engineering paper sizes are also in this category with sizes such as 9"x12" (A size) 12"x18" (B size), 18"x 24" (C size), 24"x36" (D), 36"x48" (E size).



Here is a selection of popular paper sizes in North America.

2.4 Quiz

Question 1 of 4

Point Value: 25

Size of paper in the US (North American) market is based on caterogies of paper.

- True
- False

PROPERTIES

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Properties...



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2.5 Review

You have learned about two of the most important sets of standards in the paper industry. The differences in standards become more and more important to understand with the globalization of business.

Given that there are two different standards in the sizes of paper, it's not hard to make the assumption that there are two sets of standards for the weights of paper. Let's take a look at those standards now.

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Paper Specifications

The topics of discussion are:

- Basis Weight
- Basic Size and Basic Weight
- Measuring Thickness
- Conversions
- Paper Curl
- Grain
- Moisture
- Storage Area
- Packaging
- Paper Handling
- Electrical Properties
- Brightness
- Opacity
- Smoothness
- Finish
- Whiteness
- Lint

The following topics of Paper Specifications will be covered in this lesson.

3.1 Basis Weight

Basis weight in North America is defined as the weight in pounds of a ream (500 sheets) of paper.

In other countries (Europe, and Asia), basis weight is defined using grams per square meter (gsm or g/m^2) as defined by the International Standards Organization (ISO).

The North American system is somewhat complicated by the fact that different paper categories use different sheet sizes as a means of identifying basis weight.

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3.2 Basic Size and Basis Weight

The basis weight refers to the weight in pounds of 500 sheets of paper when it has been cut to that paper categories (Bond, Ledger, Cover, etc.) standard basic size.

For example, the basic size for Bond paper is 17 x 22 inches. If 500 sheets (a ream) of Bond is cut to its basic size of 17 x 22 inches and weighs 20 pounds, it is classified as 20 lb. bond.

If a 17" x 22" ream of Bond paper weighed 24 pounds it would be called 24 lb. Bond, and so on. The chart shown here contains some common paper types and their basic sizes.

In the Metric system, basis weight is based on the weight of ONE sheet, one square meter in size (A0 size) and is measured in grams per square meter (GSM or g/m²).

This avoids much confusion, as *GSM is an absolute value (regardless of the type of paper)*.

Paper Type	Basic Size
Bond	17" x 22"
Ledger	17" x 22"
Offset	25" x 38"
Book	25" x 38"
Cover	20" x 26"
Index Bristol	25-1/2" x 30-1/2"
Vellum Bristol	22-1/2" x 28-1/2"
Printing Bristol	22-1/2" x 28-1/2"
Tag	24" x 36"

Weight	Bond	Offset	Cover	Tag	Index	Points	*Caliper	millimeter	Metric
							(inches)		(grams/sq meter)
16	41	22	37	33	3.2	0.0032	0.081	60.15 gsm	
18	45	24	41	37	3.6	0.0036	0.092	66.61 gsm	
20	50	27	45	41	3.8	0.0038	0.097	74.01 gsm	
24	60	32	55	49	4.8	0.0048	0.12	88.81 gsm	

[More information on ISO sizes](#)

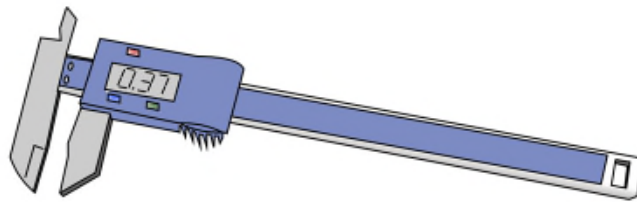
This chart shows some common paper types and their basic sizes.

3.3 Measuring Thickness

Caliper refers to the thickness of a sheet of paper. The readings are taken with a caliper or micrometer gauge, which measures the thickness of the paper in thousandths of an inch.

For copiers/printers, caliper is a very important factor from a technical point of view. The uniformity of a sheet's caliper or thickness is vital to performance in copiers/printers.

Variations in paper thickness lead to problems not only with paper jamming but also with image consistency such as solid-area mottling.



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Variations in paper thickness lead to problems not only with paper jamming but also with image consistency such as solid-area mottling.

Click on the button below to display a chart detailing the actual thickness of various weights and grades of paper.

Common Weight Chart

Click on the button below to display a chart detailing the actual thickness of various weights and grades of paper.

3.4 Conversions (1/3)

We learned that there are two different standards in size and weight in particular. This must mean that there is also a way to describe the size and weight characteristics in each language (NA and ISO). However, to translate the sizes and weights from North American Standards to ISO standards we have to use a little math. Take a look at how to convert size and weight from North American standards to ISO and ISO to North American standards.



