Department of Textile and Fibre Engineering

Indian Institute of Technology Delhi

Technology of Pre-treatment and Finishing

(TXL-241)

Introduction and Mechanical Finishing of Textiles

About the Course

This subject aims to provide you with comprehensive lessons in ***textile finishing*** and prepare you with knowledge and understanding of ***principles and technology of textile chemical finishing*** with emphasis on the **mechanism** and **chemistry underlying of the processes.**

Intended Learning Outcomes

- To understand the know-hows of the finishing techniques.
- Apply their knowledge of chemical mechanisms and technologies to select the correct machinery, processes, processing conditions and technologies to achieve the specific effects required for different end-uses.
- To minimize and solve technical problems involved in the process.

References

- Textile Finishing Edited by Derek Heywood, Society of Dyes and Colourists. 2003
- Chemical Finishing of Textiles, W. D. Schindler and P. J. Hauser, CRC Press 2004
- Principles of Textile Finsihing, Asim Kumar Roy Choudary, Woodhead publishing, 2017.

Indicative Syllabus

Section 1 Mechanical Finishing

- Calendering, Raising, Sueding, Emerising, Shrink proofing.

Section 2 Chemical Finishing

- Softening Finish, Biopolishing, Easy care, Oil/Water/ Soil repellent finishes, Flame Retardancy, Antimicrobial finishes, Wool finishing.

Section 3 Finishing Machinaries

- Low liquor application techniques and machinery, Stenters and dryers.

Evaluation Policy

MARKS DISTRIBUTION:

- Minor: 40
- Major: 40
- Quiz: 20 (2 Quiz – Pretreatment + Finishing)

Attendance Policy:

- Ideally should be 100% (Award Marks: 5)
  - Maximum of 2 days exemption on health grounds (IIT hospital Cert)/ On Institute Duty.
- If < 75%, 1 grade down
- If < 30% 2 grades down
- No re-minor will be conducted for candidates having <50% attendance.

Effective after add/drop period
08-01-2024

Introduction

Pre-treatment

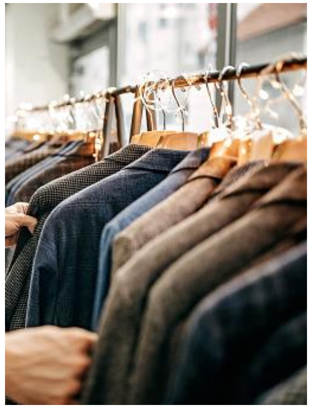
- Removal of impurities
- Make fabric suitable for dyeing and finishing with good absorbency.

Dyeing & Printing

- To impart uniform colour and coloured pattern on fabric.

Finishing

- To make fabric fit for end use.
- Impart Functional Properties



Key Advantages of Finishing

- Improved appearance – ***Lustre, Whiteness*** etc.
- Improved Feel – ***handle*** of fabric and its ***softness, suppleness and fullness*** etc.,
- Improved wearing qualities – ***Anti-crease and Non-soiling***.
- Special Properties – ***Water Proofing, Flame Proofing*** etc.

Other added benefits

- Covers ***faults*** in the fabric.
- Improves fabric ***weight***.
- Increase the ***selling price*** of the material.
- Improves the ***natural attractiveness***.
- Improves the ***serviceability*** of fabric.

Which fabric and what finish to choose?

The variations of finishing depend on the following factors

- ***The most important factor,*** the desirable properties of the material during its use.
- The type of fibre and its arrangement ***in yarn and fabric***.
- The physical properties of fibres such as ***swelling capacity*** and behaviour when ***pressure or friction*** is applied.
- The capacity of fibres to ***absorb chemicals***.
- The susceptibility of the materials to ***chemical modification***.

Classification of Finishing

The finishes applied using
- *Chemicals*

Physical principles
- *Pressure*
- *Tension*
- *Friction*
- *Temperature*

Textile Finishing
- Chemical
  - Reactive
    - Parchmentising
    - Chlorination of wool
    - Flame redardent
    - Soil Release
  - Deposition
    - Temporary
      - Stiff finishing
      - Soft Finishing
      - Optical Brightening
    - Permanent
      - Crease resistant
      - Waterproof
      - Permanent Stiff finish
- Mechanical
  - Temporary
    - Calendaring
  - Permanent
    - Raising
    - Sanforising
    - Milling

Classification of Finishing based on their durability

- **Temporary Finish**
  - *A finish which is not stable and goes off after the first wash and subsequent washing. – **Calendaring, embossing, starching**.*
- **Permanent Finish**
  - *A finish which is remains unaffected through all conditions of wearing and washing treatments. – **Sanforizing, Mechanical Milling, Resin Finishing, Water/ flame proof finish.***
- **Semi-Permanent Finish**
  - *A finish which is remains unaffected few washes and goes off afterwards.- **Stiff finish, schreiner calendaring.***

Mechanical Finishing

- *Calendaring*
- *Emerizing*
- *Raising*
- *Shearing*
- *Shrink Proofing/ Sanforizing*
- *Weft straightening*
- *Heat Setting*

Calendaring

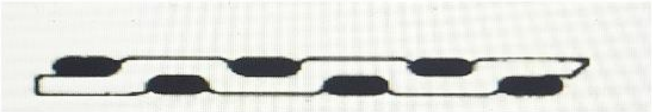
- A flat, compact and polished fabric is produced by passing open width fabric between two adjacent rollers (one soft (***bowl***) and other hard roller) under pressure.
- Suitable for calendaring cotton, linen, rayon and silk materials, synthetic fabrics (under temperature).

