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# BEST MAINTENANCE PRACTICES FOR ENHANCE PAPER MACHINE CLOTHING PERFORMANCE


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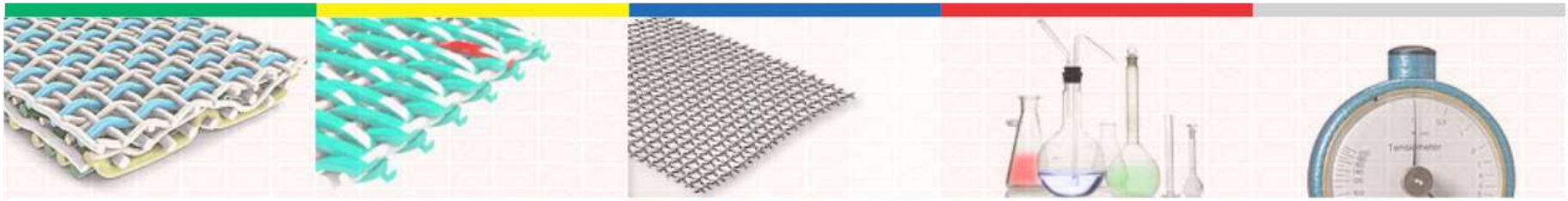


Forming Fabrics
Conveyer Belts
Press Belts-ETP

Dryer Screens
Spiral Screens

Stainless Steel Mesh
Phosphor Bronze Mesh
Pulp Fabrics

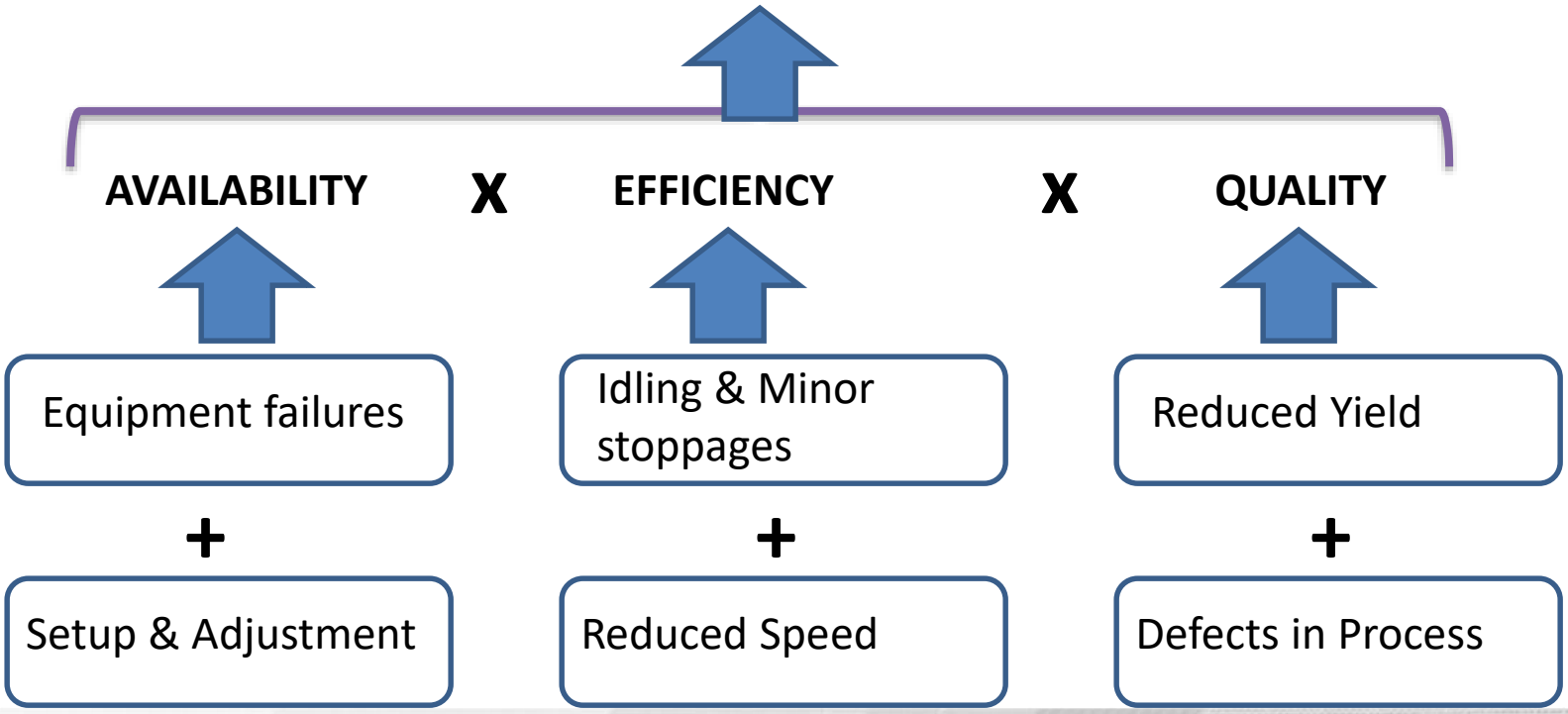
Chemicals

Accessories

# OEE – need of hour

## WORLD CLASS MANUFACTURING

**OEE is an internationally accepted measure of equipment effectiveness during planned production.**
**It measures how effective equipment is at adding value to the Production process.**



# Importance of Effective Maintenance Program

**Best maintenance Practices helps in achieving business Excellence**

- **P** To achieve Planned Production effectively
- **Q** To improve Product & Process Quality
- **C** To reduce Costs
- **D** To meet Delivery targets
- **S** To maintain Safety
- **M** To improve Morale

**Through --Inspection, Cleaning, Lubricating, Making minor adjustments**

Machine break down cost is sometimes difficult to measure. The cost of machine break down is more than just the maintenance labor and materials to make the repair. Actual breakdown cost is high 4 to 15 times more.

# Why Best maintenance practices in PMC??

**Paper machine clothing** is not just conveying and dewatering

It has more functions on the end quality of paper as **clothing are designed for specific quality demand** by the different configuration of machines with variant in furnish, speed and end products.

The variants might be in specifications, i.e. surface characteristics, open area, void volume, permeability, smoothness, etc. are engineered to achieve specific goals in the papermaking process.