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As defined by ISO, paper size is described in metric measure, more specifically in millimeters. The first conversion ratio is how many millimeters there is in an inch. There are 25.4 millimeters in one inch.

The conversion procedure involves multiplying the inches by the conversion factor (25.4), and rounding off to the nearest millimeter.

This is the process for size conversion between the standards. Refer to the Notes page for detailed information.

NOTES: For example, to convert the size of the standard 8 1/2 x 11 letter size from inches to millimeters:

Multiply the width in inches by the conversion factor: $8 \frac{1}{2}'' \times 25.4 \text{ mm} = 215.9 \text{ mm}$

Round the product off to the nearest millimeter: 216mm

Multiply the length in inches by the conversion factor: $11'' \times 25.4 \text{ mm} = 279.4 \text{ mm}$.

Round the product off to the nearest millimeter: 279mm

The measurement therefore becomes: US Letter (8 1/2'' x 11'') = 216 mm x 279 mm.

This process can be reversed to determine the inch size of paper (or anything else) initially describe in millimeters.

We saw earlier that ISO A4 paper is 210mm x 297mm. How would we find out what the inch size of A4 is?

We would take the width and divide by the conversion factor: $210/25.4 = 8.2677$

Round the quotient off to the nearest 1/4 inch: 8 1/4

Divide the length by the conversion factor: $297/25.4 = 11.6929$

Round the quotient off to the nearest 1/4 inch: 11 3/4

The measurement therefore becomes: ISO A4 (210mm x 297mm) = 8 1/4'' x 11 3/4''

The metric basis **weight of paper** is stated in grams per square meter (g/m^2).

To convert to metric standard, you must know which North American paper category you are converting. This is important because the North American basis size is a critical component of the conversion calculation. Remember, 20 lb. Bond has a basis size of 17" x 22", but Book paper has a basis size of 25" x 38".

This conversion is a little tricky in that we have to convert both weight and size to reach grams per square meter.

To convert North American basis weight to grams per square meter:

Convert the weight in pounds to metric grams:

Basis weight (lbs) x 453.6 = Metric Weight (g)

Convert the area of the basis size sheet from square inches to square centimeters:

Total square inches x 2.54 x 2.54 = Total square centimeters (cm^2)

Convert square centimeters result to square meters:

Total square centimeters x 0.0001 = Total square meters (m^2)

The resulting number is the metric weight of the paper:

Metric Weight (g), Total square meters (m^2) = Metric Paper Weight (g/m^2)

This is the process for weight conversion between the standards. Refer to the Notes page for detailed information.

NOTES:

For example:

To begin, you must keep in mind the following facts:

Typical Copier/printer paper is 20 pounds.

When used in a copier/printer it is usually 8.5"x11" in size.

However, this paper is category of Business paper, and the standard size used to determine basis weight is 17" x 22".

The weight of 500-sheet of this standard is 20 pounds.

The formula used in this conversion is:

Basis weight (lbs.) x 1406.16/(basis size)

For example:

To convert from 20 lbs of Business paper (Standard size; 17 "x 22"):Therefore, 20 Bond would be equivalent to 75 g/m^2 .

To convert from 50 lbs of Book paper (Standard size; 25" x 38"):%

Therefore 50 lb. Book would be equivalent to 74 g/m^2 .

To convert from g/m^2 to pounds the procedure is reversed:%

Multiply the g/m^2 by the square inches in the base sheet and divide by 1406.16.

3.5 Paper Curl

The combination of moisture content and characteristics of fiber cause the paper to curl. It's also related to the formation of paper fibers. As you may recall, the paper's moisture content is controlled during the manufacturing process. If the paper moisture changes between shipping points and points of consumption, due to poor storage of paper next to sources of heat or cold such as by open windows in low temperatures or in non-humidity controlled storerooms, the condition of paper fiber is changed. A curl will result due to this imbalance of humidity/moisture between the front and backsides of the paper. Heavier paper, and one side coated papers are particularly susceptible to curling.

Proper paper storage is very important in preventing curling problems. Even when sheet of paper is flat, if it contains high amounts of moisture, it may cause a curl problem after passing through the fusing section.

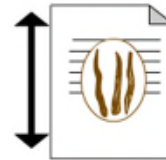
Paper Curl is a very common problem. No paper, because of its very nature, is immune to the absorption or evaporation of moisture unless treated with wax or some other chemical surface binder. Paper curl can negatively impact proper printing and copying, and paper should be properly stored to minimize the impact of environmental conditions that might increase the possibility of paper curl.

3.6 Grain (1/2)

The grain of the paper refers to the direction of the fibers in a sheet of paper. The grain direction results from how the paper fibers lie parallel with one another during the paper manufacturing process in the direction they ran in respect to the wire belt. This grain direction effects how the paper will curl.

