



The Biofore Company **UPM**

MAKING PAPER



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MAKING PAPER



The basic principles of papermaking have remained almost unchanged for two thousand years. Fibres are distributed evenly in water and the water is drained, leaving the fibres bonded together. Today, we utilise the most advanced technology, not only to make paper, but also to ensure that the process utilises raw materials in the most sustainable way, with minimal impact on the environment at every stage from resources to recycling.

The raw material for paper is usually wood fibre in primary virgin, or recycled, form. Other raw materials used in the manufacture of paper are water, pigments called fillers and some additives. The coating of paper requires binders and pigments that are mostly minerals.



RESOURCES

The three main resources in papermaking are water, energy and fibres. The forest provides wood fibres. Lakes and rivers provide the water. Part of the energy used is generated from by-products and residuals of the papermaking process itself.

Water, energy and wood procurement.

Water is a very important process material in papermaking. Technological progress has greatly reduced water consumption. Due to process advances and effective effluent treatment, water discharges into the environment are well controlled. The waste waters are monitored regularly and their impact on watercourses analysed. Water is used many times in the production process before being biologically cleaned and returned to nature.

Pulp and papermaking are energy intensive, which is why the efficient use of energy is important. Wood based production residues are used as biofuel to generate energy in the mills. The chemical pulping process is more than self-sufficient in terms of energy needs.

Forests must be used in a sustainable manner and according to sound environmental principles. Through forest certification, UPM verifies that the wood used for its products comes from sustainably managed forests. A Chain of Custody follows forest products from their source to our customers.



The forest provides hard and soft wood fibres used in paper making. Lakes and rivers provide the water.



Wood fibres

Different types of paper require different types of wood pulp. The properties of wood fibres depend on the species of tree they come from, and the pulping process. The paper industry uses mainly spruce, pine and hardwood fibres such as birch and fast-growing eucalyptus trees as raw material. Much research has also been carried out to assess new types of wood fibres to evaluate their suitability for paper production.

Recycled fibres

Recycled fibres produced from recovered paper are used more and more in modern papermaking. Thanks to recycling, the original wood fibres can be used several times before they become unsuitable for papermaking. UPM uses recovered paper at mills located in highly populated regions, to ensure a sufficient quantity of locally sourced recovered paper, avoiding long distance transportation which would be neither economically nor ecologically efficient.

Use and origin of fibres

Short fibres (hardwood)

for bulk, opacity, softness, printability

- birch
- eucalyptus
- aspen

Long fibres (softwood)

for strength, runnability

- spruce
- pine

Recycled fibres

for economical reasons and sustainability

- recovered paper



PULPING

Pulping, in which the wood is broken up into wood fibres, is the first stage of paper manufacturing. The choice of pulping process depends on the type of wood and the end use of the paper. There are two principal methods of producing pulp from fresh wood: mechanical and chemical.



Mechanical pulp

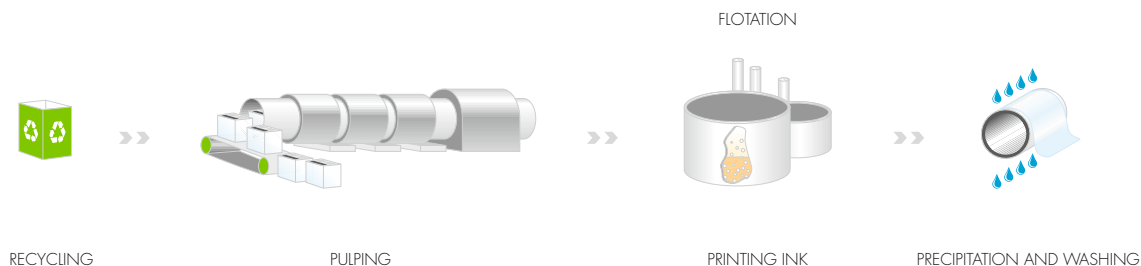
In mechanical pulping, fibres are separated mechanically. There are two basic methods:

- Logs of approximately one metre in length can be ground. During grinding, debarked tree trunks are pressed against a rotating grindstone.
- Wood chips are put into refiners, where separation of fibres takes place between two rotating disks. Pressure and heat are used to speed up the process.

Chemical pulp

The most common process to produce chemical pulp is currently the **sulphate process**. This method uses alkaline cooking liquor and is suitable for nearly all types of wood. This is the method used by UPM.

Paper made from 100% chemical pulp is called wood-free paper. This means that the wood fibres are cooked in a chemical solution to remove the wood's natural binding agent, the lignin. This ensures paper lasts longer and stores better. Modern chemical pulp mills are more than self-sufficient in terms of energy, as wood material dissolved in the cooking liquor is concentrated and used as fuel.



Recycled fibre pulp

Recycled fibres come from recovered paper and are an excellent and economical raw material, especially for newsprint. Recovered paper needs to be de-inked before it can be reused. This process needs some chemicals and a certain amount of energy. Theoretically, a paper fibre can be used five to seven times in production. These fibre losses mean that virgin fibres will always be necessary to maintain the fibre balance.

De-inked pulp preparation requires a multi-stage process. This includes the dispersing of paper in water, several impurity-removal stages, ink removal and sometimes also bleaching. There is one basic rule in using recovered paper for new printing papers: only light-coloured recovered papers (newsprint, magazines, advertising materials) are accepted as raw material.

There are two alternative methods of de-inking: washing and flotation. Washing requires more water than the flotation process. In flotation, air is blown through the liquid, causing a foaming mass of bubbles. The ink attaches itself to these bubbles, which float to the surface for easy ink collection.

Every tonne of recycled paper usually leaves about 100–150 kg of residue in the form of de-inking waste, which is most commonly burned for energy production. The ash produced is used, for example, as a binding agent for concrete and in road construction.

Pulp bleaching

Bleaching whitens pulp and eliminates impurities. Pulp is bleached in several consecutive stages. The type and amount of bleaching chemicals depends on how the pulp has been produced and the degree of brightness required.

Wood pulp can be bleached with chlorine or chlorine compounds, ozone or oxygen in different forms as well as hydrogen peroxide. UPM's pulp is bleached using the ECF (Elemental Chlorine Free) process. For environmental reasons, UPM neither uses chlorine gas in its own bleaching processes nor purchases pulp bleached with chlorine gas.

Recycled fibres come from recovered paper and are an excellent and economical raw material, especially for newsprint.



MECHANICAL PULPING

ADVANTAGES	DRAWBACKS	END USES*
<ul style="list-style-type: none"> • Excellent fibre yield (over 90% of wood is transformed into pulp) • High opacity • Good printing characteristics 	<ul style="list-style-type: none"> • Low strength • Yellowing • High energy consumption (with TMP pulping) 	<ul style="list-style-type: none"> • Newspapers • Periodicals • Books • Paperbacks
* Products that do not require long storage periods		

CHEMICAL PULPING

ADVANTAGES	DRAWBACKS	END USES
<ul style="list-style-type: none"> • Resistance to yellowing • Energy self-sufficiency at mills • Good strength (sulphate) • Easier bleaching (sulphite) 	<ul style="list-style-type: none"> • Low fibre yield (60% of the tree is transformed into pulp) • More waste to be purified 	<ul style="list-style-type: none"> • Writing • Printing, copy • Envelopes • Industrial papers • Packaging • Sanitary

RECYCLED PULPING

ADVANTAGES	DRAWBACKS	END USES (% OF RECYCLED FIBERS)
<ul style="list-style-type: none"> • Lower energy consumption than in mechanical pulping processes • Fibre recycling 	<ul style="list-style-type: none"> • Low opacity, low bulk 	<ul style="list-style-type: none"> • Boards (0–100%) • Packaging (0–100%) • Newsprint (0–100%) • Printing paper (0–100%) • Soft tissue (60%) • Forms, envelopes (0–100%)

PAPER MANUFACTURE

Papermaking today requires more technology than a jumbo jet. The paper machine is as wide as a two-lane highway and operates 24 hours a day, seven days a week, almost all year long.