The need to implement an effective PMC maintenance program has become increasingly crucial in recent years due to increasing levels of recycled furnish, usage of many chemicals to achieve final sheet properties, faster machine speeds and accompanying technology, increased sheet quality requirements, and the desire for longer fabric life.

# What needs from Forming fabric

# How to maintain these properties

Either by **mechanical (Showering) or Chemical**.

Effective cleaning system can employ both methods on a **continuous and/or batch basis**

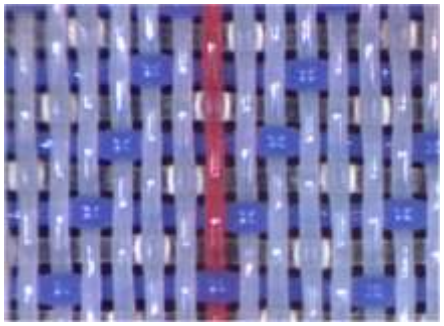
Keep mechanical conditioning :

- by Proper showering
- by Proper cleaning
- by Proper lubricating
- by Optimum tension
- by maintain table elements

It is also usual to clean the whole fabric with chemical solvents during machine shutdowns

Proper cleaning and conditioning of PMC is most effective when done through a systems approach. This means using a combination of **fabric design, showering, and chemicals**. All three should be considered together as a system for the most effective cleaning program for a machine.

# Forming fabric – Designs available



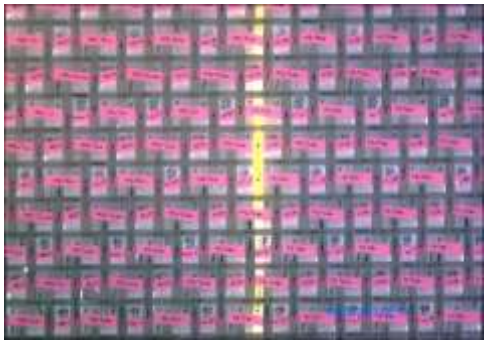
Single layer

**Advantages:**

- ✓Most versatile Design
- ✓Easy to drain
- ✓Easy to keep clean

**Limitations:**

- ➢Dimensional Stability
- ➢Poor formation
- ➢Low retention
- ➢High Elongation
- ➢Bleeding



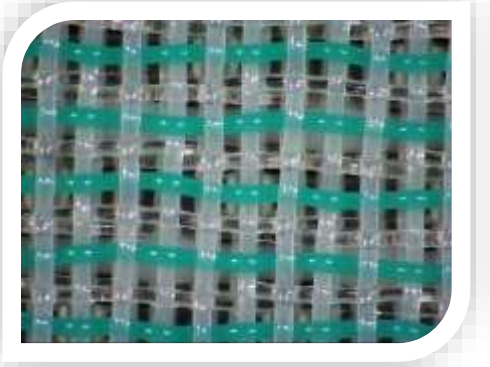
Multi layer

**Advantages:**

- Higher life potential
- Improved retention
- No Bleeding
- Improved formation

**Limitations:**

Wire marking
Drainage limitation
Cleaning requirement
Angular drainage path

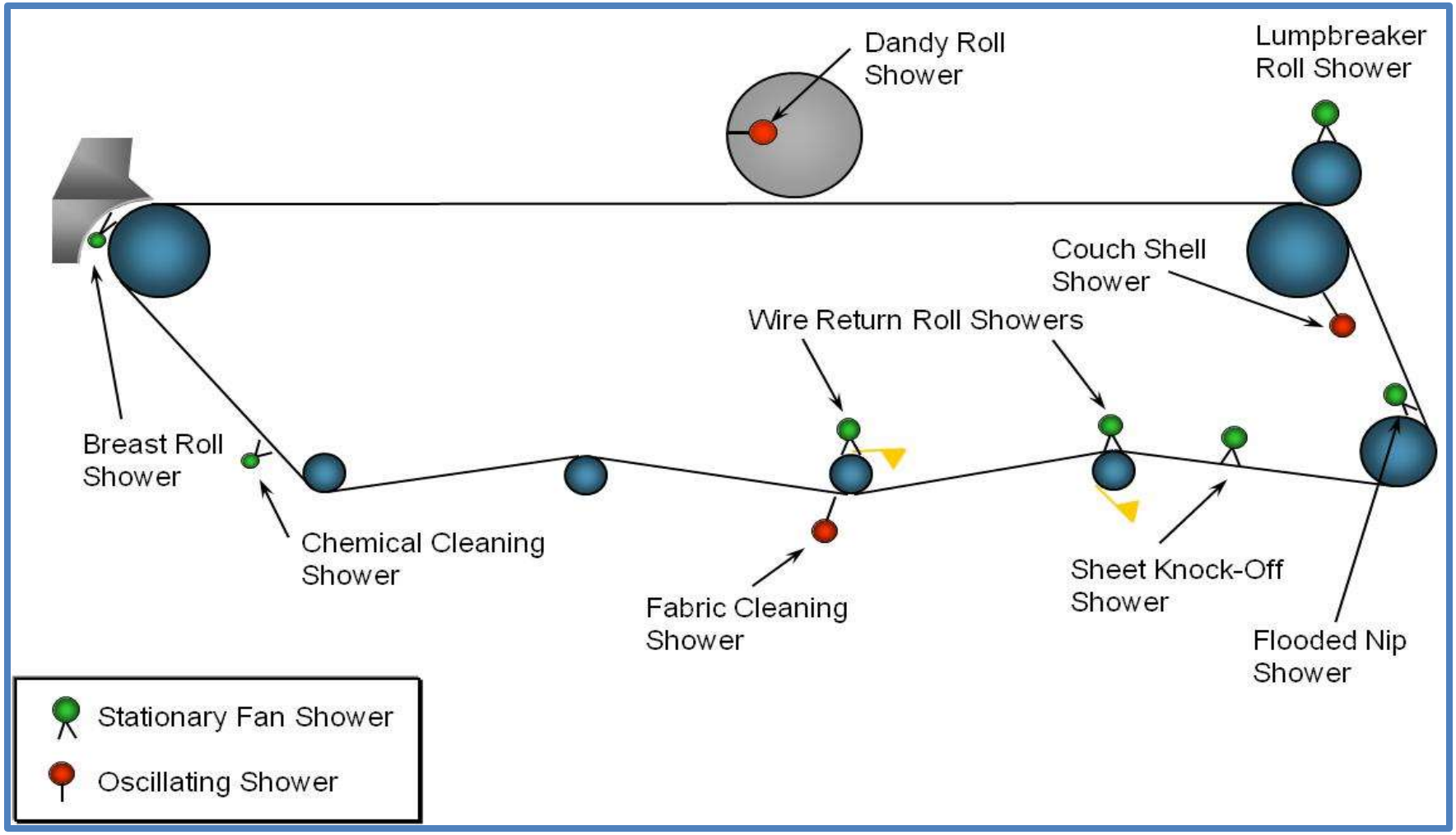


**STL/UltraEDGE/UltraPACK**

**Advantages:**

- Higher life potential
- Improved retention
- Better formation
- Easy to drain
- Easy to keep clean
- Straight through drainage path
- Designed top for property and bottom for life enhance