The objectives of normal calendaring is to

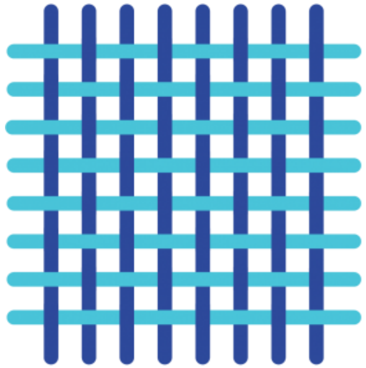
- *Flatten yarns, compress fabric and reduce thickness.*
- *To close interlacements in fabric and improve opacity.*
- *To impart a lustrous, smooth feel to the fabric.*
- *To reduce air permeability by changing porosity of fabric*

Calendaring

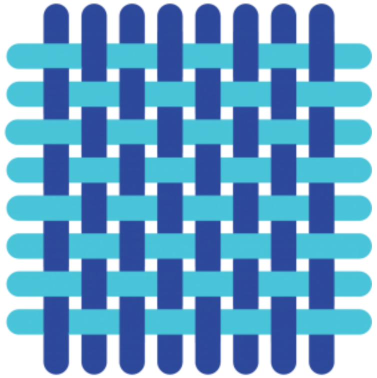
Before calendering process



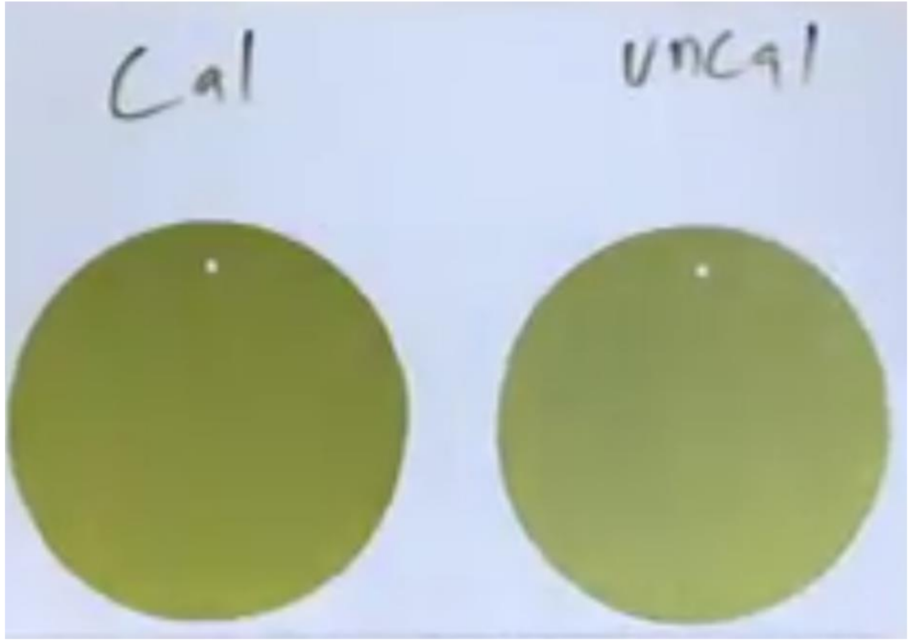
After calendering process



pre-calendered



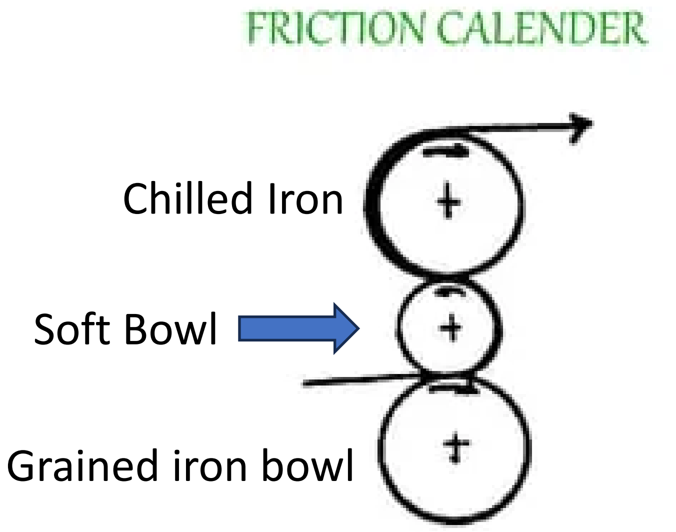
calendered



Friction Calendaring

The standard three-bowl heavy friction calender consists of

- steam-heated chilled iron bowl on top
- Fibre/soft bowl in the middle
- close-grained cast iron bowl at the bottom



Roller Width	1600-6000MM
Speed	5-100M/MIN
Pressure	5-20T
Working temperature	160 ℃ MAX.

Friction Calendaring

- For friction or glazing finishes top and bottom bowls run in ***differential surface speeds*** needed for the friction effect.
- Smooth metal bowl ***run faster upto 3x*** than the softer composition bowl.
- The fabric enters the nip and tends to ***stick to the softer bowl***
- The faster-moving metal bowl then imparts a glaze or highly lustrous surface to the fabric.
- The cloth handle can become ***quite papery and thin.***

Caution

- In Chintz finish of cotton incorrect fabric presentation into machine can lead to poor handle that cannot be corrected.
- More damage is caused by low moisture content.

Home Textile – Chintz

Engineering Aspects of Calendar

Key Parameters affecting Calendaring

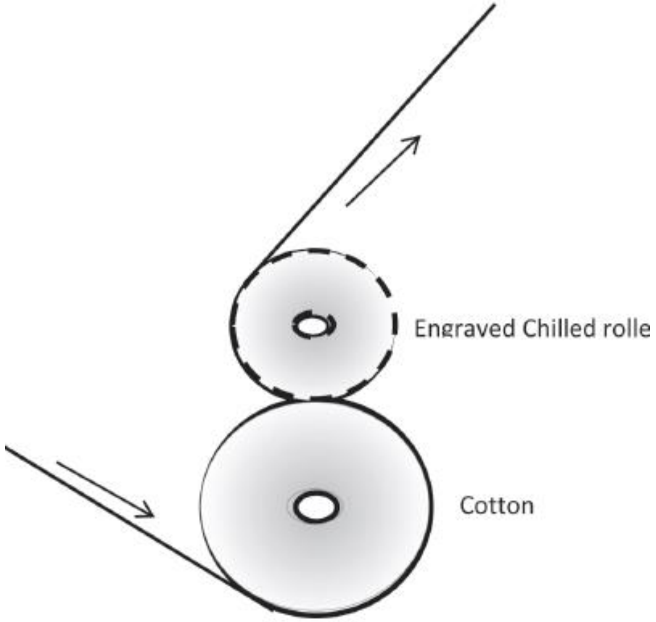
- Moisture Content
- Temperature
- Pressure
- Soft Bowl composition (wool/cotton/linen paper)
- Hard roller composition (Chilled iron, coarse-grained cast-iron roll)
- Number and arrangement of bowl
- Speed of the machine

Types

- Friction
- Schreiner
- Embossing

Schreiner calendaring

- ***Papery thin handle problem*** of friction calendaring is solved by "Schreiner" calendars.
- Fabric is passed through the nip between the heated ***engraved metal roller fine lines*** and a filled/ soft bowl.
- The line impressions are transferred to the fabric to create high sheen effect by ***reflect light differently***.
- Produced, mainly on sateen fabrics and also called as ***silk finish.***