The end use of the paper defines the basic fibre mix needed to achieve the expected functional properties. Sophisticated controls are necessary to produce an accurate paper profile, which is measured in microns.

Paper structure

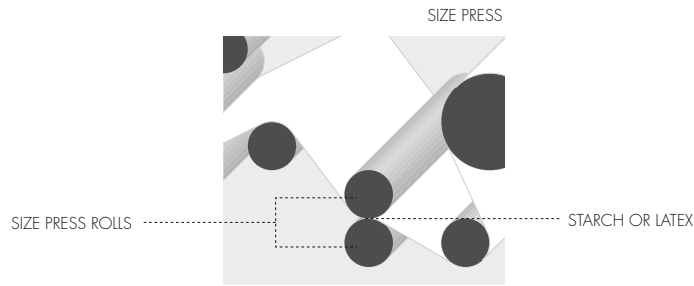
The fibre mix also requires certain additives to obtain the expected paper characteristics. Mineral fillers, such as china clay, talc and calcium carbonate, make the paper smoother and more receptive to ink. They also improve opacity, brightness and printability. Mineral pigments, together with dyes, give the desired shade. Finally, binders such as starch and latex are added to provide strength and right ink absorption characteristics.

Paper machine

A paper machine is an extremely complex piece of equipment. Different types of machines have been designed to produce the desired paper grades. Modern machines can be up to 150 m long and 10 m wide and their speed can reach 2000 m/min or more.

A paper machine is basically a dewatering machine that removes water from the stock by filtration, pressing and drying. The main sections of a paper machine are the headbox, wire section, press section, dryer section and the reeler.





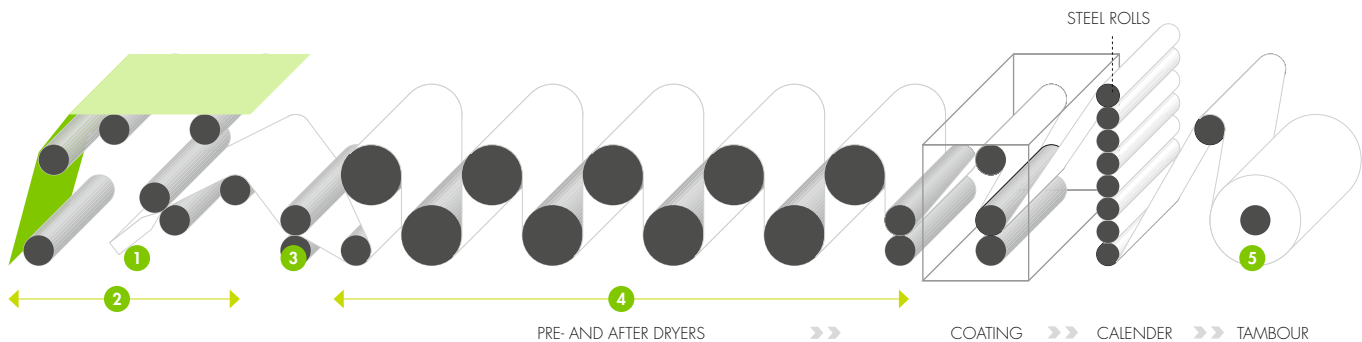
99%

80%

50%

3–8%

WATER CONTENT



1. Headbox

Papermaking begins at the headbox, where pulp is injected between two fast-moving wires. The stock in the headbox is 99% water, while there is just 1% pulp and filler. The wire section forms the stock into a net, which is made up of pulp mixed with water and additives.

2. Wire section

The water drains away and fibres are screened on the top of the wire, i.e. on a finely woven plastic mesh, in an absolutely even layer. The wires are specially designed to keep the bound fibres lying down, letting the water drain. Water is collected throughout the papermaking process for reuse. The direction of the fibre in the paper is determined in the wire section, where strength, formation and two-sidedness can also be affected.

3. Press section

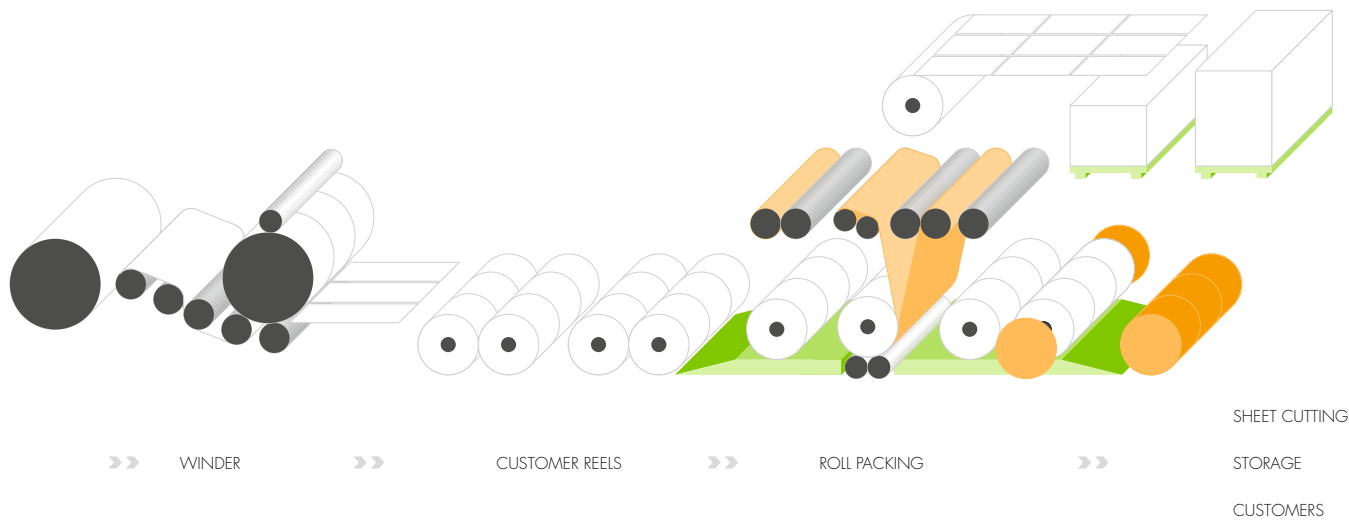
The stock is now 80% water. The pulp is taken into the wet presses by the press felt. The wet presses squeeze the water content down to 50% and the felts absorb water from the paper web. Pressing improves fibre bonding by bringing the fibres closer together. In the pressing section the bulk, stiffness, opacity and surface roughness of paper can be controlled.

