IBM Advanced Function Printer Cut-Sheet Paper Reference for use with IBM Electrophotographic Printers

G544-3915-00

Note

Before using this information and the product it supports, be sure to read the general information in "Notices" on page ix.

First Edition (April 1994)

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Preface

This publication is a general guide for paper and special stocks used in IBM electrophotographic cut-sheet printers. For specifications unique to your printer, refer to your printer's paper specifications.

This publication is intended for use by *operators, planners, buyers, or others* who use IBM cut-sheet printers or who order paper and special application materials. It is also useful for those who plan for and design special applications such as optical character recognition (OCR), bar-codes, and pre-punched paper for IBM printers. Planners and buyers may give this publication to *manufacturers* or *suppliers* of paper and special application materials as an aid to determine which materials will work best for given applications.

Choosing the right supplies, as well as storing and handling these supplies correctly, is important for trouble-free operation of the printer. Because a broad range of supplies are available, and because some supplies work better than others, it is important to understand some characteristics of paper and special application materials.

The information in this publication is intended to help you improve the quality of your printed output and to minimize the maintenance on your printer.

Terminology

For definitions of terms used in this publication, refer to the Glossary on page G-1.

Related Publications

Typically, there is a series of publications supporting each IBM printer. These include:

Introduction and Planning Guide
Operator's Guide
Product Description
Paper Reference

Refer to your printer's publications for specific information about your printer.

In addition, the following publications provide useful information about printing environments.

About Type: IBM's Guide for Type Users, G544-3122

About Type: IBM's Technical Reference for Digitized Type, S544-3516

Guide to Advanced Function Presentation, G544-3876

Advanced Function Presentation: Printer Information, G544-3290

Document Composition Facility: Bar Code User's Guide, S544-3115

Bar Code Fonts User's Guide, S544-3190

Chapter 1. Xerographic Paper

Xerographic paper is designed specifically for use in electrophotographic printers and copiers because the paper is subjected to stresses that are different from those of other printing processes. Also, key characteristics of xerographic paper are carefully controlled. This is not necessarily true for non-xerographic paper.

Use only high-quality xerographic paper for optimum paper and printer performance and print quality.

This chapter describes the characteristics of xerographic paper. For special-application material characteristics see Chapter 2, "Special-Application Material Characteristics" on page 2-1.

With high-quality xerographic papers, there is minimal or no difference in printer performance or print quality regardless of the paper grade. Any difference in cost is a function of the paper's brightness.

Paper Characteristics

Following is a list of significant characteristics of xerographic paper. Following the list are descriptions of these characteristics.

Paper Weights

Paper used for printing is manufactured by weight. In metric units, paper weight is given in grams per square meter (g/m²). In English units, paper weight is expressed in pounds (lb).

The pound weight of paper is the weight of a basis ream (500 sheets) of paper. The length and width dimensions and the pound weight of the basis ream are determined according to the general end-use application for the paper. For example, a basis ream of 20-lb bond xerographic paper contains 500 sheets and weighs 20 lb. The basis weights of other end-use papers are shown in Appendix A, “Basis Weight and Grams/Square Meter of Paper” on page A-1.

In this manual, pound-weights apply to xerographic paper unless otherwise specified. Use Appendix B to convert g/m² to pound-weight for other grades of paper.

Most xerographic paper is in the range of 75 to 90 g/m² (20 to 24 lb)[1]—80 g/m² (21 lb) in World Trade countries, and 75 g/m² (20 lb) in the U.S.A. and Canada. In the U.S.A. and Canada, specify number 1 or number 4 grade[2] .

An important factor in maintaining optimum print quality and printer performance is the consistency in the weight of the paper. The use of different weights of paper can cause a wide range of variability in performance; therefore, use a narrow weight range of paper.

Paper Sizes

Typical printers operate reliably with paper stock in a wide range of sizes including A-sized papers (ISO/DIN)[3].

Note: Not all paper sizes can be used in all printers. Refer to your printer’s Paper Specifications for paper that is appropriate for your printer.

For ISO-A and ISO-B standard paper sizes, see Appendix C, “ISO Standard Paper Sizes” on page C-1.

Temperature and Humidity

Both temperature and humidity affect paper’s performance in a printer. Not all printers operate in the same environmental ranges. Refer to your printer’s Paper Specifications for the range that is correct for your printer.

The paper used for printing is most effective in a narrower range of temperature and humidity than for the printer. See “Storing Paper” on page 5-8 for temperature and humidity considerations for storing paper.

1 In countries served by the IBM World Trade Corporation, the most commonly used paper weight is 80 g/m² (21 lb). In the U.S.A. and Canada, the most commonly used paper weight is 75 g/m² (20 lb). In this guideline, 80 g/m² and 75 g/m² are synonymous as are 21 lb and 20 lb. The 80-g/m² (21-lb) paper weight is acceptable for optimum print quality and paper performance in the printer.

2 The number grade in the U.S.A. and Canada is a grading system based on paper brightness. It does not apply to World Trade countries.

3 ISO (International Standards Organization); DIN (Deutsche Industrie Norm).

Moisture and Paper Curl

Moisture causes paper curl. Paper curl is the major problem for most automated paper-handling mechanisms. Excessive paper curl can cause paper misfeeds and paper jams. This condition can affect the print quality and blur the print image.

Nearly all paper has curl or at least a tendency to curl. Curl can occur after the paper passes through the printer's fuser where it is exposed to high temperatures.

In most paper, curl results from unusually large, sudden, or uneven changes in moisture content. This problem is intensified with unprotected reams. Normally, if paper gains or loses small amounts of moisture evenly, it remains fairly flat; it should feed through the printer with little difficulty. However, if moisture changes occur, primarily to the edges of the paper, the paper usually develops curl. Also, the more moisture changes that occur, or the greater the amount of moisture change that occurs, the greater the amount of curl that is developed. Excessive curl can cause feed problems and poor stacking in the output stacker. Moisture sensitivity can also cause faded printing. Because of these moisture-related problems, better grades of xerographic paper are made with relatively low moisture content and are packaged in moisture-resistant wrappers. See "Packaging by Supplier" on page 1-9.

Xerographic paper is manufactured to minimize curl; thus, there is less curl with it than with nonxerographic paper. Refer to "Determining Curl" on page 5-13 for additional information.

Fusing

Fusing causes toner particles to adhere to the paper surface and to the individual fibers of the paper structure. This process uses heat to soften the toner; and pressure to press the softened toner into the paper.

Note: The ingredients used in paper manufacture significantly affect the fusing, print quality, and resistance of printed characters to accidental or deliberate erasure. Differences in paper additives, especially sizing materials, can affect the adhesion of toner to the paper.

Preprinted paper can interfere with optimum toner adhesion because toner does not bond efficiently to inked surfaces. Therefore, it is not recommended to print over the preprinted areas of preprinted paper because it can degrade fusing. The processes and printing inks used on xerographic paper are specifically designed to reduce the possibilities of poor toner adhesion. Check with your paper supplier for the availability of xerographic preprinted paper for your application.

Selecting a high-quality xerographic paper such as IBM Multi-System Paper improves the process of fusing the toner to the paper.

Edge Quality

Rolled edges (the edge of one or more sheets are rolled over the edges of other sheets in the ream) can cause misfeeds or cause more than one sheet to feed at a time, and paper jams can result. Rolled edges are typically caused by dull or improperly adjusted cutting equipment at the paper mill.

Ragged edges can cause paper misfeeds and paper jams. Also, ragged edges tend to deposit excessive paper dust throughout the printer. This contamination can degrade print quality by causing streaks, spots, and voids.

Fiber Content

High-quality xerographic paper is made from 100 percent chemically pulped wood[4]. Chemical wood-pulp fiber gives the greatest stability of all common paper-making fibers. The addition of special fibers, such as cotton, sometimes causes curl and can result in paper-feeding problems. The higher the cotton content, the more problems you can encounter.

Inexpensive paper can contain mechanically pulped wood. This fiber does not have all the natural impurities removed, and can contaminate the printer and cause degraded print quality and unreliable printer performance.

Grain Direction

During the paper-making process, paper fibers are predominantly oriented in one direction, known as the grain direction of the paper. Grain-long paper is cut with its longer dimension parallel to the grain direction, and is the recommended choice. Grain-short paper is cut with its longer dimension perpendicular to the grain direction.

Paper is normally stiffer in the grain direction. It exhibits more stiffness when it is folded perpendicular to the grain. Because cut-sheet paper is cut grain long, your printer was designed to run grain-long paper. If you have an application that requires grain-short paper you may encounter degraded paper handling performance. It is recommended that you test samples of grain-short paper in your printer before purchasing large quantities.

See also “Grain Direction and Weight Considerations” on page 2-9.

The grain direction of nearly all xerographic and other business paper is shown on the label of each ream.

The three tests to determine the grain direction of a paper are:

Tear—Tear a sheet of paper lengthwise; repeat crosswise. Compare the two tears. Paper always tears straighter with the grain. See Figure 1-1 on page 1-5.

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[4] In Europe, this product is known as wood-free pulp.

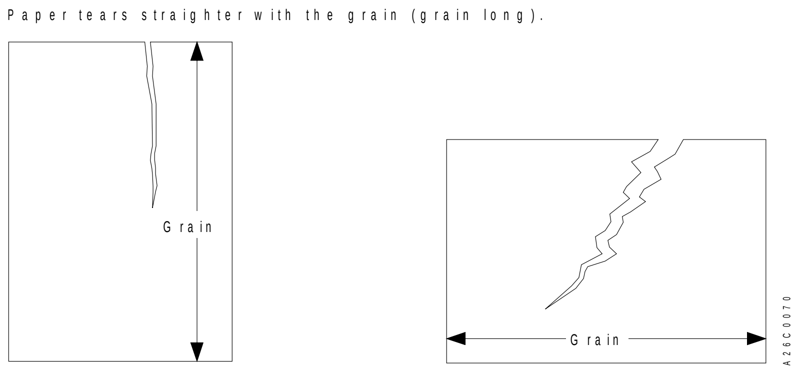


Figure 1-1. Grain and Paper Tearing

Fold—Fold a sheet of paper lengthwise; repeat crosswise. Compare the evenness of the two folds. Paper always folds smoothly with the grain. Cross-grain folds tend to be rough and crack. See Figure 1-2.

Moisten—Moisten two adjacent edges of a sheet of paper. The grain long direction is perpendicular to the edge that becomes wavy.

The grain should generally be parallel to the long side of the sheet for best printer performance. These papers are called grain-long and can be twice as stiff in the long direction.

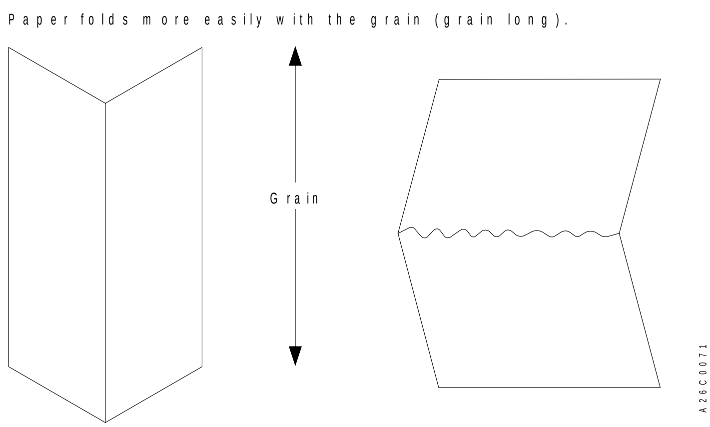


Figure 1-2. Grain and Paper Folding

Electrical Conductivity

As paper runs through the printer, it receives an electrical charge. Paper that is too conductive yields poor image quality. Paper without some conductivity builds up excessive static and causes misfeeds and paper jams. Although most bond paper falls within an acceptable range of conductivity, xerographic paper is manufactured specifically for this characteristic and performs better than non-xerographic paper. Paper conductivity is related to moisture content; follow storage and operating recommendations to maintain image quality and paper handling performance.

Sizing

All paper that is intended for writing or printing must be *sized*. Sizing adds small amounts of special materials to the pulp to control the penetration of fluids, such as ink, in the finished paper. Without sizing, the paper behaves similarly to blotter paper, allowing ink to run, and resulting in blurred and fuzzy writing or printing.

There are two sizing steps in the manufacture of printing and writing paper. First, sizing chemicals are blended into the pulp before it is formed into paper in the paper making process. This step is known as internal sizing. Second, sizing chemicals are added to the fully formed paper. This step is known as surface sizing.

The two types of internal-sizing are the acid-rosin process and the synthetic process (also known as the neutral or alkaline process). The alkaline process is sometimes used for paper that will be preserved in archives. Most of the paper made today, because of environmental considerations, uses the neutral or alkaline process. Incorrectly blended or excessive amounts of acid-rosin sizing can result in paper that deposits small amounts of rosin on various printer components. With long-term usage of this type of paper, rosin deposits can accumulate sufficiently to cause degraded print quality, or paper-handling problems, or both.

Incorrectly blended or excessive amounts of synthetic sizing can leave sizing that is not fully reacted on the surface of the finished paper. Sizing on the surface of the paper interferes with the correct bonding of the toner used by electrophotographic printers, and results in print that can easily smudge or that can be easily removed by abrasive forces.

If you use synthetically sized paper, test a few sample boxes for toner adhesion characteristics before you make a large purchase. To test this paper, print the same image on both the test paper and on a standard paper (of known and acceptable quality) under similar printing conditions. Make a simple comparison of abrasion resistance by scratching the toner images with your fingernail, a penknife, or a similar instrument.

Surface sizing of most printing and writing paper is done with paper-making starch, regardless of the type of internal sizing used.

Manufacturers of high-quality xerographic paper know the problems that both sizing processes can present for electrophotographic printing. Their paper is carefully controlled to minimize these problems.

Smoothness (Sheffield)

Xerographic paper is generally smoother than most business papers. The degree of smoothness directly affects print quality. If the paper is too rough (such as cockle- and laid-finish paper) halftone and solid images do not print well. If the paper is too smooth, it cannot feed correctly through the printer. Refer to Table 5-1 on page 5-1.

Grades and Brightness of Paper

Paper grade refers to the brightness of a sheet of paper. It is a measure of the amount of light reflected by the paper, the more light it reflects, the higher the brightness.

Grade or brightness of paper is an aesthetic consideration only and does not effect print quality or printer performance. Brightness can enhance the contrast between paper and image, and improve readability.

Note: Brightness should not be confused with *whiteness*, which is the shade of the paper rather than the amount of reflected light.

Paper Contamination

Paper can be contaminated internally or externally. Internal contamination is due to waxes, chemicals, or adhesives. Wax contamination is typically the result of a coated or laminated ream cover which should not be used. Adhesive residue can be a problem with recycled papers (see “Recycled Paper” on page 1-9).

For best performance, use only mill-cut and mill-sealed paper reams from a supplier whose quality assurance procedures provide for strict control of paper dust. External contamination can be caused by paper dust. Paper dust causes difficulties by accumulating in the printer where it degrades image quality, contaminates printer components, and can lead to a variety of difficult-to-diagnose problems. Paper dust results from sheeting and wrapping operations, and is more likely to be a problem with sheets trimmed to final size with a “guillotine” cutter.

Paper itself also can be a contaminant in the printer. Paper that is poorly made, with fibers and chemicals insufficiently bonded to the paper's surface, can contaminate internal printer components with loose fibers (fuzz), causing premature developer failure. Loose material can also accumulate in roll fusing systems producing oil streaks.

Paper that is poorly manufactured, contains cotton fibers, or any rag content should not be used.

Acidity and Alkalinity

Acidity or alkalinity of paper is determined by the sizing used during the paper’s manufacture. Paper can range between high acidity to high alkalinity and is measured on a pH scale of 0 to 14 where pH 7 is neutral, 0–6 is acidic, and 8–14 is alkaline.

Paper with high acidity ages rapidly, and becomes yellow and brittle. Paper with high alkalinity can last long periods of time. The American Society for Testing and Materials (ASTM) has established standards of permanence for paper. Papers with a pH of 5.5 (ASTM III) or higher last a minimum of 50 years, paper with a pH of 8.0 (ASTM I) can last several hundred years.

Although there are no restrictions on the use of alkaline paper, care must be exercised to select paper that does not create an excessive dust contaminant problem such as can occur if excessive calcium carbonate is used during manufacture. High alkaline papers have difficult-to-control frictional properties which can result in poor feeding reliability and poor image fusing.

Stiffness (Taber)

Stiffness refers to the rigidity or the bending resistance of paper. Thicker papers and paper in the long-grain direction are stiffer than lighter papers or short-grain papers. In general lighter papers do not have the stiffness of heavier stock and will wrinkle or bunch-up in the printer, causing jams and misfeeds. Paper that is too stiff, such as index stocks, may have readability and print quality problems (skips, blurs, deletions) because of their reduced ability to bend around internal components of the printer.

Abrasiveness

Some papers, because of coating or other additives, can be highly abrasive. These papers can cause contamination and excessive printer wear. Abrasive papers should not be used in electrophotographic printers.

Paper Cut

Paper that is incorrectly or poorly cut can cause misfeeds and jams. All paper should be cut to size minimizing variation between sheets in width, length, and squareness.

Thickness (Caliper)

The thickness of paper depends on its weight and the amount of pressing (calendering) applied during its manufacture. Thinner paper is usually smoother than thicker paper, more pressing makes the paper thinner, smoother, shinier, and less stiff. Thicker paper, conversely, is stiffer, less smooth, and duller.

Thickness of paper is a significant consideration because:

- Too-thin paper can result in wrinkling, bunching-up, and jams.
- Too-thick paper can cause print quality and jamming problems because the stock is too stiff to bend around components within the printer.
- Non-uniform thickness within a sheet can cause print quality problems.
- Paper-tray capacity is altered depending on the thickness of the paper.

Tensile and Tear Strength

Tensile and tear strength are important both during the printing process and after the prints have been made. Low-strength papers can tear and fray on the edges as they move through the printer and the durability of the finished print is reduced. Some elasticity is desirable to minimize breaks or tears.

Porosity (Gurley)

Porosity is a significant consideration when using printers with vacuum feed mechanisms. A paper that is too porous allows too much air to pass through the paper and can cause misfeeds. Poor print quality, in the form of solid area mottling and image smears is also possible with paper that has excessive porosity.

Scorch Resistance

Scorch resistance is an important consideration because the printing process uses heat with pressure to fuse images to the paper. Low resistance to scorching causes the prints to become yellowed, more brittle, and to have a reduced storage life.

Friction

Friction between sheets must be controlled to allow sheets to separate easily. Otherwise, multiple sheet feeds, misfeeds, and jams can occur.

Opacity

Opacity is a significant concern in duplex printing where images are printed on both sides of the sheet. Satisfactory paper must not allow images to show through from the reverse side of the duplex sheet or from a subsequent sheet in a set in simplex printing.

Recycled Paper

Some paper suppliers offer *recycled* xerographic paper. Recycled paper must conform to the fiber-content characteristics (see “Fiber Content” on page 1-4) previously described (100% chemically pulped wood)[5]. In addition, recycled paper must be free of any contaminants added to the paper from its previous application. Some of these contaminants can interfere with print quality, feeding reliability, or toner adhesion. Additionally, these contaminants can build up on various paper-path and print-element components, and cause premature failure of these components.