# Forming fabric - Showering



# Forming fabric - Showering

Effectiveness of **High Pressure showers** works on

Good water filter operation
Adequate water pressure
Proper nozzles
Optimized diameter of nozzles
location, distance and angle
Proper oscillation

**Flooded Nip Shower**

This will help in loosening the fibers which is embedded with the fabric in vacuum boxes. The loosened fibers will get rid off by wire return roll and will be doctored-off. The high pressure oscillating shower will chisel-out the fines and fillers from the fabric.

The breast roll shower kept clean the fabric between fabric and the jet, and also release any air pockets in between. Further the wash roll showers will keep the fabric free from any dirt; it needs to cover full width of fabric with wide angle nozzles.

# Forming fabric - Optimum tension

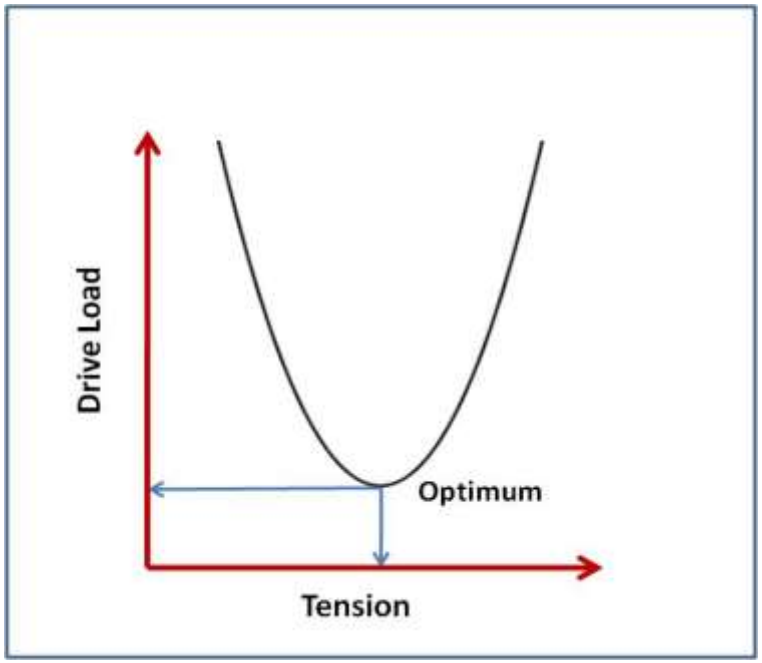
Optimizing the **fabric tension and wrap angle** will keep the fabric **long life and with less drive power**.

It is suggested to keep higher tension for better drainage and no slippage.