Long grain paper refers to paper in which the fibers run in the same direction as the longest measurement of the paper.

Short grain paper refers to paper in which the fibers run in the same direction as the shortest measurement of the paper.



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Long grain paper refers to paper in which the fibers run in the same direction as the longest measurement of the paper.

Short grain paper refers to paper in which the fibers run in the same direction as the shortest measurement of the paper.

Refer to the Notes page for additional information.

NOTES: Question? How is most letter paper fed thru the copier/printer?

Answer: Crosswise or sometimes referred as Speed Letter. This due to the fact that CPM or PPM is faster in this direction than Letter Lengthwise or Letter S direction. But, most papers used in copier/printers today are Long Grain paper, which means it will feed better in the Letter Lengthwise direction. So, when using Long Grain Letter Paper in the Letter Crosswise direction, the copier or printer has more of a chance of having a misfeed or paper jams due to the paper curling.

There are several methods to check the grain direction:

- One method used to determine the grain is to fold a sheet of paper lengthwise, then make a crosswise fold. Compare the two folds. Paper folds smoothly with the grain. Cross-grain folds tend to be rough and cracked.
- Another method used to determine the grain direction of a sheet of paper is to tear the sheet widthwise. Paper always tears straighter with the grain.

For best copier and printer performance, the grain direction should be parallel to the long side of the sheet. Long-grain papers are about twice as stiff in the long direction. Short-grain papers are about twice as stiff in the short direction.

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3.7 Moisture

Paper moisture is one of the most important properties of paper for copiers and printers. Upon completion of the paper manufacturing process, the moisture content would be between 4% and 6%, depending on the grade and application.

The paper's moisture content is tied directly to its dimensional stability and strength. Too much moisture causes excessive curl, jams, and print quality problems. If the paper's moisture content is too low static problems may result, which can also create jams and misfeeds as well as cause image quality problems.

The best performance in electrographic printing systems comes with papers that have nominal moisture content of 4.5 ± 0.5 %. Usually, the paper for copiers/printers is manufactured to have the aforementioned moisture content.

Moisture content can be affected by the environmental conditions of packaging and storage. The paper ream should be packaged to ensure moisture integrity. Moisture-proof ream wrappers are essential to maintaining the correct moisture level.

NOTE: The term electrographic is commonly referred to as electrostatic in Europe.

Paper moisture levels directly affect proper copier and printer performance. Moisture content can be impacted by paper storage procedures, so paper should be maintained in moisture-proof ream wrappers to help maintain the correct moisture level.

3.8 Storage Area

Relative humidity and **temperature** are the most important environmental factors related to paper storage.

The best paper storage area is an air-conditioned room. In an environment that is not air-conditioned it is recommended that temperature and humidity is controlled to the following levels.

Minimum: 50°F (10°C) at 15% relative humidity.

Maximum: 81°F (27.2°C) at 85% relative humidity.

Paper storage locations should maintain a constant temperature and the humidity level should be maintained.

3.9 Packaging

Regular paper for copier and printers is shipped in fiberboard cartons containing 10 reams of 8 1/2 by 11-inch paper (or A4 metric paper). If a large quantity has been ordered, the paper usually arrives on wooden pallets.

Paper reams should be packaged in moisture-proof wrappers. Moisture-proof wrappers are generally made of polyethylene laminated material and/or clear plastic.

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Paper reams should be packaged in moisture-proof wrappers. Moisture-proof wrappers are generally made of polyethylene laminated material and/or clear plastic.

3.10 Paper Handling

These are the procedures you should follow for storing and handling copier and printer paper.

- Do not store the cartons directly on the cold floor like a concrete floor; this increases the possibility of moisture absorption.
- Store the cartons on pallets, shelves, or in cabinets in an area protected from extremes of temperature and humidity.
- Do not open any reams or cartons of paper until you are ready to use them.

These are the procedures you should follow for storing and handling copier and printer paper. Refer to the Notes page for detailed information.

NOTES: If the paper is moved from a storage area to a location with a different temperature and humidity, the paper should be conditioned to the new location before it is used. Conditioning may require leaving the paper in the new location for 12-24 hours or longer depending on the temperature.

When paper from an opened ream will not be used for a period of time, such as overnight, the open ream wrapper should be re-sealed with tape or the paper placed in a large zip lock bag. Fanning a new opened ream of paper is extremely important and should be performed each time paper is loaded. Fanning the paper allows the paper to feed better due to less surface friction between the sheets and it helps remove any paper lint before being placed in the machine. Fanning is especially important when using paper that has been pre-drilled. Although manufacturers make every effort to ensure that the holes are free of punch debris, punch debris may still exist in the hole channels. Fanning the paper is a little step that, when done properly, can reduce or eliminate paper misfeeds for your customers and help to keep the machine free of dust and other paper debris.

