

- **What is Paper Board**

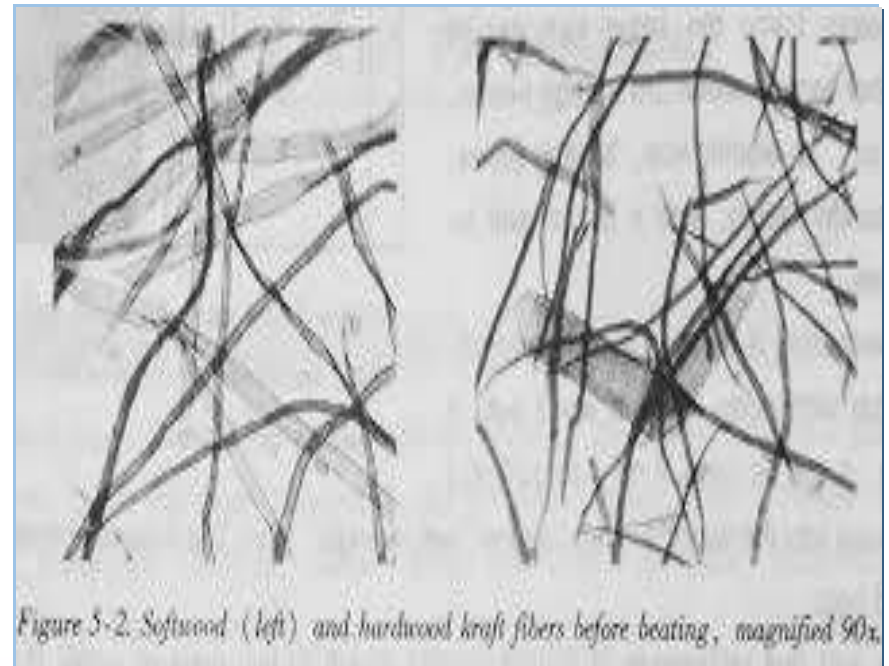
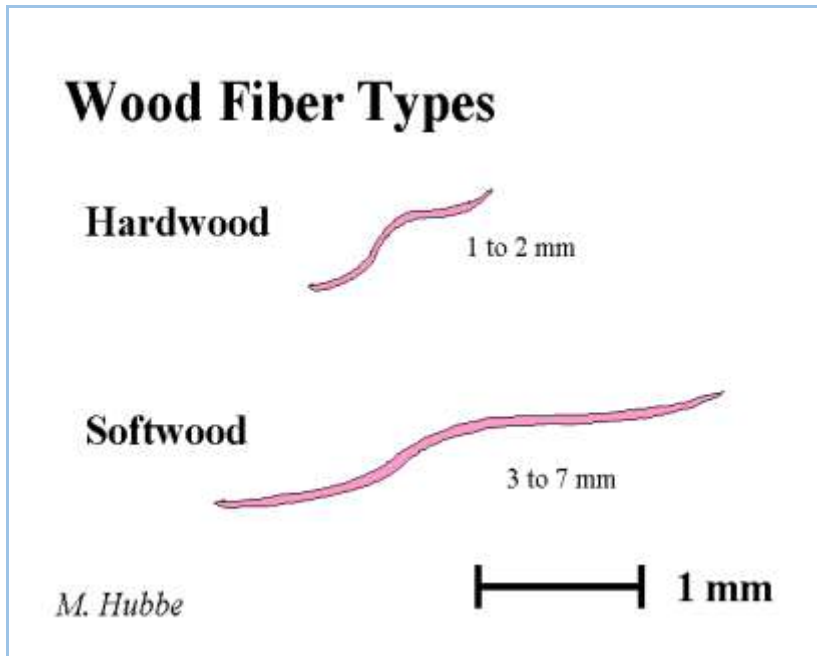
- Paper Board can be in several plies (multi-ply)
- Paper Board usually requires a combination of several layers of fiber in wet state
- In general, basis weight is 160 g/m<sup>2</sup> and above we call it as Paper Board.

- **Features of paper board**

- Middle ply enables the paper board maker to optimize surface characteristics in the outer plies
- Easier to optimize in a multi-ply construction without compromising on bulk, strength and stiffness
- The advantage of a multi-ply construction in a paper board mill is that the quality can be adapted to different end uses
- Single-ply or dual ply producer has limited possibilities.

- Pulping
  - Refining
  - Forming & Press section
  - Pre dryers, MG and Post dryers
  - Size Press & Pre calendaring
  - Coating & Soft nip calendaring
- 
- **Types of fibers: -**
    - Forest Products: - Hard Wood fiber, Soft Wood fiber & Bamboo
    - Agriculture residues: - Rice straw, Wheat straw & Bagasse
    - Reclaimed waste paper: - Pre consumer waste & Post-consumer waste

- This process preserves fiber length and pure cellulose develops a high degree of consolidation
- Both features which give a very strong sheet
- The fiber is flexible and soft, giving creasing, embossing and cutting properties
- Bleached cellulose pulp has high whiteness, brightness and light stability



- This process gives a very high yield from the timber
- The presence of lignin has a number of implications the fiber is hard and rigid and this gives the sheet a limited degree of consolidation, high bulk, resilience, dimensional stability and stiffness

## Mechanical pulp

Wood is grinded mechanically to make stone pulp. Also steaming may be used in the process, to reduce the total energy needed, and to decrease the damage to fibres. Mechanical pulps are used for products that require less strength, such as newsprint and paperboards.

