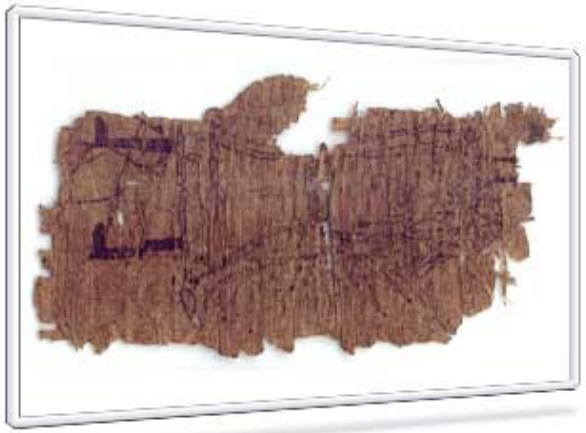
History of Papermaking



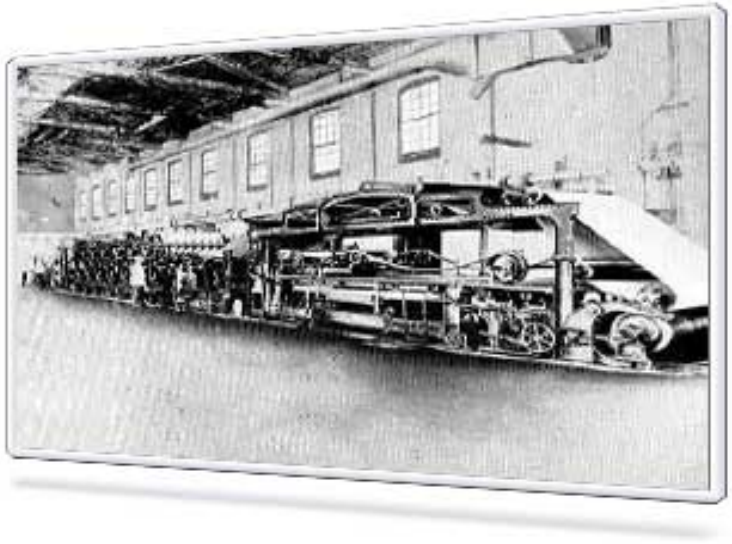
The Egyptians wrote on a crude form of paper made by weaving strips of the papyrus plant into flat sheets. It is from papyrus that the word paper gets its name.

The Persians wrote on a parchment made from the skins of goats, sheep and calves. The parchment was made by splitting the skins, soaking them in lime, scraping them smooth and drying them.

However, it was the Chinese who were the first to make paper as we know it, nearly two thousand years ago. They made it by soaking and pounding rags and plant fibres into a watery pulp which they poured onto a woven bamboo screen. It was lifted off carefully and, as it dried, it matted into a sheet of paper.

Paper continued to be made in this way for hundreds of years until a Frenchman, René de Reamur, having watched American wasps making nests from chewed up wood fibre, commented in 1719 that this would be an ideal way to make paper. It was not until 1844 though, that wood began to be commonly used for pulp.

A Frenchman, Louis Robert, was the first person to patent a design for a continuous paper machine in 1799. The first machine to be ever built and successfully operated was in England in 1803, which the Fourdrinier brothers took over in 1804. By 1807, they had acquired all the patent rights for the process, following which this machine became known as the Fourdrinier machine. The early paper machines consisted of a head box that added the pulp paper stock to a moving wire that was supported between two rolls. The wet sheet was pressed once on the wire and thereafter taken to a felt, where it was run through another nip press, before being accumulated on a roll for eventual drying in sheeted form. These age old principles of pulping, dewatering and drying still apply today in any papermaking process.



Introduction

This document covers the various processes involved for the manufacture of our range of publication papers like Newsprint, Directory and Scholastic grades - where they come from and how they are made. The importance of these papers in our daily lives needs no exaggeration - Most of the daily and weekly publications, telephone directories and other books are printed on these papers, and a lot of scribblers and jotter books are also made out of these, for basic writing applications.

Pulping

The first step in making paper is to turn the wood into pulp and then breaking down of the wood into fibres, which is called the Pulping Process. Wood is made up of cellulose fibres held together by a resinous substance called lignin, and it is from these fibres that paper is made.

Hardwoods, like Eucalyptus, have shorter fibres which help to fill in the sheet of paper, making it smooth and dense. If you tear a piece of paper you will see a number of whiskers sticking out from the line of the tear, which are actually the wood fibres.

Softwoods, like Pine, have longer fibres and these are sometimes used alone, where strength is needed; hardwood fibres are seldom used alone due to the lower strength of the shorter fibres, which provide bulk for the sheet. Most papers are made from a blend of both types to achieve the finally desired properties.

We use two different processes to produce pulp, which make up the blends for the various grades of paper. These different types of pulp derive their names from the respective processes used to produce them. These are Thermo-Mechanical Pulp (TMP), obtaining from wood through a process that combines heating and mechanical operations and Recovered Fibre Pulp (RFP), which is obtained by the re-pulping of de-inked paper from old newspapers and magazines.