4. Drying section

The paper web continues into the drying section, which consists of steam-heated cylinders that evaporate more water. After going through the drying section, paper has a moisture content of 3–8%, depending on the paper grade. Drying requires a large amount of steam, which is produced in the integrated power plant of the mill. The drying section can affect the curl of the paper.

5. Reeler

At the end of the machine, the paper is wound onto spools, called tambours. Most paper machines use reelers to form the tambour that can be up to 4 m in diameter, weigh 100 tonnes and contain 100 km of paper. These rolls are then brought to the finishing machines.



Surface treatments and finishing

Different end uses call for different paper qualities. Art books, magazines and mail order catalogues require high quality paper. A good base paper is only the first step. Surface treatment and finishing are used

to precisely engineer a paper for its intended end use – improving printability, information capacity, or enhancing the quality of pictures. Some of these finishing stages can take place while the paper goes through the paper machine.





Surface sizing

The paper is passed through the nip of a size press, or starch bath. Sizing makes the paper surface stronger and its moisture resistance properties can also be improved. The sizing agent used is normally starch. A size press in the paper machine's dryer section usually applies the surface sizing agent.

Glazing and calendering

The paper can be further glazed and calendered at the end of the paper machine by passing it between two or several rolls. As a result of this machine glazing and calendering, the paper acquires a one sided glossy surface (MG) or a smooth machine finished (MF) surface.

Coating

Coating is applied to papers in order to give a brighter, even smoother and more closed surface. Paper grades are given different names depending on the amount of coating applied. Coating recipes depend on the end use of the paper, the paper machines, the coating method and the location of the mill.

Coating colour contains pigments (kaolin, china clay, talc, carbonate), binders and additives (starch, latex). It is applied to one or both sides of the paper either once, twice or three times and varies from 3–40 g/m²/side of paper. Coating pigments improve the surface and optical properties of the paper.

Binders give strength and stiffness as they bind the coating particles to each other and onto the paper. The binders are natural or polymer-solvents.

Additives are used to improve both the coating process and certain paper characteristics, depending on the coating method and paper requirements.

The base paper can be coated on an online or offline coating machine. To ensure perfect coating, continuous online measurements are needed. The method of coating is not visible to the end user.

Supercalendering

Supercalendering can also take place either online or offline, and this is done at the end of the papermaking process, before cutting. The supercalender consists of 10 to 12 steel and elastic cylinders. The paper web snakes around each roll, and heat, pressure and friction in the nips glaze both surfaces of the paper to make them smooth and glossy.

At the same time glazing makes the paper thinner and more transparent, and reduces stiffness. With calendering, the final surface of the paper can also be adjusted to matt, silk or glossy. All grades requiring high gloss are supercalendered.

Winding, sheet cutting and wrapping

At the dry end of the paper machine, the reeler rolls the paper web into jumbo reels. The paper reel, or tambour, is now finished. It can weigh up to 100 tonnes. The paper will be slit or cut according to the customer's specification, and it is then packed for storage and distribution.

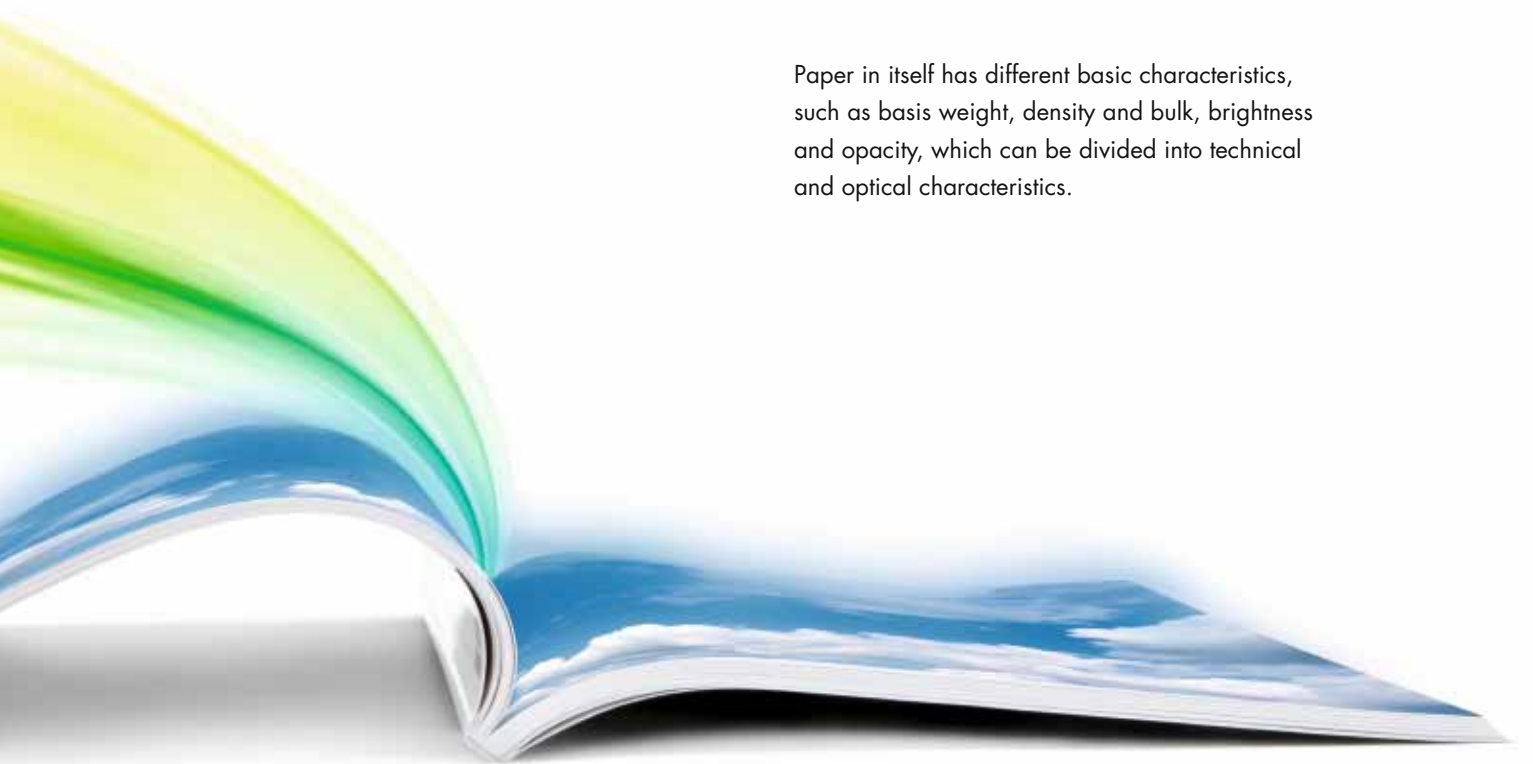
Paper can be cut into reels or sheets. If the paper is required on reels, it is cut on a winder. These reels are wrapped for transport and labelled with necessary identifications, such as paper type and bar code. Paper in sheets is cut on a separate web-fed sheet cutter. Sheets are usually palletised and wrapped. In case of cutsize paper, sheets are ream wrapped and packed in cardboard boxes.