3.11 Electrical Properties of Paper

The **surface resistivity** of paper is one of key factors of the electrographic process. Highly conductive paper can cause deletions and other imaging defects. Highly resistive paper, on the other hand, can cause static buildup between paper sheets, leading to multi-feeds, jams, and problems in stacking the printed sheets.

This electrical property of the paper must be balanced to prevent deletions under humid conditions as well as background (spots and streaks) and static under dry conditions.

The **surface resistivity** also can be influenced by the environmental conditions of packaging and storage, thereby affecting the moisture content. The ream should be packaged to ensure moisture integrity. Moisture-proof ream wrappers are essential to maintaining the correct moisture level.



Surface resistivity can impact moisture and printing qualities of paper. Because of this, paper should be contained in moisture-proof wrappers.

3.12 Brightness

Brightness refers to the percent of light reflected back from a sheet of paper as measured by a light meter. Contrast is reduced and highlights are not as strong when paper with a lower brightness is used for a printed piece.

The quality and brightness of paper is organized into six categories.

Usually the brightness range of paper for copier/printers is 84 to 94. Low brightness is easy on the eyes, and high brightness provides high contrast. When used on color copiers/printers, High brightness paper will produce sharper and more impressive looking prints.



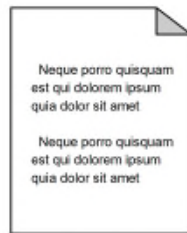
Paper Brightness		
Premium	Quality =	88.0 to 95.0 Brightness
Number 1	Quality =	85.0 to 87.9 Brightness
Number 2	Quality =	83.0 to 84.9 Brightness
Number 3	Quality =	79.0 to 82.9 Brightness
Number 4	Quality =	73.0 to 78.9 Brightness
Number 5	Quality =	72.9 and below

When used on color copiers/printers, High brightness paper will produce sharper and more impressive looking prints.

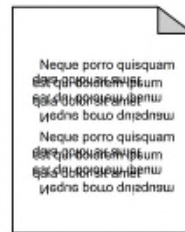
3.13 Opacity

Opacity is the measure (percent) of the amount of light passing through a sheet of paper. Some papers have more fibers and/or fillers and as a result are more opaque than others. Papers containing more fibers and fillers have the ability to hold a printed image without showing through to the backside as easily as papers without as many fibers and fillers.

Just because a paper is thicker does not guarantee that it is more opaque than a thinner paper. Some thinner papers may be more opaque because there are a greater number of fibers and/or fillers in their composition.



More Opaque Paper



Less Opaque Paper

The opacity of paper impacts the quality of duplex copying and printing.

3.14 Smoothness

Smoothness is a measure of the surface characteristics of paper. The flatter or more even the surface, the higher the level of smoothness. With a smoother surface, the stock can provide a fully shaped dot resulting in a sharper and higher quality image.

Smoothness is a measure of the surface characteristics of paper. The flatter or more even the surface, the higher the level of smoothness. With a smoother surface, the stock can provide a fully shaped dot resulting in a sharper and higher quality image.

Finish refers to the surface characteristics of the paper such as how the paper feels.

- Does the paper have a glossy appearance such as coated glossy papers or is it dull like bond paper?
- Does the paper enhance the look of the printed piece similar to watermarked paper, or is it purely functional like newsprint?
- Does the paper have a high ink absorption rate, as does Vellum¹, or poor absorption such as on coated papers?

Finishes can be applied to paper during the manufacturing process or produced offline. A finish such as Laid² can be created while it is being manufactured with the use of a marking roller that forms the pattern in the paper while it is still wet. Paper finishes provided offline are usually accomplished with steel rollers that press the pattern into the paper. The offline finishes are known as embossed finishes. Some common paper finishes are described in the next few slides.

¹: **Vellum** is a slightly rough surface on a sheet of paper which allows the paper to absorb ink faster.

²: **Laid** is a linear pattern applied to paper in the grain direction while it is still wet. It gives the paper the look of hand made paper.

The various finishes applied to paper stock can have an impact on the copying and printing process, as well as impacting the look of the copied or printed material.

3.15 Finish Examples

Cockle

Felt

Gloss

Laid

Linen

Matte

Parchment

Smooth

Instructions

These are examples of finished paper surfaces. Click on the buttons to view examples of different surface types.

PROPERTIES
Allow user to leave interaction: [Anytime](#)
Show 'Next Slide' Button: [Don't show](#)
Completion Button Label: [Next Slide](#)

Properties...