Test recycled paper by using a process that is similar to the process for special-application materials (see Chapter 2, “Special-Application Material Characteristics” on page 2-1). This process consists of:

- Testing an initial sample (500 to 1000 sheets) of the recycled paper.
- Demonstrating the ability to perform over a long period (30- to 60-day supply).

Notes:

1. The photoconductor and the fuser roll should be periodically checked for any contamination caused by the recycled paper. Also, monitor the environment for any volatile emissions caused by the recycled paper.
2. Use IBM Recycled Multi-System Paper, or its equivalent.

Packaging by Supplier

Xerographic paper is usually wrapped at the paper mill in special moisture-resistant wrappers. Although these special wrappers look like heavy paper, they are specially processed to minimize moisture penetration to protect the package contents from unwanted moisture changes. One popular wrapper design incorporates a thin, moisture-barrier material sandwiched between two layers of paper.

[5] Recycled paper that contains mechanical pulp must be manufactured by a process that eliminates natural impurities that can cause contamination and parts wear in the printer.

Plain *kraft* paper wrappers or wax and oil-impregnated wrappers are not sufficient to adequately protect paper from undesirable moisture changes. Xerographic paper, including special-application materials such as preprinted forms, should be packaged by the supplier in ream quantities in appropriate moisture-barrier materials. Waxes and oils used in the fabrication of impregnated wrappers also can contaminate the paper inside the wrapper and cause jams, poor print quality, and contamination of the printer.

Non-Xerographic Papers

There are many other kinds of paper available. Not all of which may have xerographic paper characteristics. Some may work in a electrophotographic printer but will likely cause degraded performance with loss of printer availability and increased service costs.

Avoid using non-xerographic papers in your electrophotographic printer.

Paper Types and Grades

There are many types and grades of paper available, not all of which may be available as xerographic paper. Paper types include, but are not limited, to:

- Offset paper
- Multipurpose paper
- Bond paper

See "Additional Papers and Stocks" on page 2-12 for more information.

Offset Paper

Offset paper, sometimes referred to as "book" paper, has high brightness and moisture content and is designed for use with offset printing processes where the image is transferred from a master plate to a rubber blanket and then to the paper.

Offset paper has good surface strength and water resistance. It is graded by brightness on a scale of 1 to 3 where 1 is the brightest.

Offset paper is often used for letterheads when a high-quality premium bond is not required.

Because of its high moisture content, some offset paper can curl excessively with the potential for printer problems.

Multipurpose Paper

Multipurpose paper is designed to work in more than one application. Because of the necessary compromises in the paper's design, it is not always satisfactory when used in a electrophotographic printer.

An exception is multipurpose (sometimes called dual-purpose paper) that has been developed for offset and electrophotographic printer use. This paper should be tested before extensive use. See Chapter 5, "Selecting, Pretesting, Ordering, Storing, and Using Paper and Stock Supplies" on page 5-1 for testing information.

Bond Paper

Bond paper is the type most used for writing, printing, and copying. Bond paper is defined as a “strong, superior stock of paper with a hard surface” used for letterheads and general office needs. Bond paper ranges in grade from premium, with high brightness that is made of rags or cotton fibers to less expensive grades of lower brightness. Bond paper represents the bulk of paper used for general purposes.

Some bond paper has a rough textured surface. When used in the electrophotographic printing process, it does not perform well because of poor toner bonding. This paper also has a higher coefficient of friction and greater stiffness than paper intended for xerographic use.

Sulfite Bond: Sulfite refers to the process used to make the wood pulp that is used in this paper. Although the sulfite process is infrequently used today, the term continues to be used. The *kraft* or sulfate process is in dominant use now. Sulfite bonds are classified as grade numbers 1, 4, and 5.

Premium Number 1 bond is the brightest and most expensive. It is watermarked and not often used.

No. 1 bond is similar to premium Number 1 bond, but it is slightly less bright.

Premium Number 4 and Number 4 bonds are not watermarked and are less bright than Number 1 bonds. Premium Number 4 is brighter than Number 4 bond. The majority of cut-sheet paper available today is one of these two grades.

Number 5 bond has relatively low brightness and is the least expensive.

Rag Bonds: Rag bonds are the “prestigious” papers favored by businesses for letterheads and are much more expensive than sulfite bonds. Rag bonds are made from a combination of cotton and wood fibers to achieve a pleasing appearance and strength. These papers are watermarked to specify their cotton content and are graded accordingly:

Number 1 bonds = 100% cotton fiber
Number 2 bonds = 50 to 75% cotton fiber
Number 3 bonds = (obsolete)
Number 4 bonds = 25% cotton fiber

Because rag bonds usually have rough surfaces, toner generally fuses poorly to them in the xerographic process. Also, they have a higher coefficient of friction and stiffness that can increase the frequency of paper jams. If rag bonds are preferred, select a rag bond that was developed for use in electrophotographic printers.

Chapter 2. Special-Application Material Characteristics

Many printers can run certain special-application materials. In all cases, when using special materials, refer to your printer's Paper Specifications to ensure that there are no unique requirements for your printer and to your printer's *operator guide* for instructions on how to use these stocks with your printer. All special-application materials should be tested in small quantities before purchasing large quantities of stocks. See "Pretesting Paper and Stocks" on page 5-3.

Select materials that are specifically designed and treated for xerographic use when choosing:

- "Preprinted Electronic Forms"
- "Negotiable Documents" on page 2-6
- "Optical Character Recognition Paper" on page 2-8
- "Prepunched Paper" on page 2-11
- "Perforated Paper" on page 2-8
- "Adhesive Labels" on page 2-11
- "Heavyweight Stocks" on page 2-11
- "Colored Papers" on page 2-12
- "Parchment Papers" on page 2-12
- "Vellum Stock" on page 2-13
- "Non-tearing Papers" on page 2-13
- "Transparencies" on page 2-13

This chapter describes the characteristics of special materials and stocks that can be used in printers. For special materials suitable for your printer, refer to your printer's Paper Specifications.

"Non-recommended Papers and Stocks" on page 2-13 discusses attributes of certain papers and stocks that should not be used.

Preprinted Electronic Forms

You can use preprinted paper or electronic forms for personalizing your forms with graphics, signatures, logos, and so on. A *preprinted* form is one on which ink has been applied before the printer prints on it. An *electronic* form is one on which predetermined logos, rules, or other images are applied at the same time as variable information is printed.

Preprinted Forms

When the printer feeds paper, slight registration variations in the print position on the page can occur. Allow for a print-position variation and alignment to a preprinted form.

Most printers do not print images up to the edge of the paper. When you design forms, it is recommended that a margin is maintained between the image and the edge of the paper. This prevents loss of information and image-quality problems.

Notes:

1. Not all paper sizes can be used in all printers. Refer to your printer's Paper Specifications for paper that is appropriate to your printer.
2. Some printers can be adjusted a small amount in the X and Y direction to match the nominal print position on the paper. When you use preprinted forms, the preprinted-form design must allow for some character clearance plus any sheet-to-sheet positional variations from the manufacturing preprinting process.
3. If printing is required within the minimum margin area there may be a loss of image. These applications should be carefully checked for print quality.

Background printing can interfere with optimum toner adhesion because toner does not bond efficiently to inked surfaces. The processes and security printing inks used to make xerographic security paper are specifically designed to reduce the possibilities of poor toner adhesion. Printing applications should avoid printing over preprinted area to avoid degraded quality and increased service costs. Check with your paper supplier for the availability of xerographic security paper for your application.

Preprinted Image Considerations and Guidelines

The following guidelines can help you prepare preprinted materials:

Process

- Use offset lithography to produce preprinted supplies for your printer.
- Minimize unnecessary preprinted information.
- Avoid embossed designs. Embossed designs can adversely affect print quality near the design and can cause adjacent sheets of paper to partially interlock. This can result in feeding more than one sheet or failing to feed the sheet.
- Consider the paper-drawer capacity, which can be decreased with ink build-up, adhesives, or perforations.
- When purchasing forms with sequential numbers, specify that the stock is stacked in a fashion appropriate for your printer; for example, with the sequence numbers face down, and the highest number at the bottom of the ream. Refer to your printer's operator guide for the correct paper feeding orientation of preprinted paper.

Paper

- Choose a paper with a surface that allows for good ink absorption and curing. See Chapter 1, "Xerographic Paper" on page 1-1 for recommended xerographic paper characteristics.
- Avoid paper that is poorly cut or poorly drilled. This can cause adjacent sheets to become partially interlocked and can result in feeding more than one sheet or a miss-feed.
- Select paper with pH (hydrogen-ion concentration) for correct ink curing, based on ink and printing conditions.
- Some paper may have emissions when exposed to high temperatures and pressure. Small amounts of some compounds (such as sulphur compounds, chlorides, resin-base aerosols, and organics) that may cause nuisance odors.

- Avoid coated paper and paper with a waxy surface; these can cause feeding and fusing failures.
- Embossed paper can cause wear on printer components, such as photoconductors and fuser rolls, and reduce print quality.
- Paper with embossed watermarks may exhibit the same characteristics as rough paper.

Inks

- Avoid designs that use large, solidly-filled areas of ink. If you must use these types of designs, break up the solid area by using a line screen (halftone) print to avoid possible flooding of the solidly-filled area with ink. Flooding can prevent or severely retard proper curing of the ink. These areas can usually be screened to 50 percent or less without detracting from their appearance. A darker ink can be used to compensate for color density that can be lost in using line-screen printing. See “Printing Inks” on page 2-4 for additional information.
- Minimize the amount of ink used in printing. The amount of ink applied can often be decreased by screening a deeper hued ink to get the color you desire.
- Minimize the amount of fountain application when preprinting with wet offset to reduce cockling or waviness of the paper when it is printed on the printer.
- When preprinting is wet offset, avoid using more than one preprinted color if possible. The addition of each color during preprinting introduces additional moisture stress to the paper that can subsequently cause cockling or waviness of the paper when it is printed on the printer.
- Ensure that the printer room and the area around your printer are adequately ventilated, especially when running multicolored, heavily-inked paper. This paper sometimes exhibits a characteristic, pungent odor at room temperature.

Storage

- After the preprinting is completed, cure the forms for 7 to 10 days before packaging them. Protect the paper from acquiring stresses induced by changes in moisture. Cover stacks of preprinted forms with a plastic sleeve as they are staged for curing and final packaging. (Certain chemicals such as accelerators and the use of dryers on the printing press can speed up the curing process.)
- Package the forms in a moisture-barrier wrapping for adequate protection from environmentally induced moisture changes during shipment and storage. Paper, polyethylene, paper-laminated wrap, or plastic shrink-wrapping of the forms is recommended in units of 500 to 1000 forms per package. Protect these packages from shipping and handling damage by enclosing them in adequate, corrugated-paper-board cartons.
- Ensure that the shrink-wrapping is not applied tightly, to avoid crimping or curling damage to the edges or corners of the sheets. This damage prevents reliable feeding of the sheets in the printer. Locate air-exhaust holes at least 38 mm (1.5 in.) from any package edge.
- Ensure that the curing characteristics are not counteracted by anti-oxidants in the ink or on the printing press.

- After the forms are wrapped, allow from one to two weeks before you use the forms in your printer to complete the curing process and minimize the chance of ink offset in your printer.
- Store the preprinted forms in an environment of moderate temperature ideally similar to the printer's operating environment.

Printing Inks

Preprinted forms to be used in cut-sheet printers must be preprinted with inks that dry well, are not tacky, are not electrically conductive, and do not offset. When choosing an ink, the printer making the forms must consider the conditions to which the forms will be exposed while passing through the printer, taking into consideration the amount of heat and pressure, as well as the time during which the forms are subjected to these conditions. In addition to heat and pressure, printing inks are exposed to fuser oil or lubricant during the printing process.

Printing inks that are specially formulated for forms that will be used in electrophotographic printers are becoming more readily available. These inks dry rapidly (approximately 24 hours) and significantly reduce problems that can arise with the use of other inks. Other inks that work well for electrophotographic printer applications are oxidative type ink, and inks that are cured with ultraviolet (UV) light.

- If tinting inks are used, enhance fusing quality by screening, or do not ink the area where the printer printing will be placed.
- Avoid solid preprinted areas on forms, particularly reverse headings and logos. To decrease the amount of applied ink, screen the deeper-hued ink to obtain the desired color. These areas can usually be screened to 50% or less without losing their identity.
- Avoid vertical lines on preprinted forms. They are more susceptible to ink transfer than horizontal lines. If vertical lines cannot be eliminated, screen them, if possible.
- Use inks that can withstand high fusing temperatures and fusing pressures without transferring from the paper to the printer components (see "Fusing" on page 1-3). Ink that has transferred to the heated fuser rolls interferes with the toner-release characteristics and can cause poor print quality (for example, offset[1]) and paper jams. Generally, radiation-curing inks, ultra-violet (UV) and electron-beam (EB), withstand the high fusing temperature and pressure better than latex inks.

  Use paper and inks that, when subjected to fusing temperatures and pressures, do not:

  – Emit any volatile components that cause discomfort to operators or service personnel
  – Emit any volatile components that cause printer parts to deteriorate
  – Contain additives that adversely affect print quality
- Avoid the use of metallic-filled inks. These inks can chip or flake off during the printing process and contaminate the printer, severely degrade the print quality

[1] Offset or set-off is unwanted images. Offset can occur when the ink from improperly cured preprinted paper sticks to the printer's fuser and offsets from the fuser onto the next print. In electrophotographic printing, offset can occur when residual toner from the previous print is not properly removed from the photoconductor and is then deposited onto the next print.

of following prints, and require operator or service intervention. Electrical conductivity of metallic-filled inks can alter the electrostatics of the printer and degrade the print quality.

- Avoid the use of coldset inks. These inks penetrate into the paper but never really dry.
- Avoid the use of rubber-based inks. These inks can cause printer contamination resulting in service calls.

Ink Formulation

Ink should not emit significant amounts of vapors such as low-boiling aldehydes or halogen-containing compounds, ketones (for example, benzophenone), or esters (for example, triacetin). These components can cause irritations or other industrial hygiene considerations to printer operators and service personnel. Vapors can also cause printer parts to deteriorate.

The best results are obtained with a thin film of ink and driers that provide both internal and surface curing of the ink. Curing characteristics should not be negated by antioxidants in the ink or in the printing press. Avoid using slip agents, such as waxes or silicones, because they can affect the ability of the preprinted surface to accept toner. Avoid using long-chain fatty-acid derivatives in ink formulations. For example, stearate-coated calcium carbonate is often used in extenders when producing light-colored background inks (ammonium or calcium stearate with a certain wax content).

The majority of paper of the type used on cut-sheet printers are preprinted by letterpress (direct or dry offset) and lithographic processes. Inks used in these processes typically fall into classes defined by their setting mechanisms: penetration and absorption, quick-set, oxidation, heat-set and moisture-set.

Based on the physical and chemical properties of these inks, IBM recommends the nonvolatile and cross-linkable polymer types, such as oxidating inks containing drying or resin oils. Inform your preprinted paper supplier that these forms are to be used in an electrophotographic printer.

Raised/Engraved Images

Raised or engraved images (usually letterheads) are made with letterpress type, thermographic processes, engraving, or specially-formed printing inks. These materials are especially susceptible to smudging while feeding and to melting during the heat-fusing process because of:

- The raised nature of the letters
- The soft, foam-like nature of some inks
- The large amounts of ink used

The following guidelines should be adhered to for best performance when using these stocks:

- Avoid letterheads made using the standard thermographic process.
- Ensure that the letterhead stock is heat resistant.
- Ensure that the letterhead stock is resistant to abrasion and scuffing.
- Use letterhead stock made from very high-quality, high-temperature, thermoplastic resins.
- Perform a test of the letterhead stock to ensure there are a minimum of problems.

Electronic Forms

Advanced Function Printing (AFP) starts with blank paper and prints any combination of words and pictures. This mixture of text, fonts, and graphics gives you better quality and clearer communication at a reduced overall cost. IBM's Advanced Function Printing capabilities reduces or eliminates concerns associated with preprinted forms. For additional information about AFP, see *A Guide to IBM's Advanced Function Presentation*, G544-3876.

Negotiable Documents

Special paper and inks are used for negotiable documents (for example, checks) to improve the anti-fraud characteristics of the documents.

Security Paper Considerations and Guidelines

Some documents are printed on special security paper that is capable of being used with most printers. These documents are designed to show evidence of tampering, for example, attempted erasures or other alterations. Usually, tamper-evident paper has a printed background that is easy to rub off or reacts chemically with ink eradicators to expose a hidden message, for example, the word *void*. These security printings are often transparent and cannot be observed until tampering attempts are made.

The following guidelines can help you prepare paper for negotiable documents:

- If tinting inks are used, enhance the fusing quality by screening or leaving the area not inked where the printing will be placed. Use only inks intended for use in electrophotographic printers.
- Change the application program and format to print the amount in words and numbers with no loss in throughput. Also, the numeric amount field can be printed with a reverse character set, that is, the background is toned and the digits are the color of the paper.
- If the document has to be folded, carefully select a grade of paper that enhances fusing and lessens the chance of toner cracking on the fold, which can cause character breaks.
- Use a good fusing paper base for preprinting (see “Fusing” on page 1-3).
- Allow ink to thoroughly dry before further processing.

Refer to “Pretesting Paper and Stocks” on page 5-3 for initial testing of security paper stocks.

The printer can print legal and notarial documents that meet the unprinted paper and print-quality criteria (see Table 2-1 and Table 2-2 on page 2-7).

Table 2-1 (Page 1 of 2). Unprinted Paper Properties

Parameter	Typical Values
Paper weight (mass)	60 g/m² (16 lb) minimum
Folding endurance	150 double folds (along the length and the width of the paper)
Fiber composition	Chemical wood-free pulp, DIN 827, Class Z100
Opacity	80% minimum
Ink-writing characteristics	0.8 mm (0.03 in.) line will not feather or penetrate

Table 2-1 (Page 2 of 2). Unprinted Paper Properties	
Parameter	**Typical Values**
Suitability for stamping	Stamping must be wipe resistant
Durability of printed material	Loss of strength on accelerated aging (temperature and humidity) decreases the folding endurance no more than 40 percent.

Table 2-2 provides typical print quality values for security paper used in the IBM family of cut-sheet printers.

Table 2-2. Print Quality	
Parameter	**Typical Values**
Contrast factor	Print contrast signal (PCS), 0.85 percent minimum
Brightness of all white print	Reflectance, 0.75 percent minimum
Legibility	Maintained during the life of the toner and developer mix
Fade resistance	Contrast decrease of 20 percent maximum, while legibility is maintained
Behavior on erasing tests	Writing must not be removable without clearly visible traces of the attempt
Rub resistance	Using a soft rubber eraser, no traces of blur should occur after rubbing 180 seconds
Stability of image with accelerated aging	Contrast decrease of 20 percent maximum, while legibility is maintained.

Magnetic Ink Character Recognition

Magnetic Ink Character Recognition (MICR) uses special magnetic toner ink and specially shaped font characters to create machine-readable images. A typical MICR document is a check, which constitutes the majority of MICR applications.

MICR documents are typically intended for further processing and must meet the requirements of both the printer and of the post-processing equipment.

A listing of standards for check printing are given in Appendix B, “Document Standards” on page B-1.

Current ANSI Standard X9.18, approved by the American Bankers Association (ABA), specifies that if 24 pound (90 g/m²) paper is used (the recommended weight) then the grain direction used for checks may be either direction. Additional requirements to meet all current banking specifications are:

- Sheffield smoothness between 120 and 150
- Moisture content of 4.5%
- Moisture-proof package wrapping
- Avoid use of cut-sheet paper made from fan-fold stock
- No ferromagnetic material contained in paper

Optical Character Recognition Paper

The typical paper weight for optical character recognition (OCR)[2] paper is 75 g/m² (20 lb) basis weight OCR xerographic paper.