## Virgin fibres



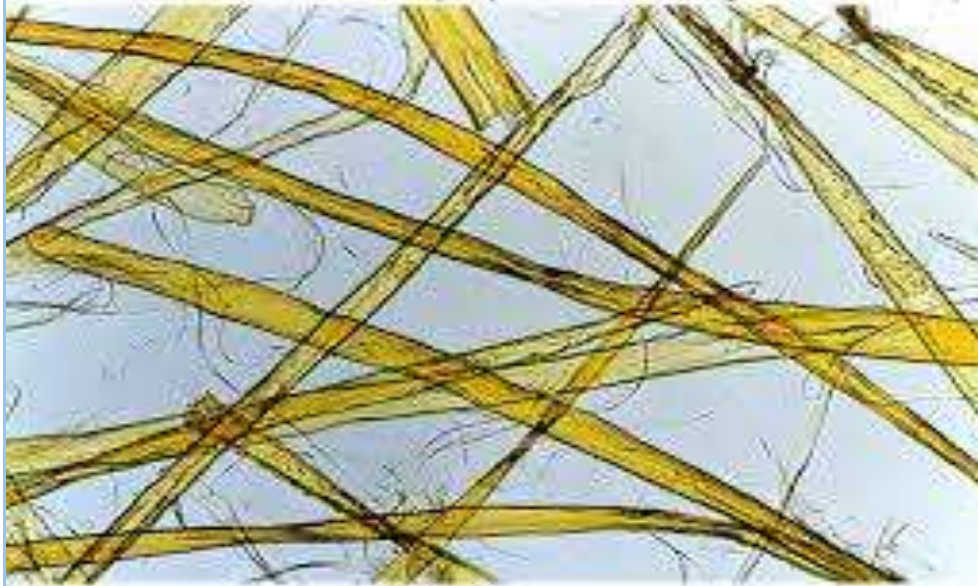
## Groundwood

Logs of debarked soft wood are pressed against a rotating grinding stone while water is added in order to separate the fibres

## CTMP (Chemi Thermo Mechanical Pulp)

Wood chips are impregnated with appropriate chemicals and heated before separating the fibres by a mechanical refining process. The pulp is bleached and washed in several steps.

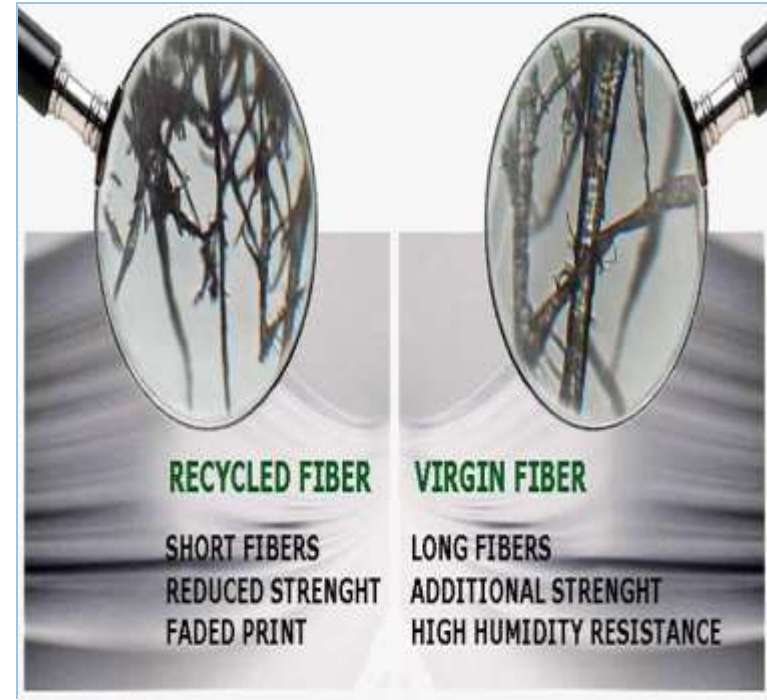
**Refiner mechanical pulp** (BauerMacNett fraction +28, microscope picture, enlargement 145 x)



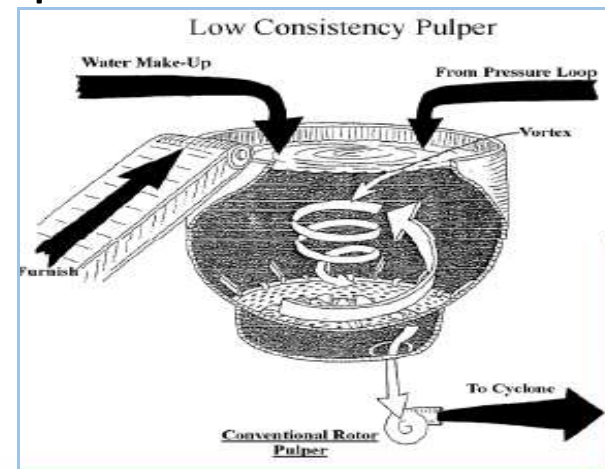


# Re cycled fiber

- Fiber is recovered in the recycling process by mechanical agitation in water
- The pulp produced after thorough screening and cleaning to remove foreign particles from recovered fiber
- Each time fiber is recycled, it is contaminated, shortened
- The pulp has less predictable composition and performance than Virgin fibers.
- The strength reduces by 10 – 15 % as no. of times the paper is recycled.