After cutting, the paper needs to be delivered to the customer in perfect condition. That calls for secure packaging and minimal handling.



CHARACTERISTICS OF PAPER

Paper in itself has different basic characteristics, such as basis weight, density and bulk, brightness and opacity, which can be divided into technical and optical characteristics.



Technical characteristics

Technical characteristics are those referring to the physical properties of the paper and depend on many factors, such as the type of fibres used, fillers and finishing.

Basis weight

Basis weight refers to the weight in grams per square meter (g/m^2) of a paper grade. As paper fibres both release and absorb water from their surroundings, the weight of any given paper can vary. Basis weight is therefore determined under standard conditions, i.e. at a specified ambient moisture and temperature.

Density

Density is the specific weight of a material. Paper density indicates how compact the paper has been made. High density gives good smoothness.

Bulk

Bulk expresses the specific volume of a material. High bulk offers greater stiffness. In the paper trade bulk is a

more commonly used measure than density for indicating the compactness of paper. When paper has a high mineral content and/or it has been heavily calendered, its properties include high density and low bulk.

Strength

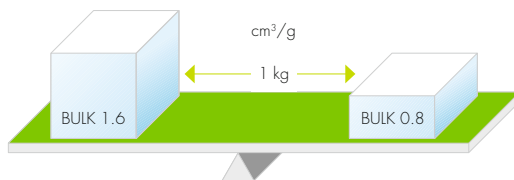
The strength of paper is measured as tensile strength, tearing strength, bursting strength, surface strength and bonding strength. Strength is always affected by the ambient humidity. The greater the moisture content, the more elastic the paper becomes. Tearing strength and breaking strength are the parameters usually measured.

Roughness

Roughness depends on pulp composition, web formation and degree of calendering. The term roughness is usually only used in relation to uncoated paper. The glossy surface of coated paper, with its smaller irregularities, is considerably smoother.

Fibre direction

During the papermaking process, fibres are laid in the direction set by the machine. Fibre orientation must be taken into account during printing and when the paper is later stitched or bound. The fibre direction affects, for example, folding, stiffness, tensile stress and tearing resistance.



Optical characteristics

The optical characteristics of paper are those that can be discerned by the human eye. They include the reflection of light from the surface and transmission of light through the paper. Optical characteristics depend on the degree to which the fibres are bleached.

Brightness

Brightness is the reflection of light from the paper surface which can be measured with different standards (DIN, D65, ISO, SCAN and TAPPI). The best meter for brightness is, however, the human eye. This value can vary considerably between mechanical papers and woodfree papers. Brightness affects the readability of the paper, so grades with high brightness are mainly used for colour printing.

Whiteness

Whiteness is a combination of the shade (bluish, yellowish, reddish, greenish) and the brightness (white vs. black) of the paper surface. Certain shades are perceived as having a whiter visual appearance. Brightness measurements alone do not take into account the shade factor, which is why paper is measured more frequently on its whiteness.

Opacity

Opacity is the transmission of light through the paper. When light strikes the paper, it is partly absorbed into the paper itself and partly refracted back. The greater the refractory quality of the paper, the better its opacity. Opacity also is related to paper transparency, as grades with poor opacity are relatively transparent.





Gloss

Gloss expresses the amount of directed light that is reflected with a specific angle of incidence. This can be measured with a gloss meter that can use different standards (DIN, TAPPI). Glossy papers reduce the readability of text but they are superb for reproducing pictures.

Runnability

Good runnability means excellent production efficiency in the printing and converting process. The strength acquired by paper while going through the paper machine is usually enough for good runnability. Runnability problems can include breaks, waste, build-up and folding problems.

Printability

Printability is the quality potential of paper in printing. Printability parameters are measured as optical, colorimetric and mechanical print properties. Printability is the result of interactions between paper and both the printing ink and printing press.

PAPER GRADES

Various paper grades with different properties are made for all kinds of applications. Within each grade different sub grades are also made to meet customers' specific requirements.





Printing papers

Woodfree coated papers (WFC), woodfree uncoated papers (WFU), coated mechanical papers (MWC, LWC), uncoated mechanical papers and newsprint are called printing papers.

Their end uses include, among others, magazines, newspapers and their supplements, sales catalogues and direct mail.

Woodfree coated papers (WFC)

Coated fine papers have been designed for demanding printing. The amount of coating, surface gloss and other special characteristics vary according to the final use. Fine papers may be coated once, twice or three times and their surfaces can be matt, silk or glossy.

The very highest quality coated fine paper is called art paper, which is used in the printing of art books, annual reports and deluxe advertising materials. Coated fine papers have a wide range of applications – magazines and magazine covers, advertising materials, brochures, books and catalogues.

Various paper grades with different properties are made for all kinds of applications for example magazines, brochures or newspapers.



Fine papers are printed mainly in heatset web offset or sheet fed offset and also, to a lesser extent, in roto-gravure printing.

Woodfree uncoated papers (WFU)

Uncoated fine papers are a large group of machine finished or supercalandered paper grades used for a multitude of print jobs such as advertising materials, books, maps and office papers.

WFU papers are available in a wide range of basis weights, stretching from very low basis weights to near-cardboard grades.

Coated mechanical papers

MWC (medium weight coated) papers have an even surface, excellent smoothness and good gloss. The even surface provides for low dot-gain in offset printing, which is why these papers are used in demanding four colour printing such as magazines, special sales catalogues and advertising materials.

MWC papers are manufactured in silk or matt finishes for offset and roto-gravure printing.

LWC (light weight coated) papers are used for magazines and sales catalogues that feature a large number of advertisements and colour pictures. The papers can be very glossy and bright, but are also made in matt and silk.

LWC papers are manufactured to meet the demands of both the heatset offset and roto-gravure printing methods.

Uncoated mechanical papers

SC papers (supercalendered) are the most economical magazine papers in terms of cost and using paper's ability to convey information. There are several sub-grades of SC papers, which are used for sales catalogues, general and specialist interest magazines, supplements and advertising materials.

SC grades with either a matt or glossy finish are manufactured for rotogravure and offset printing.

Machine finished speciality grades (MFS) are manufactured from mechanical or recycled pulp. Characteristics common to MF grades are good brightness, surface structure and bulk. MFS papers, both white and coloured, are found in telephone directories, technical catalogues, timetables and special Sunday editions of newspapers.

Coloured newsprint falls into this category although technically these papers are very similar to ordinary newsprint. The most common colours are salmon, pink, yellow, orange, blue and green. Coloured newsprint is used mainly for newspapers and newspaper supplements.



Newsprint

Newsprint is manufactured either from mechanical pulp or recycled fibre. It is the most economical paper grade. Newsprint tends to be lightweight. In recent years, the average basis weight has continued to fall as lighter paper produces savings in transportation, handling and storage. The most important technical characteristic of newsprint is consistently reliable runnability. It is mainly used in the printing of newspapers, but magazines and less demanding advertising materials can also be printed on newsprint.

The most common printing method for newsprint is cold-set offset, although letterpress and flexo printing can be used as well.

Cutsite papers

The use of cutsite papers has increased the world over. Cutsite paper must run faultlessly through the printer without curling or jamming. Excellent dimensional stability is required for the best runnability in duplex printing.