Non-printed OCR paper is similar to smooth bond paper, except that it ensures lower levels of contaminants that can interfere with the OCR reading process. Some paper manufacturers offer OCR grade paper that is designed for printing on electrophotographic printers. This paper is preferable to standard OCR paper for maximizing print quality and paper-path reliability. Check with your OCR paper supplier for the availability of xerographic OCR paper for your application.

OCR documents are sometimes printed on special security paper. Refer to "Negotiable Documents" on page 2-6 for additional information.

Background printing can interfere with optimum toner adhesion because toner does not bond efficiently to inked surfaces. The processes and security printing inks used to make xerographic OCR paper are specifically designed to reduce the possibilities of poor toner adhesion. Check with your OCR paper supplier for the availability of xerographic security paper for your application.

Note: For specific recommendations relating to various paper characteristics for optimal OCR scanning, see "Paper Specifications for OCR" in section 4 of the *International Standards Organization (ISO) Printing Specifications for Optical Character Recognition* (ISO 1831, 1980 edition).

Refer to "Pretesting Paper and Stocks" on page 5-3 for initial testing of OCR stocks.

Perforated Paper

Perforated paper must be smooth, flat and without damaged or curled edges. Paper should be re-calendered after perforations are made. Check for ragged or interlocked edges along the perforations.

Printing closer than 3 mm (0.12 in) to any perforation should be avoided. Doing so may cause a loss of image or reduced print quality.

The perforation strength is important for reliable feeding and stacking. If there are too many perforations, or if they are too weak, the stiffness of the paper can be decreased to the point where it does not feed reliably, for example, with lightweight paper.

Depending on the quality and type of perforations, the paper-drawer capacity can be reduced by the extra thickness of the perforations.

For some printers, stock with perforations should conform to the following criteria:

- Minimum paper weight of 75 g/m² (20 lb)
- Maximum of two perforations in either direction

[2] If you use IBM's OCR fonts, available with Bar Codes/Optical Character Recognition, Licensed Program 5688-021, refer to *About Type: IBM's Guide for Type Users*, G544-3122, and *About Type: IBM's Technical Reference for Digitized Type*, S544-3516, for information about these fonts.

- Ties range from 0.2 to 1 mm (0.008 to 0.039 in.)
- Cuts range from 0.3 to 4 mm (0.012 to 0.157 in.)
- Tie-to-cut ratio not below 1:4
- Tensile strength not below 1.0 kN/m
- Perforations must end with a tie on the edge of the paper

Ensure that the cutting die is sharp and produces cleanly cut perforations with minimal embossing. Embossing tends to cause adjacent forms to stick together, and results in multiple sheet feeding or failure to feed.

Grain Direction and Weight Considerations

The grain direction and the weight of the paper are important considerations in applications where a document is torn at the perforation and later fed through a document reader/sorter. The paper shown in Figure 2-1 is grain long, but when the document is removed, it becomes grain short and may not feed through the document reader properly unless the paper weight is 90 g/m² (24-lb) bond or heavier. Perforated documents printed on 75 g/m² (20 lb) bond should use grain-long layouts similar to layouts **C** and **D** in Figure 2-2 on page 2-10.

See “Grain Direction” on page 1-4 for additional information about grain direction.

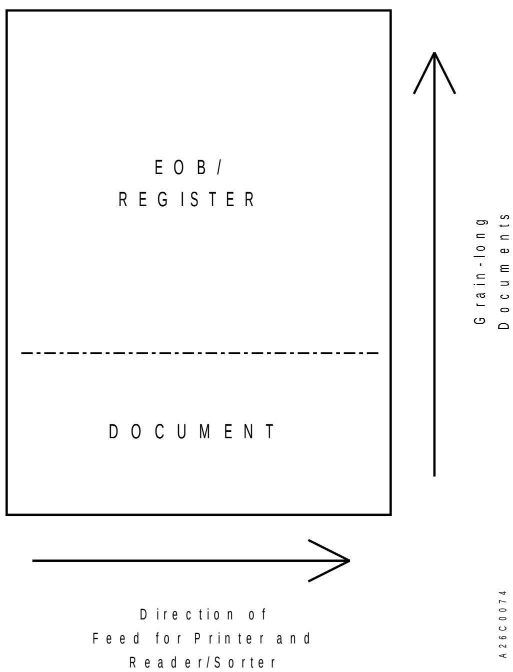


Figure 2-1. Grain Considerations for Perforated Paper

Page Layout

Figure 2-2 shows sample page layouts for a payment document application. EOB in the figure is the acronym for *explanation of benefits*. Layouts **B** and **F** exceed the limit of two perforations in either direction and are not recommended.

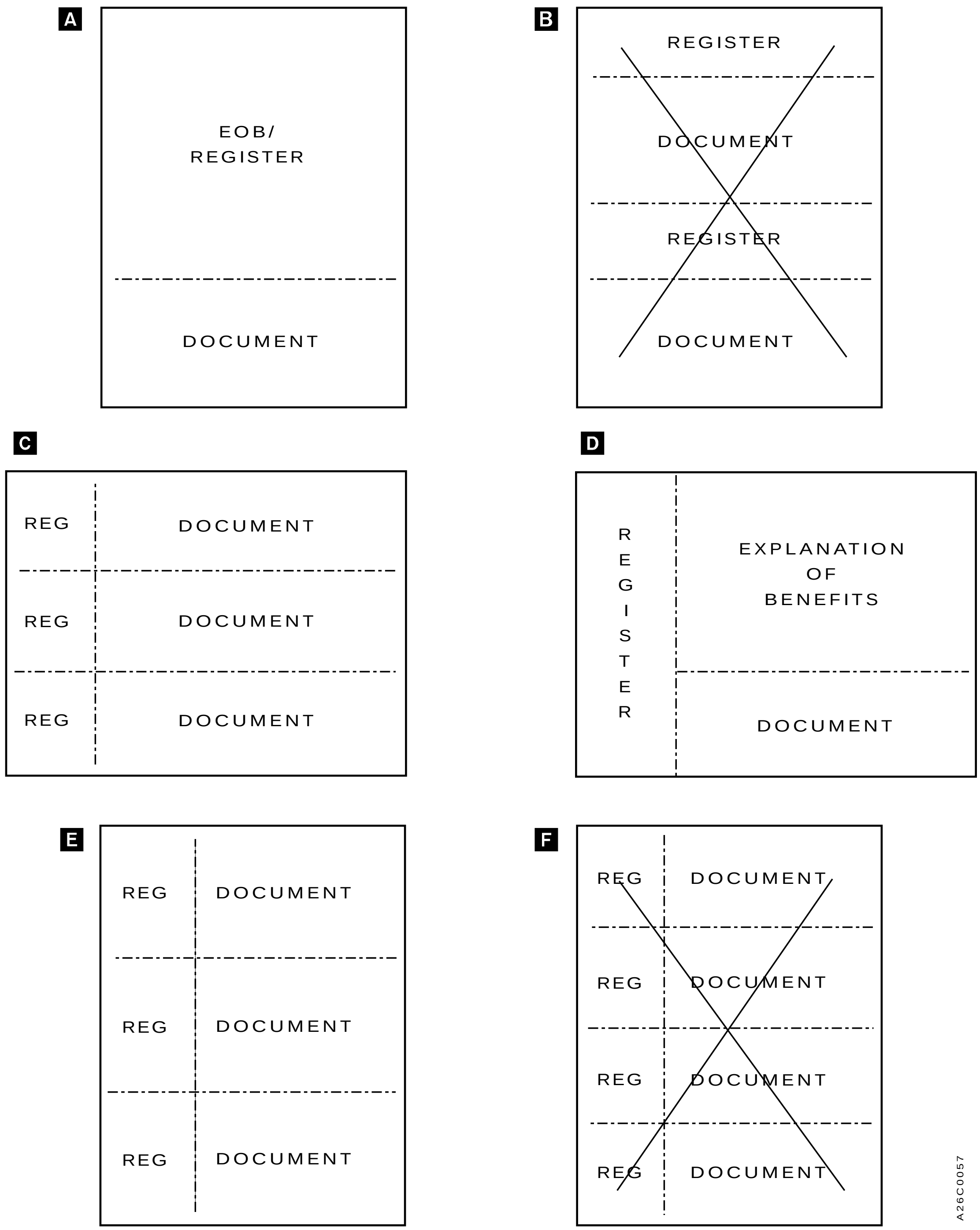


Figure 2-2. Sample Page Layouts for Payment Documents

Prepunched Paper

Pre-punched paper must be smooth, flat and without damaged or curled edges. Check for ragged or interlocked edges around the pre-punched holes. These characteristics can cause the printer to feed more than one sheet at a time and can cause jams requiring operator intervention or a service call. Hole orientation may be critical in your printer; refer to your printer's Paper Specifications for possible hole-exclusion zones.

Different printers accommodate significant variations from this criteria. If your requirements differ from this criteria, you should test the paper (see "Pretesting Paper and Stocks" on page 5-3). Also, refer to your printer's Paper Specifications.

Edge-Reenforcement

Edge-reenforced papers have a plastic strip along the hole edge, this reenforces the holes, reducing the possibility of the holes tearing out. These papers reduce the capacity of a paper drawer and may cause paper feed and fusing degradation.

Adhesive Labels

Some printer's can print self-sticking, adhesive-backed labels. For detailed information on labels, refer to Chapter 3, "Adhesive Labels" on page 3-1.

Heavyweight Stocks

Heavyweight stock includes index paper, cover stock, and bristols. These stocks can be troublesome for several reasons. Although the stock may be within the weight specifications for your printer, they can cause problems because many heavyweight stocks are cut grain-short. For most applications they should be cut grain-long and it should be free of edges that are stuck together because of the type of cutting frequently used.

Heavyweight stocks are not recommended for every printer. Refer to your printer's Paper Specifications to verify that your printer is capable of handling these stocks.

Grain Direction

When ordering heavyweight paper, specify 100% grain long. Heavyweight stocks are commonly cut grain short, and are sometimes packaged in mixed (grain short and grain long) form. Because grain short paper is nearly twice as stiff in the grain short direction as in the grain long direction, 110-lb index stock will almost certainly be too stiff (in its direction of travel through the printer) for acceptable performance.

See "Grain Direction" on page 1-4 and "Grain Direction and Weight Considerations" on page 2-9 for additional information about grain direction.

Short Direction Curl

Another difficulty with grain short stock is its propensity to exhibit short direction curl. This curl does not conform to the transport path, and may present a curved leading edge to machine parts resulting in poor paper handling performance.

Grain long stock, on the other hand, exhibits a long direction curl that conforms more easily to the contour of the transport path, and may be beneficial for paper handling.

Edge Sticking

Heavyweight stocks are prone to edge sticking (sheet edges stick together), usually as a result of trimming difficulties, and can cause misfeeds. All four sides of heavyweight stock should be thoroughly fanned prior to loading to minimize the effects of edge sticking.

Index Paper

Index paper is heavier weight paper. Table 2-3 lists the standards for testing index paper parameters to help you and your paper supplier choose the paper that is most suitable for the printer.

Table 2-3. Standards for Testing Index Paper Parameters

Parameter	**Standard for Testing (see note 1)**	**Typical Specification**
Basis weight	T 410, ISO 536 (see notes 2 and 3)	163 g/m² (90 lb) 199 g/m² (110 lb)
Caliper (thickness)	T 411, ISO 534 (see notes 3 and 4)	8 mils (200μ) 10 mils (250μ) maximum
Stiffness (Taber)	T 489 (see note 4)	163 g/m² (90 lb)–MD: 25.0 max.; CD: 12.3 max. 199 g/m² (110 lb)–MD: 30.0 max.; CD: 15.0 max.

Notes:

1. All tests are conducted per TAPPI 402 or ISO 187, except caliper, which pertains to the paper as packaged. See Appendix B, “Document Standards” on page B-1 for a list of paper standards.
2. Testing method of the American Society for Testing and Materials (ASTM).
3. Testing method of the International Organization for Standardization (ISO).
4. Testing method of the Technical Association of the Pulp and Paper Industry (TAPPI).
5. MD (machine direction), CD (cross direction) relative to the grain direction of the paper as it is fed through the printer.

Additional Papers and Stocks

Additional papers and stocks that may be considered for use in the IBM family of cut-sheet printers are described in the following section.

Colored Papers

Colored (tinted) xerographic papers are available in a wide range of shades. Typically, they do not differ from white versions of the same paper and manufacturer in terms of print quality or performance in the printers.

Parchment Papers

Parchment paper has an appearance and feel similar to genuine parchment. It has a rough, mottled surface that simulates the look of parchment. The surface finish of these papers may cause print quality degradation.

Vellum Stock

Vellum stock is a very smooth, translucent paper typically used in drafting and engineering activities. It is produced by the addition of organic resin in a solvent during the papers manufacture. Unless specifically developed for use in paper printers it can emit an unpleasant odor during the image fusing process. Vellum stock for use in printers should not contain high levels of plasticizers which can cause photoconductor spots and cause contamination problems.

Note: Vellum finish is a rough surface finish on the paper which may, or may not also be translucent. Vellum finish papers should be avoided for use in printers.

Non-tearing Papers

Non-tearing papers are actually a coated, polyester film that is waterproof, soil resistant, and extremely difficult to tear. This stock is particularly useful for printing documents that must be preserved, subject to harsh usage, or handled frequently.

Non-tearing paper is not recommended for continuous long runs (greater than 1500 sheets) because it is essentially non-absorbent and allows fuser oil to remain on the sheet and be carried through the printer.

Note: This problem can be minimized by occasionally running a few sheets of xerographic paper through the printer.

Non-tearing paper may also increase the number of jams in the printer.

Transparencies

Transparency stock is used primarily to create images that can be used with projection equipment. Transparencies are made from polyester film that has been specially coated to allow toner to readily stick to it.

There are several types of transparency stock available for printer use; paper-backed, removable-stripe, duplicator white-striped, and clear. Refer to your printer's Paper Specifications for specific details in your printer.

When using transparencies, the following suggestions may improve performance.

- To reduce sticking, fan the transparencies before loading.
- Load the transparencies on top of a small stack of the same sized paper.
- If the transparencies are striped stock, be sure to load them according to the instructions given in the printer's *Operator's Guide*.
- If a jam should occur, do not resume printing until all parts of the jammed transparency have been removed, or severe printer damage can occur.

Non-recommended Papers and Stocks

Certain stocks are not recommended for use in printers because of their potential for contaminating the printer, causing poor printer performance, and resulting in possible service calls. It is recommended that these stocks be avoided.

Envelopes

Not all printers have the capability to print envelopes. Refer to your printer's publications to determine if your printer can print envelopes.

Duplicator Papers

Duplicator papers are very smooth, well-sized, and highly resistant to liquid penetration. They are designed for use in spirit (alcohol) or gelatin duplicators. Duplicator papers can cause paper handling problems in cut-sheet printers because they are thin, lack stiffness, and have a low coefficient of friction.

Mimeo Papers

Mimeo papers are tough, thick, and porous so that ink can be readily absorbed during the mimeograph process. Their extreme roughness can result in poor fusing in electrophotographic printers with roll fusing systems. In addition, chemicals on the paper can contaminate some printer parts.

Carbonless Papers

Carbonless papers allow the creation of multiple part forms. These papers can cause photoconductor problems if not specifically designed for use in electrophotographic printing applications.

Carbonless papers reproduce an image when chemical-containing capsules coated on one or both sides of the paper are broken from the pressure of a pen, typewriter, or impact printer. Most carbonless papers, unless specially developed for printer use, present a significant contamination problem, particularly if used in large quantities.

Coated

Coated stocks have binders, adhesives, and pigments applied to their surfaces on one or both sides. These binders consist of starch, rubber, plastic resins, or latex. They are use to produce a paint-like finish, either dull or glossy.

Because of the variation in materials and the techniques used to apply them, it is impossible to predict how a coated stock will perform in a printer. Problems that can occur include:

- Blistering of the coating during the fusing process causing contamination or possible damage to the printer
- Pigment separation from the stock causing contamination of the fuser, belts, and transport mechanism causing misfeeds
- Failure of the toner to adhere to the stock
- High-static with result of sheets sticking together
- Possible unpleasant odors

Highly Conductive Paper

Highly conductive paper, such as aluminum foil backed, should **never** be used in a electrophotographic printer. Electric arcing can occur causing poor print quality and printer damage. Conductivity problems can also occur with preprinted forms that use conductive inks.

Paper with high moisture content and/or high salt content may be too conductive to hold a sufficient charge to allow for efficient ink transfer. The result can be low print density, poor solid area density, or image deletions.

Papers with Talc

Talc is sometimes used in the paper manufacturing process to control the effect of pitch in paper; unfortunately, these talcs are difficult to hold within the paper. Even small amounts of talc, 1% or less, can cause significant problems by reducing the friction between paper and the transport mechanism.

Symptoms of problems associated with talc include:

- Increasing rates of jams and misfeeds
- Background spots on the prints caused by loose talc
- Contamination of, and reduced life span of the print cartridge, photoconductor, or developer system

Papers with Wax, Stearate, or Plasticizers

Wax, stearate, and plasticizers in paper can cause paper-handling problems because of their friction-lowering effect on paper and the paper transport mechanism. These substances can also cause print quality problems due to spot formations on the photoconductors.

The usual cause of wax problems is wax-laminated ream wrappers; the wax in the wrapper transfers onto the paper. Stearates and plasticizers are found in a variety of stocks (some vellums, calendered stocks, and coated stocks).

Chapter 3. Adhesive Labels

Most printers can print self-sticking adhesive-backed labels. The labels must be supplied on carrier sheets (the backing to which manufacturers attach adhesive labels) and can be either pre-cut or machine cut by a suitable device after printing. When printing on labels, it is recommended that you maintain a minimum margin between the image and the edge of the label. This prevents image-quality problems and loss of information. Refer to your printer's Paper Specifications.

General Considerations

The IBM family of cut-sheet printers accept a variety of inks, adhesives, and labels. However, they all must be able to withstand the fusing temperature and the mechanical action of the printer.

Inks, adhesives, and labels exposed to fusing temperatures must not emit harmful vapors to the environment at levels that create industrial hygiene considerations.

Inks, adhesives, and labels that soften and transfer to the printer components, such as the heated fuser roll or photoconductor, interfere with the toner release characteristics and cause print failures. Some of these supplies also prevent toner from adhering to the paper.

The customer and forms supplier are responsible for ensuring that inks, adhesives, and labels used for printing do not degrade printer performance. At the time the forms are ordered, specify that the forms are intended for use in electrophotographic printers. For additional information on recommendations for preprinted forms, see "Preprinted Image Considerations and Guidelines" on page 2-2.

Applications

Self-adhesive labels can be used for addressing personal greeting cards to marking components for inventory and quality control in a large automotive factory. Examples of common applications that can be printed on the printer are:

- Common mailing label
- Shipping label
- Retail sales item marking or bar-code label
- Retail sales shelf marking or bar-code label
- Work-in-process bar-code label
- Stock inventory bar-code label
- Tamper-proof label
- Drafting applique label

Other label applications are suitable for the printer. Some label manufacturers will develop special configurations or materials to satisfy unique applications. A label manufacturer can ensure that a label is suitable for the job by knowing the application and the imaging process for the label. Often, manufacturers can meet requirements with existing materials and configurations.