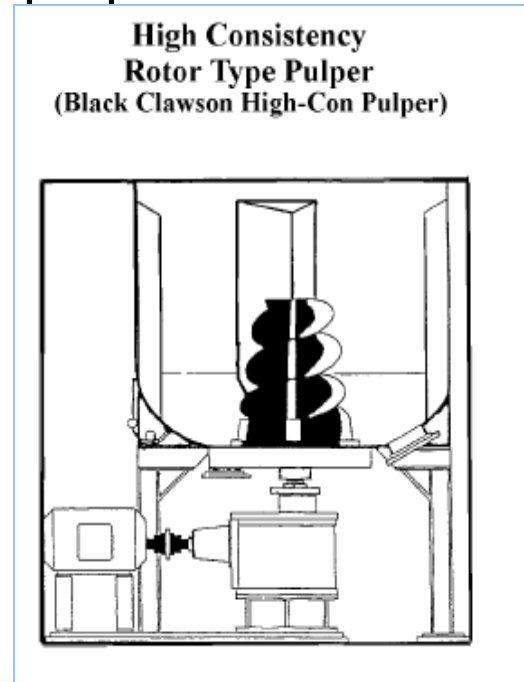


- 1. Pulping 2. HD Cleaning 3. Coarse and fine screening 4. Deinking and LD cleaning 5. Hot dispersion
- **Pulping: -**
- **Low consistency Pulper: -**
  - Operates between 3 – 6 % Consistency
  - Low profile rotor that rotates at high speeds
  - Motion of rotor causes vortex of pulp stock. The baffles are used to improve mixing
  - High mechanical force due to impact of rotor can damage fiber and break contaminants.



## High consistency Pulper

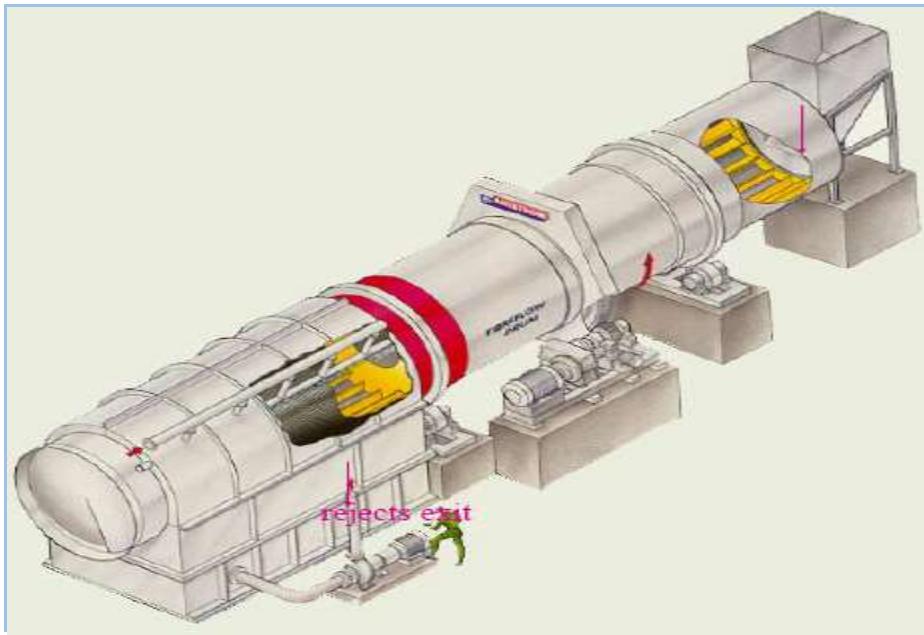
- Typically operates between 8 – 18 % consistency
- High profile rotor used. The Helical screw type rotor is needed to pull down the non-fluid like high consistency stock from top to the bottom of the pulper
- At the high consistency fiber-fiber rubbing dominates the forces experienced in the pulper.



# Drum Pulper



- Ideal for mixed waste paper grades and laminated papers with more contaminants
- Gentle pulping minimizes fiber degradation
- Keeps the pulper in continuous operation as rejects are removing on continuous basis.



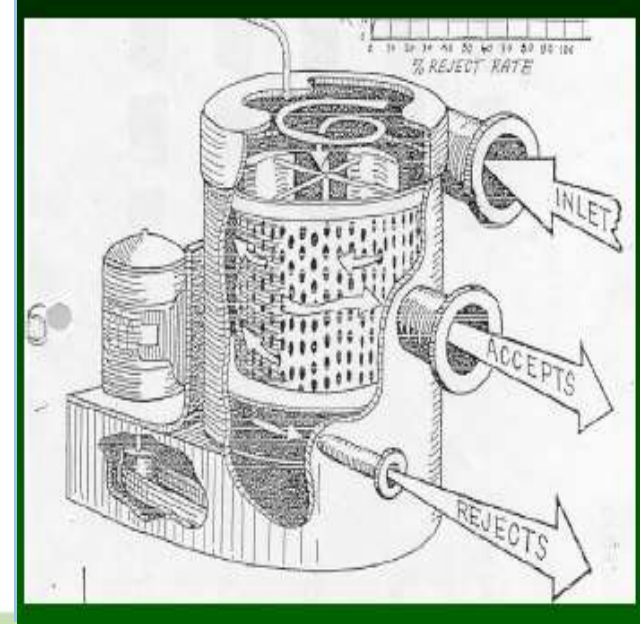
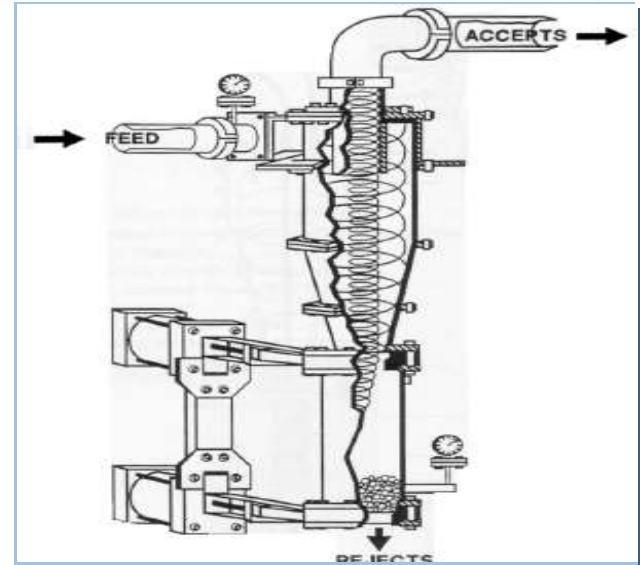