Cutsite papers are used in high-speed laser printers and copiers in data centres as well as on desk top lasers and inkjet printers in small offices and homes. Cutsite papers range from standard black and white laser printing or copying paper, to color laser or color inkjet printing paper.

Preprint papers

Preprint papers are used to produce forms for bank and insurance statements, for transactional documents or for company letterheads. Preprint papers are always printed twice.

Preprinting and converting of the forms is typically done on a reel-fed offset press. The document is later personalized by a reel-fed or sheet-fed laser printer and the final step is automatic insertion into an envelope after which



it will be mailed to the recipient. As the paper is printed and handled several times, preprint papers need to have good fundamental characteristics such as strength, purity and dimensional stability.

Envelope papers

Envelopes are primarily manufactured from uncoated woodfree papers and brown MG kraft paper. Coated woodfree papers are used for direct mail envelopes where higher print quality is required.

Different paper grades are used for different types of envelopes, pockets and gussets. The most important characteristics of envelope papers include good stiffness and strength, low porosity and good printability.

Digital printing papers

Digital papers have been developed especially to fulfil the demands that digital printing puts on paper. Their look and feel, however, is identical to the paper grades used in traditional printing.

Digital printing has enabled the enhancement of printed materials. Personalisation and short-print runs of four-coloured products have opened up new opportunities for the creation of brochures, advertising material, catalogues, books and invoices. New applications also include the remote printing of newspapers to ensure that dailies can be delivered on the date of issue, even to subscribers living far from the printing press.

Speciality papers

Speciality papers include those for specific end uses, for example bags, sacks, technical and industrial converting, flexible packaging and labels.

Sack papers

Sack papers are usually kraft papers made from bleached or unbleached sulphate pulp. Sack paper may either be unglazed (UG) or a microcreped grade known as extensible or clupak. In some cases airborne drying can improve the crosswise extensibility of sack paper.

Modern sack manufacture calls for great strength and porosity of paper. Strength is essential to minimise the use of raw material and the durability of packaging, while porosity facilitates quick, dust-free filling with powdered materials such as cement. Friction is a major asset when sacks are stacked and transported. The interior of sacks is usually made of brown paper. The outer side may be white, creating a better printable surface.

Bag papers

Bags are mostly manufactured from white kraft paper, though brown kraft is also used. The paper may either be machine finished (MF) or machine glazed (MG).

Typical end uses for bag papers are flour and sugar bags, carrier bags and various types of bags, for example, for bread, sweets and fast foods. Essential characteristics include strength, good runnability, purity and printability.

Technical papers

Technical papers, or industrial papers as they are also known, refer to a variety of kraft grades which can be treated with plastic, aluminium, bitumen, silicone or wax. They can also be used as a base in the manufacture of abrasive papers.

Technical papers are used for industrial wrappings and packaging, insulating papers for the construction industry, paper sticks, interleaving papers for the steel industry and several other applications.

Flexible packaging papers

Uncoated or coated papers and kraft papers are used as flexible packaging papers, either as such or laminated with plastic, aluminium or other materials. Major users of flexible packaging include the powdered food, tobacco and confectionery industries.

Label papers

Label papers are divided into face papers and base papers. Face papers are either one-side coated and pigmented or uncoated woodfree papers, while base papers are supercalendered kraft papers.





PRINTING PAPERS

PRODUCT DESCRIPTION	POSSIBLE FINISHING	FURNISH
Fine papers		
• Woodfree coated paper (WFC)	• gloss, premium silk, silk, matt	• hardwood and softwood sulphate pulp, filler, coating colour
• Woodfree uncoated paper (WFU)	• machine finished, supercalandered	• hardwood and softwood sulphate pulp, filler
Coated mechanical papers		
• Coated mechanical paper (MWC)	• gloss, silk, matt	• mechanical pulp, chemical pulp, coating colour, fillers
• Coated mechanical paper (LWC, MFC)	• gloss, silk, semi-matt, matt	• mechanical pulp, chemical pulp, recycled fibres, coating colour, fillers
Uncoated mechanical papers		
• Supercalendered mechanical paper (SC)	• gloss, silk	• mechanical pulp, chemical pulp, recycled fibres, fillers
• Mechanical uncoated speciality paper (MFS)	• matt	• mechanical pulp, recycled fibre
Newsprint		
• Newsprint	• matt	• 50–100% recycled fibre

CUTSIZE PAPERS

PRODUCT DESCRIPTION	POSSIBLE FINISHING	FURNISH
<ul style="list-style-type: none"> • Woodfree uncoated paper (WFU) • Microporous and cast coated photo inkjet paper 	<ul style="list-style-type: none"> • machine finished, supercalandered • ultra-glossy, glossy, satin 	<ul style="list-style-type: none"> • hardwood and softwood sulphate pulp, filler

POSTAL PAPERS

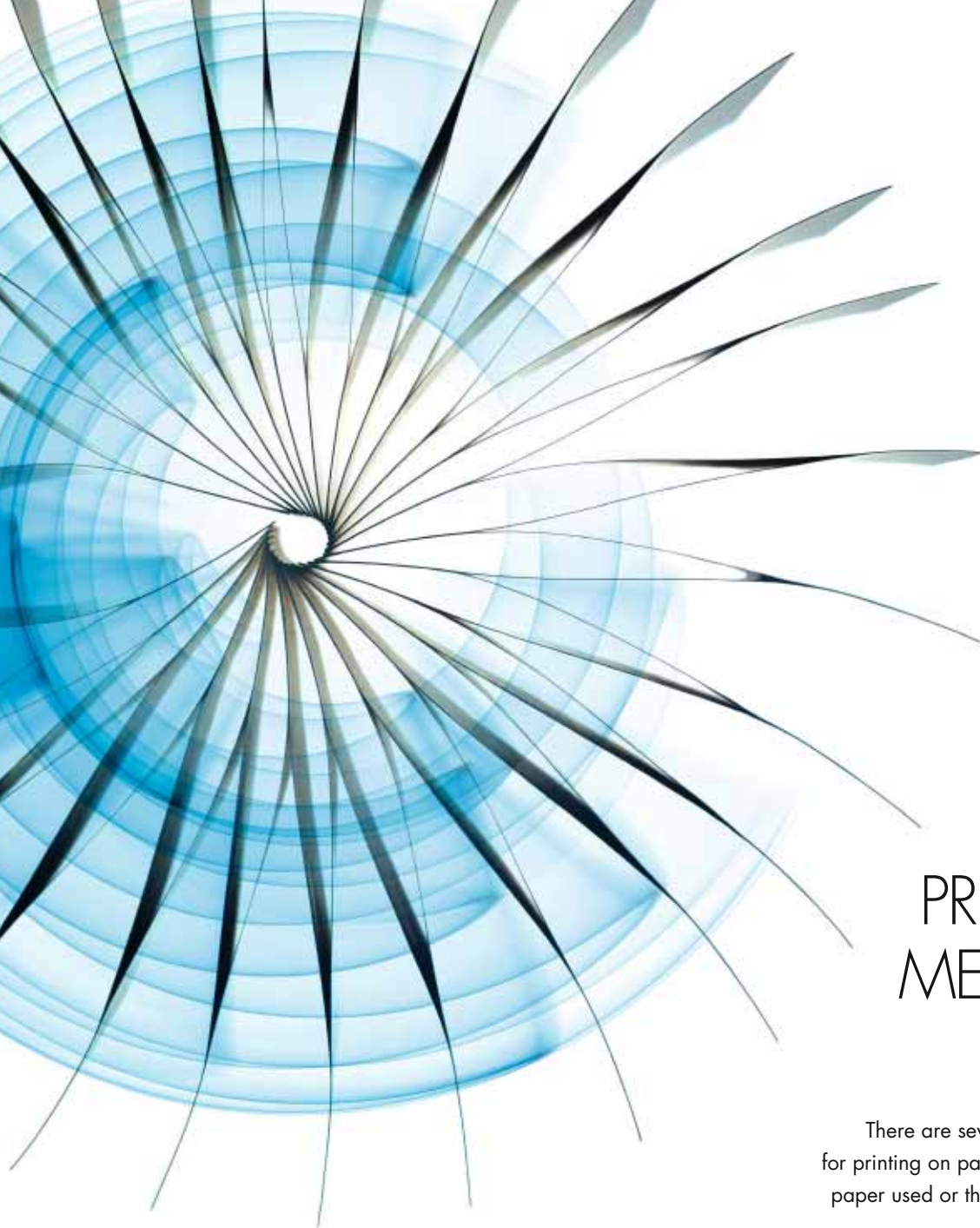
PRODUCT DESCRIPTION	POSSIBLE FINISHING	FURNISH
Preprint papers		
<ul style="list-style-type: none"> • Woodfree uncoated paper (WFU) 	<ul style="list-style-type: none"> • machine finished 	<ul style="list-style-type: none"> • hardwood and softwood sulphate pulp, filler
Envelope papers		
<ul style="list-style-type: none"> • Woodfree uncoated paper (WFU), MG kraft and specialities 	<ul style="list-style-type: none"> • matt, gloss, several felt marks available in the MG-grades 	<ul style="list-style-type: none"> • hardwood and softwood sulphate pulp, semi alkaline pulp, filler

