

Pro Carton



Glossary

A guide to the terminology used in the Cartonboard and Carton manufacturing industries



PRO CARTON

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Outline description of Cartonboard

Cartonboard, or cardboard as it is sometimes called, is the essential raw material for carton production. In Europe about 7 million tonnes of this material is manufactured each year and whilst there are a large number of variants, most of the cartonboard used falls into one of four distinct types. All cartonboard is manufactured from renewable resources.

All the grades manufactured are made using a multi ply construction and the differences in what is used to make each layer creates the differences between the four basic grades. Some use 100% pulp as a raw material, some use 100% recovered fibre and some use a combination of both. On the following pages are illustrations of the four basic types of cartonboard along with a brief indication of what they are called, how they are made and what they are generally used for.

Virtually all the cartonboard manufactured in Europe has a coating on the top or printing surface. This is designed to enhance gloss and print quality. It is however possible to get uncoated cartonboard for specialised uses such as blister cards. Cartonboard comes in many different weights or grammages. It is generally accepted that cartonboard begins at a grammage of around 160 gm² and it can go up to weights of over 600 gm².

In addition to the basic grades there are many different variants that are adapted for special uses. For example, special additives can be included in the cartonboard to make it resistant to water and moisture for use in the chilled and frozen food sector. Plastic coatings can be applied, usually by extrusion coating, directly onto the cartonboard to provide a waterproof and grease proof barrier for use, for example, in pet food packaging. Cartonboard can also be laminated with either foil or metallised polyester giving a metallic finish to the material. These types of specialised boards are becoming more widespread and there are also others such a specific material for microwaves, security board and a great many others.

Outline description of pulp and recovered fibre

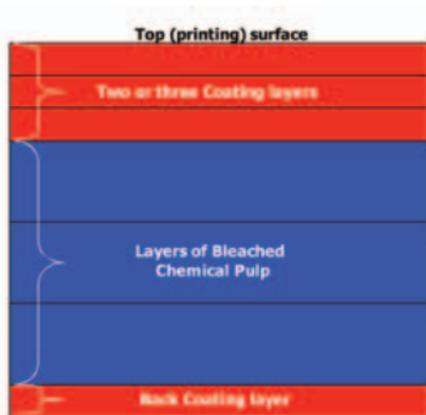
Cartonboard is made from different types of pulp or from a combination of different types of pulp. The most commonly used types of pulp are as follows:

Chemical Pulp – In the production of chemical pulp, cellulose fibres are extracted from wood by cooking the wood chips in chemical solutions

Mechanical Pulp – In the production of mechanical pulp, cellulose fibres are extracted from wood by a grinding and refining process.

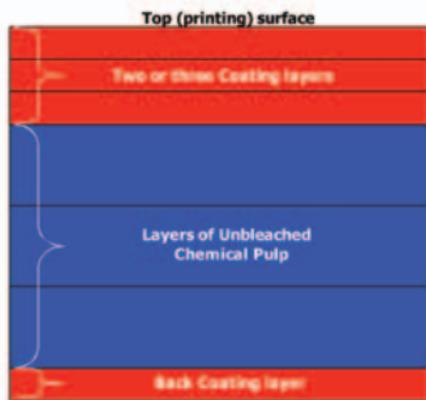
Recycled fibre pulp – Recycled fibre pulp is produced by using previously manufactured material based on cellulose fibres. For cartonboard, suitable sources of recycled fibre are waste from paper and board production and collected paper and packaging.

Basic types of cartonboard



SOLID BLEACHED BOARD SBB / SBS / GZ

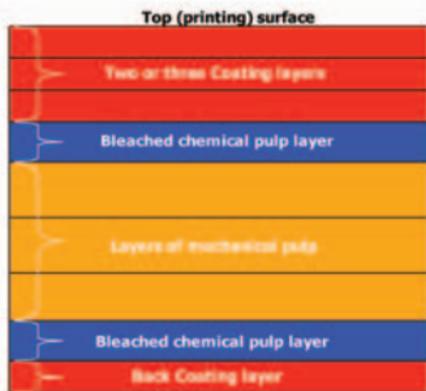
This grade is typically made from pure bleached chemical pulp with two or three layers of coating on the top surface and one layer on the reverse. It is used in such markets as cosmetics, graphics, pharmaceuticals, tobacco and luxury packaging. It can also be combined with other materials to make liquid packaging board.