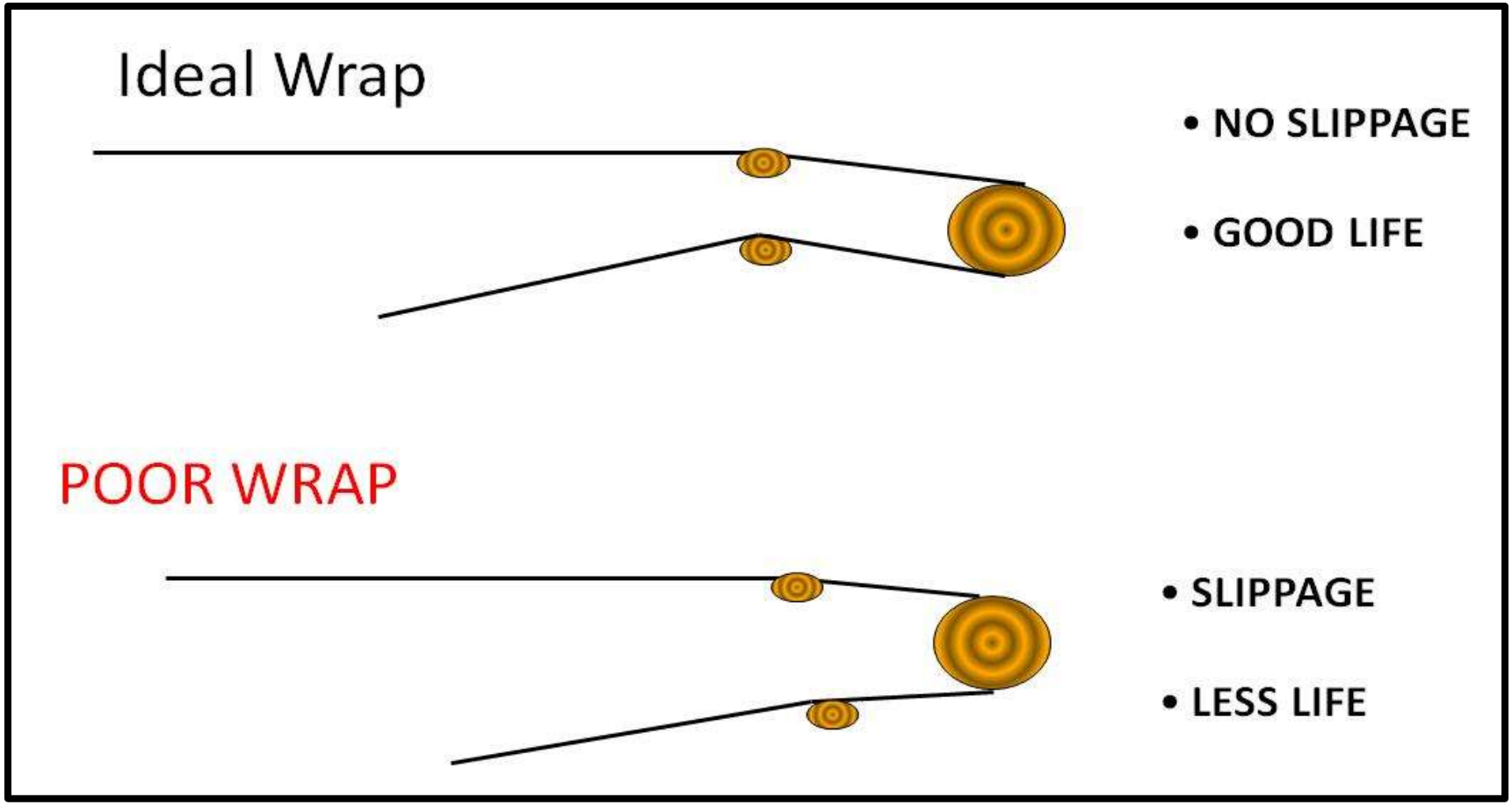
Suggested fabric tension

Single layer is 3 to 4 Kg/cm
Multilayer 4.5 to 5.5 Kg/cm
STL 5.5 to 6.5 Kg/cm.

With the optimum tension of the fabric, in suction boxes, fabric will not get sagging hence any abnormal wear on machine side.



# Forming fabric – Ideal wrap

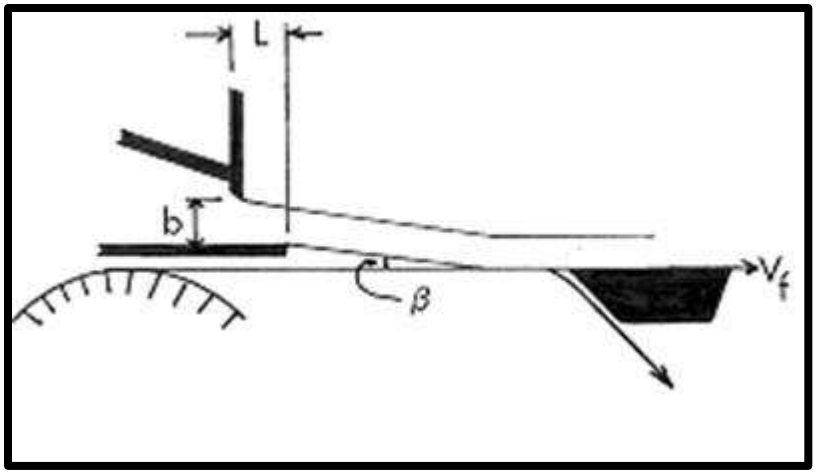



The suggested wrap angle at Couch or Forward drive roll is **180 degree and more**.

Higher the wrap will give higher power transmission, thus less drive load and no slippage. Thus less wear on machine side.

# Forming fabric - Table elements

The most abrasive element for forming fabric is drainage elements and suction box tops.




Augmented vacuum in the vacuum boxes will give better drainage in machine will reduce the unnecessary wear of forming fabrics. It is necessary **to check the uniformity, no dents, required angle**. This will fabric's life.

Even with the ceramic elements, the **jet landing plays vital roll in fabric wear**. Jet landing prior to forming board causes not only sheet sealing, due to sagging of fabric before forming blade, it wear more on the forming blade tip.

# Forming section rolls

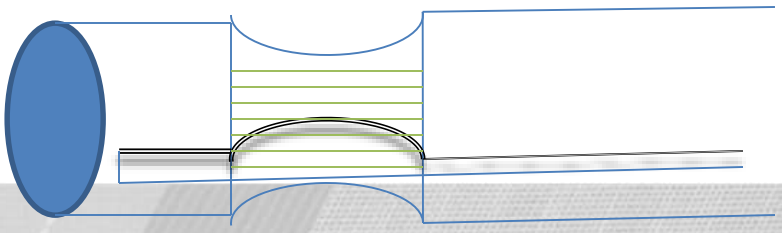
| | |
|---|---|
| If original diameter of roll is | 300mm |
| then circumference | 942mm |
| If wear is 1mm then diameter of wear part | 298mm |
| Circumference | 935mm |
| Difference in circumference | 7mm |

If wrap is 180 degree then difference in travel will be 3.5mm in each revolution of roll.

At 800rpm difference in displacement **4 Km/day**

If average life is 60 days then differential travel = friction difference of the fabric is 160km

The prediction of roll wear can be noticed by **continuous monitoring of used doctor blades**.

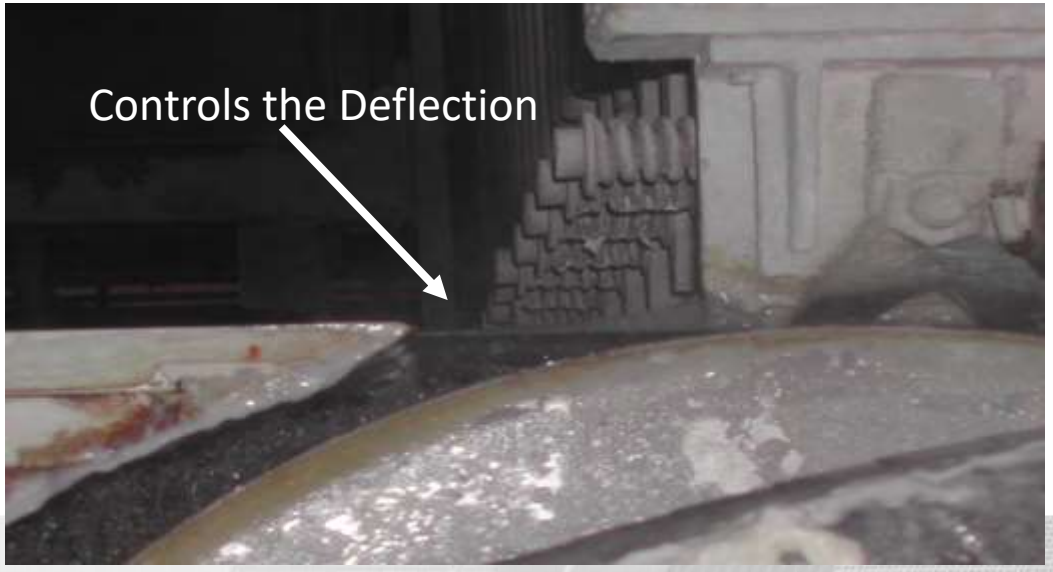


# Forming section rolls

The **stiffer forming fabric** will reduce the deflection of fabrics in the vacuum boxes hence more drainage is possible.