### HD Cleaner: -

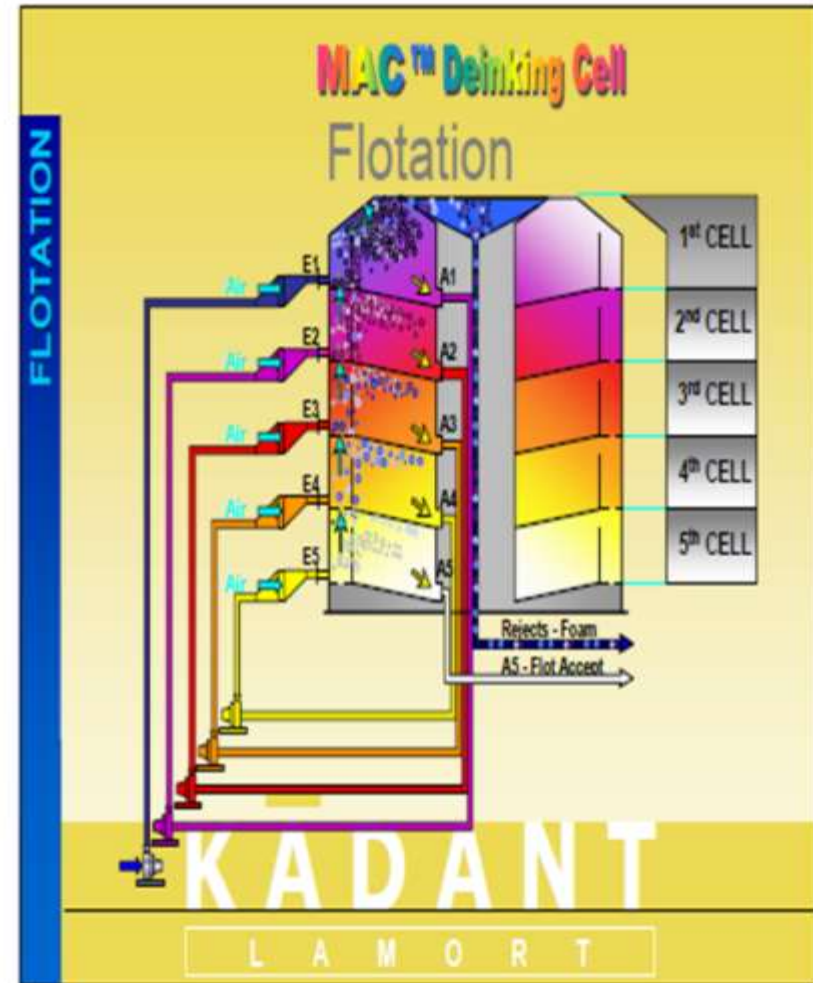
- Separates large heavy contaminants fibers to protect downstream equipment from damage and plugged
- Centrifugal forces separate materials mainly due to density/size.

### Screening: -

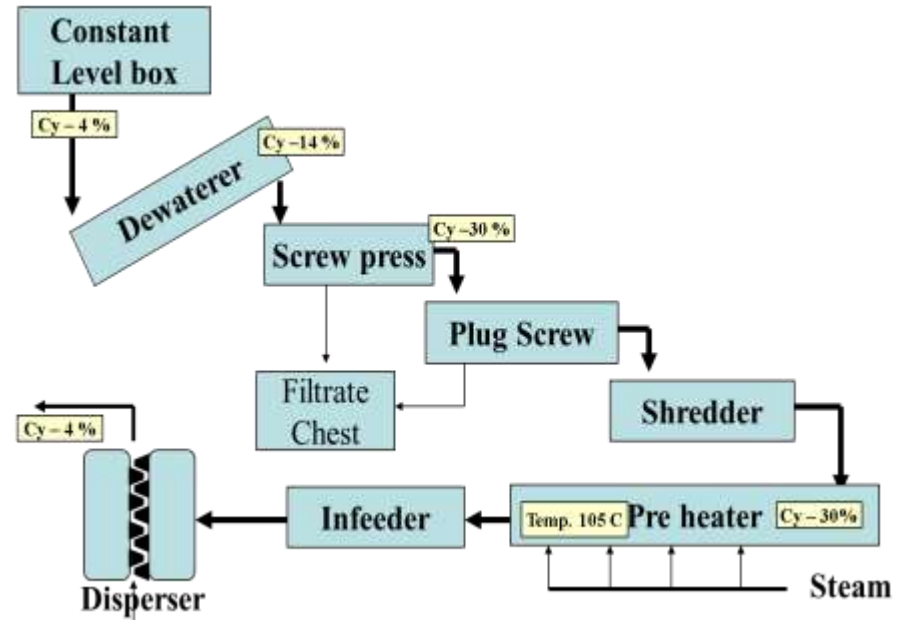
- Screening separates contaminants mainly based on size but also shape and deformability
- Performed by presenting a barrier for large contaminants (slots or holes) that allow fibers to pass through.