SOLID UNBLEACHED BOARD SUB / SUS

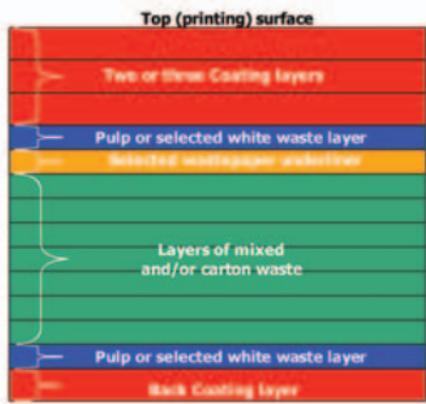
This grade is typically made from pure unbleached chemical pulp with two or three layers of coating on the top surface. In some cases a white reverse surface is applied. It is primarily used in the packaging of beverages such as bottles and cans as it is very strong and can be made resistant to water which is essential during the packing process. It is also used in a wide variety of general packaging areas where strength is important.

Basic types of cartonboard - continued



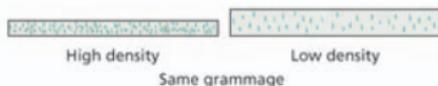
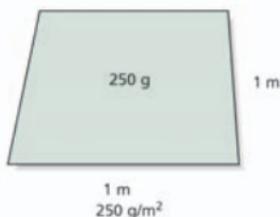
FOLDING BOXBOARD — FBB/GC/UC

This grade is typically made from layers of mechanical pulp sandwiched between two layers of chemical pulp with up to three layers of coating on the top or printing surface and one layer of coating on the reverse. It is used in such markets as drinks, pharmaceuticals, frozen, chilled and other foods, confectionery and a wide range of other markets.



WHITE LINED CHIPBOARD - WLC/GD/GT/UD

This grade is typically made using predominantly recovered fibres. It is manufactured in a number of layers each of which use selected grades of raw materials. It typically has two or three layers of coating on the top or printing surface and one layer on the reverse. It is used in a range of applications such as frozen and chilled foods, breakfast cereals, shoes, tissues, toys and many more. It can have either a white or grey coloured reverse side.



$$\text{Density (kg/m}^3\text{)} = \frac{\text{grammage (g/m}^2\text{)} \times 100}{\text{thickness } (\mu\text{m)}} \quad (\text{kg/m}^3)$$

GRAMMAGE

The weight of the cartonboard in grams per square metre (g/m^2). Paper with a grammage of more than 160 g/m^2 is normally called cartonboard, since it is first at that level that a fibre-based material can be sufficiently stiff and sturdy to function as packaging. Most cartonboard packaging has a grammage in the range of about 160 to 600 g/m^2 .

THICKNESS

The distance between the two surfaces of the cartonboard sheet measured in thousandths of a millimetre (μm). The material used in most cartonboard packaging has a thickness of 300 to $800 \mu\text{m}$.

DENSITY

Describes how compact the cartonboard is, measured in kilograms per cubic metre (kg/m^3).

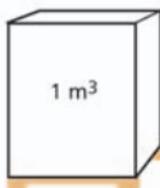
BULK

Describes how bulky (voluminous) the cartonboard is, measured in cubic metres per kilogram (m^3/kg).

$$\begin{aligned} \text{Bulk (m}^3/\text{kg)} &= \frac{1}{\text{density}} = \\ &= \frac{\text{thickness } (\mu\text{m})}{\text{grammage (g/m}^2\text{)} \times 1000} \quad (\text{m}^3/\text{kg}) \end{aligned}$$

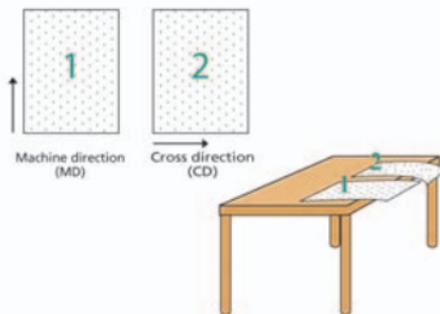


Paper
1.1 tonne



Cartonboard
0.7 tonne

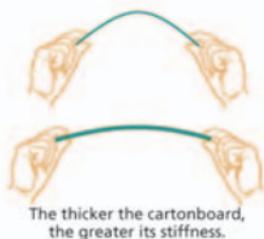
Cartonboard which is bulky (voluminous) in relation to its weight is said to have high bulk. Compact cartonboard has low bulk. Cartonboard with high bulk generally feels stiffer and thicker than cartonboard with the same grammage but with low bulk.