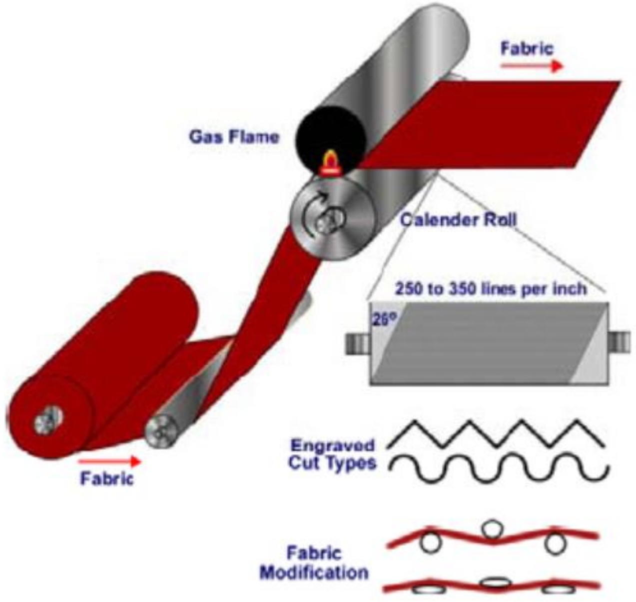
Filled/ soft bowl is not positively driven and rotates in contact with metal bowl

Schreiner calendaring

- Engravings of up to ***500 lines per inch*** at an angle of ***20° to*** the weft.
- Plain fabrics are also given an imitation schreiner finish using a bowl with only ***150 to 200 lines per inch***.
- Engraving is either a V-shape or a U-shape
  - V-shapes give more sparkle of light reflection and reduce fabric tensile strength.
  - U-shape give normal calendar glaze.

Darker the colour of a fabric sample the better it shows the lustre compared to white colour

Schreinering Diagrams

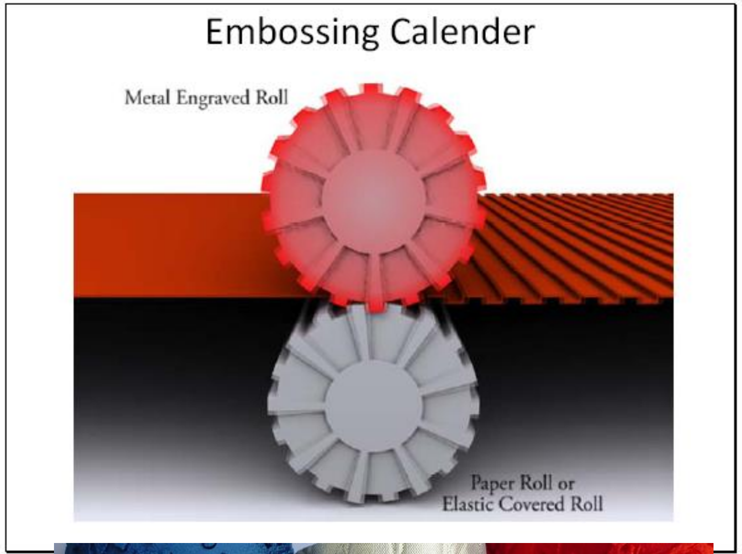


- Moisture content 9–15 % for cotton, (greater than standard regain)
- Temperature – 120–160 °C;
- nip pressure – 3.5–5.0 Bar;
- speed : 2–10 m min^{-1}

Schreiner calendaring

Embossing calendaring

- The embossing calendar usually consists of two bowls; the top metal bowl is engraved with a suitable pattern and the softer composition bowl has a surface that will accept the embossing pattern.
- The filled bowl has to be first impressed with a specific, deeper, reversed version of the design on the steel roller.
- Filled bowl is positively driven at the same peripheral speed, so that the impression remains in register.



Originally, these calenders were used to produce imitation leather cloth and book cloths.

- ***Thermoplastic synthetic fibers - the temperature of the embossing roll exceeds the heat-set temperature of the fibers.***

Emerizing

- Emerizing also known as ***sueding or sanding***
- A fabric is passed over one or more rotating ***emery/sandpaper -covered*** rollers to abrade and impart a soft luxurious handle.
- After emerising very ***low pile/ short fibres*** protruding from the fabric surface are produced.
- The handle will differ according to the type of ***fibre(s)*** present, the fibre ***linear density*** and the ***intensity*** of the emerising action on the fabric.
- Softness can be greatly enhanced by using fine ***microfibres*** (<1 dtex f^{-1}) together with chemical softening agents to give a peach-skin finish.

Peach Skin

Suede Leather

Advantages and Problems in Emerizing

Advantages

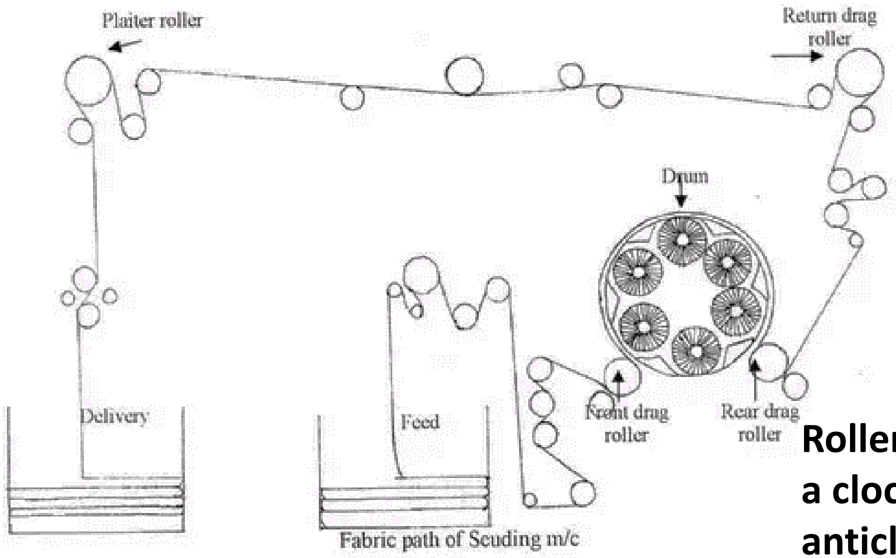
- Better Warmth to wearer
- Fabric becomes softer in hand smoother to feel
- Increase durability of fabric.
- Covers minute areas between interlacing.