To assist the label supplier, supply the following information:

- The end-use application
- The imaging process or machine that puts the image on the label

  Is the label printed by more than one process? For example, you may need shelf-marking labels imprinted with the store name by an offset printer and then add variable information such as item name and price with the printer.
- The materials and surface finishes to which the label is attached
- The environmental conditions to which the label is exposed after it is attached:
  - Is the label exposed to elements such as direct sunlight, dampness, cold, or heat?
  - Does the label carry bar-code information? How is the bar-code printed? Is bar-code scanned several times? Is the scanning device a contact (wand type) scanner or a noncontact scanner?
  - Must the label withstand washing or wiping periodically, for example, in a grocery store?
  - Is the label expected to adhere to cylindrical objects, sharp radiuses, or corners?
  - Is the label removable or permanent?

Bar-Code Application

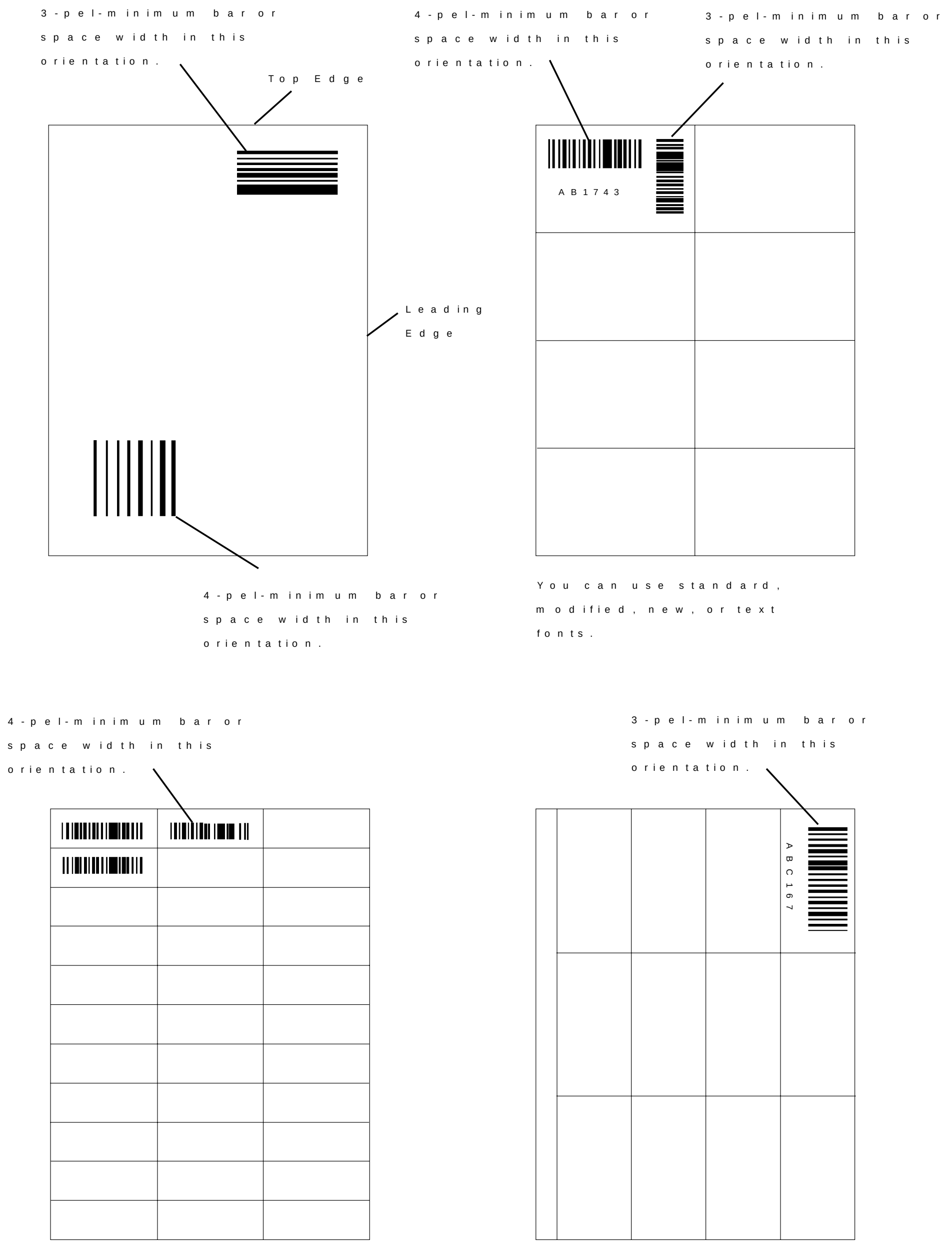
Figure 3-1 on page 3-3 shows how to orient bar-codes. Consider these options for your label applications.

Most printers support the use of the three-pel minimum-module width if the bars are perpendicular to the leading edge of the paper. Most printers also support the use of the four-pel minimum-module width if the bars are parallel to the leading edge of the paper. Refer to your printer's Paper Specifications.

Bar-codes can be created either by using fonts or by using draw rules.

The bar-code fonts that are available with Bar Codes/Optical Character Recognition, Licensed Program 5688-021, have a minimum module width of four-pels, which apply to both bars and spaces. The printer can print these four-pel module widths in either orientation on the sheet. IBM's AFP licensed programs can be used either to modify the module width (for example, to three-pels or to six-pels) or to control the orientation.

For information on the subroutine that accesses and uses these fonts, refer to *IBM Bar Code Fonts User's Guide*, S544-3190. For information on IBM's AFP licensed programs, refer to the *Guide to Advanced Function Presentation*, G544-3876.



Note: 3- and 4-pel minimum values may vary.

Figure 3-1. Sample Bar-Code Orientation

Label Construction

Figure 3-2 shows the typical label construction used for the manufacture of labels. All of these label types must meet the requirements in this document.

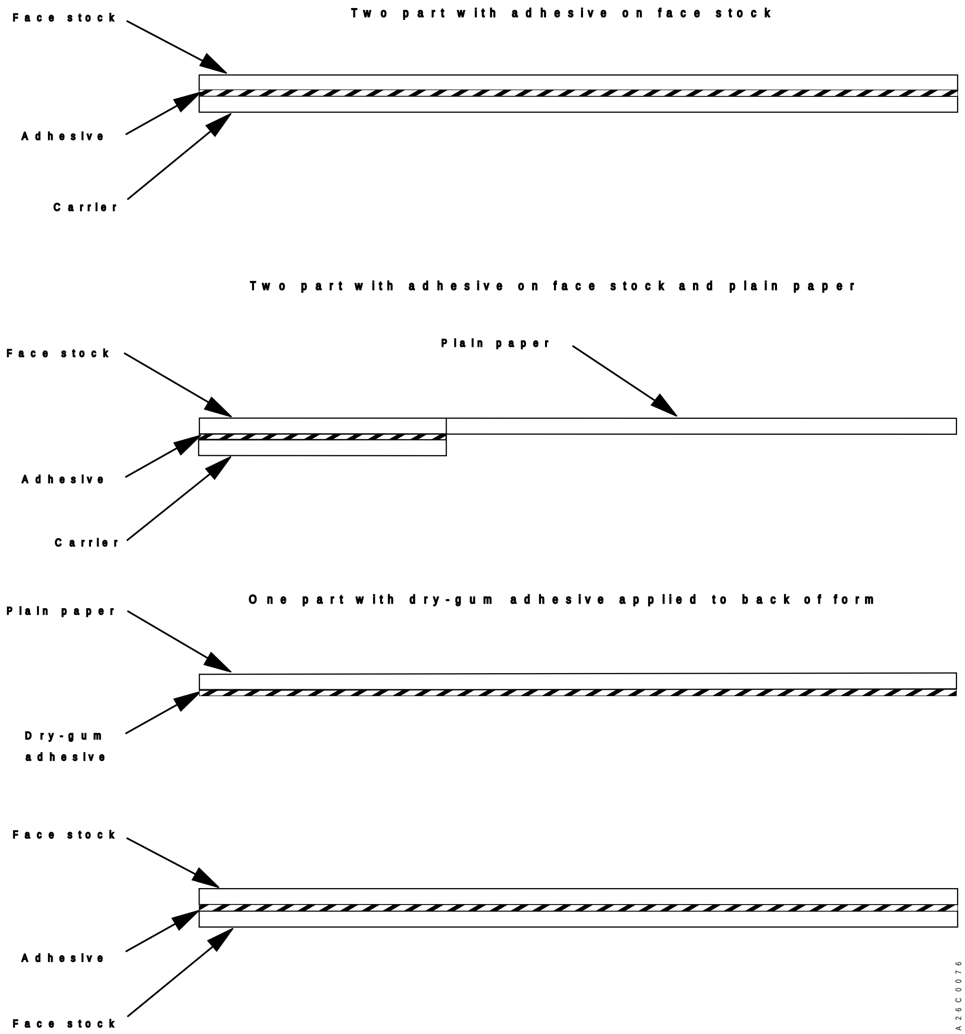


Figure 3-2. Types of Labels

Materials

Common face-stock material (the basic label component itself) that can be used with most printers include:

- Paper
- Latex-impregnated paper

Notes:

1. Any labels (paper and latex-impregnated paper) that exceed the maximum equivalent paper weight for your printer can cause severe feeding problems.
2. Do not use face-stock containing polyolefin fibers because the melting point of certain polyolefins is lower than the normal operating temperature of the fuser in the printer.

All label components, including face stock, adhesive, and carrier sheets, must withstand brief exposure to the temperature and pressure generated in the printer's fuser without permanent deformation or plastic flow and without producing objectionable odors or hazardous vapors.

Paper face stock must consist of 100-percent chemical wood pulp and may contain up to 18 percent by weight filler. (Wood-free pulp in Europe is synonymous with chemical wood pulp in the U.S.A. and Canada.) Filler materials can be kaolin or china clay (both are aluminosilicate) or calcium carbonate. Also, small amounts of titanium dioxide can be put into the filler as an optical brightener. Paper face stock can be coated with low-coat weights of kaolin clay, calcium carbonate, but must not be super-calendered after coating. The coating must be left with a matte or dull finish. Shiny finishes must be avoided on all face stock materials. Shiny finishes generally do not allow as high a degree of image fusing as dull finishes.

Paper face-stock sizing must be conventional alum precipitated rosin with starch, or modified- or activated-starch surface sizing. Reactive synthetic sizings such as alkyl-ketene dimer or alkenyl-succinic anhydride also can be used, but ensure that excessive amounts of sizing that is not fully reacted, do not remain on the paper after processing. Synthetic sizing remaining on the paper acts as a releasing agent and can prevent effective adhesion of the toner, and result in poor fusing of the image.

Tests are available to check for synthetic sizing that is not reacted, but they are impractical for most users, because these tests require special chemical analysis. The most practical test is to print sample quantities under simulated production conditions and check the adequacy of the fusing in the anticipated application.

Toner Adhesion

When you order labels, inform the supplier that the labels will be printed with an electrophotographic process. The labels must have good toner adhesion.

Be aware of potential image-fixing problems. Some manufacturers offer special coatings specifically designed for improving toner bonding to the paper surface. Usually, these coatings have materials that are chemically similar to the toner itself, such as styrene rosin esters. Label manufacturers can apply these coatings to many label face-stock materials.

These coatings can be applied to any of the face-stock materials that are suitable for use in your printer. These coatings are effective on coated and latex-impregnated paper or uncoated paper. The effectiveness of these coatings depends on the surface energies of the uncoated paper and the overall weight of the label sandwich, which is the combined unit of the face stock, adhesive coating, and the carrier sheet. These coatings have minimal effects on improving the adhesion of the toner to the face stock.

To determine the usefulness of a toner-adhesion enhancement coating, obtain sample quantities of the label (with and without the coating). Print the samples under simulated production conditions. Then evaluate them in your application. Alternatively, you can make a simple comparative evaluation by scratching the images several times with your fingernail, pen knife, nail file, or similar instrument. Observe the difference in the relative ease of image removal between the coated and uncoated samples.

Curl

The correct balance of the reactive curl characteristics of the label sandwich (the combined unit of the face stock, adhesive coating, and the carrier sheet) is important when you select labels. Reactive curl is the curl observed when the label sandwich is exposed to environmental changes, in particular, sudden and extreme changes such as exposure to the printer’s fuser temperature.

Usually, paper face stock has the greatest tendency toward reactive curl because paper always contains a certain amount of moisture. When the paper is exposed to a sudden temperature increase, it loses some of its moisture which causes the paper to shrink. Because the other materials in the label sandwich are less prone to moisture loss, they do not shrink as much or as rapidly as the paper face stock. In fact, the other materials can even expand with the application of heat. The resulting stress between the face stock and the rest of the label sandwich causes it to curl toward the label side. Similar stresses within the label sandwich can occur even with face stock that is not made of paper. This occurs because of different thermal expansion characteristics of the various materials in the sandwich. Labels that are specifically designed for electrophotographic or electrophotographic printing are manufactured to minimize the curling stresses in the label sandwich. For paper face stock, xerographic labels generally contain relatively low moisture. This results in minimal dimensional changes during the fusing process. For non-paper face stock, be aware of the potential curl problems caused by differences in the thermal expansion characteristics of the materials used in making the label sandwich. Try to select materials with similar thermal expansion properties.

Basis Weight

The typical printer is designed to handle paper from 75 g/m^2 (20 lb) for optimum performance. Refer to your printer's Paper Specifications for specific information.

Because of their multiple layer construction, almost all self-adhesive label composites are significantly heavier than 105 g/m^2 (28 lb). The lightest labels weigh about 158 g/m^2 (42 lb). These are generally paper labels with light to moderate adhesive coat weights. Face stock containing latex, combined with permanent adhesives designed for moderately rough surfaces such as die castings, can cause label composite weights to exceed 282 g/m^2 (75 lb).

The greater basis weights, combined with the obvious structural differences between labels and paper, increase the difficulties for the printer to handle the labels. Therefore, labels have less paper-path reliability than 75 to 105 g/m^2 (20 to 28 lb) paper. Refer to your printer's Paper Specifications for specific information.

The increased weight of labels also puts an increased thermal load on the printers fuser because there is a greater mass-per-unit area to absorb heat. This can contribute to difficulties in obtaining good fusing of the image. When selecting labels, select the lightest weight label that can do the required job. Label manufacturers familiar with making labels for copiers and electrophotographic printers are sensitive to the limitations posed by heavy-weight labels. They can assist you in choosing labels that are the right weight for your application.

Label Size and Cutting Configurations

The typical printer requires labels that are supplied on 215.9 x 279.4 mm (8.5 x 11.0 in.) or 210 x 297 mm (8.3 x 11.7 in.) sheets. Label face stock can be either uncut (in applications where labels are cut after printing) or pre-cut to the size you specify before printing. The carrier sheet must *not* be scored, cut, or perforated. Labels must be butt-cut with no matrix removal (removal of the label face-stock material between adjacent labels).

Labels can be manufactured with a gripper edge that aids the offset press in label preprinting. See Figure 3-3. If a gripper edge is used, it can be located either along one of the long edges of the label sheet or on the top or bottom of the label sheet. The gripper edge must be at least 9.5 mm (0.38 in.) wide. If the gripper edge is located on one of the long edges of the sheet, it *cannot* be used as the leading edge when loading it into your printer.

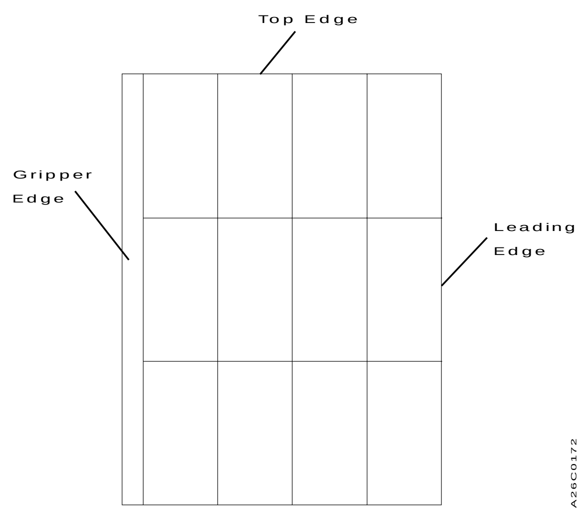


Figure 3-3. Label Gripper Edge

The label face stock must extend continuously from edge to edge of the sheet in both directions, with no exposure of the top side of the carrier. The size of the individual labels can vary widely, but should not be less than 15.9 mm (0.62 in.) in the shorter dimension, or less than 38 mm (1.50 in.) in the longer dimension.

Labels with a loose tab with no adhesive are known as pull-tab labels. Do not use pull-tab labels in the printer.

Label Preprinting

Consider the advantages of using the electronic forms capabilities of the printer for printing labels. For more information about electronic forms and print registration, see “Preprinted Electronic Forms” on page 2-1, “Electronic Forms” on page 2-6, and “Bar-Code Application” on page 3-2, which also applies to label printing.

You can have your labels preprinted before using them in the printer. Preprinting can be done by direct- or dry-offset letter press or offset lithography. Care must be exercised when using offset lithography. This process involves the use of a fountain solution (typically, a water or alcohol solution) that wets the areas not printed.

The fountain should be kept as dry as possible on the offset blanket to avoid the transfer of too much moisture to the face stock. This can later cause curling or buckling problems when the labels are run through your printer.

The best ink types dry or *cure* by oxidation or polymerization of the ink carrier when exposed to the atmosphere. When cured, the ink becomes hardened on the paper and is not easily removed by contact with, or rubbing against, other surfaces—including heated surfaces in the printer fuser. These inks typically consist of fatty acid esters of glycerol. The desirable characteristics of these inks can be compromised by the elimination of curing additives recommended by the ink manufacturer, or over usage of anti-oxidants designed to help clean the press. Label manufacturers experienced in the production of preprinted labels for use in the IBM electrophotographic printers are familiar with the class of inks that were developed to meet the requirements of that printer. These same inks are an ideal choice for preprinting labels for use on the printer.

After the labels are printed, at least ten days should be allowed before you run the labels in your printer. The labels should be cured in a well-ventilated room where the temperature is between 18°C and 26°C (65°F and 80°F), and the relative humidity is below 50 percent. The labels should be cured in open stacks or in ventilated cartons. If the printed labels are cured inside cartons, and you observe ink offset when you run them in your printer, remove them from the cartons and allow them to cure for an additional four or five days before trying to run them again.

The preprinted labels should be processed with the least amount of ink, to further prevent ink offset. Large, solidly-filled areas, as in some logos, should be avoided. Specify that the large, solid-colored areas are made with a halftone screen of a darker colored ink, rather than a solid area of a lighter ink. Printing with the halftone screen helps to avoid having the surface coated with too much ink. Heavy films of ink are slow to cure completely.

The chemistry of most inks suitable for preprinted supplies have low surface energies, and make it difficult to fuse toner images to the cured ink surfaces. Use preprinted designs that do not require the printer to print on top of inked surfaces.

Labels should not be placed in moisture-barrier packaging before the ink has fully cured. Normally, at least ten days are required to properly cure the oxidation-cure inks recommended for your printer.

Never use metallic inks. These inks can prevent proper toner transfer to the label face stock and result in markedly degraded print quality (normally, low image density). Also, the metallic fillers can flake off from the printed stock, and contaminate the printers photoconductor or developer.