The **new generation forming fabrics** will give the additional advantage of stiffness.

Stiffer fabric will give uniform basis weight profile as the fabric will not generate cross flows while jet landing on the forming board.

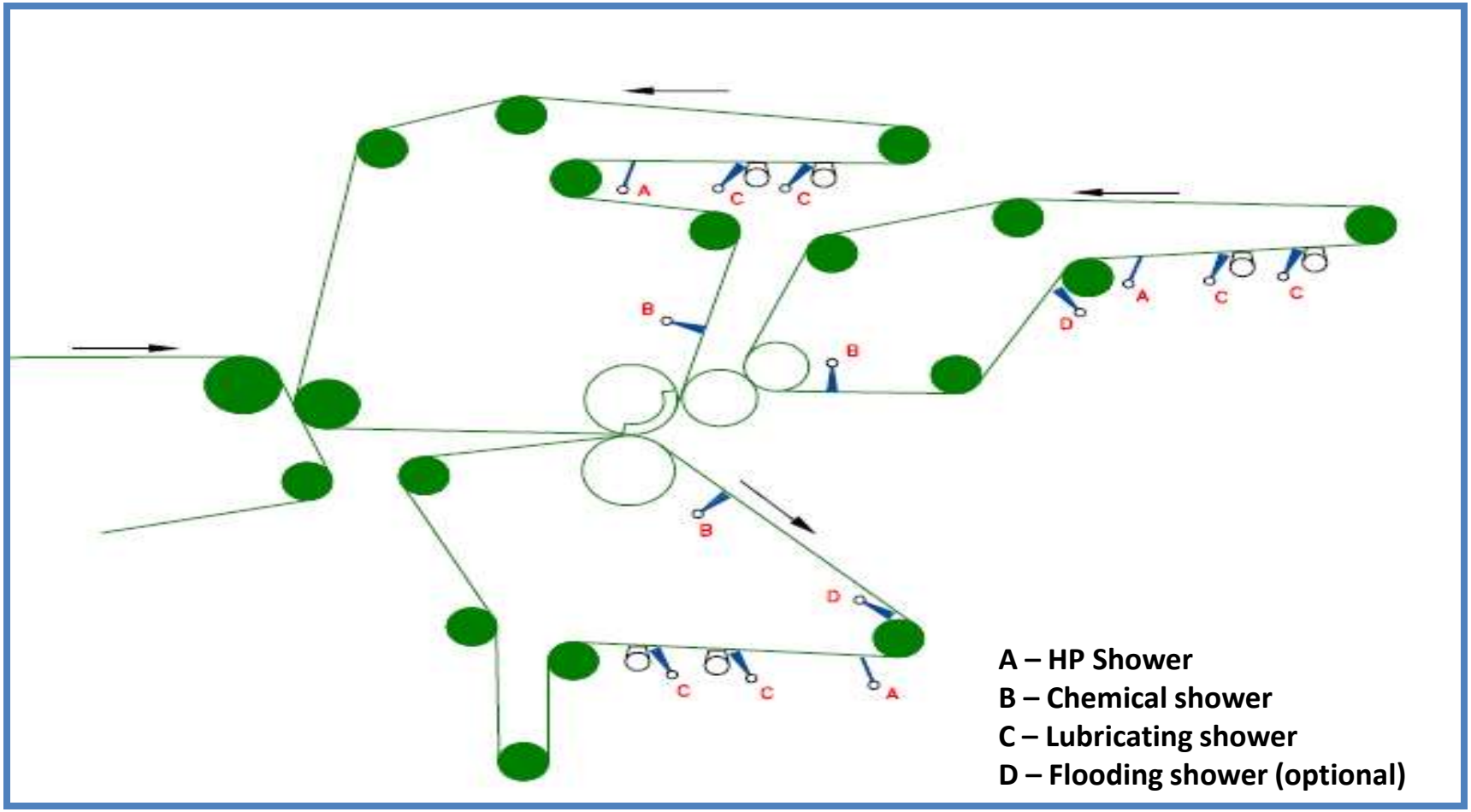


# Press fabrics

Sheet dewatering occurs when the press fabric transfers water from the sheet to the press through a **series of microscopic voids.**
Water transfer cannot occur if the channels are locked with flocculated contaminants or gels.
Properly designed and cleaned press fabrics maintain their voids and provide consistent, maximum dewatering performance throughout life and have a positive effect on dewatering efficiency, energy use, profile, sheet bulk and press fabric life.

Press fabric **filling is dependent on particle size**. The press fabric constructions will hold 100% of particles larger than 50 microns and 90% of particles larger than 24 microns on the surface. Particles of 10 microns or smaller will pass through the press fabric. High-pressure showers remove the surface contaminants in the 24- to 50-micron range, while flooded nip showers remove the embedded particles in the 11- to 50-micron range.

# Press fabric - Showering

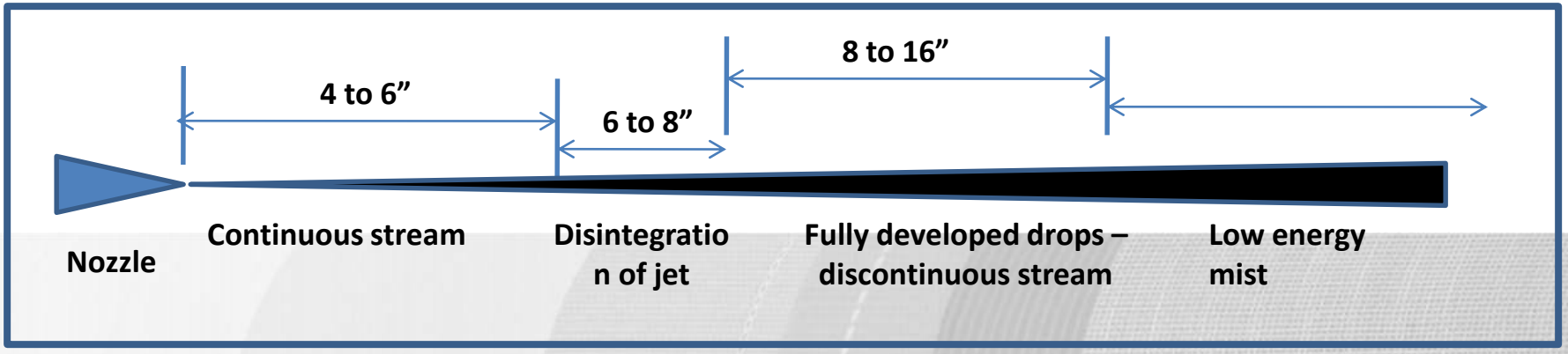



A – HP Shower
B – Chemical shower
C – Lubricating shower
D – Flooding shower (optional)