Cautions

- Emerizing of microfibre fabrics should be carried out prior to dyeing to avoid unevenness, and especially stripiness after dyeing.
- A further problem arises from the coloured dust generated.
- Emerizing at grey fabric stage will help to remove the dust in subsequent dyeing and rinsing

Types of Emerizing Machines

Multi-roller Emerizing

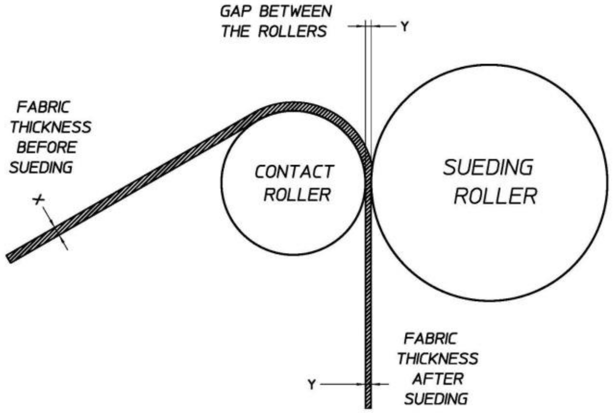


Rollers rotated in a clockwise or anticlockwise direction

- Flexible and versatile, wide variety of fabric structures
- More productive than single-roller emerising.
- Velvet-like, very short pile or nap fabrics

Speed: 15–25 m min^{-1}

Single Roller Emerizing



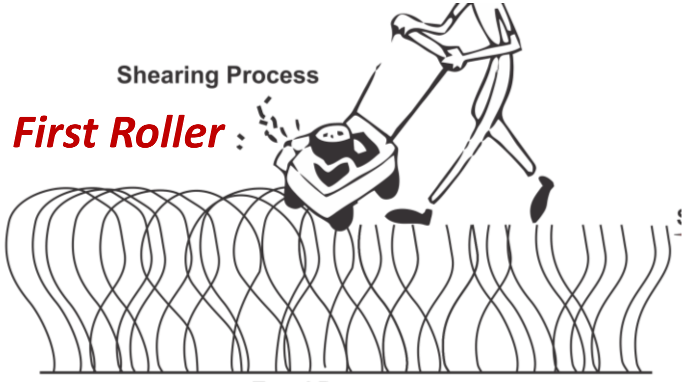
- Fabrics with ***terry loops*** on the face is presented to suede roller.
- Fabric styles where the fabric surface must be effectively shaved to produce a polished or burnished effect

Speed: 7-10 m min^{-1}

Parameter Influencing Emerizing Process

- ***First roller*** run in the counter direction to the fabric passage to exert mechanical action against the weft threads ***lifting the surface***.
- ***Second roller*** operates in the same direction as the fabric passage, ***which emerizes the weft thread***.
- ***Third roller*** runs in the ***opposite direction*** to intensify the process and the following rollers run in the same direction as the cloth to produce the nap.

First Roller



Second Roller

Because of the abrasive action on the fabric, care is required to ensure that the loss in fabric strength is not excessive.

Parameter Influencing Emerizing Process

The emerised or sueded effect obtained is dependent upon the degree of mechanical action on the fabric and controlled by

- the ***number of rollers*** in operation
- the ***direction*** of rotation of the rollers (that is, with or against the fabric)
- the fabric ***tension***
- the fabric ***wrapping angle*** on the rollers
- the fabric ***speed***
- the ***grade of abrasive grit*** used in the emery-paper-covered rollers

Fabric Properties

Fabric Construction

- The ***weft yarns*** contribute the most towards surface fibre development and ***Long weft*** floats can be utilized to enhance surface fibre development
- Thus, a tight fabric construction in a ***plain weave*** will be much more difficult to suede or ***emerise than a 2/1 or 3/1 twill***.
- ***Microfilament*** based fabrics have low resilience to mechanical action, and the handle is softer after emerising.

Fabric Tension

- The tension should be controlled at a pre-set level and any changes in fabric length should not lead to ***tension changes*** on the machine.
- Care must be taken in emerizing knitted fabrics which are generally more ***dimensionally unstable*** compare with woven fabrics.

Abrasives and emery grades

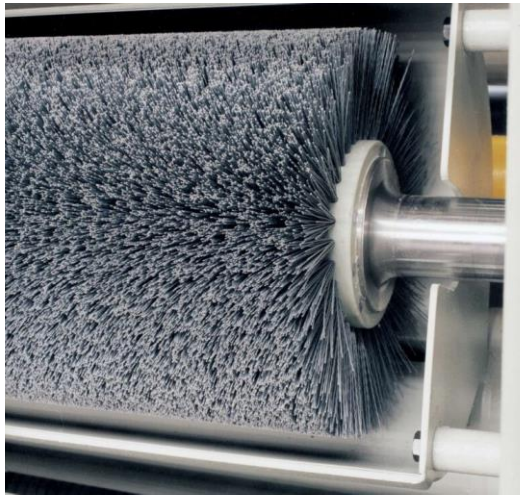
- The use of a relatively coarse grade (grain or grit size) of ***80–100*** produces a dense, long pile.
- Light-weight ladies' Outerwear fabrics of 100–180 g m^{-2} are sueded with a grain size of ***280–320*** to produce a short, dense nap.
- With the finer microfibres of polyester and nylon, the grain size is increased to ***400–600*** for emerising.
- Higher grain size ***600–800*** exert a polishing action rather than an emerising action on the fabric

Emery Strip

Caution

- If the abrasion is too fine, then enough heat may be generated in synthetic fibre fabrics to induce fusing and harshening of the fabric,
- while too coarse an abrasive grade could tear or rip a fabric unevenly.