Inform the vendor that the ink must withstand short exposure to the temperature and pressures of the printer’s fuser, without degradation, offset, or the emission of objectionable odors or hazardous vapors.

Adhesive Types

Removable and *permanent* adhesives are used on labels. Removable adhesives are used where the label is a temporary marker. Permanent adhesives are used in applications where the label must remain attached for long periods.

The primary difference between permanent and removable adhesives is their tack strengths. Permanent adhesives have a greater tack strength that require more force to remove than a removable label of the same size. The force required to remove a permanent label is often so great that either the face stock, or the surface to which the label is attached, or both, fail before the adhesive yields. Tamper-proof labels are designed so that the face stock must be damaged substantially to remove the label. This process makes it impossible to reapply the label elsewhere.

Removable labels can be peeled off from the carrier sheet easier than permanent labels. In some areas of the printer's paper path, the sheet of labels must move around relatively tight curves. This can cause labels with a low tack strength to begin peeling away from the carrier sheet. When this occurs, the label edge can catch on paper path components, dislodge from the carrier sheet, and cause jams. Proper curl control and cutting configurations are also important in avoiding separation of labels from the carrier sheet. Suppliers experienced in providing labels for xerographic copiers and electrophotographic printers are aware of these problems. They design their removable labels to avoid premature separation.

The basic chemical composition of both removable and permanent adhesives is frequently the same. Often, non-tacky filler materials are added to reduce the strength of the removable adhesive. These fillers take up space without contributing to the adhesion of the bond, and decrease the strength of the bond area. Also, adhesive strengths can be adjusted by using different ratios of chemicals.

Some adhesives contain small amounts of unbound water that tend to vaporize when exposed to high temperatures, such as those in the printer fuser. When the water vaporizes, it can cause blistering of the face stock when it yields to the high pressure of the water vapor between the face stock and the carrier sheet. Avoid using emulsion-type adhesive labels in the printer.

Labels with dry adhesives (commonly called dry-gum labels) are designed to become tacky when moistened. These labels are usually supplied without a carrier sheet. Often, this type of label emits paper dust containing a certain amount of the dry-gum adhesive. The adhesive in the paper dust rapidly contaminates the printer, which can cause degraded print quality or premature failure of printer components. Do not use dry-gum labels in the printer unless they are specifically designed for use in electrophotographic printers.

Adhesives must be applied sparingly to minimize the chance of excessive adhesive material oozing or migrating onto the surface of the face-stock print side and to avoid excessive build up of adhesive at the label edges. Adhesive that migrates onto the print side of the label can interfere with proper sheet separation and paper-path travel, and it can contaminate the printer's photoconductor, fuser roll, and paper-path components.

Avoid adhesives that tend to soften and flow excessively under temperature and pressure. Adhesive migration and resulting printer contamination is difficult to control. Generally, acrylic polymer and styrene butadiene copolymer adhesives are more resistant to flow under heat and pressure than latex and certain elastomer resin and rosin-based adhesives. When you order labels, make your supplier aware that the adhesive must withstand short exposures to high heat and pressure. Refer to your printer's Paper Specifications for the temperatures and pressure used in your printer. Table 3-1 shows the types of adhesives for labels for use in the printer.

Table 3-1. Types of Adhesives for Labels

Adhesive Type	**Removable or Permanent**	**Printer Use**
Acrylic polymer	Removable or permanent	Yes
Styrene butadiene copolymer	Removable or permanent	Yes
Polyisobutylene	Removable	Yes
Latex	Removable	Yes
Elastomer or rubber resin	Removable or permanent	Yes
Emulsified latex	Removable	No
Emulsified rosins	Removable	No
Dry-gum adhesives	Permanent	No
Silicone	Permanent	No

The adhesives shown as acceptable are only general types. Modifications can be made to the basic chemistry of these adhesives, but modifications can make the adhesives less desirable for use in your printer.

To ensure your labels have good adhesive properties, use a label supplier experienced in providing labels for high-speed copiers and electrophotographic printers. Make the supplier aware of your application, including the temperatures and pressures in your printer.

Carrier Sheet

The carrier sheet is the backing to which manufacturers attach adhesive labels. The carrier sheet must carry the labels through the printer. The labels must remain securely attached to the carrier sheet during printing but must be easily removed after printing. For easy removal of the labels, most carrier sheets are coated on the label side with a special coating called a release agent. Release agents have low surface energies that prevent strong adhesion to their surfaces. Adhesives, on the other hand, are high-surface-energy materials.

The reverse side of the carrier sheet can be coated with a different material to counteract the stresses on the carrier sheet by the heavy coating of release agent on the label side. The carrier-sheet back-side coating can also reduce or eliminate moisture absorption by the carrier sheet. This helps to alleviate curl—especially the curl caused by moisture-laden paper being exposed to the drying conditions in the printer.

Also, the carrier sheet reverse-side coating can be designed to prestress the carrier curl toward the back side of the carrier sheet. This compensates for the opposite curling forces imposed on the label composite by the adhesive and the face stock. The coating on the reverse side of the labels allows the printer to easily separate adjacent sheets of labels. Yet, the coating must not be slippery or it will cause stacking problems with the sheets of labels. Either excessively low or high friction between adjacent sheets of labels in the input supply can prevent reliable separation. Low friction can also cause poor stacking characteristics of sheets in the printer's output stacker.

The carrier sheet must be 100-percent chemical wood pulp paper, which can be bleached white, semi-bleached, or unbleached *kraft* paper. Any release agents used must be stable and nonvolatile when briefly exposed to the high temperature and mechanical pressure of the printers fuser at standard atmospheric pressure.

Usually, heat-stable polymers are the best release agents. Fully polymerized silicone is one of the most commonly used release agent coatings and is acceptable for use with labels printed in the printer.

Avoid the use of polyolefin materials in the construction of the carrier sheet. Their melting point is too low to reliably withstand exposure to the printer fuser. Avoid waxes and oils. They will melt and vaporize in the fuser, and result in contamination and poor label release.

Label Testing

Because of the various chemical and physical characteristics of the labels, there can be significant differences in the overall performance of your printer.

Generally, you can expect the best handling, print quality, and image stability on the lighter weight paper labels—particularly for paper supplied with special toner-adhesion-enhancement coatings. However, test a small sample of labels in your printer before you purchase large quantities.

When you conduct tests, consider the environment where your printer must print the labels. The performance of the printer can be satisfactory under moderate conditions, but unacceptable under temperature and humidity extremes. The labels can be limited to a range that is narrower than the printer operating range. Read and adhere to the label-manufacturer recommendations and limitations on the label wrapper.

Test the printer output for the intended application. For example, the permanence of the print on a label can be satisfactory for bar-coding shelf items in stores where the code is scanned once with a non-contact scanner. However, the print may not be permanent enough for applications such as process control labels where a bar-code must be repeatedly scanned with a contact scanning wand. Also, the print may not be adequate for store-shelf marking where the label must be periodically washed or wiped clean.

While some label materials other than those described in this guideline are satisfactory, do not use materials specifically defined as unsuitable by this guideline. Contamination or premature failure of the printer can result.

Before ordering large quantities of any particular label, test print a sample (500 to 1000 sheets) of the labels you are considering for the actual application. If it is not possible to test an actual application, attempt to identify and simulate the stresses of the application. Consider such stresses as exposure to sunlight, heat, cold, moisture, soiling, wiping, washing, and scanning (with an optical scanner). Also, consider the types of surfaces to which the labels must adhere and the conditions under which they are applied. Is the surface rough or smooth? Of what materials is the surface made? Will the label have to wrap around tight radii? Are the surfaces cold or hot at the time of application? Is the humidity likely to be high at the time of application? Must the label be removed? If so, after how long, and after exposure to what elements?

Your testing must include printing the labels in the printer. Wherever possible, print the labels with the exact images that you will use in the production application. Also, print the labels under actual or simulated production environmental conditions. Consider especially the range of temperature and humidity for a complete year.

While testing the labels with the intended application, it is useful to recognize obvious problems and incompatibilities. The success of your testing does not constitute a proof that the application will work problem free. A small sample of labels (100 to 200 sheets) printed and tested under the anticipated printing and application conditions can give a fairly reliable indication of what the toner adhesion, image density, and image resolution characteristics are under actual production conditions. However, such a small sample cannot produce a reliable indication of long-term feed reliability. This type of testing cannot reveal any information about the effects of the labels on printer wear or contamination. Only long-term tests, involving several thousands of sheets, can provide reliable data about these characteristics.

Work with suppliers familiar with producing labels for electrophotographic copying and printing. Order small quantities of labels the first few times, no more than a one- to two-month supply. After you establish the reliability of a certain label, work with your supplier to ensure that future orders are filled with labels that have the same characteristics.

Label Selection

Table 3-2 lists standards for testing label parameters and provides recommendations to help you and your paper supplier choose the labels that are most suitable for your printer.

Table 3-2. Standards for Testing Label Parameters

Parameter	Standard for Testing (see note 1)	Typical Specification
Total basis weight	T 410, ISO 536 (see notes 2, 3, 4, and 5)	199 g/m² (53 lb) maximum (Heavier in certain printers) (see note 6)
Caliper (thickness)	T 411, ISO 534 (see notes 2, 3, and 7)	2.54 mm (0.010 in.) maximum
Coefficient of friction (static, sheet to sheet)	T 549 (see notes 5 and 8)	0.35 to 0.62
Face-stock smoothness (print side)	T 538, ISO 2494 (see notes 2, 7, and 9)	100 to 200 Sheffield units
Internal sizing (paper face stock, not impregnated)	N/A	Acid rosin or synthetic (alkyl-ketene dimer or alkyl-succinic anhydride)
Surface sizing (paper face stock, not impregnated)	N/A	Starch. Do not use synthetic surface sizing.

Note:

1. All tests conducted per TAPPI 402 or ISO 187, except moisture and caliper, which pertains to the paper as packaged. See Appendix B, "Document Standards" on page B-1 for a list of paper standards.
2. Testing method of the International Standards Organization (ISO)
3. Refers to the total label composite, including the face stock, adhesive, and the carrier.
4. The basis weight refers to a 431.8 x 558.8 mm (17 x 22 in.) basis ream.
5. Testing method of the American Society for Testing and Materials (ASTM).
6. Heavier weight labels should be tested before running jobs. The heavier stock labels can cause severe picking and feeding problems in the printer.
7. Testing method of the Technical Association of the Pulp and Paper Industry (TAPPI).
8. Use a pull rate of 127 mm/min (5.0 in./min).
9. The test must be conducted on a large, section of face stock without score lines to prevent interference by the score lines.

Before you order labels, review "Label Testing" on page 3-12 and "Storing Labels" on page 5-8.

Chapter 4. Troubleshooting Paper and Stock Problems

This section describes paper-related problems that can occur when running your printer. The use of high-quality, properly stored and conditioned xerographic paper should minimize the occurrence of these problems.

The following suggestions are intended to help resolve problems that may occur when using a variety of papers in the IBM family of cut-sheet printers. Hints are given to attempt to get paper to run satisfactorily or to suggest alternate papers that meet the requirements for your application.

Your service representative can verify the correct operation of your printer and if a paper problem exists, suggest possible solutions. It may be necessary to change:

- The ream, carton, or, if a problem persists, paper from a different manufacturing lot
- The type, weight, or brand of paper
- The conditions (temperature or humidity) in your paper storage area
- The temperature and humidity levels in the printer environment

These alternatives are usually under your control. It may be necessary to change all, or some combination of these factors, to resolve a problem.

Problem Resolution

The following pages describe remedies for common paper-related printer problems:

- Repeated jams in the processing area (see Table 4-1 on page 4-2)
- Paper multiple feeds or skewed feeds (see Table 4-2 on page 4-2)
- Frequent misfeeds (see Table 4-3 on page 4-3)
- Frequent jams in the output station (see Table 4-4 on page 4-3)
- Sheets stick together in the output station (see Table 4-5 on page 4-4)
- Streaks appear on the prints (see Table 4-6 on page 4-4)
- Leading edge of the paper tears or binds (see Table 4-7 on page 4-4)

Additional, print-quality related problems, can occur because of photoconductor spots (Table 4-8 on page 4-5) or fuser area condensation ("Fuser Area Condensation" on page 4-5).

Repeated Jams in the Processing Area

Possible causes and suggested remedies for repeated paper jams in the printer's processing area are shown in Table 4-1.

Table 4-1. Repeated Jams in the Processing Area

Causes of Jam	Suggested Remedies
Excessive Curl	1. Turn paper stack over in feeder 2. Replace paper with paper from new ream
Paper too stiff	• Try lighter weight paper
Paper too limp	1. Try using a paper with lower moisture content 2. Try using a stiffer paper
Excessive smoothness	• Try using a rougher paper
Bent corners	1. Remove all paper with bent corners 2. Turn paper stack in feeder, reversing leading edge 3. Replace paper with paper from new ream
High moisture content	1. Replace paper with paper from new ream 2. Check storage area for correct temperature and humidity 3. Try using a different kind of paper
Plugs from pre-drilled paper in paper path	• Fan paper thoroughly to remove plugs

Paper Multiple Feeds or Skewed Feeds

Possible causes and suggested remedies for paper multiple feeds or skewed feeds are shown in Table 4-2.

Table 4-2. Paper Multiple Feeds or Skewed Feeds

Causes of Multiple Feed or Skewed Feed	Suggested Remedies
Poorly cut paper	1. Fan paper thoroughly on all four sides to remove dust and shavings 2. Turn paper stack in feeder to reverse leading edge 3. Replace paper with paper from new ream
Wrapper wax or glue on sheets	1. Remove a few sheets from the seam side of ream before loading 2. Fan paper thoroughly on all four sides to remove dust and shavings 3. Replace paper with paper from new ream
Low humidity	• Raise humidity in printing room
Poorly drilled/punched paper	1. Fan paper thoroughly on all four sides to remove dust and shavings 2. Replace paper with paper from new ream
Paper too porous	1. Turn paper stack over in feeder 2. Replace paper with paper from new ream
Feeder incorrectly adjusted for paper size in use	1. Verify paper is allowed size and correctly loaded 2. If problem persist with all papers, call your service representative

Frequent Misfeeds

Possible causes and suggested remedies for frequent paper misfeeds are shown in Table 4-3.

Table 4-3. Frequent Misfeeds	
Causes of Misfeeds	**Suggested Remedies**
Excessive curl	1. Turn paper stack over in feeder 2. Turn paper stack in feeder to reverse leading edge 3. Replace paper with paper from new ream
Excessive static	1. Fan paper thoroughly before loading 2. Increase relative humidity in the printer room 3. Replace paper with a different type of paper
High moisture content	1. Replace paper with paper from new ream 2. Check storage area for correct temperature and humidity 3. Replace paper with a different type of paper
Plugs from pre-drilled paper in paper path	• Fan paper thoroughly to remove plugs
Poorly cut or drilled/punched paper	1. Fan paper thoroughly on all four sides to remove dust and shavings 2. Turn paper around in feeder, reversing leading edge 3. Replace paper with paper from new ream
Paper coating or chemical content causes sheets to stick	• Try using a different type of paper
Paper outside weight or stiffness parameters for your printer	• Try using a different paper of the correct weight and/or stiffness
Paper has too much surface texture	• Try using a different paper with less rag or cotton content
Paper has rippled or damaged edges	1. If only one edge is damaged, turn stack around, and reverse leading edge 2. If only a few sheets are damaged, remove and discard damaged sheets 3. Replace paper with paper from new ream
Feed rollers/belt contaminated with paper dust	1. Consult your printer's operator guide for cleaning the paper path 2. Contact your service representative
Feed rollers/belt glazed by coating from paper	1. Consult your printer's operator guide for cleaning the paper path 2. Contact your service representative

Frequent Jams in the Output Station

Possible causes and suggested remedies for frequent paper jams in the output stations are shown in Table 4-4.

Table 4-4. Frequent Jams in the Output Station	
Causes of Jams in Output Station	**Suggested Remedies**
Excessive curl	1. Turn paper stack over in feeder 2. Replace paper with paper from new ream
Paper's moisture content too high or too low	1. Replace paper with paper from new ream 2. Check storage area for correct temperature and humidity 3. Try using a different type of paper
Low humidity in printer room	• Increase relative humidity in printer room

Sheets Stick Together in the Output Station

Possible causes and suggested remedies for sheets sticking together in the output stations are shown in Table 4-5.

Table 4-5. Sheets Stick Together in the Output Station	
Causes of Sticking Sheets in Output	**Suggested Remedies**
Low humidity in printer room	• Increase relative humidity in printer room.
Excessive static	1. Fan paper thoroughly before loading. 2. Increase relative humidity in the printer room. 3. Replace paper with a different type of paper.
Paper dust on static eliminator (if printer is so equipped)	• Have your service representative check machine. **CAUTION:** **Never use antistatic sprays to combat this condition.**

Streaks Appear on Prints

Possible paper-related causes and suggested remedies for streaking on the output prints are shown in Table 4-6.

Table 4-6. Streaks Appear on Prints	
Causes of Streaks on Prints	**Suggested Remedies**
Fuser is contaminated by pigment particles from abrasive paper	1. Use a smoother paper. 2. Have your service representative check the fuser.

Leading Edge of Paper Tears or Binds

Possible causes and suggested remedies for binding or tearing of the paper's leading edge are shown in Table 4-7.

Table 4-7. Leading Edge of Paper Tears or Binds	
Causes of Paper Leading Edge Tears	**Suggested Remedies**
Poorly cut paper	1. Fan paper thoroughly on all four edges before loading. 2. Turn paper stack around in feeder to reverse leading edge. 3. Replace paper with paper from a new ream.
Sixteen (16) pound or lighter paper is being used	• Try using a heavier weight paper (20 pound).
Excessive curl	1. Turn paper stack over in feeder. 2. Replace paper with paper from a new ream.
Wrapper wax or glue on sheets	1. Remove a few sheets from the seam side of ream before loading. 2. Fan paper thoroughly on all four sides to remove dust and shavings. 3. Replace paper with paper from new ream.

Photoconductor Spots

A variety of materials and substances can cause spots on the photoconductor of printers. Table 4-8 lists possible causes and suggested remedies.

Table 4-8. Photoconductor Spot Causes and Remedies

Causes of Spots	Suggested Remedies
Carbonless papers (encapsulated solvents, dust)	• Avoid use of carbonless paper if problems are caused.
Preprinted forms (non-drying or low temperature-resistant inks)	1. Use only preprinted forms using recommended inks (see "Printing Inks" on page 2-4). 2. Avoid preprinted forms made using coldset inks.
Plasticized or solvent-containing papers	• Try switching to a different brand or manufacturer.
Wax laminate ream wrapper	• Use only paper packaged in a plastic laminate wrap.
Glue spots (from ream wrapper)	• Discard top several sheets from ream (nearest seal side).
Paper dust (from low quality paper)	1. Use only high-quality xerographic or dual-purpose papers. 2. Ensure all required printer maintenance is done on schedule.
Environmental dust in printing room	1. Ensure that storage and printing rooms are as dust free as possible. 2. Ensure all required printer maintenance is done on schedule.
Talc (from manufacturing process)	• Purchase only papers with guaranteed xerographic performance.
Anti-offset spray (from manufacturing process)	1. Require vendor to eliminate or minimize use of anti-offset sprays during forms manufacture. 2. Pretest all forms for satisfactory performance in your printer before purchasing large quantities.
Atmospheric corrosives and dusts (from manufacturing process)	• Keep printer in a dust-free environment, closed off from any dust producing activities.