- Primary activity is ink removal.
- Works on flotation principle
- Inlet consistency and foam level plays a major role
- Brightness gain and ash loss are the evaluating parameters.



- The primary activity is dispersion
- Contaminants like hot melts, glue and wax gets softened in the operation.
- Ink particles gets fragmented into micro particles.



- **Refining** of chemical pulps is the mechanical treatment and modification of fibers so that they can be formed into **paper** or board of the desired properties. It is one of the most important unit operations when preparing papermaking fibers for high-quality **papers** or paperboards.
- The main target of refining is to improve the bonding ability of fibers so that they form strong and smooth paper sheet with good printing properties
- The most commonly used refining method is to treat fibers in the presence of water with metallic bars
- The consistency is typically 3%–5%
- External fibrillation, the partial removal of the fiber wall, leaving it still attached to the fiber
- Cutting and shortening of fibers



- The pulp slurry prepared in the wet end contains between 0.1 and 1% pulp fibers by weight.
- The slurry passes through a slit 2-6 mm wide and is spread onto a moving mesh belt called the "wire" which is the full width of the paper machine.
- The key function of the head box is to distribute the slurry very uniformly and consistently across its full width.

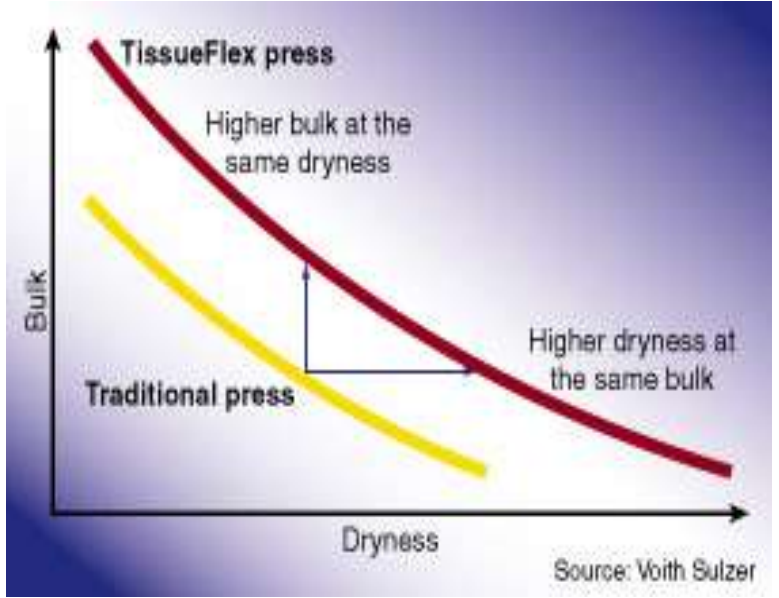
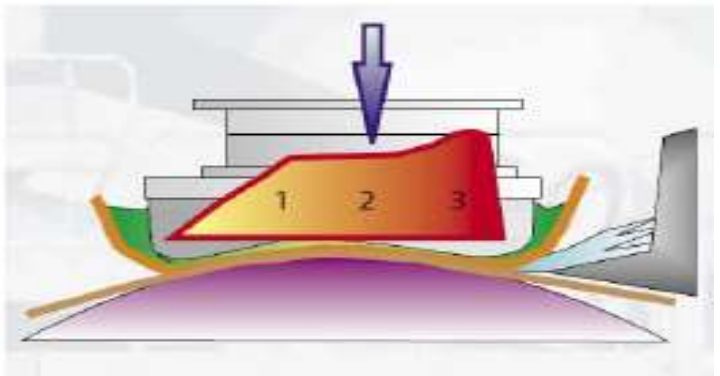
Rushing the jet: - Jet velocity greater than wire speed. CD fiber orientation. Sheet has less MD strength.

Dragging the jet- Jet velocity less than wire speed. MD fiber orientation. Sheet has more MD strength.

**DUO former :-**

- objective is to dewater from top side of the layer.