# Press fabric maintenance

Best results are achieved when the **oscillator speed** is set to move the shower one nozzle diameter for every felt revolution.
Machine direction streaks and damage to the press fabric will occur if the oscillator fails.
Because the needle jet shower can damage the press fabric, the **pressure needs to be just high enough** to clean the fabric

Proper **location of the shower and proper press fabric design** will minimize the need for high pressure. The needle jet shower is most effective when it is located on the **face side of the press fabric**.
The shower should be located as soon as possible after the press and before any face side rolls. The water jet from a needle shower is **homogeneous with laminar flow** for the first four to six inches.
This distance depends on **water pressure and temperature, as well as nozzle design**.



# Press fabric maintenance

Fan showers are used to apply water or chemicals evenly across the width of the press fabric.
Unlike needle jet showers, **flooded nip showers** use fan nozzles and apply a **large volume of water to flush** embedded contaminants out of the press fabric.
Water movement is necessary to clear the embedded contaminants out of the press fabric.

**Chemical Cleaning:** The use of recycled fiber generally results in an increased amount of contaminants in the Paper making process. These contaminants are generally more difficult to remove, and therefore it is necessary to include chemical cleaning in the cleaning and conditioning system to optimize press fabric life and performance.

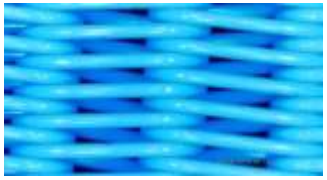
**Caustic** will help in removing Pitch, Rosin, Mineral deposits and fibers
**Kerosene, Xylene, Toluene** will help in removing Tar or stickies.

The reason for importance of fabric design is to **better heat transfer** by contact area and appropriate **permeability** for better mass transfer.

The modern dryer fabrics should serve for energy efficient way for Quality output. To improve the heat transfer, it is necessity of **high contact** of web with the dryer cylinder. To help, the modern high contact dryer screen design developed.

There is lot of options available with low contact SLDF screens (~17%), Woven long float dryer screen (~27%) and high contact **Unotier (~50%).**

Proper selection of dryer screen with required contact area and permeability is important for efficient operation.



SLDF

Woven Dyer Screen

Unotier

# Dryer fabric maintenance

The efficiency is lying in the maintaining the dryer screens surface from any **contaminant** and maintain the **permeability** as new as possible to extract maximum efficiencies of dryer screens in the drying process.

Most common consequences of **dryer fabric contamination** are:

- Sheet moisture profile unevenness
- Sheet instability, particularly near the edges
- Inferior heat transfer and paper marking caused by dryer fabric surface deposits
- Heat transfer reduction caused by deposits left on the cylinders
- Plugged vacuum rolls
- The transfer of deposits from the dryer fabric to the paper
- The increased dryer fabric cost that results when running time (fabric life) is reduced by plugging

# Dryer fabric contaminants

Dryer fabric contaminants come primarily from **furnish** (virgin pulp and recycled fibers) and its **additives and from coating** or size press chemicals.
Cleaning should proceed only after identifying the type and degree of contamination of your particular fabric.

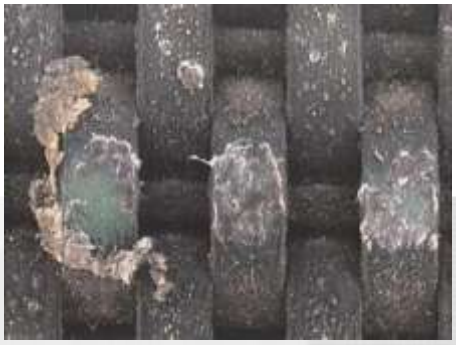
Common Dryer fabric contaminants

**1. Dust** - Short cellulose fibers.

**2. Organic substances not cross-linked** – Pitch, Asphalt, tar, wax (often from recycled furnish), Sizing material CMD size press, starch and casein types, Bearing oil and grease.

**3. Cross-linked organic substances -** Wet strength resins, Latex based coating chemicals (SBR, acrylic, and others)

**4. Non-organic substances**- Alum, calcium carbonate, kaolin, titanium dioxide, rust, scale and filler materials.



# Dryer fabric cleaning

A regular, **periodic air shower** is best for cleaning high permeability dryer fabrics that are plugged with fiber dust or loose dirt.

The air shower is often insufficient for removing resins and sticky particles from low permeability dryer fabrics. Low perm dryer fabrics require **water or steam showering**. .So that loosened dirt does not circulate in the dryer hood, high pressure air showers should be placed so that the dirt can be directed toward the exit duct in the dryer hood or down into the pit.

Cleaning is much better when a **short distance** is used between the nozzle and the fabric. At long distances, the air jet loses energy. For space and safety reasons, distance should be 30 to 50 mm.

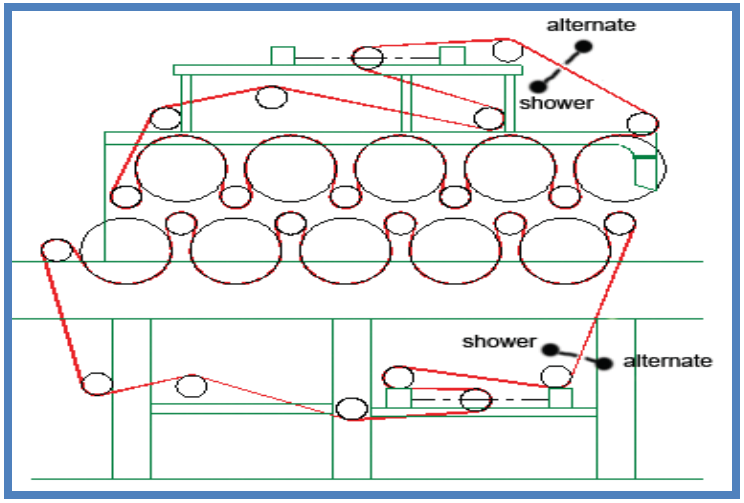
When air pressure is raised, permeability increases. Low pressure < 30 psi results in poor cleaning. To avoid unnecessarily large air consumption, a **nozzle diameter** of 2.5 to 3.0 mm is recommended.