Fuser Area Condensation

Occasionally, combinations of printer temperature, printer room temperature and relative humidity, printer condition, and paper moisture can result in moisture condensing around the fuser area of the printer. This is usually a sporadic and temporary condition.

High Printer Maintenance

High printer maintenance, frequent replacement of consumables, frequent cleaning, or frequent service calls can be the result of the following items:

- Poor quality paper
- Abrasive paper
- Preprinted forms that are not completely cured
- Dirty or dusty environment

Post-Processing Problem Resolution

Processing operations that follow printing, such as slitting, folding, and envelope-insertion, require special attention. Traditionally, equipment for post-processing operations has been designed based on the handling characteristics of materials printed by offset lithography. However, paper printed in a electrophotographic printer differs in several significant ways:

- The printed sheets are drier, and thus more susceptible to static, which can cause a variety of post-processing problems.
- The paper may contain fuser oil or lubricant. Oiled sheets are more susceptible to slippage, and may not be immediately receptive to the further application of printing, typing, or other marking.
- The edges of the sheets may be wavy.
- The sheets may contain varying amounts of curl, from passage through the paper path and the application of heat and pressure during the fuser operation.
- Xerographic prints have a high degree of calendering (gloss) due to the extreme pressures generated during the fusing process.

Equipment to handle these sheets must operate with minimal static generation, neutralize existing static, operate with fuser oil or lubricant on the drive belts/rollers, and keep curled and wavy papers under control.

Paper that will be processed after printing must be selected with the post-processing operations in mind. Paper must work well in both simplex and duplex printing operations, and must also offer a minimum of problems from distortion, static, and slipperiness.

Although paper can be successfully handled by a electrophotographic printer, it is no guarantee that it can be successfully manipulated by the post-processing equipment. Because of the high costs associated with post-processing activity, test and purchase paper from the standpoint of total system performance.

Wavy Edges

Wavy edges occur when hot, dry stacks of printed sheets undergo rapid absorption of moisture in the sheet edges. The edges expand, but the sheet centers do not. The result is a wavy deformation that can be permanent.

The amount of deformation can be reduced by the following procedures:

- Condition the reams, in their wrappers, in the machine room.
- Lower the print room relative humidity to below 50% (but not so low as to create static problems).
- Post-process the printer output immediately, before significant moisture can be absorbed.
- Cover the printed sheets with plastic drop-cloths, or box covers, to minimize exposure to atmospheric moisture.
- Let the sheets condition slowly for a number of hours (or days) to reduce the difference between the moisture content of the sheet edges and centers.
- Try to complete the conditioning time rapidly. Paper stacks can require days to achieve edge-to-center uniformity, but uniformity can occur in a single sheet in about 60 seconds if it is fully exposed on both surfaces to ambient relative humidity. Equilibrium can be accelerated by:
  - Slow fanning of the stack of printed sheets
  - Breaking large stacks of printed sheets into smaller stacks.

Static Problems

Static problems can be caused by low moisture or low conductivity in paper. Static can prevent sheets from separating from one another, and cause feed problems in post-processing equipment.

Out-of-the-wrapper sheet conductivity should be sufficient to dissipate excessive static, but not so conductive as to affect image quality under humid conditions.

Out-of-the-wrapper sheet moisture should not be so low as to contribute to excessive static, nor so high as to aggravate curl and image quality problems under humid conditions.

Solutions to static problems include:

- Ensure that antistatic devices in the printer and post-processing equipment are installed and operating properly.
- Increase the relative humidity in the post-processing area
- Condition the input paper by placing it in the machine area well before printing. Do not remove it from its wrappers during conditioning. Fan the printed sheets before post-processing.

Grain Direction and Handling Problems

Before beginning a job that involves post-processing, note any grain direction requirements of the post-processing equipment. The grain direction can change based on the cutting of sheets after they have been printed. Any time you change, by cutting, what was a vertical sheet into horizontal finished pieces, you change the grain direction.

Many types of post-processing equipment must have grain-long materials in order to operate properly. You may have to print your sheets with grain-short paper so that, after cutting operations, the pieces are presented as grain-long to the post-processing equipment.

See “Grain Direction” on page 1-4 for additional information about grain direction.

Chapter 5. Selecting, Pretesting, Ordering, Storing, and Using Paper and Stock Supplies

The following sections describe procedures and considerations for selecting, pretesting, ordering, storing, and using paper and stocks.

Selecting Paper and Stocks

Always refer to your printer's Paper Specifications for requirements for your printer.

Table 5-1 summarizes typical specifications that can help you and your paper supplier choose the paper that is *most suitable* for your printer.

See Chapter 2, "Special-Application Material Characteristics" on page 2-1 for information and recommendations concerning special paper, such as preprinted, pre-punched, and perforated paper. For selecting labels, see "Label Selection" on page 3-14 For packaging recommendations, see "Packaging by Supplier" on page 1-9.

Always use xerographic paper in weights specified for your printer. Initially test a small sample of paper in your printer before you purchase production quantities for a given application.

Table 5-1 (Page 1 of 2). Paper Selection Criteria, Typical Specifications

Parameter	Test Method	Typical Specifications
Paper Grade	(see Note 1)	No. 1 or No. 4 Xerographic
Color		White or colors
Ash Content	T 413, ISO 2144 (see Notes 2 and 3)	18 percent maximum
Filler		Kaolin or china clay (aluminosilicate) or calcium carbonate. Titanium dioxide or magnesium silicate may be added to improve brightness.
Wood Pulp		100% chemical
Brightness (% ref)		83.0% (minimum) (average)
Optical Brightener Contribution %		4.5 ± 1.0
pH		8.0 (type III permanence)
Grain Direction		Parallel to the long dimension (grain long).
Cutting Method		Rotary precision cut (Lennox, Will, or equivalent)
Cutting Tolerances		Length and width: ±0.787 mm (±0.031 in.) Squareness: All corners 90° ± 0° 6'
Basis Weight (Preferred) Acceptable Basis-Weight Range	T 410, ISO 536 (see Notes 3 and 4)	75 g/m^2 (20 lb) or 80 g/m^2 (21 lb) 90 g/m^2 (24 lb) for MICR documents 60 g/m^2–120 g/m^2 (16—32 lb) 75 g/m^2–120 g/m^2 (20—32 lb) for MICR documents
Thickness (Caliper)	T 411, ISO 534 (see Notes 2 and 3)	20–32 lb (75–120 g/m^2): 3.8–5.0 mils (90–127μ) 16–19 lb (60–72 g/m^2: 3.2–4.0 mils (81–102μ)

Table 5-1 (Page 2 of 2). Paper Selection Criteria, Typical Specifications

Parameter	**Test Method**	**Typical Specifications**
Smoothness (Sheffield)	T 538, ISO 2494 (see Notes 2 and 4)	20–32 lb (75–120 g/m^2): 100–200 Sheffield units 16–19 lb (60–72 g/m^2): 70–170 Sheffield units
Porosity (Gurley)	T 460, ISO 3687 (see Notes 2 and 4)	10 sec/100 ml minimum
Coefficient of Static Friction	T 549 (see Notes 3 and 5)	0.35 to 0.62
Surface Sizing		Starch—Do not use synthetic surface sizing.
Internal Sizing		Acid rosin or synthetic (alkyl-ketene dimer or alkyl-succinic anhydride)
Stiffness (Taber)	T 489 (see Note 2)	16–19 lb (60–72 g/m^2) MD:1.4 min; CD: 0.5 min 20–32 lb (75–120 g/m^2) MD:1.7–4.5; min CD: 0.8–2.4 min
Moisture Content	T 412, ISO 287 (see Notes 3 and 4)	3.4 to 5.5 percent 4.0 to 5.5 percent for MICR documents
Burst (Mullen)	T 411 (see Note 2)	20 psi (138 Kpa) minimum
Tear (Elmendorf)	T 414 (see Note 2)	MD: 441 millinewtons minimum[8] CD: 520 millinewtons minimum[8]
Surface Resistivity	D 257 (see Notes 3 and 6)	$5x10^9$ to $1x10^{12}$ ohms
Fiber Composition	(see Note 7)	100 percent chemical pulpwood or wood-free pulp, either sulphite or *kraft* (see Note 6); free from recycled cotton or synthetic fibers.
Abrasion Resistance		12 mg weight loss maximum per 50 revolutions
Wax Pick (Dennison)		12 minimum
Dust		65 mg per carton maximum
Porosity (Gurley)		12 minimum
Coefficient of Friction Paper to Paper Sheet to Sheet Differential		0.40 to 0.70 0.075 (delta maximum)
Opacity (%)		85.0% (minimum)

Notes:

* All tests conducted per TAPPI 402 or ISO 187, except surface resistivity which uses ASTM.

1. The number 1 or number 4 designation applies to only the United States—it does not apply to World Trade countries.
2. Testing method—Technical Association of the Pulp and Paper Industry (TAPPI).
3. Testing method—American Society for Testing and Materials (ASTM).
4. Testing method—International Organization for Standardization (ISO).
5. Use 127-mm/min (5.0 in./min) pull rate.
6. Isolate the test specimen from the metal backing plate with a piece of smooth, nonconductive polyester film, at least 0.254 mm (0.010 in.) thick; use 100 volts.
7. See “Recycled Paper” on page 1-9.
8. MD = machine direction (grain-long); CD = cross direction (short-grain)

Paper Rejection Criteria

Do not use paper with:

- Formulations that, under fusing temperatures and pressure, emit volatile components into the environment that can cause industrial hygiene considerations.
- High moisture content (see “Moisture and Paper Curl” on page 1-3).
- Calender cuts, grease spots, loose sizing particles, wrinkles, voids, cuts, and tears. To keep the printer clean, the paper should be reasonably free from

dust. Accumulations of paper dust can cause printer problems, requiring either operator intervention or a service call.

- Rough or textured finishes, for example, cockle- and laid-finish paper. This type of paper can cause misfeeds and can cause degraded print quality.
- Poorly cut paper or pre-punched paper that is poorly drilled. These conditions can cause adjacent sheets to become partially interlocked. This can result in feeding more than one sheet, or in not feeding at all.
- Embossed designs. Embossed designs can adversely effect print quality near the design and can cause adjacent sheets of paper to become partially interlocked. This can result in feeding multiple sheets or not feeding at all.

Pretesting Paper and Stocks

This section discusses the basic requirements for pretesting print materials intended for use on a cut-sheet printer. It also contains a set of questions to help identify and avoid potential paper-related problems.

To get maximum reliability and print quality from the printer, it is recommended that you rely on your paper supplier, your IBM marketing representative, or your Pennant Systems representative to help you choose the best paper and special-purpose materials for your applications.

An ideal application for a printer would print standard-font text and simple images on plain white xerographic paper, 75-g/m² (20-lb) bond. This paper would be manufactured specifically for use in non-impact printers, and would be free of binder holes, cut-outs, and other cuts. The page layout would keep text and images away from perforations. After leaving the printer, output from an ideal application would be allowed to cool, and would receive minimal handling, rubbing, and creasing.

When it is processing an ideal application, a printer can deliver close to maximum print quality and reliability. With applications that deviate from the ideal, print quality may decrease, and the need for operator interventions may increase. This does *not* mean that a printer cannot be used for a particular application; it *does* mean that you need to thoroughly test the application and decide if it meets your standards for print quality and printer reliability.

For information about pretesting labels, see “Label Testing” on page 3-12.

Applications That Should be Tested

An application should be tested if the page layout includes:

- Bar-codes
- OCR print
- Solid-fill areas
- Printing near perforations
- Large amounts of text in very small fonts
- Images
- Adhesive labels
- Preprinted forms
- Pre-drilled paper
- Light or heavy paper

- Rigid paper
- Colored paper
- Recycled paper
- Paper with binder holes, cut-outs, or other cuts
- Paper with running perforations or multiple perforations

Additional considerations include:

- Heat and pressure

  Electrophotographic printers use heat and pressure to put print on the paper; heat and pressure applied to printed output can change the output. For example, paper, still warm from the printer, and put into a tall stack can stick together because of the weight of the stack. The same effect can result from using a shearing press to cut stacks of warm paper.

- Moisture

  Water and other solvents can cause print to smear on some paper. For example, perspiration on an operator's hand might leave a blurry thumbprint.

- Handling

  Frequent handling or rubbing can erase print from paper. For example, print on a price tag might rub off as shoppers repeatedly handle the tag to look for size and price information.

Possible Testing Results

Possible test results are:

- The application completes successfully, with satisfactory output.
- The application cannot run at all.
- The application completes, but with some reduction in print quality or printer reliability.

Applications in the last category should be reviewed for acceptability of the output and reliability achieved. In some cases, changes that can improve the test results may be possible.

- Printer adjustments

  Some printers have print quality controls that are accessible to the operator and allow the operator to adjust print quality.

  If print quality problems persist, the service representative may be called; however, aside from making sure that the printer is adjusted to specification, there is little that can be done.

- Adjust the process

  Changing any one element in the overall printing process can affect other elements. Review the application from start to finish to determine where adjustments can be made. Consider the following:

  – Change the paper?
  – Change the way the paper is stored?
  – Change the application?
  – Change the way the paper is handled after printing?

  For example, if a particular preprinted form is giving trouble, consider whether an electronic overlay could be substituted to achieve the required result, and eliminate the preprinted form completely.

Consult with paper suppliers, they can identify which of their products are suitable for processing on an electrophotographic, hot-fusing printer. Also, use your Pennant Systems printing specialist as a source of information about paper and applications that are being used successfully with your printers.

Kinds of Testing

Initially, a small sample (500 to 1000 sheets) of the paper or special-application materials should be tested in the printer before purchasing production quantities for a given application. Small samples can be tested to get a good indication of what to expect for print quality, toner adhesion, and printer reliability. However, the success of this initial testing does not constitute proof that the application will be successful over a long time.

Only tests of several, or many, thousands of sheets can provide reliable data about characteristics such as environmental changes, paper-path reliability, paper-dust contamination, loose filler, and so on. Initial orders of special supplies should be limited to a 30- to 60-day supply until you are confident of their ability to perform over a long time.

Because every installation's needs and processing environment are unique, no two test plans are identical. Whenever possible, after the initial pretesting has proved satisfactory, run the following three tests for each paper and application combination:

- Single-box test
- Multiple-lot test
- Sample production run

Ideally, these tests should be run in the processing environment, using the actual applications.

Single-Box Test

The single-box test consists of printing an entire box of a particular paper. Consider the following questions while the printer is running:

- Does the paper feed smoothly from the input area?
- Do you detect any odors that could indicate possible health and safety hazards resulting from heating the paper?
- Does the printer issue messages requiring operator intervention?
- Does the application process smoothly, without pauses or jerky motions?
- Does the paper generate noticeable paper dust, chad, or other debris?
- Do adhesive labels peel off their carrier?
- Does any glue seep out from under adhesive labels during printing and contaminate the drum, hot roll, or other parts of the printer?
- Does the paper fold and stack correctly?

After the entire box has been printed, inspect the printer, and consider the following questions:

- Did paper dust, chad, loose labels, or other debris accumulate in the printer during processing?
- Are there adhesive, ink, or toner deposits on the printer rollers?

Inspect the printed output and consider the following questions:

- Is the printing crisp and clear, especially close to edges, perforations, holes, and cuts?
- Is print quality uniform across the page and throughout the box?
- Can OCR and bar-code output be read correctly by their intended scanners?
- Are solid-fill areas printed evenly?
- Does toner leave “ghost” images on facing pages?
- Does the paper show any discoloration after processing?
- Do colored inks on preprinted forms change color?
- Does the paper shrink or change shape during processing?
- Does the paper get wrinkled during processing?

Multiple-Lot Test

The multiple-lot test helps determine whether a manufacturer’s paper is uniform across different lots. To perform the multiple-lot test, take samples from several boxes of the same type of paper. Print identical output on each of these samples, and compare the quality. Are the results uniform?

Sample Production Run

Running a full-scale production job, including all pre and post-processing, can reveal potential trouble spots that were not evident in the shorter tests. When you evaluate the sample production run, use the procedure described in “Single-Box Test” on page 5-5. Be sure to monitor the entire printing process, and examine samples from the beginning, middle, and end of the job.

Post-processing

Consider the following questions as the paper is handled during post-processing activities.

- Does the print smear?
- Does the print rub off or erase easily?
- Does the paper stick together after it has been refolded and allowed to cool?

Evaluating the Test Results

The tests described here raise important questions. Only you and your user community can determine which of these questions are most important, and what levels of quality and reliability are acceptable in your particular circumstances.

The most important result of paper testing is *knowledge*. A well-designed test lets you know what kind of print quality and reliability you can expect. Based on this knowledge, you can make informed decisions and trade-offs in choosing paper and applications for use with your printer.

Ordering Paper Supplies

Although several high-quality xerographic papers are available, use *IBM Multi-System Paper*. Each lot of *IBM Multi-System Paper* is manufactured to IBM specifications and tested for strict adherence to these specifications, both at the paper mill and the IBM laboratory.

You can order paper and other supplies for IBM printers by any of the following methods:

- Contact a Lexmark** International, Inc. authorized supply dealer.
- Call Lexmark Telemarketing at 1-800-438-2468 8 a.m. to 8 p.m. Eastern Standard Time.
- Fax completed order form to 1-800-522-3422.
- Write Lexmark Telemarketing, at:

  Lexmark Telemarketing
  1221 Alverser Drive
  Midlothian, VA 23113

Lexmark Telemarketing can provide you with the names of Lexmark authorized supply dealers who sell supplies for your printers, or take your order.

Lexmark warranties paper supplies to be free from defects in materials and workmanship for one year from date of purchase. If the supplies you receive are defective, return them to the place of purchase during the warranty period for a free replacement.

Supplies purchased from a dealer should be returned to that dealer. Supplies purchased from Lexmark should be returned to:

Lexmark International, Inc.
c/o Associates Warehouse K
251 Price Road
Lexington, KY 40511
Attention: Supplies Return

Please include a copy of your invoice, a description of the problem, print quality samples, and an estimate of the amount of printing already done with that supply.

This information only applies to supplies purchased in the U.S.A. In other countries, contact your point of purchase for returns information.

See the “Supplies Ordering Work Sheet” in your printer’s *Operator’s Guide* for more information about paper you can order.

Storing Supplies

Storing Paper

Proper storing of paper protects against paper damage. Store your paper in an environment where the temperature and humidity are similar to the environment or the printer room or area where the paper will be used.

If your paper-storage area has a noticeably different temperature than your printer room, ***allow the paper to adjust to the printer-room environment before you open the paper cartons.*** Stack the cartons at least 50 mm (2 in.) apart for uniform air circulation around each carton.

Avoid storing paper in an environment over 43°C (109°F). If the temperature difference between your storage area and your printer room is:

- Between 5°C and 10°C (41°F and 50°F), allow 6 to 10 hours for adjustment.
- More than 10°C (50°F), allow a minimum of 24 hours for adjustment.

If the printer is turned off overnight or for more than one shift, add only enough paper to the paper-supply drawers to print the jobs that are run before shutdown. Paper left in the paper-supply drawers when the printer is not running can collect moisture, which can cause print-quality problems and paper jams when the printer is restarted.

Paper size is affected by variations in temperature and humidity. Humidity has the greater effect on print quality and printer performance. Humidity extremes can cause permanent paper damage. See “Temperature and Humidity” on page 1-2 for information about the temperature and humidity operating ranges of paper.