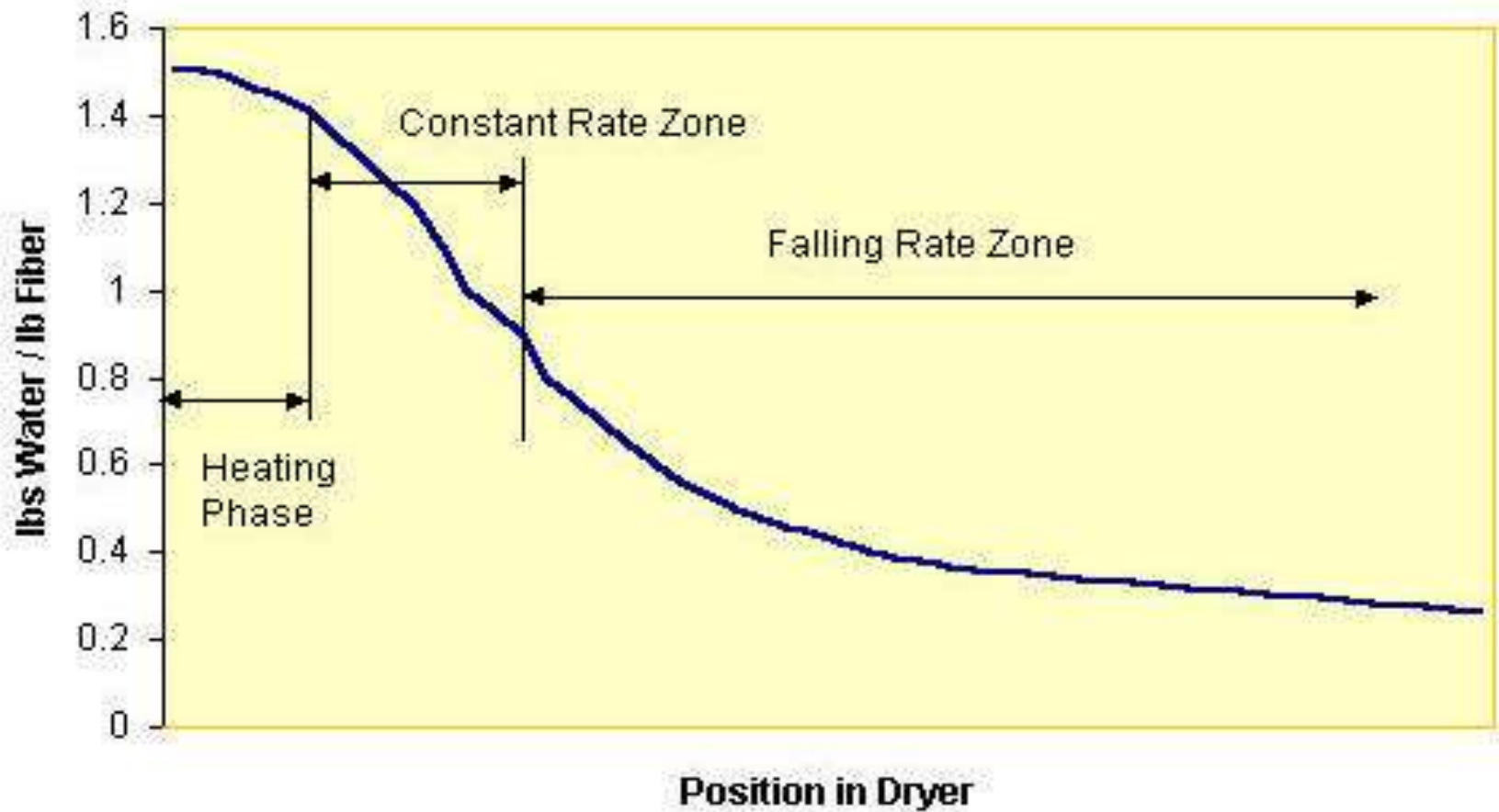
- The paper board web, sandwiched between fabrics(felts), is passed between rubber covered steel rolls which removes water by pressure and suction.
- The second section of the paper machine is the press section
- Removes much of the remaining water via a system of nips formed by rolls pressing against each other aided by press felts
- The paper web consistency leaving the press section can be above 40%.
- Simple press rolls can be rolls with grooved or blind drilled surface.
- More advanced press rolls are suction rolls
- A stationary suction box is fitted in the core of the suction roll to support the shell being pressed
- Extended Nip Presses (or ENP) are a relatively modern alternative to conventional roll presses
- The goal of the ENP is to extend the dwell time of the sheet between the two rolls thereby maximizing the de-watering.



- When the paper/board sheet enters the paper machine Dryer Section, it is about 50% water.
- It must be dried to less than 10% water for a finished product.
- The most common Dryer Sections include Steam Cylinders and Air Dyers.
- Infrared Dryers are most commonly used on coating lines.



## Drying Zones



- Drying occurs in Three Phases or Zones.
- In the Heating Phase the sheet enters at about 100F and is brought up to about 180F.
- Generally, about the first 5 cylinders are considered the 'Heating Phase'.
- In the Constant Rate Zone, heat is added at about the same rate that evaporation is removing the heat.
- Most of the water is removed in the Constant Rate Zone.
- The Falling Rate Zone is the most difficult as it must remove the last 10% or so of moisture without causing problems related to un-even or over-drying.

- Steam Cylinders/Cans/Drums (Conduction)
- Air Dryers (Convection) – Non contact drying
- Infrared Dryers (IR) (Radiation) - Non contact drying
- **Steam cylinders:** - Steam cylinders are 4 – 5 feet in diameter and slightly longer than the width of the paper sheet.
- A typical paper machine has 40 to over 100 steam cylinders, depending on the line speed; the faster the line speed, the longer the drying section.
- **Air dryers:** - Air dryers are direct fired or use steam-to-air heat exchangers to produce a hot air stream that is forced over the surface of the paper.
- Hoods or 'caps' are used to contain and direct the air flow.
- Air dryers tend to be used on lighter weights of paper, such as tissues, and to supplement the drying of steam cylinders.
- **IR Dryers:** - IR Dryers produce infrared radiation from a hot surface.
- Different wave lengths are produced from different kinds of heaters and varies with temperature.

**Dryers section:** - The paperboard web is passed over a number of steam heated polished steel cylinders which progressively removes moisture by applying heat.

The drying operation has to be properly controlled to ensure optimum drying without stress on the web and to ensure a uniform moisture profile.