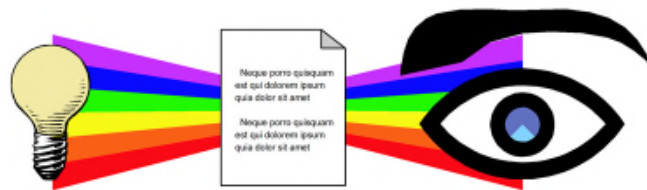
Edit in Engage

These are examples of finished paper surfaces. Click on the menu to view examples of different surface types.

3.16 Whiteness

The **whiteness** of paper is the measure of its ability to reflect the colors of light equally. The more evenly a paper reflects all colors of the spectrum, the whiter the sheet.

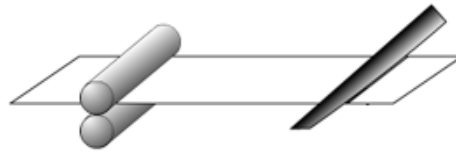
There is no such thing as a pure white sheet of paper, since the lighting of our environment and the reflections from surrounding objects always influences the white that we see.



The whiteness of paper is the measure of its ability to reflect the colors of light equally. The more evenly a paper reflects all colors of the spectrum, the whiter the sheet. There is no such thing as a pure white sheet of paper, since the lighting of our environment and the reflections from surrounding objects always influences the white that we see.

Lint and **dust** are particles of fibers, coated material, or internal binder that separate or “dust off” from paper during manufacturing, and converting operations. Too much of either on the paper will cause print imperfections. Most dust is produced at the converting operation, when the paper edge is being cut. To help reduce this problem, a high-carbon steel blade is used and the dust is vacuumed at cutting area.

When you open a package of paper, check the edge of paper. If you see the paper dust, it could cause a paper dust problem.



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When you open a package of paper, check the edge of paper. If you see the paper dust, it could cause a paper dust problem.

When troubleshooting, check the inside of the machine and clean up any paper dust.

Checkpoints for paper dust:

- Optical Sensors
- Paper Feeding Rollers and Paper Path
- Paper Dust Remover Section
- Drum Cleaning Section
- Developing Section
- Image Transfer Section
- Fusing Cleaning Section



When troubleshooting, check the inside of the machine and clean up any paper dust.

3.18 Quiz

Question 1 of 6

Point Value: 10

The basis weight of Book Paper is usually between 30 and 100 pounds.

- True
- False

PROPERTIES

On passing, 'Finish' button:

On failing, 'Finish' button:

Allow user to leave quiz:

User may view slides after quiz:

User may attempt quiz:


[Goes to Next Slide](#)


[Goes to Next Slide](#)

[At any time](#)

[At any time](#)

[Unlimited times](#)

 Properties...

 Edit in Quizmaker

3.19 Review

As you can see, there's much more to paper than a white sheet used to store and transfer information. The characteristics of paper offer its users a myriad of choices of weights, sizes, brightness, and finishes. From a technical standpoint, everything from the manufacturing process to environmental conditions can impact how well (or poorly) paper runs in a copier/printer.

Now let's take a look at some of the various types of paper available. There are several categories of paper. Each category is distinguishable by one or more of the characteristics that we've just learned about.

As you can see, there's much more to paper than a white sheet used to store and transfer information. The characteristics of paper offer its users a myriad of choices of weights, sizes, brightness, and finishes. From a technical standpoint, everything from the manufacturing process to environmental conditions can impact how well (or poorly) paper runs in a copier/printer.

Now let's take a look at some of the various types of paper available. There are several categories of paper. Each category is distinguishable by one or more of the characteristics that we've just learned about.

Lesson 4: Types of Paper

The topics of discussion are:

- Business Paper
- Letterhead Paper
- Book Paper
- Cover Paper
- Index Paper
- Tag Paper
- Bristol paper
- Carbonless Paper
- Label Paper
- OHP Film
- Envelopes
- Paper Description

These are the topics for this lesson.

4.1 Business (Bond/Writing) Paper

- Basis weights usually ranging from 13 to 28 pounds
- Basic size: 17" x 22"

Business paper is a cotton content writing or printing paper that is designed for the printing of bonds, legal documents, etc., and is distinguished by superior strength, performance, and durability.

Most papers for copiers and printers are in this category and were developed to meet the requirements of copier and printer specifications.



Business bond paper used for copiers and printers was developed to possess superior strength, performance and durability.

4.2 Letterhead Paper

Letterhead paper is usually bond paper that contains cotton fiber (25% and more). It may cause a paper curl problem because of the cotton fiber content. In addition, letterhead paper generally includes a preprinted logo.

The type of preprinted ink must be checked before being run on any copier/printer.

Raised letterheads are made with a letterpress type, thermographic processes, engraving, or special foamed printing inks. These materials may cause paper jams, and ink offset onto the fusing rollers and onto subsequent pages.

The best way is to use forms and letterhead paper printed by offset lithography or engraving and to avoid using low-temperature inks.