Storing Labels

The following guidelines summarize recommendations that can help you achieve optimum performance from your labels:

- Store labels in a clean, dry location where the temperature is maintained at 13°C to 29°C (55°F to 85°F) and where the relative humidity does not exceed 55 percent. Obtain specific storage recommendations and shelf-life projections from your label manufacturer or supplier. (The typical shelf life of labels is 12 to 18 months from the date of manufacture.)
- Leave the labels in their original packaging until you load them into your printer. Do not allow new labels to stand in unprotected stacks. Store new labels in their original packaging and reseal the packaging with tape. If the original packaging becomes too damaged to allow reuse, store and seal the unused labels in plastic bags large enough to allow the labels to lie flat for storage.
- Store and use labels on a first-in, first-out basis.

Using Paper/Stock from Storage

Correct paper and stock conditioning, and pre-loading preparation is essential for satisfactory printer performance.

Conditioning Paper

If 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 prior to its use.

The amount of time required for conditioning is determined by the amount of difference in temperature and humidity between the old and new locations. Also, the number of cartons to be conditioned affects the conditioning time; the greater the number of cartons, the longer the conditioning time. Table 5-2 gives the conditioning time for various combinations of temperature and quantity of cartons. It is assumed that the paper has been stored in unopened cartons and in an area with controlled temperature and humidity.

Table 5-2. Paper Conditioning

	Temperature						
	5.5°C (10°F)	**8.5°C (15°F)**	**11°C (20°F)**	**13°C (25°F)**	**17°C (30°F)**	**22°C (40°F)**	**28°C (50°F)**
Cartons	**Hours**						
1	4	8	11	14	17	24	34
5	5	9	12	15	18	25	35
10	8	14	18	22	27	38	51
20	11	16	23	28	35	48	67
40	14	19	26	32	38	54	75

Notes:

1. The temperature value is the difference in temperature between the storage area and the operating area.
2. The table refers to moving paper cartons loaded together on a pallet. Conditioning can be accelerated by separating the cartons (and reams) from each other. Do not open individual reams until ready for use.

Note: Avoid leaving paper, labels, or other special materials in the paper supply drawer of an inactive printer for extended periods of time, for example, overnight.

Conditioning Labels

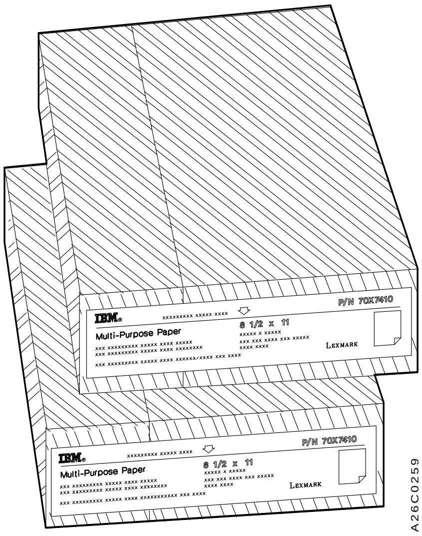
Condition labels to your printer-room environment *before* you open the boxes or packages that contain them. Move the labels into your printer room at least 24 hours before opening the boxes or packages.

Paper Pre-Loading Preparation

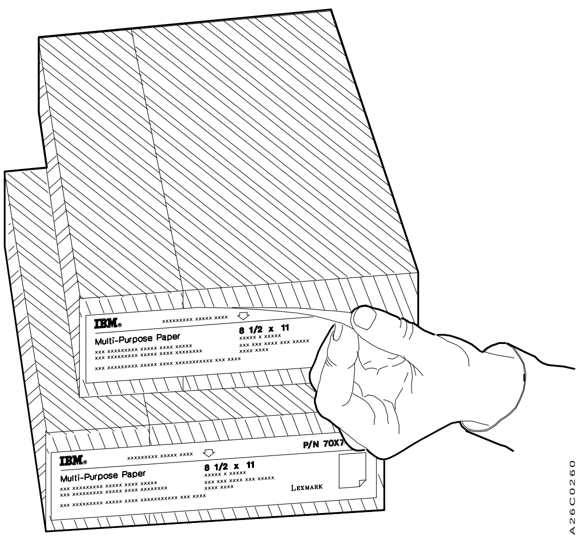
The following procedures describe how paper reams should be opened and the paper prepared for loading in the printer.

Opening the Reams

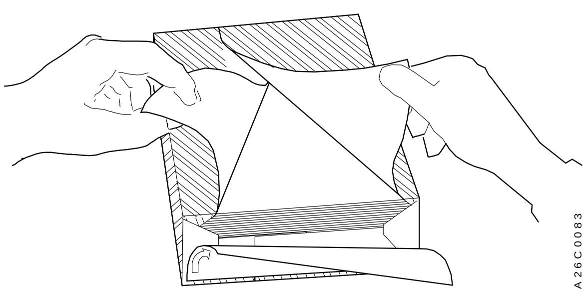
Paper reams should be opened carefully to avoid nicking, crimping, or otherwise damaging the sheets of paper.



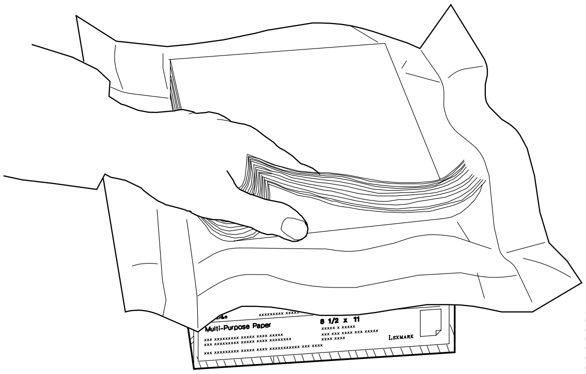
1. Stack the reams of paper with the *seam side* up.



2. To open the reams, pull the label area on the wrapper down.



3. Open the wrapper along the length of the seam and fold back the wrapper.



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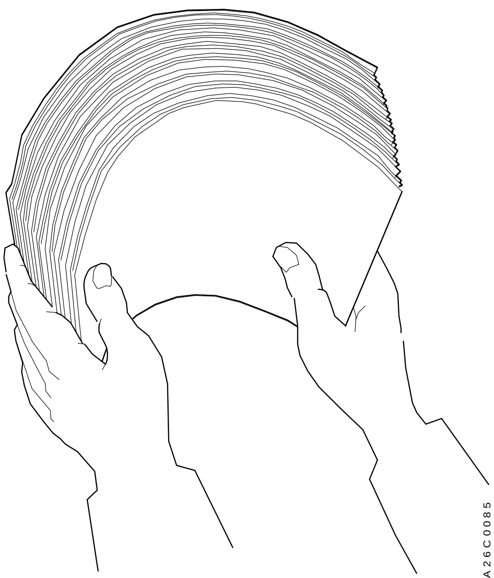
4. With one hand, grasp either short side of the paper ream, ensuring that your thumbs are on the bottom side of the paper stack (the side away from the wrapper seam).

   Note: This is an important technique. It helps to keep the correct paper orientation. When the paper is loaded into the printer, the paper is loaded with the *curl* side up, reducing the possibility of paper jams.

Fanning the Paper

Fanning the paper is important because it allows air to get between the sheets in the paper stack. This reduces the friction between sheets and reduces multiple sheet feeds and paper misfeeds.

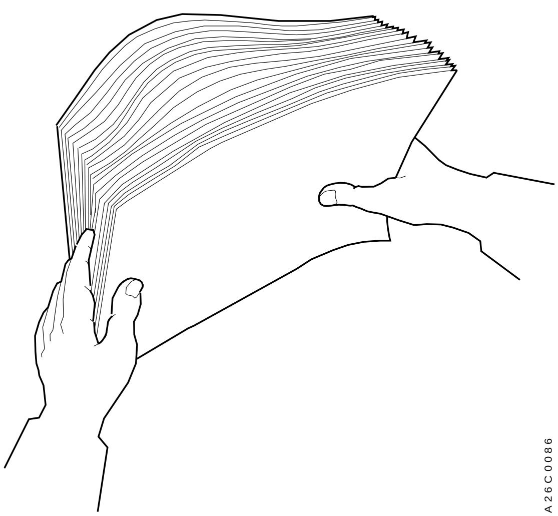


A26C0085

Operator Tip

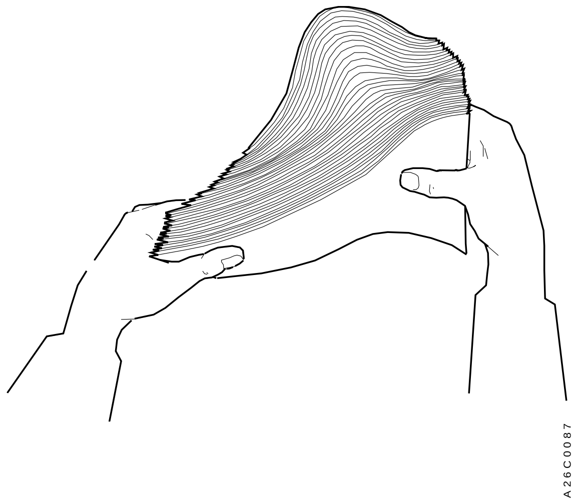
Do not fan an entire ream of paper the first time you do this procedure. Each ream of paper weighs approximately 2 kilograms (5 pounds).

1. With both hands, gently form a horseshoe shape with the paper stack.

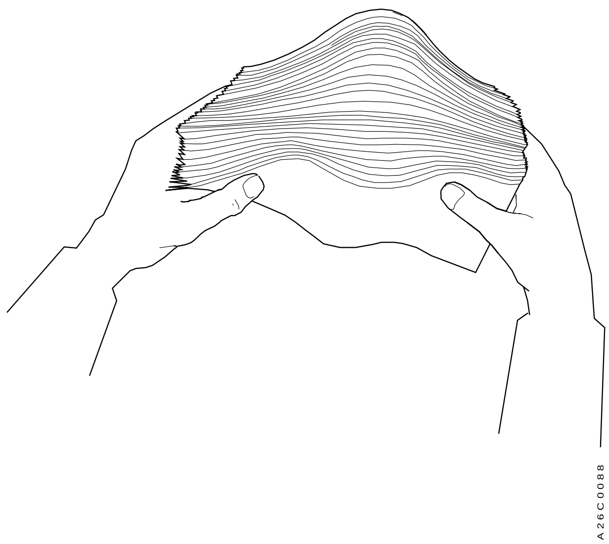


A26C0086

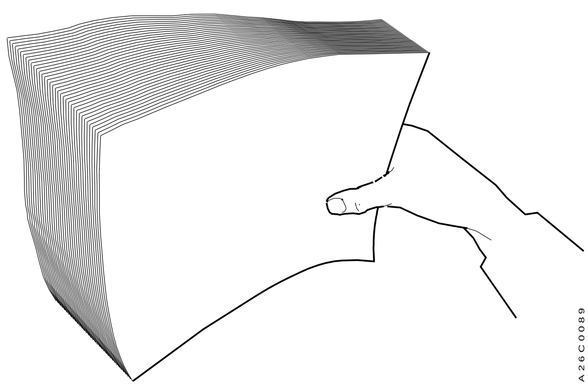
2. Carefully release your grip on one side of the stack, and let the sheets separate from one another.



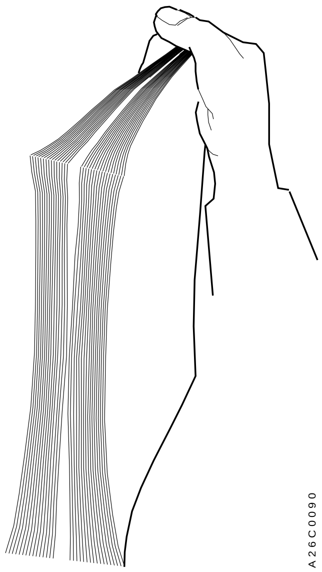
3. Grasp the end of the paper stack and gently arch the paper while rocking it from left to right.



4. To allow more air to pass through the paper stack, rock the paper one more time.



5. Completely let go of one side of the paper stack to allow the paper to air and flatten out.

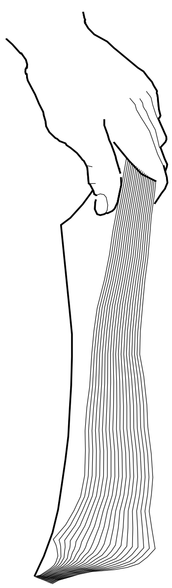


A26C0090

6. Check to ensure the that paper *curl* is facing the same direction. See “Determining Curl” on page 5-13 for additional information.

   Note: This illustration shows a ream of paper with two different directions of curl.

7. To correct the curl, find where the paper stack splits into two different directions. At that point, divide the paper and re-stack it with the curl of each stack facing the same way.



A26C0091

8. The curl is now facing the same direction for the entire ream. Load the ream into the paper tray.

Determining Curl

Most paper intended for xerographic purposes is usually marked with an arrow indicating the preferred printing side for either simplex printing or first side duplex printing. Depending on your printer, or the specific tray in your printer, the paper could be loaded either up or down; refer to your printer’s *Operator’s Guide* for directions.

If a paper ream is not marked for correct print-side orientation, determine the curl direction as follows:

1. Hold a one-half inch stack of paper by one of its short sides.
2. Let the paper hang with its long edges perpendicular to the horizontal.
3. Observe which way the paper tends to curl. Either the lower short edge or the two long edges will curl slightly toward center); this is the curl side.

Note: The curl side is opposite the preferred print side (the side identified by the arrow).

Appendix A. Basis Weight and Grams/Square Meter of Paper

Table A-1 gives the conversion values of common paper stocks.

Table A-1 (Page 1 of 2). Conversion of Basis Weight (Pounds/Ream) to Grams per Square Meter

Bond 17X22	**Cover 20X26**	**Carbonizing 20X30**	**Postcard 22.5X28.5**	**Index 25.5X30.5**	**Tag/Tab Card 24X36**	**Book/ Offset 25X38**	**Grams/ Meter²**
		5.5					13
		10.0					23
					18		29
8						20	30
					30		49
					32		52
16							60
						42	62
					40		64
						45	67
18							68
						50	74
20							75
					50	55	81
						60	89
24							90
					60		98
						70	104
28							105
	40						108
						75	111
					70		114
						80	118
32							120
				72	80		130
						90	133
36	50						135
					90		146
			67				147
						100	148
40							150
					99		161
	60						162
				90	100		163
44							165
			80				175
	65						176

Table A-1 (Page 2 of 2). Conversion of Basis Weight (Pounds/Ream) to Grams per Square Meter

Bond 17X22	**Cover 20X26**	**Carbonizing 20X30**	**Postcard 22.5X28.5**	**Index 25.5X30.5**	**Tag/Tab Card 24X36**	**Book/ Offset 25X38**	**Grams/ Meter²**
						120	178
					110		179
	70						189
	72						195
			90				197
52				110			199
					125		203
	80						216
			100				219
				125			226
					150		244
				140			253
			120				263
	100						270
			125				274
					175		285
			140	170			307
					200		325
			150				329
			160				351
	130		175				384
			180				395
				220			398
					250		407
			200				439

Appendix B. Document Standards

Technical Association of the Pulp and Paper Industry (TAPPI) Standards

Standard	Description
T400	Sampling and Accepting a Single Lot of Paper
T402	Standard Conditioning and Testing Atmospheres for Paper
T403	Bursting Strength of Paper
T409	Machine Direction of Paper
T410	Grammage of Paper (Weight per Unit Area)
T411	Thickness (Caliper) of Paper and Paperboard
T412	Standard Test Method for Moisture Content of Paper and
T413	Ash in Paper and Paperboard
T414	Internal Tearing Resistance of Paper
T460	Air Resistance of Paper (Porosity of Paper)
T489	Stiffness of Paperboard
T538	Smoothness of Paper (Sheffield)
T543	Stiffness of Paper (Gurley Type Stiffness Tester)
T549	Standard Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting

TAPPI standards manuals are published by:

Technical Association of Pulp and Paper Industry
Technology Park
P. O. Box 105113
Atlanta, GA 30348

American National Standards Institute (ANSI) Standards

These ANSI standards are applicable to paper used for MICR documents:

Standard	Description
ANSI X9.3	Check Endorsements
ANSI X9.7	Bank Check Background and Convenience Amount Field
ANSI X9.13	Placement and Location for MICR Printing
ANSI X9.18	Paper Specifications for Checks
ANSI X9.27	Print Specifications for MICR
ANSI X9/TG-2	Understanding and Designing Checks

These ANSI standards manuals are published by:

Secretariat
X9 Financial Services
American Bankers Association
1120 Connecticut Avenue, N. W.
Washington, D.C. 20036

International Organization for Standardization (ISO) Standards

Standard	Description
ISO 187	Paper and Board Conditioning of Samples
ISO 287	Method for the Determination of Moisture Content of Paper (Oven-Drying Method)
ISO 534	Determination of the Thickness of Single Sheets of Paper
ISO 536	Determination of Paper Substance (or Determination of Grammage)
ISO 2144	Paper and Board - Determination of Ash
ISO 2494	Recommended Procedure for the Determination of Roughness - Constant Pressure Air-Flow Method
ISO 3687	Paper and Board, Determination of Air Resistance

These ISO standards manuals are published by:

International Organization for Standardization
1, Rue de Varembe
Geneve, Switzerland

American Society for Testing and Materials (ASTM) Standards

These ASTM standards are applicable to paper used for MICR documents:

Standard	Description
D 257	Standard Test Method for D-C Resistance or Conductance of Insulating Materials

These ASTM standards manuals are published by:

American Society for Testing and Materials
1916 Race Street
Philadelphia, Pennsylvania 19103

Appendix C. ISO Standard Paper Sizes

This appendix identifies the ISO-A and ISO-B paper sizes.

ISO-A Standard Paper Sizes

Figure C-1 shows how the main ISO-A series of sizes is obtained from the basic size (A0) of the A series.

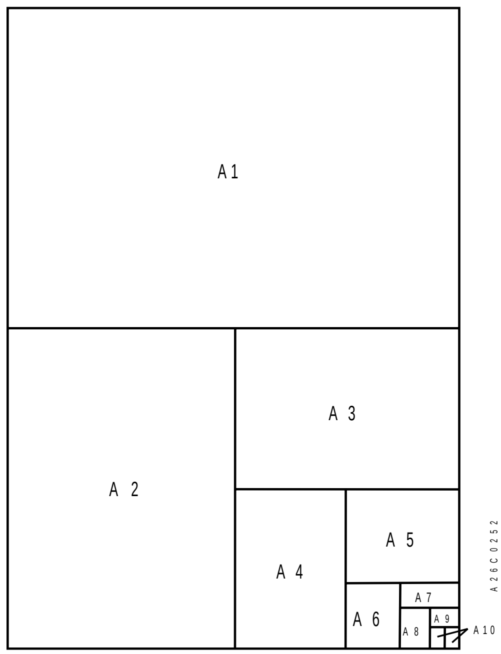


Figure C-1. ISO-A Standard Paper Size Diagram

Table C-1 shows the trimmed sizes in the A series.

Table C-1. ISO-A Standard Paper (Form) Sizes

	Millimeters		Inches	
Size	**Short Side**	**Long Side**	**Short Side**	**Long Side**
A0	841	1 189	33.11	46.81
A1	594	841	23.39	33.11
A2	420	594	16.54	23.39
A3	297	420	11.69	16.54
A4	210	297	8.27	11.69
A5	148	210	5.83	8.27
A6	105	148	4.13	5.83
A7	74	105	2.91	4.13
A8	52	74	2.05	2.91
A9	37	52	1.46	2.05
A10	26	37	1.02	1.46

ISO-B Standard Paper Sizes

Figure C-2 shows how the ISO-B series of sizes is obtained from the basic size (B0) of the B series.