DIGITAL PAPERS

PRODUCT DESCRIPTION	POSSIBLE FINISHING	FURNISH
Papers for professional digital printing		
<ul style="list-style-type: none"> • Woodfree or mechanical papers, coated or uncoated (MFS, WFC, WFU, MWC, LWC, MFC, SC-A+, MFS) 	<ul style="list-style-type: none"> • gloss, silk, matt, supercalendered, machine finished, pigmented 	<ul style="list-style-type: none"> • hardwood and softwood sulphate pulp, mechanical pulp, fillers, coating colour

SPECIALITY PAPERS

PRODUCT DESCRIPTION	POSSIBLE FINISHING	FURNISH
Label papers		
<ul style="list-style-type: none"> • Base papers: glassine, supercalendered kraft (SCK), clay coated release liners • Face papers: one-side coated woodfree MF/SC paper 	<ul style="list-style-type: none"> • a wide selection in smoothness, transparency, lay flatness, dimensional stability and printability 	<ul style="list-style-type: none"> • softwood and hardwood pulp
Packaging papers		
<ul style="list-style-type: none"> • Machine finished (MF), unglazed (UG), semi- and fully extensible (clupak), machine glazed (MG) paper, one-side coated paper 	<ul style="list-style-type: none"> • bleached, unbleached, a wide range of porosity, friction, strength and smoothness 	<ul style="list-style-type: none"> • unbleached sulphate pulp, softwood kraft pulp (ECF), bleached hardwood and softwood pulp (ECF)



PRINTING METHODS

There are several different methods for printing on paper, depending on the paper used or the end use application.

Coldset web offset (CSWO)

In coldset offset printing, ink is first transferred from the printing plate onto a rubber 'blanket' cylinder and then onto the paper. The ink dries through absorption into the paper and evaporation. The printing surface and non-printing surface of a printing plate are level but have a different surface tension.

Coldset offset is mainly used in newspaper printing.

Heatset web offset (HSWO)

The heatset offset printing method is similar to coldset offset when it comes to the actual printing but the two methods employ different types of inks. Ink is transferred from the printing plate onto a rubber blanket and then onto the paper. The ink is then dried, for a mere second, at the high temperature of a dryer, or oven. The printing and non-printing surfaces of the printing plate are level but they have a different surface tension.

Due to low initial outlays, the heatset offset printing method is suitable for a variety of purposes. It is mainly used in the printing of magazines and advertising material.

Rotogravure (RG)

In the rotogravure process, ink is transferred onto paper from small recesses engraved either mechanically or by laser into the impression cylinder. Each shade of ink is dried separately at a high temperature before the next colour is printed.

Rotogravure is best suited to the printing of large circulation catalogues and magazines.

Sheet fed offset (SFO)

The actual printing in sheet fed offset is the same as in the CSWO and HSWO processes except that the inks are dried through oxidization.

The sheet fed offset printing method is used in the printing of graphic papers and packaging.



Digital printing

Digital printing is the fastest growing printing method. The two main digital printing methods are inkjet and electrophotography. Digital printing is particularly suited to short print runs and offers a number of advantages over traditional methods, most importantly flexibility. Changes can be made up to the very last minute, even when documents are already being printed. This flexibility enables the updating of information and individual print runs with changing contents.

Letterpress

In letterpress printing, ink is transferred onto paper from the raised surfaces of a relief plate or printing plate. The ink dries through absorption and evaporation.

Letterpress printing is today used mainly for short print runs of business cards, invitations, forms and the like. Previously, telephone directories and newspapers were also printed using letterpress.

Flexography

Flexo is a variation of letterpress printing with a flexible printing plate. Ink is transferred onto paper from the raised surface of a relief plate or printing plate and dried through absorption and evaporation.

Flexo printing is mainly used in the printing of packaging and wrappers, and occasionally newspapers.



PRINTING METHOD	PAPER PROPERTIES
Coldset web offset (CSWO)	<ul style="list-style-type: none"> • Sufficiently absorbent (no drying stage) • No heavy calendering • Allows use of coated grades, if coating correctly formulated
Heatset web offset (HSWO)	<ul style="list-style-type: none"> • Smooth, closed surface • Surface strength • Low moisture (7.5–5%)
Rotogravure (RG)	<ul style="list-style-type: none"> • Smooth surface • Sufficiently closed surface • Good compressibility
Sheet fed offset (SFO)	<ul style="list-style-type: none"> • Smooth, closed surface • Moisture • Surface strength • Proper pH (so that ink dries evenly)
Digital printing	<ul style="list-style-type: none"> • Inkjet: ink absorption, colorant fixation, low cockling tendency, waterfastness • Electrophotography: low moisture (4.5–5.5%), smooth surface, high stiffness, dust free
Letterpress	<ul style="list-style-type: none"> • Smooth surface • Ink absorption • Good compressibility (compensates for roughness)
Flexography	<ul style="list-style-type: none"> • Smooth surface • A closed surface (when water-based ink is used)