RAISING

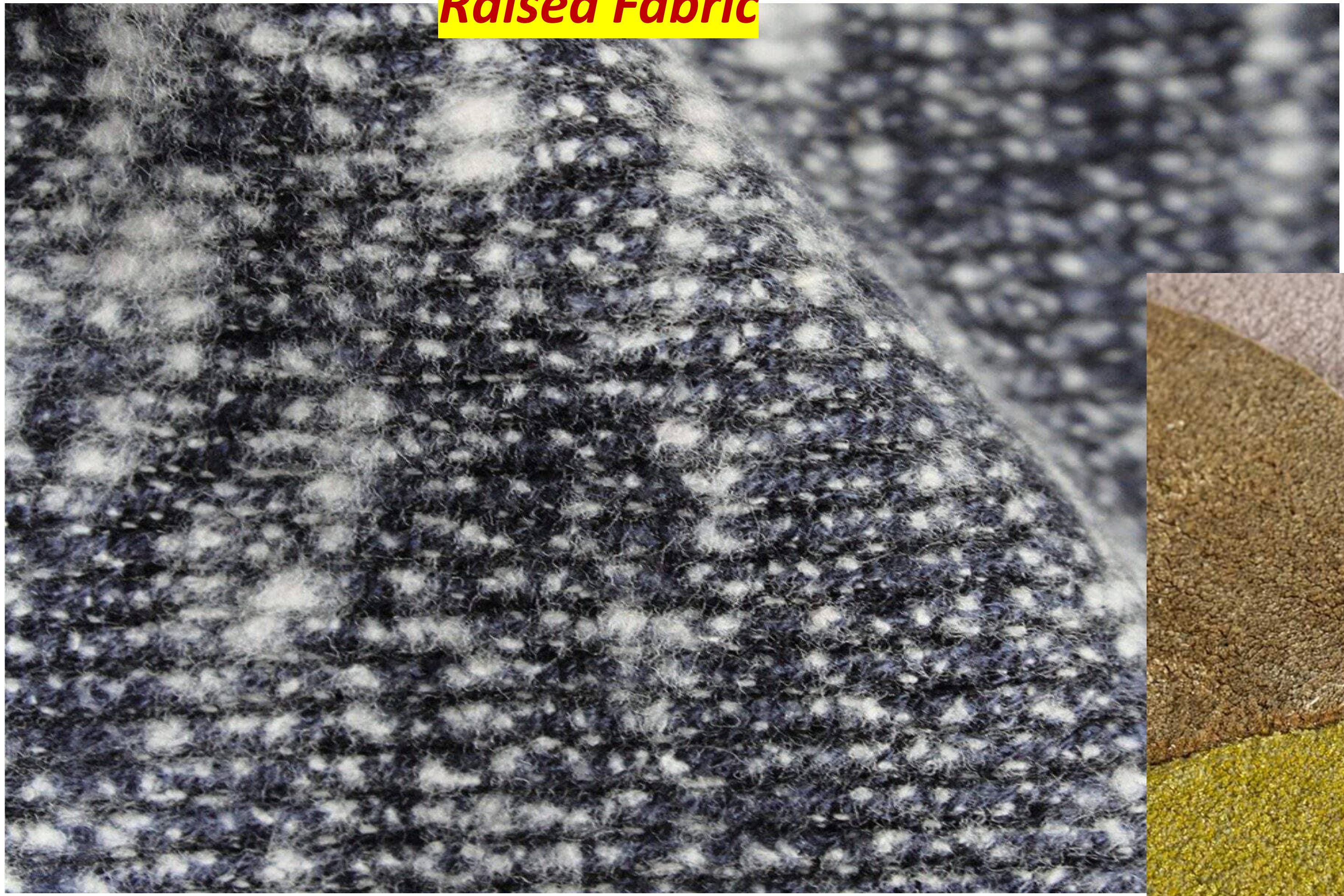


- Fibre raising involve the use of ***wires or brushes*** which catch yarns in the textile structure and ***pull individual fibres*** partly from the yarn structure.
- The resulting fabric *is* ***warmer, softer and more comfortable***.
- In staple fibres fabrics, ***pulling*** out a layer of fibres from the structure of a fabric to form a ***pile***.

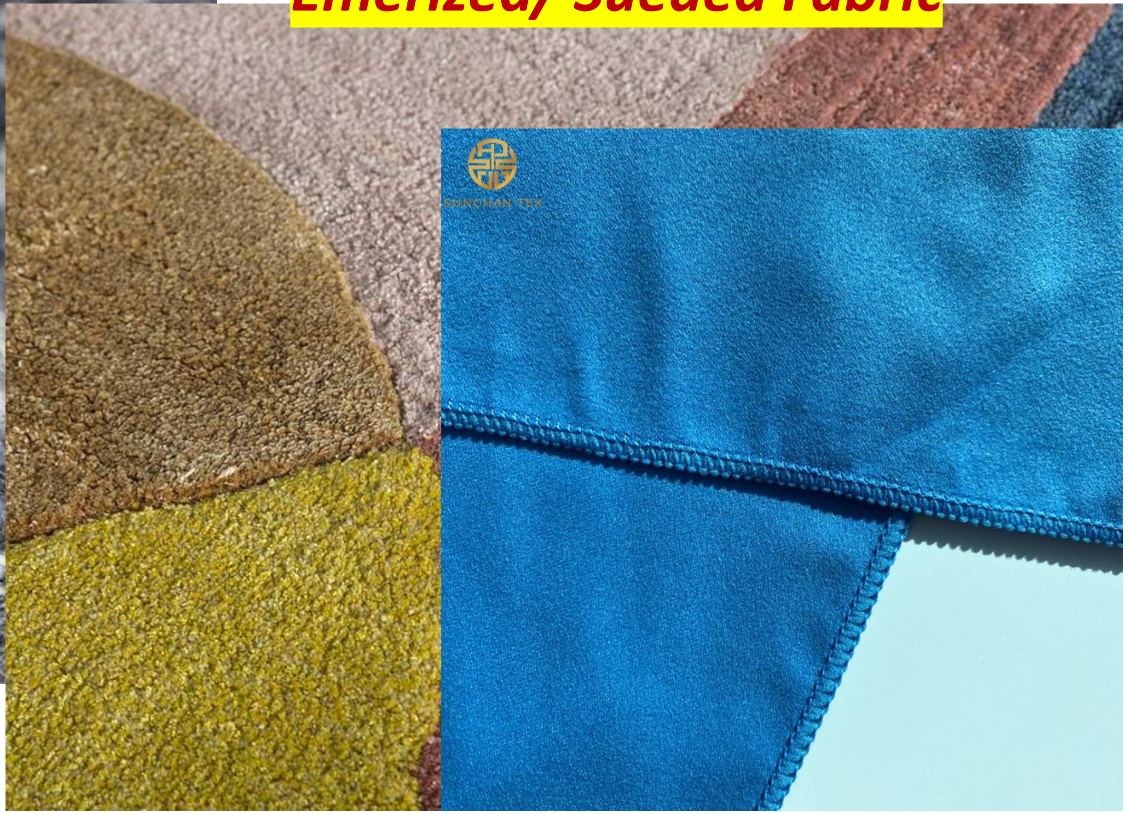
- Raised loop fabrics are used for ***nightwear or bed sheets***.
- In the case of ***filament yarns***, loops in the fabric structure are ***stretched*** by the raising action but are not usually broken.