If you are not sure of the type of ink materials used, have a small trial run by the printer. Also, do a test in the copier/printer before purchasing a large quantity that may not work.

Letterhead paper is usually bond paper that contains over 25% cotton fiber. The additional cotton fiber may cause curl issues in the copier or printer.

4.3 Book Paper

- Basis weight for Book Paper usually ranges from 30 to 100 pounds
- Basic size: 25" x 38"

Book paper is a general term for a group of coated and uncoated papers (exclusive of newsprint) suitable for use in the graphic arts. They are characterized by a wide variety of surface finishes (e.g. antique, eggshell, machine, English, super-calendered, dull-coated, matte-coated, glossy-coated, etc.).

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4.4 Cover Paper

- Basis weight for Cover Paper usually ranges from 40 to 130 pounds
- Basic size: 20" x 26"

Cover paper includes a wide variety of fairly heavy plain or embellished papers which are converted into covers for books, catalogs, brochures, and pamphlets.

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4.5 Index Paper

- Basis weight for Index Paper usually ranging from 90 to 220 pounds
- Basic size: 25.5" x 30.5"

Index paper is a class of heavyweight papers used for index cards. They can be produced from chemical wood and/or cotton pulps in solid or two-ply pasted form, in white and other colors.

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4.6 Tag Paper

- Basis weights usually ranging from 100 to 250 pounds
- Basic size: 24" x 36"

Tag paper may be made from a variety of materials, such as rope fiber, sulfite or mechanical wood pulp. Various types of waste papers, such as manila clippings, bottle cap waste cutting, and reclaimed shipping sack Kraft are also materials that can be made from Tag Paper. The board is sometimes tinted or colored on one or both sides. It may be vat lined and is often coated.

The more durable tag stocks, such as those used in foundries, machine shops, laundries, nurseries, etc., are made of rope and jute. Tag stock, depending upon its intended use, has the following properties to a greater or lesser extent: good bending or folding qualities, suitable bursting and tensile strength, good tear and water resistance, and a surface adaptable to printing, stamping, or writing with ink.

Tag paper is made from various materials, including recycled materials, and often has great durability and resistance to tearing and water resistance.

4.7 Bristol Paper

- Basis weight for Bristol Paper usually ranges from 80 to 120 pounds
- Basic size: 22.5" x 28.5"

Bristol paper is a general term for a solid or laminated heavyweight printing paper made to a thickness of 0.006" (6 mils) or greater. The name is derived from the original pasted rag content board made in Bristol, England.

Bristol paper is solid or laminated heavyweight printing paper of a thickness of 6 mils or greater.

4.8 Carbonless Paper

Carbonless paper is coated with chemicals that enable transfer of images from one sheet to another with pressure from writing or typing. Carbonless paper is usually pre-collated in sets of white, canary, and pink colored sheets. This type of paper is generally used for forms that require multiple copies of a document be produced simultaneously. (i.e. invoices, bills of lading, etc.)



Carbonless paper is used to transfer impressions from a top sheet to several sheets below, in order to reduce redundant writing.

4.9 Label Paper

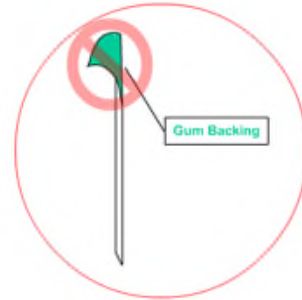
There are two types of **labels** available in the market. One is a Pressure-sensitive label; the other one is a dry-gum label. The dry gum label requires moistening before being applied.

Dry gum labels pose a potential contamination problem to copier/printers. The heat and pressure of the fusing process can cause dry glue particles to detach from the label backing and attach on the fusing rollers and other parts causing jam problems and spot image problems. Dry gum labels are not recommended for use in copier/printers.

Pressure-sensitive label stock consists of three layers: the face sheet, the pressure sensitive adhesive, and a silicon-treated backing sheet.

There are many types of face sheets. Face sheets are the labels printing surface and may be bond paper, latex impregnated and surface coated papers, or heat resistant synthetic materials such as polyester film.

There are adhesives designed for both permanent and removable applications.



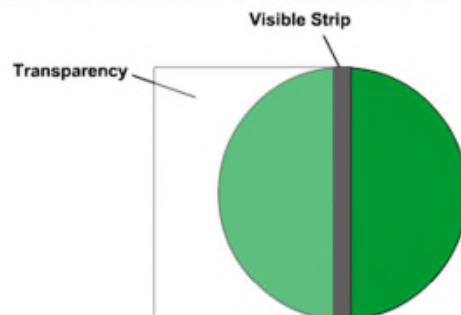
Label paper is used to identify objects. Its use of gum or adhesive makes it not recommended for use in copiers or printers without special configurations.