MACHINE DIRECTION

When cartonboard is manufactured the pulp fibres are aligned parallel to the direction in which the cartonboard web is moving. This means that cartonboard is always stiffer and stronger in that direction.

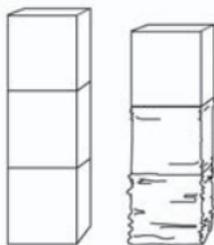
The machine direction is therefore at right angles to the width of the web. In terms of creaseability, a crease across the machine direction is better than a crease parallel to the machine direction (See "CREASING").



The thicker the cartonboard, the greater its stiffness.

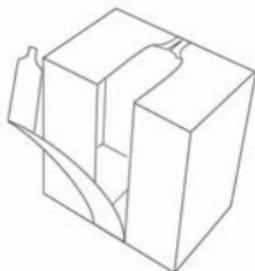
STIFFNESS

Stiffness is one of the most important properties of cartonboard. The demand for stiffness occurs throughout the entire chain from shipping via the store shelf to the consumer. Cartonboard is the only material which has this ability to offer high stiffness per unit of weight. Without stiffness, cartonboard could not fulfil its primary function, which is to protect the contents of the packaging.



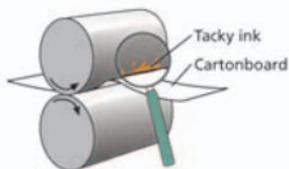
COMPRESSION STRENGTH

When cartons are stacked on top of each other the bottom layer naturally bears the greatest load. To avoid the cartons collapsing, the most important property of cartonboard as a material is good compression strength.



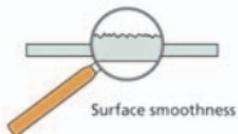
TEAR STRENGTH

The force required to tear a cartonboard sheet along an existing incision. This is important, for example, so that a tear strip will work when packaging is being opened.



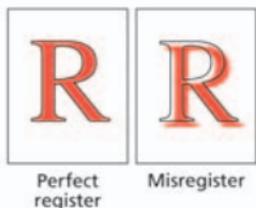
SURFACE STRENGTH

Cartonboard's ability to tolerate forces on its surface, for instance from the tackiness of the ink during printing, is important. The cartonboard surface must not be torn away by the printing ink during the printing process.



SURFACE SMOOTHNESS

A measurement of how smooth the cartonboard surface is. A smooth cartonboard surface is important for achieving satisfactory printing and varnishing results.



DIMENSIONAL STABILITY

Resistance to dimensional changes in a cartonboard sheet due to changes in such properties as moisture content. Dimensional stability is important during printing and conversion to avoid such errors as misregister (see also "REGISTER").



FLATNESS

The cartonboard's ability to remain flat (retain its shape) during printing and converting.



Cartonboard with different hues of white.

WHITENESS

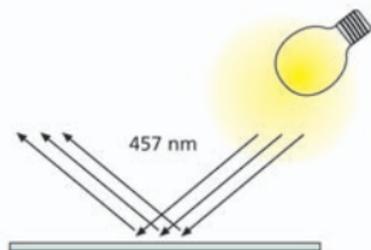
The Cartonboard's visual impression of whiteness. Whiteness is expressed by means of a single value.

BRIGHTNESS

Brightness is a concept used in two different contexts:

1) When referring to image reproduction, brightness describes the intensity of the colours. This is also called luminance, i.e. how light or dark an image is.

2) When referring to cartonboard, brightness is expressed as the percentage of light which is reflected from a cartonboard surface at a wavelength of 457nm (nm = nanometre).

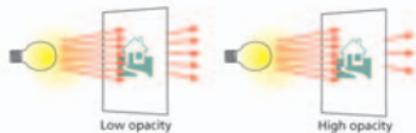


GLOSS

The more light which is reflected by the cartonboard surface, the higher the gloss. Gloss can be achieved with various varnishing methods.

OPACITY

Opacity is a measurement of the capacity of cartonboard to obscure what lies behind it, and is expressed as a percentage. A high percentage corresponds to a cartonboard sheet with low transparency (high opacity). A cartonboard sheet with 100% opacity is completely opaque. The degree of opacity depends on how well the light is scattered and absorbed by the cartonboard. High opacity is important when printing on both sides of the cartonboard sheet.