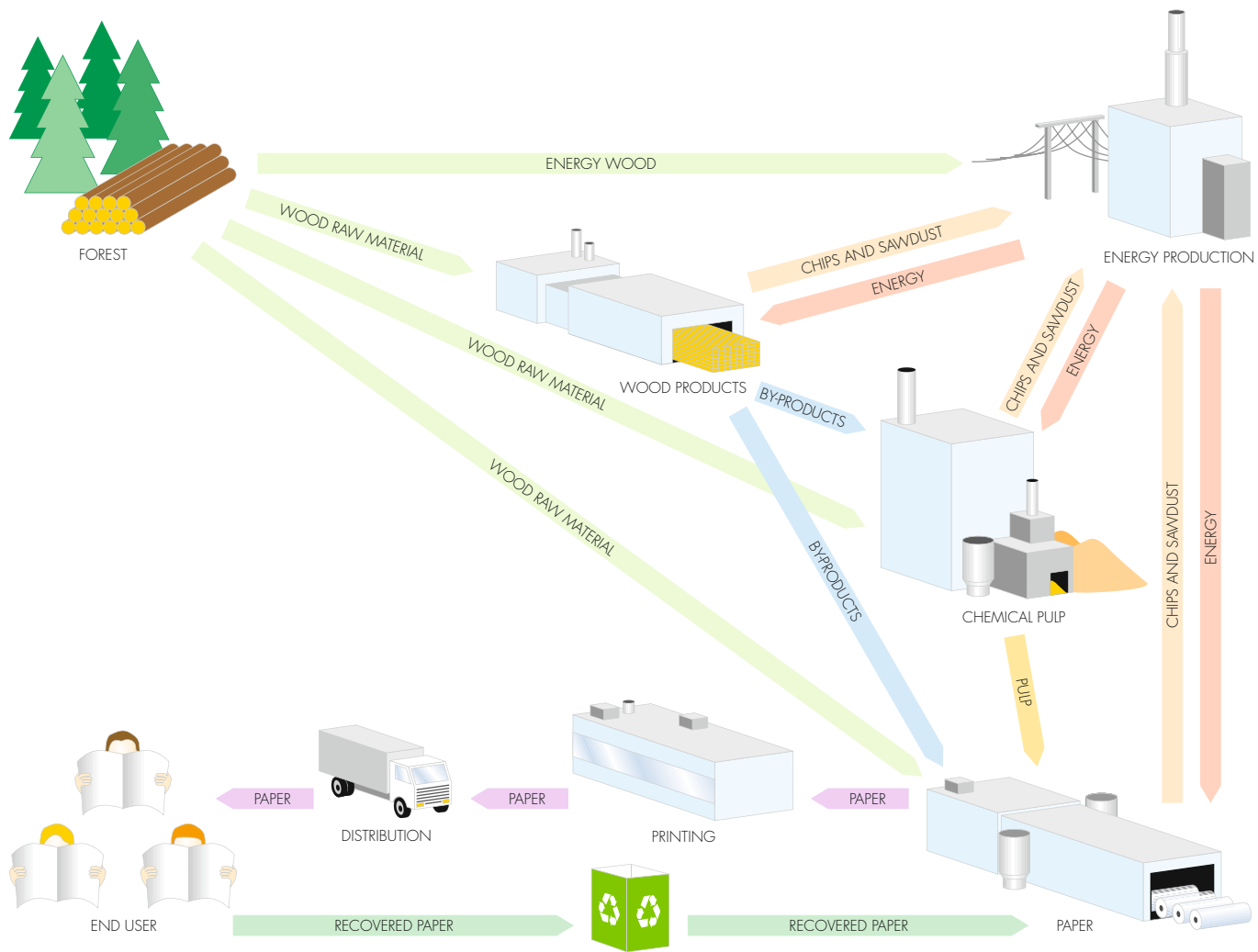
PAPER AND THE ENVIRONMENT

UPM's environmental approach comprises continuous improvement and focus on the product's lifecycle from the origin of wood raw material to the product recycling or disposal after use. UPM aims in all parts of its activities to minimise the burden on the environment.

Sustainable raw materials

UPM's production is based on wood as its renewable natural resource. The company complies with the principles of sustainability. Use of Forest certification ensures that our wood raw material originates from sustainably managed forests. A "Chain of Custody" verifies the origin of the wood and traces its progress from the forest, through the mill, to the product.

Recovered paper is as important a raw material as fresh wood fibres for UPM. Currently we use around 2.8 million tonnes of recovered paper each year, which makes us one of the world's largest users of recycled fibre in printing papers. Recycled fibre represents around a quarter of the total amount of fibres used in paper production.





UPM's production relies mostly on wood as its renewable natural resource. Forest certification is requested to ensure that our wood raw material originates from sustainably managed forests.

Environmental performance

Certified environmental management systems provide the practical tools for continuous improvement of environmental performance. The international ISO 14001 standard as well as the European EMAS Scheme (Eco-Management and Audit Scheme) are applied at UPM's pulp and paper mills. Setting high environmental standards is part of everyday life not only within the mill sites, but also for our suppliers and transportation partners.

Energy generation and effluent treatment are indispensable co-processes at UPM's production facilities. Energy generation is the main source of air emissions from a mill, but these are controlled and minimised through the use of renewable fuels, flue-gas purification and efficient methods of production and recovery of energy. The mills' wastewater is purified in multi-staged effluent treatment plants before being released back into the watercourse. The quality of purified water released is monitored regularly.

Waste management, logistics and material supply are equally important when analysing the environmental performance of products throughout the entire lifecycle. Wood-based production residuals are used mainly as biofuel for the mills' energy generation. The resulting ash represents the most significant proportion of solid waste from a mill and this is reused, for example, in the building industry. The environmental impact of logistics is reduced through efficient routing, favouring rail and ship transportation and the use of low-emission fuels. All material suppliers are assessed in terms of their own environmental and social responsibility.

Product safety

UPM's papers are safe to use. They pose no danger or harm to people and the environment. After use, UPM products can be recycled as raw material for new paper products, used as fuel, or they can be composted. To ensure the recyclability of the final product, the paper industry, printing houses and ink and glue manufacturers work closely together.





END-USES OF UPM PAPERS

Paper is a material which alters its character according to its end use and the range of grades varies accordingly. For each end use there is a specific grade, tailored and developed according to specific requirements, keeping in mind technical qualities and the need for an individual look and feel for each product.



PRINTING PAPERS

PRODUCT DESCRIPTION	END USES
Woodfree coated papers (WFC)	
• UPM Finesse	• high quality magazines and catalogues, magazine covers, advertising material, annual reports, brochures, direct mail, newspaper supplements, prestigious books
Woodfree uncoated papers (WFU)	
• UPM Fine	• advertising material, books, business forms, comics, magazines, manuals, maps, newspaper supplements, posters
• UPM Book Premium	• books, pocket books, cartoons and youth literature
Coated mechanical papers	
MWC papers	
• UPM Star	• high quality magazines, special interest magazines, special sales catalogues, advertising material, direct mail, books
LWC papers	
• UPM Ultra	• upmarket magazines, sales catalogues, advertising material, direct mail
• UPM Cote	• magazines, mail order catalogues, advertising material, direct mail
• UPM Satin	• special magazines, sales catalogues, advertising material, inserts, books, direct mail
• UPM Matt	• newspaper supplements, advertising material, special newspapers
• UPM Book Matt	• books, pocket books, cartoons and youth literature
Uncoated mechanical papers	
SC papers	
• UPM Smart	• advertising material, catalogues, magazines
• UPM Cat	• catalogues, magazines, supplements, advertising material
• UPM Max	• magazines, newspaper inserts, supplements, catalogues, advertising material
• UPM Eco	• special interest magazines, catalogues, direct mail, advertising material, newspaper inserts
MFS papers	
• UPM Brite	• newspaper inserts, special newspapers, direct mail, advertising material, special interest magazines
• UPM EcoPrime	• advertising material, direct mailing, magazines, newspaper inserts, newspapers
• UPM Opalite	• telephone directories and other directories, mail order catalogues, advertising material
• UPM Color	• newspapers, newspaper inserts, advertising material
• UPM EcoLite	• catalogues, manuals, timetables, registers, booklets, books, inserts, leaflets, advertising materials
• UPM Book	• books, pocket books, cartoons and youth literature
Newsprint	
• UPM EcoBasic	• advertising material, newspaper inserts, newspapers
• UPM News	• newspapers, inserts, supplements