4.10 OHP Film

OHP films or transparency films are made of polyester film that is specially coated to make toner readily adhere to it. The base material and coating type are both very important in the final quality of the projected image.

Some copiers/printers use an optical sensor to detect the clear transparency (media) as it passes through the machine to paper jamming problems. These machines require a transparency with an opaque strip along one edge, or a paper backing, in order for the machine to "see" the transparency and not react as if a paper jam had occurred.

It is important to select the OHP film that meets the machine's type of sensor system. Please refer to the Konica Minolta recommended OHP films.



OHP films or transparencies are made of polyester film that is designed to allow toner to adhere to its surface. It is important to select the OHP film that meets the machine's type of sensor system.

4.11 Envelopes

Envelopes can be based on any of the paper types previously mentioned, the notable exception being carbonless paper. An envelope is simply a sheet of paper that has been folded (converted) into a pocket intended to hold documents or other items.

Envelopes generally have flaps that allow the envelope to be sealed. The sealing adhesive may be made of dry gum or pressure sensitive varieties.

Envelopes have the potential to cause a myriad of problems when used as stock in a copier or printer. Therefore, it is highly recommended that you consult the user manual and approved paper guide for the machine being used.



Envelopes can be based on any of the paper types previously mentioned, the notable exception being carbonless paper. Envelopes have the potential to cause a myriad of problems when used as stock in a copier or printer. Therefore, it is highly recommended that you consult the user manual and approved paper guide for the machine being used.

4.12 Paper Description

Most **ream wrappers** contain the following information about the paper that it contains:

- **Size** - Sheet or roll size in inches and metric in mm.
- **M Weight** - The weight in pounds of 1,000 sheets of paper. On the label of a ream of paper, the M Weight (for the Roman number M, meaning 1,000) typically appears after the paper dimensions.
- **Basis Weight** - basis weight in pounds and g/m²
- **Grain Direction** - Direction of the paper fibers. Long grain means grain is parallel to the long dimension of the paper. Short grain means grain is parallel to the short dimension.
- **Color** - The color of paper (i.e. white)
- **Quantity** - The number of sheets in one ream
- **Brightness** - The percentage of light reflected by paper
- **Finish** - The grade of paper (i.e. linen)

Rollover Buttons to Highlight Label Items.

Finish	M weight	 <p>Paper Product NewStyle Linen Writing Laser Compatible</p> <p>Sub 24 / 90 g/m² 8¹/₂" x 11" 216mm x 279 mm 500 sheets 12M Long White</p>
Sub weight	Grain Direction	
Sheet Size	Color	
Number		

These are some of the basic identifiers present on the wrapper of a typical ream of paper.

4.13 Quiz

Question 1 of 3 ▾

Point Value: 30

Basis weight is usually indicated on the paper ream label in pounds or gm2.

- True
- False

PROPERTIES

On passing, 'Finish' button:

On failing, 'Finish' button:

Allow user to leave quiz:

User may view slides after quiz:

User may attempt quiz:

[Goes to Next Slide](#)

[Goes to Next Slide](#)

[At any time](#)

[At any time](#)

[Unlimited times](#)



Properties...



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4.14 Review

As you have learned so far, paper has many characteristics and comes in many different flavors of those characteristics. The paper industry uses robust labeling to let the user know the characteristics of the paper they have purchased and are working with. Let's take a look at paper labeling and how to interpret it.

You should now have an understanding of the categories of paper, as well as some of the specialty papers you will encounter in the field.

Now let's take a look at how many of the characteristics of paper are represented when packaged.

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Troubleshooting

The topics of discussion are:

- Causes
- Paper Jams
- Image Quality Problems
- Other Problems
- Preventative Maintenance

These are the topics for this lesson.

5.1 Causes

Paper can be the root cause of several copier and printer related issues. Paper jams may be caused by paper, by virtue of the paper's curl for instance. Image quality problems may be attributable to the paper as well, usually due to the paper's moisture content. Therefore, troubleshooting some issues may be as simple as examining the paper, and its storage. Resolution of paper related issues may be as simple as educating the end user.

Paper may cause a number of several printer and copier issues, including paper jams and low image quality. Be certain that you and the customer understand what type of paper with what characteristics are needed for a job, and that the paper is properly packaged and stored to avoid issues relating to paper.

5.2 Paper Jams

Introduction

Paper jamming problems are very typical. Most paper jams are caused by one or more paper characteristics. When you have paper jamming problems, check the paper feed tray from which the paper was fed! The following jams, organized by area of the machine, may be related to paper.

Click on the red buttons to learn more.