PRINTING METHODS

LETTERPRESS

In this printing method the ink is applied into the raised types of the printing cylinder and then transferred to the cartonboard surface.



Illustration of the letterpress method

GRAVURE

Gravure is a direct printing method in which the image areas to be printed are made up of many small recesses which are engraved on a copper printing cylinder and are filled with ink. Gravure printing presses are reel-fed presses which print at very high speeds.

Gravure is best suited to long print runs due to the high initial cost and low unit cost. The method gives good image reproduction.

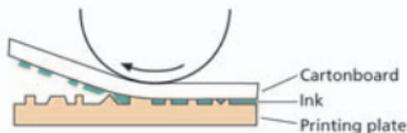


Illustration of the gravure method

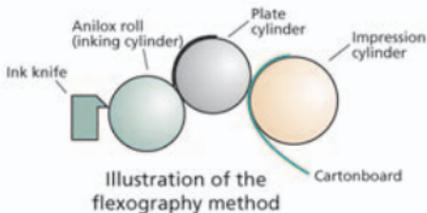
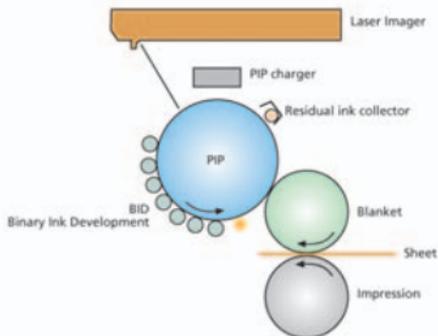


Illustration of the flexography method

FLEXOGRAPHY

In this direct printing method the image areas to be printed are raised above the non-image ones. The printing plate is made of rubber or photopolymer.

The advantage of flexography is that it can be used to print on most materials. Water-based printing inks can be used. The disadvantage is that flexography often has difficulty reproducing all colour hues.



DIGITAL PRINTING

A printing press which prints information directly from a computer in a similar way to a computer printer. There is therefore no need to produce film or a printing plate. The advantages are speed and low costs for small four-colour print runs.

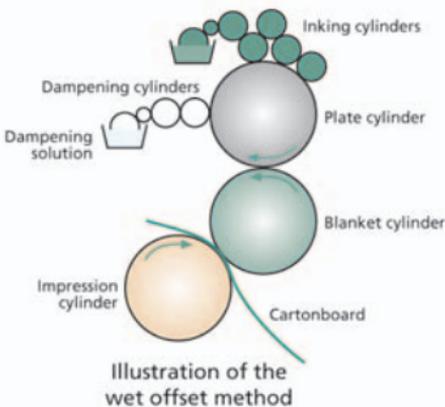


Illustration of the wet offset method

OFFSET

Offset is the most common printing method for cartonboard. The most frequently used method is sheet-fed offset, in which the printing press is fed with cartonboard sheets. This contrasts to web offset, which is reel fed.

Offset is an indirect printing method. The ink is not transferred to the cartonboard sheet directly from the printing plate. The printing cylinder sets off (hence "offset") the printing ink onto a rubber-covered blanket cylinder, which transfers the ink/printing image to the cartonboard sheet. "Offset" usually refers to offset lithography, a printing method in which the image areas to be printed are distinguished from the non-image areas by the use of chemical properties rather than differences in level.

PRINTING TERMS

PRINTING PLATE

The printing image used in offset printing.

RUBBER BLANKET

A rubber sheet which transfers the printing image from the printing cylinder to the cartonboard sheet in offset printing.

PRINTING INK

Coloured pigment which is transferred from the printing plate with the aid of a vehicle (a carrier) and is then bound to the cartonboard surface with a binding agent such as resin.

VARNISH

There are different kinds of varnish, all of which have their own advantages and properties. A cartonboard surface is varnished to protect it against scratches or to stop it getting dirty. Varnish can also be used to emphasise the gloss of a design in whole or in part. The varnish is either applied to the cartonboard directly on the printing press or afterwards in a separate operation.

Printing varnish - an oil-based varnish which is spread on in a printing press. Protects against scratches.

Emulsion varnish - is spread on in the printing press at a varnishing station. Protects against scratches.

UV varnish - is spread on either directly in the printing press or in a separate varnishing machines. Gives a glossy surface.