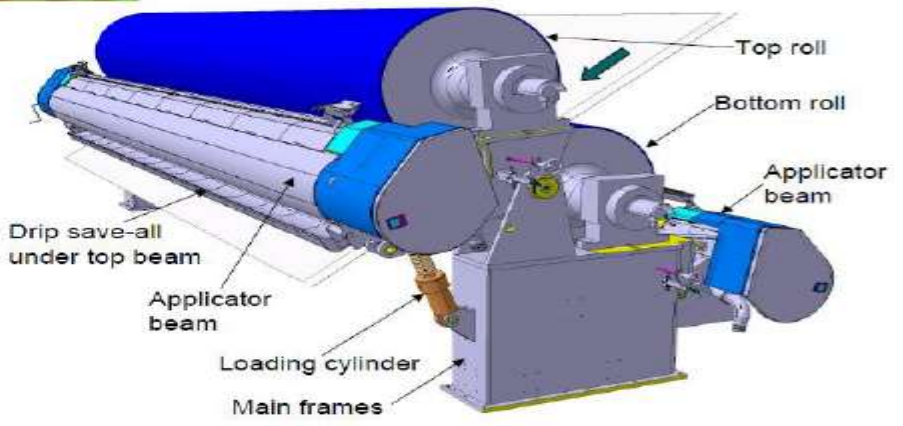
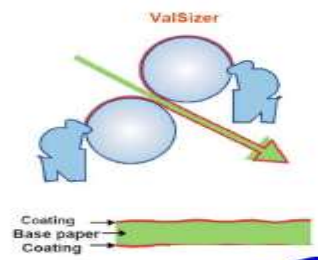
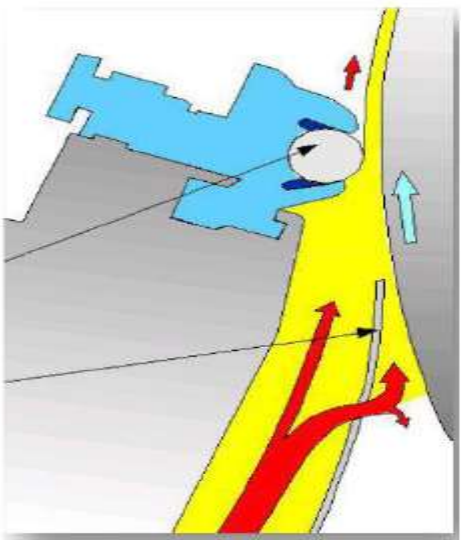
**MG & Dryers section:** - Machine glazing is used during board manufacture to dry the wet paperboard surface in contact with a large, polished drying cylinder. Thus a smooth surface can be achieved with minimum loss of thickness and stiffness.

**Pre calendar:** - In this process the paperboard is nipped between steel rollers which gives uniform thickness and surface smoothness to the base board web.

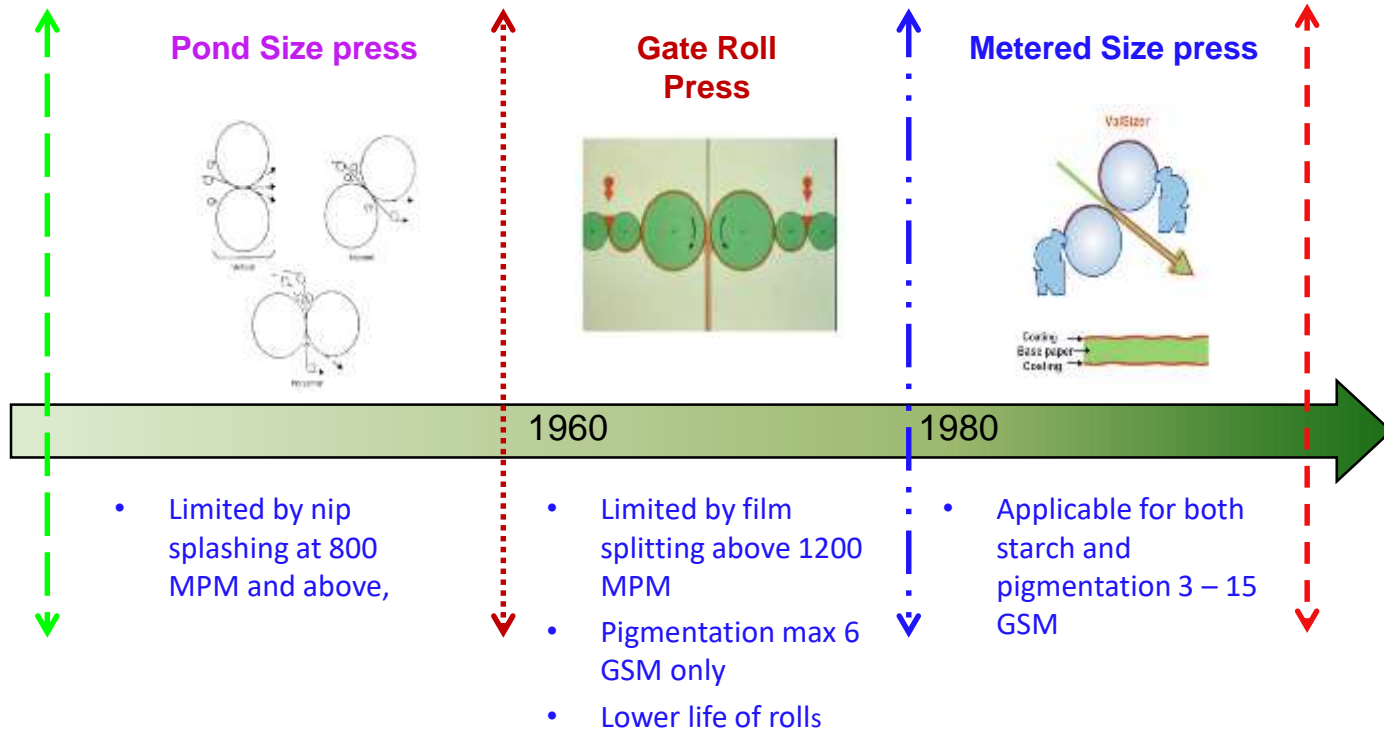


- A starch solution, sometimes pigmented, is applied to either one or both sides of the paperboard at the size press. The surface sizing prevents surface fiber shedding from uncoated surfaces and improves strength, smoothness and printability.
- MSP can apply 20 % more starch

## Process Flow – size press



# Chronological Developments Metering Size Press



**Surface Coating:** - Basic purpose of coating the Board is to get good smoothness and better gloss in the board thereby achieving better printed surface. But coating can only improve the board property and cannot cover defects in the base board.