PROPERTIES
Allow user to leave interaction: [Anytime](#)
Show 'Next Slide' Button: [Don't show](#)
Completion Button Label: [Next Slide](#)

[Properties...](#) [Edit in Engage](#)

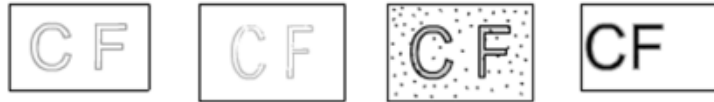
The diagram shows a cross-section of a paper feed mechanism. At the top, a paper sheet is being fed from a tray. Below it, a series of rollers and gears are shown. A red plus sign is located on the roller assembly. Another red plus sign is located on the paper tray. A third red plus sign is located on the roller assembly. A fourth red plus sign is located on the roller assembly. A fifth red plus sign is located on the roller assembly. A sixth red plus sign is located on the roller assembly. A seventh red plus sign is located on the roller assembly. A eighth red plus sign is located on the roller assembly. A ninth red plus sign is located on the roller assembly. A tenth red plus sign is located on the roller assembly. A eleventh red plus sign is located on the roller assembly. A twelfth red plus sign is located on the roller assembly. A thirteenth red plus sign is located on the roller assembly. A fourteenth red plus sign is located on the roller assembly. 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A ninetieth red plus sign is located on the roller assembly. A hundredth red plus sign is located on the roller assembly.

This interaction displays the location of common jams that may be related to paper.

5.3 Image Quality Problems

Image quality problems that may be related to paper are as follows:

- Copy or printed images being too light, which may be due to high paper moisture content or low paper surface resistivity.
- Toner comes off (a problem with fusing) the printed page (s), which may be caused, by attempting to feed paper that is too heavy in weight or too thick. This problem may also be caused by attempting to feed paper that is too smooth.
- Undesirable marks or spots on the image may be a result of impurities in the paper manufacturing process. This problem is more likely to be seen with some of the recycled papers since some impurities may not be removed in the recycling process.
- Image offset problems can be caused by low moisture content or greater paper surface resistivity.



Paper characteristics may cause various image quality problems such as: the image being too light, toner coming off the paper, undesirable spots and image offset problems.

Paper dust and some impurities (e.g. hard materials) may cause several problems. Dust and foreign material may affect optical sensors, paper feeding rollers, photosensitive materials (OPC drum), developing rollers, and fusing rollers.

In the long term, paper dust will cause problems such as:

- Jams due to optical sensors being obscured by paper dust.
- Jams or misfeeds due to paper dust adhering to rollers and causing paper slippage.
- Poor fusing due to dust on the surface of the paper.
- Spots on copies/print due to the copier paper dust affecting consumables such as the developer.

Paper dust may cause several problems. Dust and foreign material may negatively impact the performance of optical sensors, paper feeding rollers, photosensitive materials (OPC drum), developing rollers, and fusing rollers.

5.5 Preventative Maintenance

To avoid problems caused specifically by paper dust, one should check the inside of machine and clean up the paper dust.

Locations to check and clean paper dust from are:

- Optical Sensors
- Paper Feeding Rollers and Paper Path
- Paper Dust Remover Section
- Drum Cleaning Section
- Developing Section
- Image Transfer Section
- Fusing Cleaning Section

Think back to the paper storage and handling guidelines presented earlier. Would proper storage and handling reduce many of the problems we've just learned about? Yes, in most cases it would. The best way to prevent issues from paper is to follow the storage and handling guidelines.

5.6 Quiz

Question 1 of 3

Point Value: 40

Select all that apply. Paper jams in the cassette/deck area are often caused by:

- Attempting to feed paper that has been cut poorly (edgeweld).
- Attempting to feed paper that is too rough.
- Paper curl due to high or low moisture content.
- Attempting to feed paper that is too light.

PROPERTIES

On passing, 'Finish' button:

On failing, 'Finish' button:

Allow user to leave quiz:

User may view slides after quiz:

User may attempt quiz:


[Goes to Next Slide](#)


[Goes to Next Slide](#)

[At any time](#)

[At any time](#)

[Unlimited times](#)

 Properties...

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5.7 Review

As you have seen, paper can be the root cause of several copier/printer related issues. Paper jams and image quality issues may be directly related to the condition of the paper, so adherence to proper paper storage and use is very important to avoid many paper-related issues.

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Congratulations, you have completed the OUTWARD Associate All About Paper course. You should now be familiar with the topics listed here:

- Basics of paper manufacturing.
- Properties of paper.
- Paper specifications.
- Other types of media.
- Troubleshooting ideas.
- Proper paper handling procedures.
- Paper label information.
- Preventative maintenance procedures.

Congratulations, you have completed the OUTWARD Associate All About Paper Course. This course was designed to give you a basic understanding of the characteristics of paper in relation to copying and printing. You should now be familiar with the topics listed here.