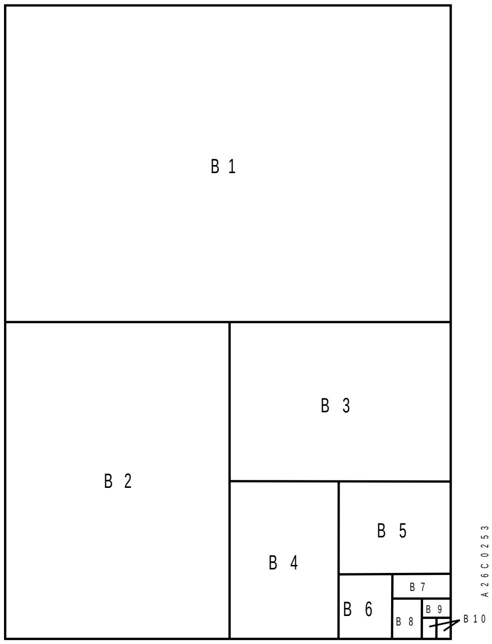


Figure C-2. ISO-B Standard Paper Size Diagram

Table C-2 shows the trimmed sizes in the B series.

Table C-2. ISO-B Standard Paper (Form) Sizes

	Millimeters		Inches	
Size	**Short Side**	**Long Side**	**Short Side**	**Long Side**
B0	1 000	1 414	39.37	55.57
B1	707	1 000	27.83	39.37
B2	500	707	19.69	27.83
B3	353	500	13.90	19.69
B4	250	353	9.84	13.90
B5	176	250	6.93	9.84
B6	125	176	4.92	6.93
B7	88	125	3.46	4.92
B8	62	88	2.44	3.46
B9	44	62	1.73	2.44
B10	31	44	1.22	1.73

Glossary

The following terms are defined as they are used in this manual. If you do not find the term you need, refer to the index or to the *IBM Dictionary of Computing,* ZC20-1699 or to the *The Dictionary of Paper.*

A

A and B sizes. The system of paper sizes used throughout the world except in North America. Based on even divisions of one meter square (A0) sheet.

acid-made. Acid-made papers generally contain clay and titanium oxide pigments. These papers tend to age quickly and are being replaced with alkaline-made papers. See also *rosin size.*

additives. Lubricants or substances used to reduce surface tension, blended into dry ink during manufacturing to assist in photoconductor cleaning in web or blade cleaning machines. Additives also tend to extend developer life.

AFP. Advanced Function Printing. The ability of programs to print all-points-addressable text and images.

aluminosilicate. A combined silicate and aluminate.

anhydride. A compound derived from another (as an acid) by removal of the elements of water.

anti-offset spray. Dry or liquid spray used on printing presses to prevent wet ink from transferring from the top of one sheet to the bottom of the next sheet.

antique finish. A natural rough finish, usually on offset or cover papers.

ASTM. American Society for Testing and Materials. An organization that tests and evaluates qualities of different materials, including the acidity/permanence level of papers.

B

bar-code. A code representing characters by sets of parallel bars of varying thickness and separation that are read optically by transverse scanning.

basis weight. Weight in g/m^2 or pounds of a ream (500 sheets) of paper cut to a given standard size for that grade.

Bendtsen Roughness Scale. A measure of the roughness or smoothness of a paper. Higher numbers indicate rougher papers.

bond paper. A strong durable paper.

brightness. The whiteness, reflectance, or brilliance of paper.

bulk. The thickness of paper, usually stated as sheets per inch.

bulking number. Number of sheets per inch.

Bristol. A stiff, heavyweight paper with a softer surface than index and very receptive to ink. Ideal for high-speed folding, embossing, or stamping.

C

C1S/C2S. Paper coated on one side only, paper coated on both sides.

calcium carbonate. Term for a natural, fine-grained material used as filler.

calender. The process of smoothing and compacting the paper.

caliper. Thickness of paper.

carbonizing paper. Lightweight base stock manufactured specifically to be converted into carbon paper.

carbonless papers. A type of paper treated with a substance that causes the writing or printing on a top sheet to be reproduced simultaneously on the sheet underneath, without needing carbon paper. Available in 2-, 3-, and 4-part formats; available in three compositions:

- CB—coated on the backside only
- CF—coated on the front side only
- CFB—coated on both front and back sides

carrier sheet. The sheet where labels are attached.

CD. Cross direction, perpendicular to the direction of the grain of paper.

chad. The material separated from paper when punching holes; synonymous with chips.

character printer. A device that prints one character at a time. Contrast with *line printer* and *page printer.*

clay. Term for a natural, fine-grained material used as filler and for coating pigments in paper manufacture.

coated papers. Papers coated with substances consisting of pigments and binders, which give them a smoother texture and brighter finish. Surfaces vary from eggshell to glossy, and can be on one or both sides of the paper.

cockle finish. A rough paper finish common in rag bonds and possessing a slightly uneven surface.

coefficient of friction. The amount of relative friction between adjacent sheets of paper in a ream.

cover stock. A heavyweight paper available in white or colors, designed for use as covers for booklets.

curl. Waviness or curvature at an edge of paper.

cut-sheet paper. Paper that has been cut into sheets 11 x 17 or smaller.

D

diazo. An ammonia-based reproduction process used to reproduce documents of engineering size.

die-cut. Cutting or shaping by sharp steel rules to a desired size, shape, or impression on the paper.

dimensional stability. The ability of a paper to retain its size under pressure or high temperature.

DIN. Deutsche Industrie Norm.

dry gum labels. Label stock backed with an adhesive that must be moistened in order for it to stick to a surface.

dry ink. See *toner*.

dual purpose paper. Paper designed for use in offset and electrophotographic printing and copying.

duplex printing. Printing on both sides of a sheet of paper. Duplex printing can be either normal duplex or tumble duplex. Normal duplex is printing on both sides of a sheet where the top is in the same position on both sides. Tumble duplex is printing on both sides of a sheet where the top on the second side is in the opposite position as the top on the first side.

duplicator paper. An extremely smooth paper, highly resistant to liquids, for use in spirit (alcohol) duplicating machines.

dwell time. The amount of time in milliseconds that a sheet of paper remains in a printer under the extreme heat and temperature conditions required to fuse an image to the paper.

E

electrophotographic process. The creation of an image on paper by uniformly charging the photoconductor, creating an electrostatic image on the photoconductor, attracting negatively charged toner to the discharged areas of the photoconductor, and transferring and fusing the toner to the paper.

embossing. Raising the surface of the paper by stamping.

ester. The compound formed by the elimination of water and the bonding of an alcohol and an organic acid.

engineering vellum. A translucent, easily erasable paper used primarily in drafting and engineering applications.

F

face stock. The printable surface of a label. The back side of the face stock typically has an adhesive coating that is protected by a removable backing sheet.

fanning. The manual process of separating sheets in a ream, before loading, to reduce the chance of misfeeds or multiple feeds.

felt side. During the manufacture of paper, the pulp mixture is poured onto a screen so that the liquid drains out leaving only the pulp which dries to form the paper. The side of the paper that is exposed (away from the screen) is called the felt side because it has more short fibers and sizing than the opposite, or wire side. It is the top side of a sheet. See *wire side*.

ferromagnetic. Having characteristics of substances with magnetic properties resembling those of iron. MICR systems use a ferromagnetic dry ink.

filler. Minerals, such as clay and other white pigments, added to the pulp when making paper.

finish. The surface contour of the paper. Characteristics include smoothness, gloss, and the ability of paper to absorb liquids.

finish size. The final size of a sheet after trimming.

foil stamp. A process for applying colored foils to paper, usually as a part of a letterhead's design.

form. A sheet with either preprinted images or created with the electronic forms capability of the advanced function printing software.

formation. The visible physical property of paper influenced by the uniformity of fiber distribution in a paper sheet. The properties of levelness and smoothness depend on the paper's uniform formation.

fountain. In printing presses, the device that stores and supplies ink or water.

fuser. The area of a laser printer in which the image is permanently fixed to the paper by heat or by heat and pressure.

fuser agent. A lubricant for the fuser roll in some laser printers to keep paper from sticking to the fuser during the fusing process.

fuser oil. High-purity, refined silicone oil used as an external release in hard roll fusers, to keep paper from sticking to the fuser roll.

fusing process. The process by which an image is permanently bonded to a sheet of paper. In laser printers this is done by heat and pressure.

G

grade. Categories of paper by which it is defined. Within a grade category, the brightness of paper is defined by numbers; the higher the brightness, the lower the grade number. No. 1 grade papers are the brightest papers available.

g/m^2. Grams per square meter.

ghosting. An undesired duplicate image that reduces print quality. See also *offset*.

grain long. A term for when the grain of the paper is parallel to the longest dimension of the sheet. The fiber alignment parallels the sheet's longest dimension. Contrast with *grain short*.

grain short. A term for when the grain of the paper runs at right angles to the longest dimension of the sheet. The fiber alignment parallels the sheet's shortest dimension. Contrast with *grain long*.

grammage. Term for expressing paper weights. The weight in grams of a square meter of paper; also called grams per square meter (g/m^2 or gsm).

guillotine cut. A method of cutting large reams of paper into smaller sizes. Cutting is done with a single stroke of a descending blade.

Gurley. See *porosity*.

gummed paper. Paper with an adhesive coating, either dry (activated by moisture) or pressure-sensitive.

H

halftone. Reproduction of continuous tone artwork with the image formed by dots of various size.

highlight color. The functional use of a specific palette of colors in a design.

high-speed labels. Adhesive labels designed for high-speed, large volume runs.

holdout. The ability of paper to resist the penetration of ink.

I

impact printer. A printer that transfers an image to paper by striking the paper, ribbon, and characters together.

index paper. A stiff paper, heavier than cover stock, available in white and colors. Used for covers, posters, and section dividers.

internal sizing. Step where sizing chemicals are blended into the pulp before it is formed into paper in the paper-making process. See *surface sizing*.

ISO. International Organization for Standardization.

J

jam. The term used to identify a paper feed or transport malfunction.

K

kaolin. White clay composed of the clay mineral and kaolinite.

ketene. A soluble gas that decomposes in water and alcohol. Used as an acetylating agent.

kraft paper. Paper made from sulphate pulp.

L

label paper. Paper that is super-calendered or coated on one side and has gumming on the other side.

label stock. Adhesive-backed sheets of paper that may be applied to a variety of surfaces. Sheets may be backed with pressure-sensitive adhesive or dry gum.

Label sheets may be uncut, or divided into any number of individual labels.

laser bond. Paper calendered to give it a very smooth finish, and with a minimum of dust and other debris, thus making it well-suited for use in laser printers.

lasography. The xerographic printing process used in laser printers. See *xerography*.

latex. Milky substance that makes a strong, durable, and weather-resistant paper when added during the paper manufacturing.

leading edge. In printing, the edge of the paper that is fed into the printer first.

line printer. A device that prints a line of characters as a unit. Contrast with *character printer* and *page printer*.

long-grain paper. Paper made in the machine direction in the longest sheet dimension. Contrast with *short-grain paper*.

M

matte finish. A coated paper with little or no gloss.

MD. Machine direction, the direction of the grain of paper.

melt mix. Initial manufacturing process for toner. The process uses heat, pressure, and mechanical mixing to combine polymer resins and evenly disperse the pigments and charge-control elements within the toner.

MICR. Magnetic ink character recognition. A printing system that uses ferromagnetic dry ink and specially shaped font characters to print documents that can be read by a machine (machine-readable).

mimeo paper. An extremely rough porous paper. Its high absorbency makes it ideal for the mimeograph printing process, which uses a stencil through which ink is pressed.

moisture content. A physical property of paper. High moisture content causes curl, jams, and poor fusing; low moisture content causes static problems, leading to increased jams and misfeeds.

mottled. Spotty, uneven coverage of ink or toner, resulting in a splotchy appearance.

M-weight. Weight of 1000 sheets of a particular size.

Mullen tester. A device that measures the bursting strength of paper.

O

OCR. Optical character recognition.

offset. Transferring toner from a freshly printed sheet of paper to another surface.

offset paper. A paper with high brightness and moisture content, designed for use in the offset printing process. Also called “book” paper.

offset printing process. A printing process in which an image is formed on a metal plate or other type of master, transferred (offset) to a rubber blanket, and transferred again to a sheet of paper.

opacity. The property of a sheet that prevents print areas from showing through the paper to the other side.

optical scanner. An input device on a computer that converts characters or marks to machine codes.

oxidation. The process of combining with oxygen.

P

page printer. A device that prints one page of text and images as a unit. Contrast with *character printer* and *line printer*.

palette. A specific set of colors chosen or used for a design.

parchment. A writing or painting surface made from goat or sheepskin and prepared for writing, drawing, and marking. A precursor of paper.

parchment paper. A type of paper resembling parchment; translucent, with an antique appearance.

perforated paper. Paper pierced with one or more rows of small holes to permit easy tearing off, or separating into sections.

permanence. A measure of how long a sheet of paper will last without becoming excessively brittle or yellow. The permanence of a paper is directly related to its acidity.

pigments. Substances used to produce colors or different degrees of whiteness in paper. Sometimes pigments are coated onto paper, which can cause contamination problems in printers.

photoconductor. In laser printers, a drum or belt device with a light-sensitive coating, which converts an optical image into a latent electrostatic image on its surface.

pH. Chemical measurement of the level of acidity or alkalinity in paper or other substances.

point. A unit of paper measurement equal to 1/1000 of an inch. A 10-point stock is 10/1000 of an inch thick. This usage is not to be confused with the same term used in typesetting where a point is 1/72 of an inch.

polyethylene. A packaging material made of thermoplastic film.

porosity. Measurement of the ability of air to pass through a sheet of paper.

PPH. Pages per inch; a measure of bulking. The number of sheets in a stack one inch in height.

PPM. Pages per minute; a measure of speed of output from a printer.

pre-drilled paper. Paper having two or more holes drilled or punched along one edge, for use in ring binders or notebooks.

preprinted forms. Paper having images preprinted on them prior to running them through a printer to add variable data.

psi. Pounds per square inch; the unit used to measure the amount of pressure.

pulp. Cellulose fiber material produced by chemical or mechanical means from which paper and paperboard is manufactured.

pulpwood. Wood that is suitable for making paper.

R

rag bond. A type of paper containing 25% or more of cotton fibers. Such papers are extremely strong and durable, with an attractive, rich-looking appearance.

ream. A package of paper, generally containing five hundred sheets of paper.

registration. The printing of variable data so that it fits correctly into areas provided for it on preprinted forms.

release agents. Wetting substances applied to the surface of hot roll fusers to prevent dry ink from sticking to the surface of the roll. Release agents can be applied externally as with fuser oil or lubricant; or they can be compounded into the toner melt mix.

resistivity. An electrical characteristic of paper that is a measure of its ability to resist an electrical charge.

rosin size. A resin added to paper to increase its resistance to liquid penetration. Sizing also helps prevent feathering or fraying.

rotary cut. A method of cutting large reams of paper into smaller sizes; paper is cut by feeding it through a rotating blade.

runability. The ability of paper to run in a printer without jams, misfeeds, or print quality problems.

S

safety paper. See *security paper*.

saturation. The intensity, vividness, or purity of a color.

screen. Creating a tone effect in the printed image.

security paper. Paper that has been specially treated. Treatment prevents erasures or alterations of any writing or printing on the surface of the paper. Used primarily for negotiable documents.

semi-bleached. Chemical wood pulp that is partially bleached.

setoff. A term used for offsetting.

shading. Printing on paper to make the area more distinctive.

Sheffield Smoothness Scale. A measure of the roughness or smoothness of a paper; higher numbers indicate rougher paper.

short-grain paper. Paper made in the machine direction in the shortest sheet dimension. Contrast with *long-grain paper*.

show-through. The undesirable condition in which printing on the reverse side of a sheet can be seen through the sheet, under normal lighting.

simplex printing. Printing on only one side of a sheet of paper.

sizing. The treatment of paper which bonds the surface fibers and gives it resistance to the penetration of liquids (particularly water) or vapors. See also *acid-made* and *rosin sizing*.

smoothness. The degree of continuous, even finish on a paper.

solid fill. An imaged area that is supposed to have 100% ink or toner coverage.

specialty papers. Carbonless, adhesive, synthetic, and other special application paper.

spirit duplicating. An alcohol-based reproduction process; also called ditto process.

stiffness. The degree to which paper resists bending.

sulphite. The acid process of cooking pulp. Wood chips are cooked in a solution of bisulphite.

super-calendering. A process of putting a high gloss finish to the paper.

surface sizing. Term for paper that has been sized by applying a sizing agent when the web of paper is partially dry. See *internal sizing*.

surface strength. Term indicating how well fibers and chemicals are bonded to the surface of a paper. Papers with low surface strength may release fibers and particles, causing contamination in the printer.

T

tab. Paper used for punched card accounting machines and for machines using continuous forms. Also, protruding portion of a form to aid in grasping.

tack. Adhesive stickiness.

tag. Strong paper.

TAPPI. Technical Association of the Pulp and Paper Industry.

tensile strength. A measure of a paper's resistance to tearing. The maximum force required to break a paper strip of a given width under prescribed laboratory conditions.

tenting. Distortion of the paper at a line of perforations.

text paper. A premium paper with a textured look and feel.

texture. The composition and feel of the surface of a paper, such as rough or smooth.

thermography. Raised printing; produced using a resin powder and heat applied to wet ink.

thickness (caliper). Thickness of paper.

tint. Color resulting from adding white to a pure hue.

titanium dioxide. Chemical to increase the whiteness and brightness of a sheet.

toner. Black powder used by printers to form images on the printed pages. Also called “dry ink” or “dry imager”.

transparencies. Sheets of clear plastic or polyester film on which images may be printed. Types include removable stripe, duplicator, paper-backed, and laser transparencies.

U

unbleached. Paper made from unbleached pulp.

V

vellum. A rough-textured, paper finish which is very absorbent for rapid ink penetration.

W

watermark. A translucent mark impressed on certain papers during manufacture. Mark is visible when paper is held up to the light. Usually denotes a high-quality paper such as rag bonds and No. 1 paper grades.

waviness. An undesirable characteristic caused by the outer edges of a stack of sheets retaining more moisture from the air than the center of the sheets, or when the center retains more moisture than the edges.

web. A roll of paper.

wire side. During the manufacture of paper, the pulp mixture is poured onto a screen so that the liquid drains out, leaving only the pulp, which dries to form the paper. The side away from the screen is called the felt side because it has more short fibers and sizing than its opposite, the wire side, the side against the screen. The wire side has more pronounced grain, fewer short fibers, and less sizing. Printing is usually done on the wire side. See *felt side*.

X

xerography. An imaging process used in copying and printing, in which a photoconductor (usually a drum or belt) is electrically charged. Mirrors, LEDs, or a laser beam then remove the charge from selected sections of the photoconductor which are not to be imaged. Dry ink is then attracted to the charged areas forming the image to be printed.

xerographic paper. Paper with controlled moisture content and other parameters to suit electrophotographic printers and copiers.

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Readers' Comments

IBM Advanced Function Printer
Cut-Sheet Paper Reference
for use with
IBM Electrophotographic Printers

Publication No. G544-3915-00

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