A white pigmented coating is applied in liquid form, smoothed and dried on either one or both sides depending on the product. Product benefits are whiteness, uniform ink and varnish absorption, and smoothness. The process gives surface suitable for printing and varnishing.

Three kind of metering devices are used to control coat weight. 1. Bar 2. Blade and 3. Air Knife

**Soft nip Calendaring:** -In order to give uniform and consistent surface characteristics for printing and varnishing the paperboard is treated by soft nip calendaring.

**Reel up (Pope reel):** - The paperboard is wound onto large steel cores in batches of between 7 to 100 tones. Each batch of product is given a unique in house identification code (lot number). This means that the product can traced and identified anywhere on any time.

The primary task of a package is to protect the contents from the surrounding environment, which might include impacts during handling, pressure in stacking, and extreme of temperature and moisture. In addition to its strength the paperboard package is also very suitable for promotional purposes. When manufacturing Paperboard, the following application requirements must be considered.

- **Promotion (end user)**

- The package promotes the product and creates an image of the product for the customer.
- The aim of promotion is to attract attention by means of graphical, surface and structural appearance.

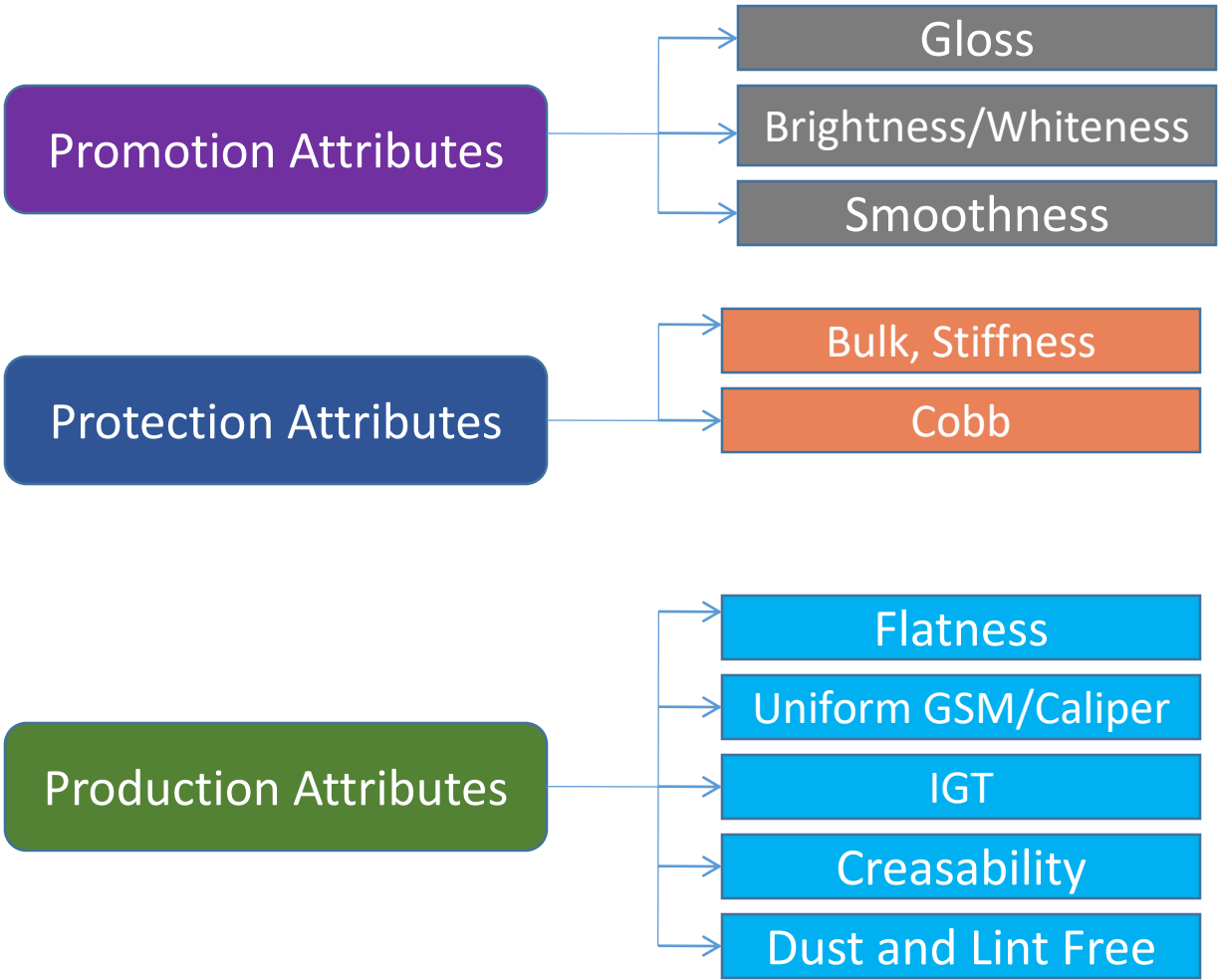
- **Protection (end user)**

- The aim of protection is to ensure that the contents of a package are unaffected by the environment
- The ability to withstand loads internally from the product and externally from the environment
- The required function to protect against moisture, dust, cold or heat

- **Production (Converter & End user)**

- Required for efficient conversion operations are Moisture, Flatness, Stiffness, Surface strength, Ply bond and Printability etc.

# End Product Requirement







Thank you