Remember, when installing your air shower; locate a position where the dust can easily be removed from the dryer section.

# Dryer fabric cleaning

**Shower types ( some continuous )**

- **HP cleaning/chemical shower**
  - **paper side of fabric, perpendicular to fabric.**
  - **beginning of return run.**
- **Single HP needle jet traversing shower**
  - **low water usage.**
  - **continuous cleaning (on the run).**
- **Steam showers**
  - **“stickies” problem.**




**Cleaning Procedure ( offline ) : Alkali**

- **Ensure cans are cooled ( 60-70C).**
- **Crawl speed.**
- **Dilute cleaning solution.**
- **Keep fabrics wet.**
- **Follow recommended cleaning time.**

**Intensively rinse fabric with fresh water**

# Check list - Forming

**While stoppage:**

Run wire part in **crawl speed**,

Examine for defects especially on the edges (loose yarns), creases, small holes, dirt or plugged pockets. Inspection in stoppage will help in down time or quality defect in startup.

**While Installation:**

Inspect the condition of

Forming foils,

forming shoe,

Hydrofoils (wear, crack, cutting edge, etc.),

Rolls (wear, rough surface, defects),

Vacuum box covers for any abnormalities,

Suction rolls holes for clogging (once in a while check the blade of the couch roll),

Rust on the frame,

Deposits of pitch or stickies.

# Check list – Press section

**While stoppage:**

Special attention should be given to the **suction box covers**, especially if using deinked pulp or clay.

Inspect the blades for wear since over time, have abrasive particles **lodged between the rolls, holders** and the blade. These can cause the fabric to lose fibers.

When operating the press fabric, the interior walls of these blades must be inspected to make sure that they are not sharp since there is a tendency to enter through the opening of the uhle box.

**While Press fabric change:**

**Recalibration of the speed** (speed-match) is necessary because the tiniest change in the thickness of the fabric can cause a difference of speed, especially in the case of tri-nip presses.

# Check list – Dryer section

The dryer fabric must be verified to see if it is **hydrolyzed.**

Folding the sides of the fabric by hand should not break it. If the fabric is hydrolyzed, discuss the problem with the supplier since there is **informative material** available to address this issue.

Hydrolysis caused by the **mixture of more temperature and moisture** (by condensate splash or oil spillages

Many mills wash their dryer fabric with a caustic solution during the shutdowns, which helps clean the surface of the dryers as well. However, a **good rinsing** must be done after the washing. Otherwise, when the steam pressure is put back on, the water in the caustic solution will evaporate and the concentration (approximately 5% at the beginning) increases quite a bit, reducing the useful life of the dryer fabric and causing damages to the seams.

Check the **seams of the dryer and press** fabrics as needed to repair them during the shutdown.

# Dryer fabric inspection…

## During shut down:

- Inspect edges
- Inspect seam
- Inspect guiding action
- Inspect stretch roll
- Hydrolysis
- Inspect fabric body for tears, cuts, etc.
- Tension
- Seam distortion / parallelism
- guiding

## For Edge damage

- Excessive guide paddle force
- Fabric rubbing against object(s)

**SEAM BOW**

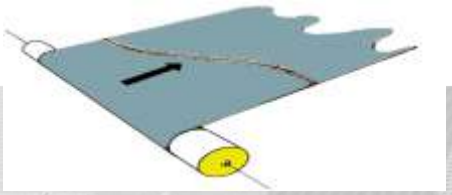
**Front to back misalignment bow:**

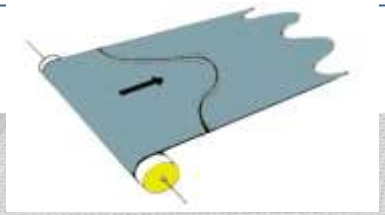
- Roll diameter – Stock or paper build up
- Misalignment