Raising Process

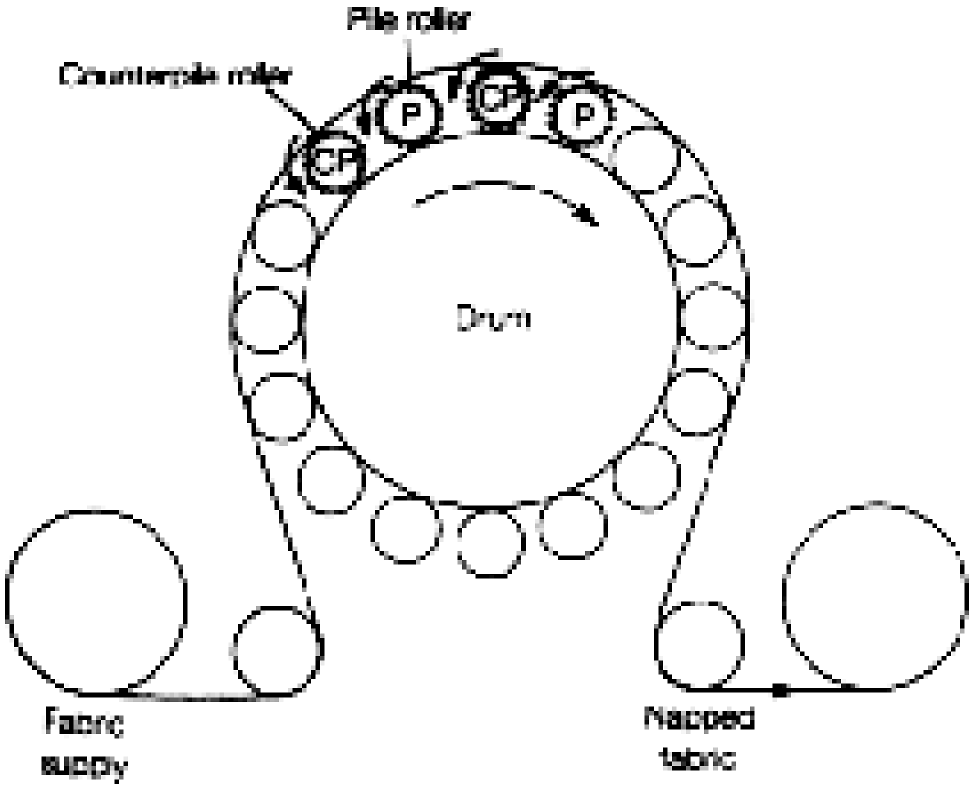
Raised Fabric



Emerized/ Sueded Fabric



Raising Machine



- Both ***pile and counter-pile*** rollers arranged depending on direction of the points in which the wires are bent to fabric direction.
- A typical raising machine is fitted with alternating ***twenty-four rollers, 12 pile and 12 counter pile***.
- Relative speeds of rollers together with that of the cloth govern the raising effect.
- Fabric may require several passes through the machine to obtain the desired effect.

Caution: If the roller peripheral speed is equal to the cloth speed, no raising takes place, and this is the '***no-raise***' condition.

Processing Conditions of Raising

- Variations in ***temperature*** and ***humidity*** conditions can affect the raising effect. Cotton is usually processed in a ***warm, dry condition***.
- If the ***pile*** action is much ***greater*** than the ***counter*** pile, the cloth may tend to cling to the pile rollers. The machine should be reset to a more balanced action.
- Uneven raising should be corrected by ***re-grinding or replacing*** the wire.
- Streaky or patchy raising may be due to traces of ***finishing agents***.

Processing Conditions of Raising

The raising effect is assessed by its influence on properties such as:

(1) tensile strength;

(2) abrasion resistance;

(3) air permeability;

(4) thickness;

(5) thermal insulation;

(6) flammability and surface flash (cellulosics).

Shrinkage

- The term '*shrinkage*' can simply be defined as a change in the dimensions (*width/length*) of a fabric or garment.
- The shrinkage, which can occur in fabrics and garments usually results from a *relaxation* of the stresses and strains created in various process.
- *Woven fabrics are much more stable than knitted fabrics* and do not react to stresses as severely.

TYPES of SHRINKAGE

- *Construction shrinkage – During Weaving/ Knitting*
- *Processing shrinkage – During Wet Processing*
- *Elastic Shrinkage – When Fabric Allowed to Relax*
- *Drying Shrinkage – Deswelling during drying operations*

Width Control

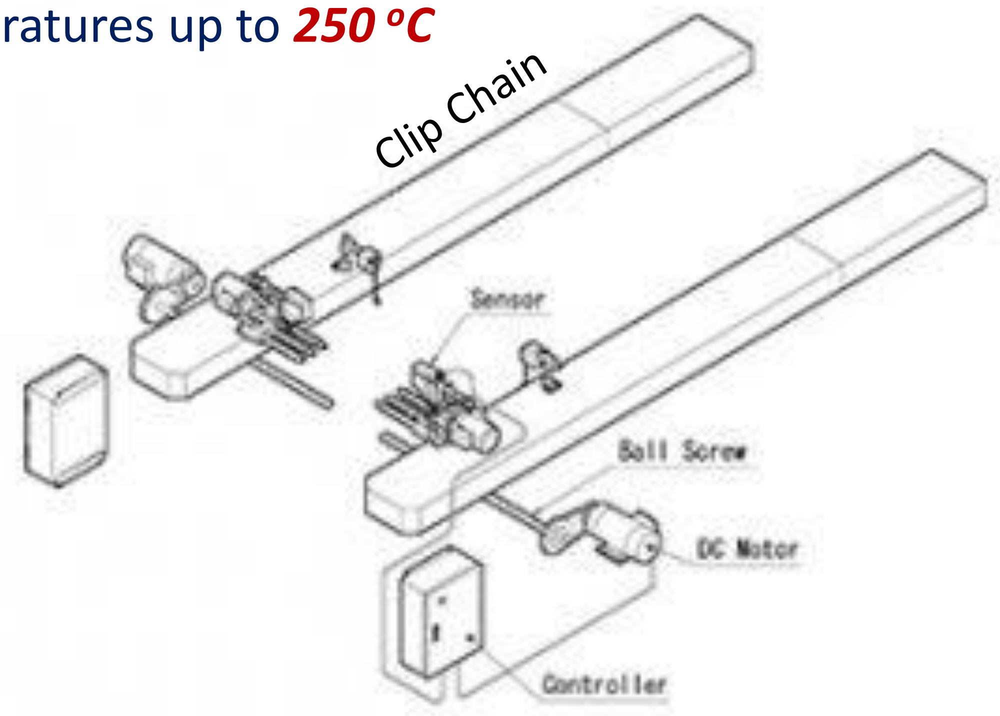
Stenter is the only ***drying*** machine that provides adjustment and setting of ***fabric width*** during drying.