DAMPENING SOLUTION

Used in web offset printing. The dampening solution has three functions in offset printing:

- to ensure that the ink does not adhere to the non-image areas
- to clean away cartonboard fragments
- to cool down the press

Since dampening solution is required in offset printing, the dimensional stability and flatness of the cartonboard are important (See “DIMENSIONAL STABILITY” and “FLATNESS”).

REGISTER

When all printing inks are in exact alignment relative to each other, e.g. the separate colour images in four-colour printing, or during subsequent die-cutting, cutting, embossing etc. Misregister occurs when the separate colour images are not printing exactly on top of each other. Misregister creates unclear images, discoloured edges etc. To avoid misregister it is important that the cartonboard sheet is dimensionally stable (see “DIMENSIONAL STABILITY”).

HALF-TONE PRINTING

Printing in which the colour images are in the form of small dots (known as half-tone dots and forming a half-tone screen). The size of the dots determines the colour intensity. The combination of different colours creates a multitude of hues.

SCREEN RULING

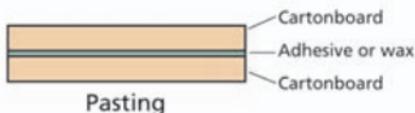
Screen ruling (also called screen frequency or half-tone resolution) is the number of screen lines per unit of length. It is measured in lines per inch (lpi). The higher the lpi, the greater the amount of details in an image. The kind of cartonboard and the choice of printing method govern the screen ruling that can be used during printing.

FINISHING



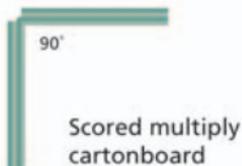
LAMINATION

The printed sheet is coated with a protective layer of plastic or metal foil - the laminate. There are gloss and matt laminates. They are applied by a special lamination machine. The laminate provides excellent protection against dirt, moisture and wear. Lamination can also be done for aesthetic reasons.



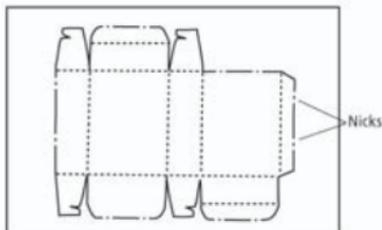
PASTING

To join two or more cartonboard sheets with adhesive or wax to create a single unit.



SCORING

A fine line is scored in the cartonboard to create a flexible hinge. A scored line is less durable than a crease line (See "CREASING").



DIE CUTTING

Die cutting occurs when the cartonboard sheet is cut into a shape, e.g. to create a blank which can be folded and erected to form a carton. After printing, die-cutting and creasing are done simultaneously in die-cutting machines. Die-cutting and creasing can be combined with embossing (See "EMBOSSING").

Cartonboard with
cutting lines —————
creasing lines
and nicks

NICKS

Nicks are non-die-cut sections which hold the blanks together to facilitate handling during the subsequent conversion process.

PERFORATION

A row of punched holes which make it easier to tear off e.g. a coupon or reply card.



Various perforation patterns

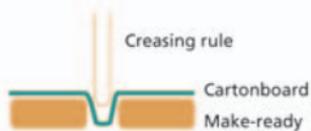


Illustration of creasing



Incorrect folding of a crease



Correct folding of a crease



Positive embossing



Negative embossing

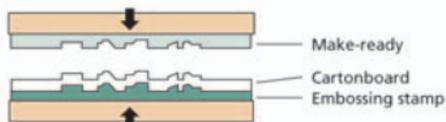


Illustration of blind embossing

EMBOSSING

Embossing means that the cartonboard is shaped into well-defined, permanent relief patterns. Before the cartonboard sheet is embossed it is often printed or foiled. If the relief is raised it is described as positive. If it is impressed, it is negative. Embossing which is done without prior printing with ink is called blind embossing.

Embossing can also create a pattern which covers the entire surface.



Illustration of hot foil stamping

HOT FOIL STAMPING

A text or pattern in metallic foil is applied to the cartonboard with the aid of heat, often in combination with embossing.

FOLDING WITHOUT PRIOR CREASING

When a cartonboard sheet is folded without a pre-existing crease or scoring (see “CREASING” and “SCORING”). This is usually done in a folding machine.



From blank to erected carton

FOLDING/ERECTING

A die-cut and creased cartonboard blank is made into a carton (see “DIE CUTTING” and “CREASING”).



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