  lead edge travels shortest distance

**Correction:**

- Verify roll surfaces
- Roll alignment using taping method





# Data Collection

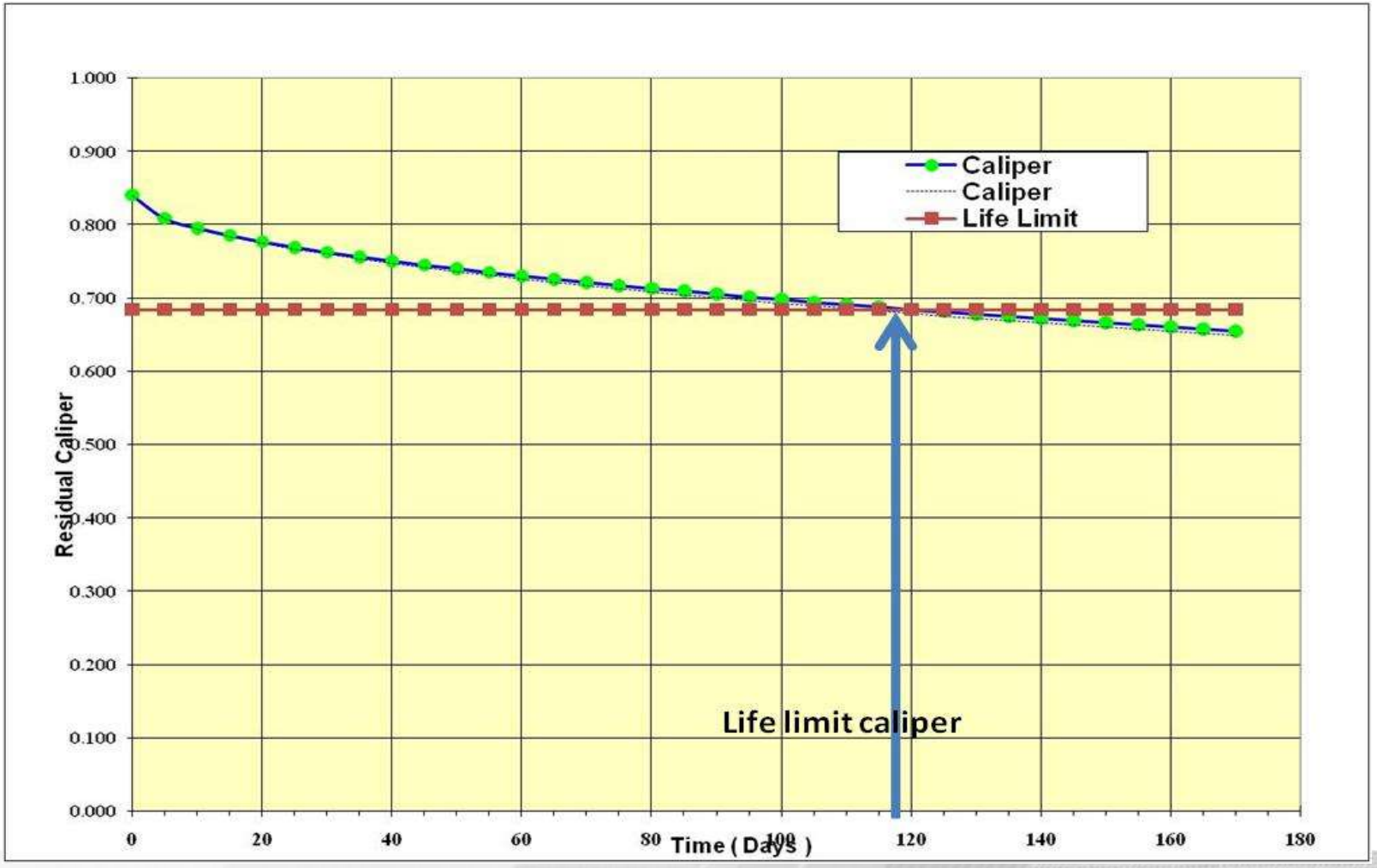
The first step in the trouble shooting is **start with the data**. More and more data will give the **accurate prediction** of troubles.

The monitoring of data on **thickness of fabric, removed doctor blade width measurement, life of doctor blade, roll change history, vacuum data, machine drive load data, head box parameter, shower nozzle change history,** will help in the prediction and take measure for problems expected.

Best maintenance practices starts from **more data collected** in process and service team, to get **as much as close to predict** the failure and life-span of any equipment or clothing.

Transactional data is incredibly important for processes because it helps them to expose variability and optimize their operations. By examining large amounts of data, it is possible to uncover hidden patterns and correlations of process changes

# Wear prediction of FF



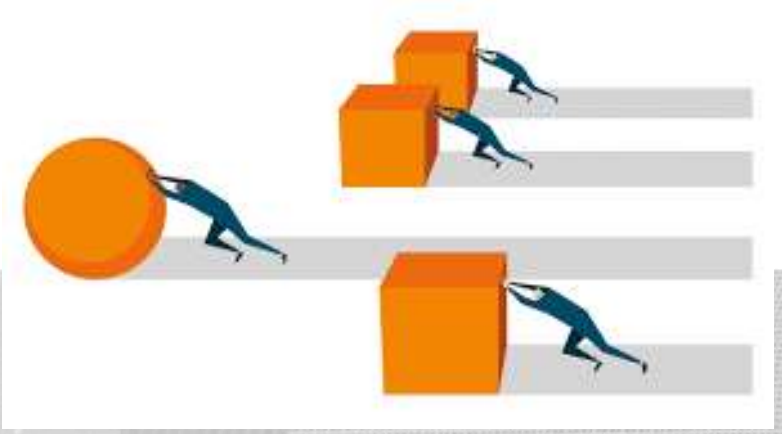
# Conclusion

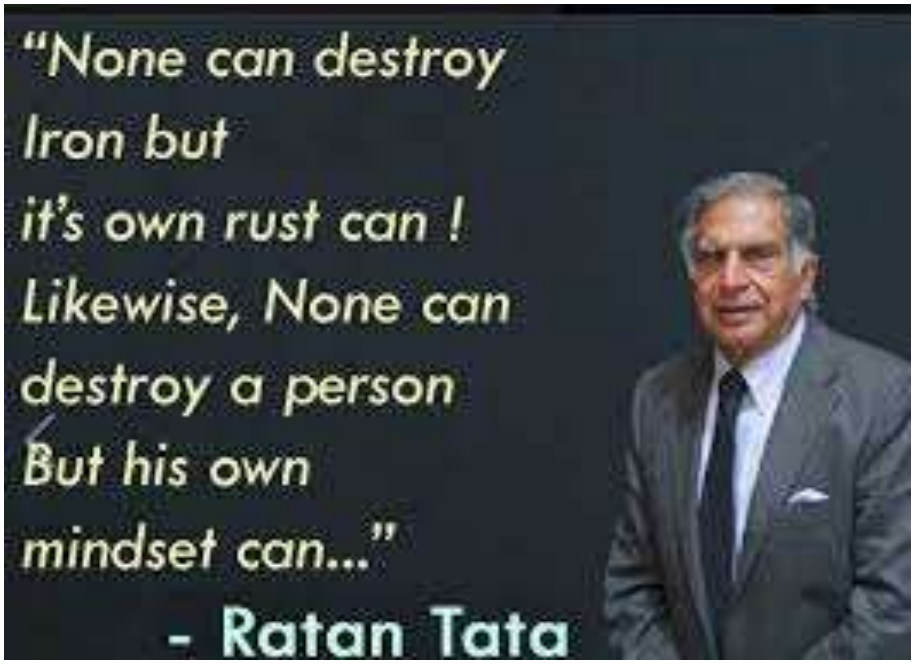
**Prevention is better than cure**, so by use of best maintenance practices along with more data, we can predict the life span of any equipment/clothing, thus get maximum benefits from the equipment/clothing.

Best maintenance practices **save time**, **cost** and lead for **safe working environment**.

By **monitoring and maintaining** the Paper machine clothing with care, it performs as new as possible till end of life.

**Discussion with the supplier** with the data will help in trouble shooting and in further performance improvement by comparing with the other paper mill's experience on best practices.






# Thank you

## For your Attention