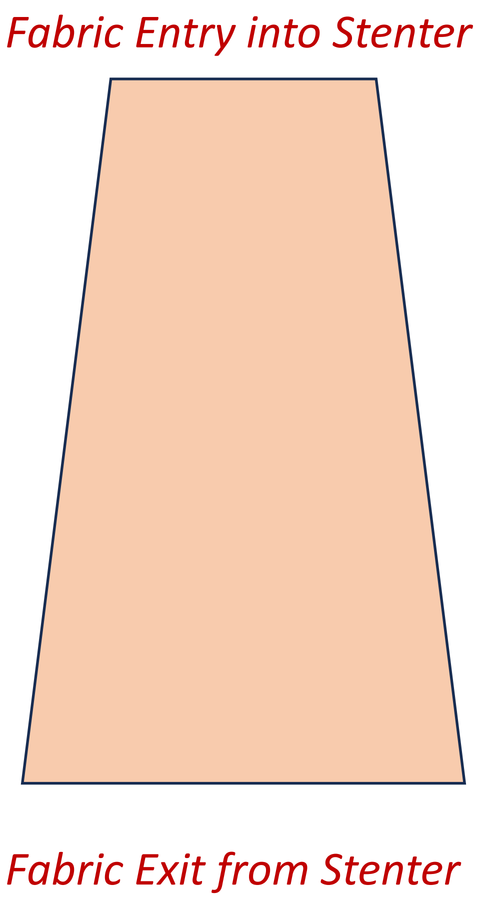
Other functions

1. ***Heat setting*** of fabrics made of synthetic fibres and blends.
2. ***Applying and fixation*** of several finishing agents.
3. Imparting a particular mechanical finish affecting appearance and feel, commonly known as ***stenter finish***.

Width Control

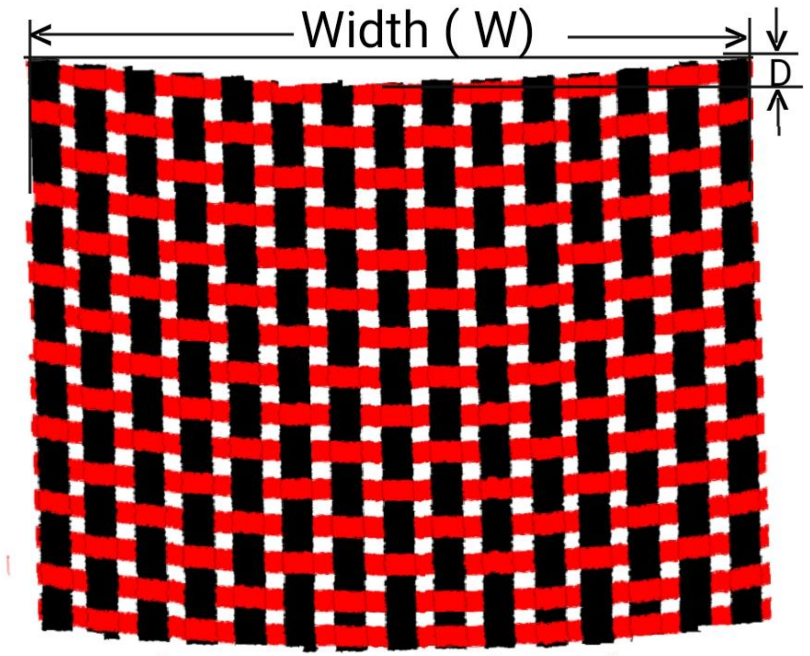
- The speed of stenter ranges from ***10 m/min*** for heavyweight to ***100 m/min*** for lightweight fabrics.
- The actual speed also depends on the particular operation (e.g., drying, heat setting, weft stretching or finishing)
- Temperatures up to ***250 °C***





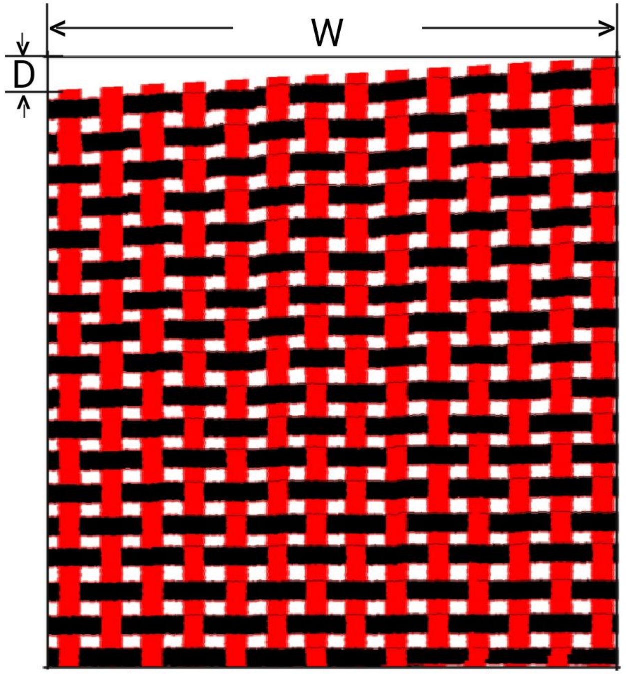
Why we need weft straightening?

Bowing & Skewing are defects which are created when there is a distortion in weft laid across the whole with of the fabric.



(Bowing in the fabric)

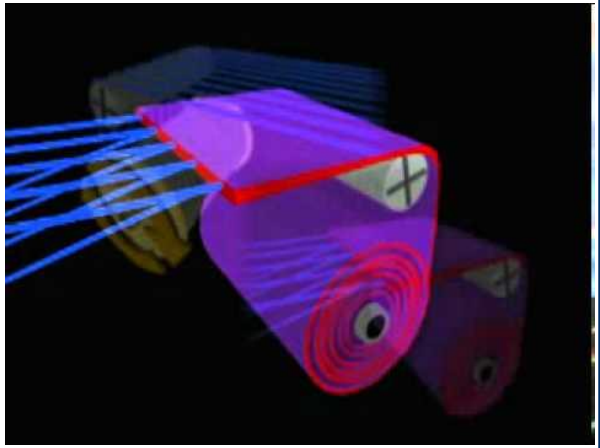
Weft or filling yarns are displaced from a line which needs to be perpendicular to the selvedge.