PRODUCT DESCRIPTION	END USES
Digital laser printing	
• UPM DIGI Finesse	• advertising material, annual reports, books, brochures, catalogues, customized direct mail, image magazines, posters
• UPM DIGI Color laser	• books, brochures, catalogues, direct mailing, leaflets, manuals, advertising material, product data sheets
• UPM DIGI Print	• brochures, customized direct mail, posters, transactional documents (invoices, order forms etc.)
• UPM DIGI Laser+	• books, brochures, manuals, product data sheets, transactional documents (invoices, order forms etc)
• UPM DIGI Laser	• booklets, manuals, transactional documents (invoices, order forms etc)
• UPM DIGI Brite	• advertising material, books, newspaper inserts, newspaper supplements, on-demand printing of newspapers
Digital inkjet printing	
• UPM DIGI Color jet	• books, statements, transactional documents (invoices, order forms etc)
• UPM DIGI Jet	• books, statements, transactional documents (invoices, order forms etc)
• UPM DIGI Print	• brochures, customized direct mail, posters, transactional documents (invoices, order forms etc.)
• UPM DIGI Personal	• books, statements, transactional documents (invoices, order forms etc)
• UPM DIGI Matt	• advertising material, art books, brochures, catalogues, image magazines, leaflets
• UPM DIGI Brite	• advertising material, books, newspaper inserts, newspaper supplements, on-demand printing of newspapers



OFFICE PAPERS

PRODUCT DESCRIPTION

END USES

Cutsizes papers

- | | |
|---------------------------------|---|
| • UPM Office recycled premium | • inkjet and laser prints, copiers and fax, high-white paper |
| • UPM Office presentation | • inkjet and laser prints, ultra-white two sided printable paper |
| • UPM Office multifunction plus | • copiers, fax, inkjet and laser prints, extra bulky all-round paper |
| • UPM Office multifunction | • copiers, inkjet, laser prints and fax, multipurpose office paper |
| • UPM Office copy/print | • b/w inkjet and laser prints, copiers, fax, paper for high-volume copying and printing |
| • Future premiumtech | • copiers, inkjet and laser prints, ultra-white paper |
| • Future multitech plus | • copiers, fax, inkjet and laser prints, extra-white bulky all-round office paper |
| • Future multitech eco | • b/w inkjet and laser prints, copiers, fax, bulky, low grammage paper |
| • Future multitech | • inkjet and laser prints, copiers and fax, all-round office paper |
| • Future lasertech | • inkjet and laser prints, copiers and fax, paper for high volume copying and printing |
| • Yes Gold presentation | • copiers, inkjet and laser prints, ultra-white paper for presentations |
| • Yes Silver star | • inkjet and laser prints, copiers, fax, extra-white multifunctional paper |
| • Yes Light | • b/w inkjet and laser prints, copiers, fax, high-white, low grammage and all-round paper |
| • Yes Silver multifunction | • b/w inkjet and laser prints, copiers, fax, high-white, all-round paper |
| • Yes Bronze copy/print | • b/w laser prints, copiers, fax, paper for daily use |

LABEL PAPERS

- | | |
|---------------------------|---|
| • UPM Label face papers | • pressure sensitive and self-adhesive labels |
| • UPM Release base papers | |

PACKAGING PAPERS

- | | |
|-------------------|---|
| • UPM Bag papers | • flour and sugar bags, fashion and carrier bags, boutique bags, root crop bags, bread and pastry bags, fruit bags |
| • UPM Sack papers | • cement, ready-mix, minerals, chemicals, food products, root crop, animal feed, refuse, pet food |
| • UPM Tech papers | • PE laminating/coating, aluminium laminating, paper tape, abrasive base, boxboard lining, interleaving, water cups, paper sticks |
| • UPM Flex papers | • flexible packaging and conventional labels |



POSTAL PAPERS

PRODUCT DESCRIPTION	END USES
Preprint papers	
• UPM PrePremium	• exclusive letterheads and stationary
• UPM PrePremium Recycled	• high quality transactional documents
• UPM PrePersonal	• high quality business forms
• UPM PreLaser	• business forms, billing documents, bank statements
• UPM PreLight	• business forms, listings, transactional documents
• UPM Form	• listing purposes
• UPM PreInsert	• forms with integrated cards and inserts
• UPM Print	• business forms, direct mailing, transactional documents
Envelope papers	
• UPM Prestige	• stock, personal and bespoke A-grade envelopes
• UPM Plus	• envelopes
• UPM Plus Insert	• direct mailing, envelopes
• UPM Print	• direct mail and bespoke envelopes
• UPM Solide	• high quality envelopes
• UPM Poste	• bespoke, stock and inserting envelopes
• UPM Poste Recycled Premium	• high quality bespoke and inserting envelopes
• UPM Poste Folio	• direct mailing, envelopes
• UPM Letter	• bespoke, stock and inserting envelopes for high speed envelope converting lines
• UPM Letter Insert	• direct mailing, envelopes
• UPM Natura	• stock and bespoke envelopes and pockets
• UPM EcoMail	• envelopes
• UPM Formula	• stock and bespoke pockets and envelopes

Abbreviations and acronyms used to describe surface finishing

Gloss	Supercalendered, high gloss
HWC	Heavy weight coated magazine paper
MWC	Medium weight coated printing paper
LWC	Light weight coated
Matt/MC	Matt calendered
MF	Machine finished
MFC	Matt finished coated mechanical paper
MG	Machine glazed
Satin	Matt calendered, smooth
SC	Supercalendered, high gloss
SCK	Supercalendered kraft
Silk	Matt calendered, very smooth
WFC	Woodfree coated
WFU	Woodfree uncoated
UG	Unglazed
C1S	Coated one side

Other common abbreviations and acronyms

TMP	Thermo mechanical pulp
CSWO	Coldset web offset
DIP	De-inked pulp
HD	High density greaseproof paper
HSWO	Heatset web offset
News	Newsprint
RCF	Recycled fibre content
RG	Rotogravure
EFC	Elementary chlorine free
TCF	Totally chlorine free
TD	Telephone directory/directory paper
OCC	Old corrugated containers



UPM – The Biofore Company

UPM leads the integration of bio and forest industries into a new, sustainable and innovation-driven future.



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