Thermo-mechanical pulp

The pulp produced from this process costs more than traditional Ground wood pulp, but the pulp has relatively longer fibres, which will strengthen the paper. Logs are conveyed from the Debarker to the Chipper, which is a large flywheel with sharp blades mounted on its surface. The logs are fed through a chute onto the flywheel which rotates at high speed and these rotating blades chop across the logs, cutting off chips.

These chips are then blown by compressed air into the chip silos for temporary storage. From the silos the chips are conveyed to screens where sawdust and any oversized pieces are removed. The remaining chips are washed to remove dirt and dust.

The next stage in the TMP process is to break down the wood chips into fibres; they are fed into a Digester, where the chips are cooked under steam pressure to soften the lignin (the wood glue) that holds the fibres together. From the Digester, the cooked chips are then fed into a series of Refiners, which comprise of two discs, rotating in opposite directions at very high speeds. These discs are covered with raised bars and fins of varying sizes and as the chips pass between the discs, they are torn apart and ground down to fibres. The refining process results in the rubbing and cutting of the fibres, reducing them to a suitable length and also the bursting of the cell walls in the cellulose chains, thereby enabling the fibres to stick together. The stock leaving the Refiners is then screened, cleaned and finally thickened before being pumped into storage tanks.

Recovered Fibre Pulp (RFP)

This Recovered Fibre Pulp (RFP) is produced by removing the printed ink from waste magazines and newspapers and thereafter reducing it to its original form.

Waste paper is pulped in a mixture of water and chemicals such as Caustic Soda, Hydrogen Peroxide and Sodium Silicate, in order to loosen the printed ink from the fibres. This grey stock is then screened and cleaned, to remove larger as well as smaller contaminants like staples, and thereafter moved to the Flotation Cells, where a soapy chemical is added.

This soap is unlike anything you would use at home; in simple terms, it causes the mixture to foam and since printers ink is hydrophobic (water hating), it clings to the air bubbles in the foam, forming a frothy scum on the surface that can be skimmed off.

Further cleaning, fine screening and thickening of this stock is carried out, followed by pressing, which removes most of the water and dissolved chemicals from the stock. The stock is then heated and refined to disperse any residual particles that have not been screened out earlier. Finally, Hydros (Sodium Hydrosulphite) is added to whiten the stock, before it is stored, ready for use on the newsprint paper machines.

Stock preparation

The next stage in the process is the blending of different types of pulp and further refining the mixture, if required, followed by the addition of various non fibrous additives. Different types of pulp are used in various combinations to produce the various kinds of paper used by the printers. These different pulps are mixed with additives such as Caustic Soda to adjust the pH level, Alum to disperse the pitch and Dyes to adjust the shade in a vessel called the Blending Chest. The combination of stock and additives which go to make up a particular type of paper is called the Furnish.

The stock is then diluted to about 99% water with less than 1% wood fibres, which is now ready to be pumped to the paper machines, where it gets converted into paper.

The Paper Machine: Forming

Sheet formation commences with the stock being pumped to the Paper Machine Headbox, which sprays the mixture onto a fast moving endless belt called the Wire. Originally, the Wire was a finely woven mesh of phosphor-bronze but nowadays, it is also made of synthetic fabrics.

The speed of movement of the Wire causes a low pressure effect, which drains some of the water through it, thereby starting the de-watering process. More water is removed by suction boxes located underneath the Wire and a suction roll at the end.

The process described above is called the Flat Fourdrinier, but most paper machines are actually twin-wire machines. These machines use two forming wires with the stock continuously squirted between the wires, and the water being removed in both directions through the wires. This shortens the distance required to de-water the stock and eliminates the one-sidedness of the paper. (The wire side of the paper tends to be smoother).

By now the stock has become a weak, wet web, which is transferred from the wire onto a moving felt at the start of the Press section.

Pressing

In the Press section of the machine, the wet web lying on the moving felt passes through pairs of heavy rollers, where. It gets pressed, squeezing more water out through the felt, till it is no longer possible to remove any more water by pressure alone. Now strong enough to sustain its own weight, the fast moving web enters the Drying section of the paper machine.

Drying and Calendering

The paper web travels through a long series of rotating, steam heated rollers, where nearly all of the remaining water is removed through evaporation.

The paper is now ready for smoothing or calendaring, which is done by passing it between heavy, polished steel rollers, called the Calender Rolls. The pressure exerted on the web by these rolls compresses it, giving it a flat, smooth and ironed like finish.

Reeling, Slitting & Rewinding

From the Machine Calender the paper is wound onto a rubber covered spool and a full spool of wound paper is called a Jumbo Reel, weighing 14 - 15 tons. When a Jumbo Reel has reached the required diameter a new spool is lowered onto the running web of paper, which is torn across its width using compressed air, for transfer onto this new spool. This is done without stopping or slowing down the machine.

The Jumbo Reel is then lifted off the Paper Machine and moved to the Slitter and Rewinder, where it is unwound, cut into narrower webs by circular slitter knives, and re-wound onto smaller reels on cardboard cores, as per various customer requirements. These final reels are now sent for wrapping, labeling and delivery.

Quality Management

Strict Quality Control is exercised at all stages of the papermaking process to ensure that our customers receive high quality paper and our Quality Management Systems conform to International standards. Several tests are conducted to ensure that the paper meets all the required specifications; some of this testing is carried out in the laboratories adjacent to the Paper Machines and continuous on-line monitoring is also done using sophisticated instrumentation.