(Skewing in the fabric)

Weft or filling yarns are distorted means pattern on one side of the fabric

Weft straightening



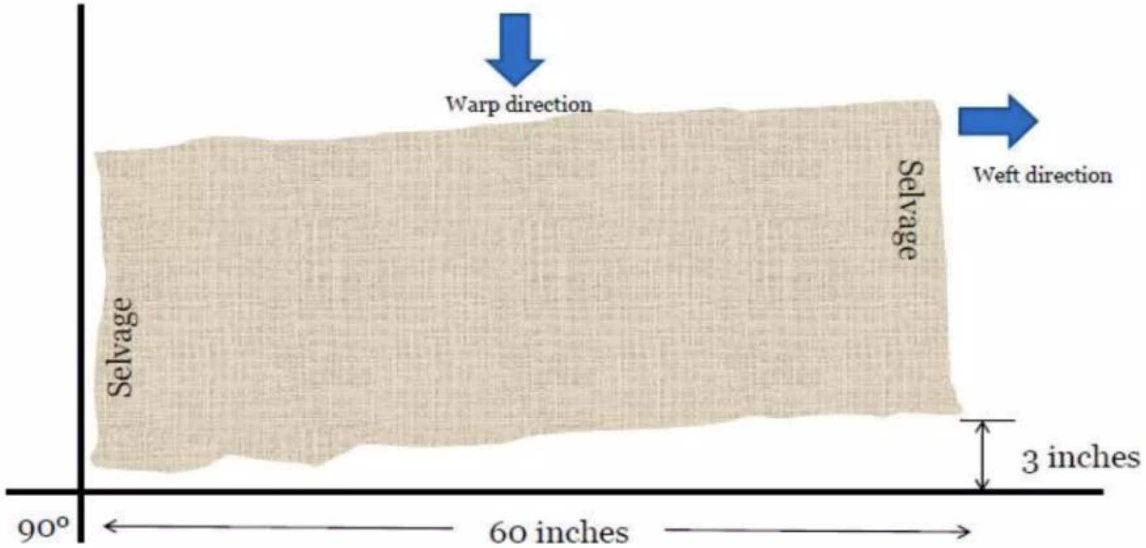
Bowing – Causes:

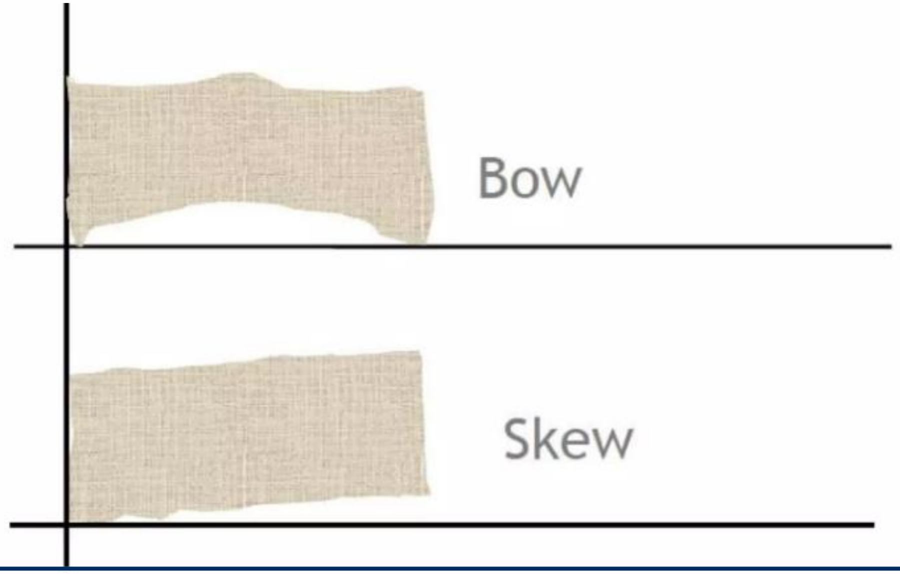
- Bowing of 1” to 1.5” is being generated in the fabric at both selvedges ends due to ***take up action*** when the fabric is being pulled then application of force.
- During all chemical processes fabric has to pass through set of ***rollers*** many times giving rise to bowing.

Skewing – Causes:

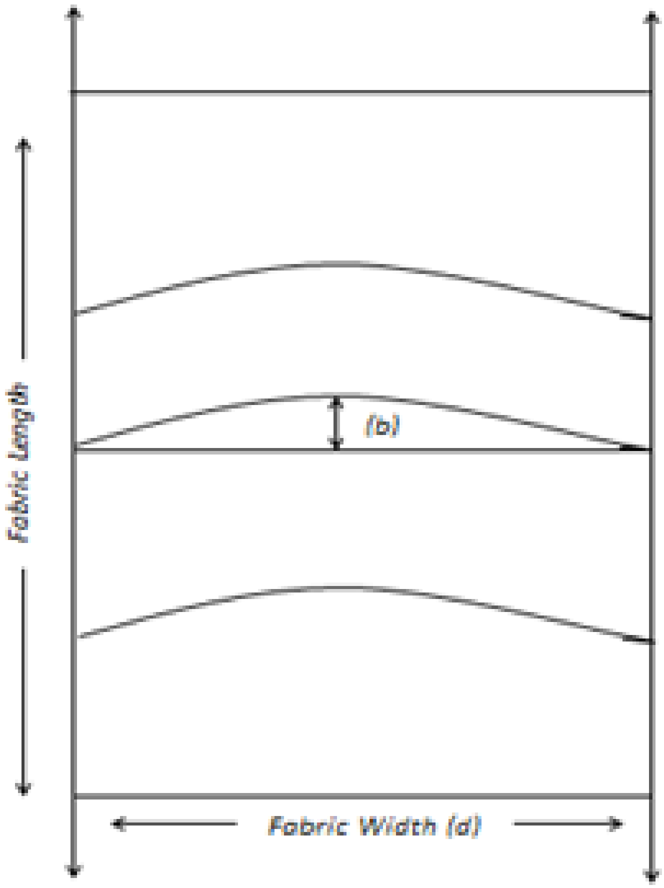
- During weaving or processing both fabric ***selvedge*** being pushed by roller with ***different force*** that cause edge cause the movement of weft pattern.

Weft straightening



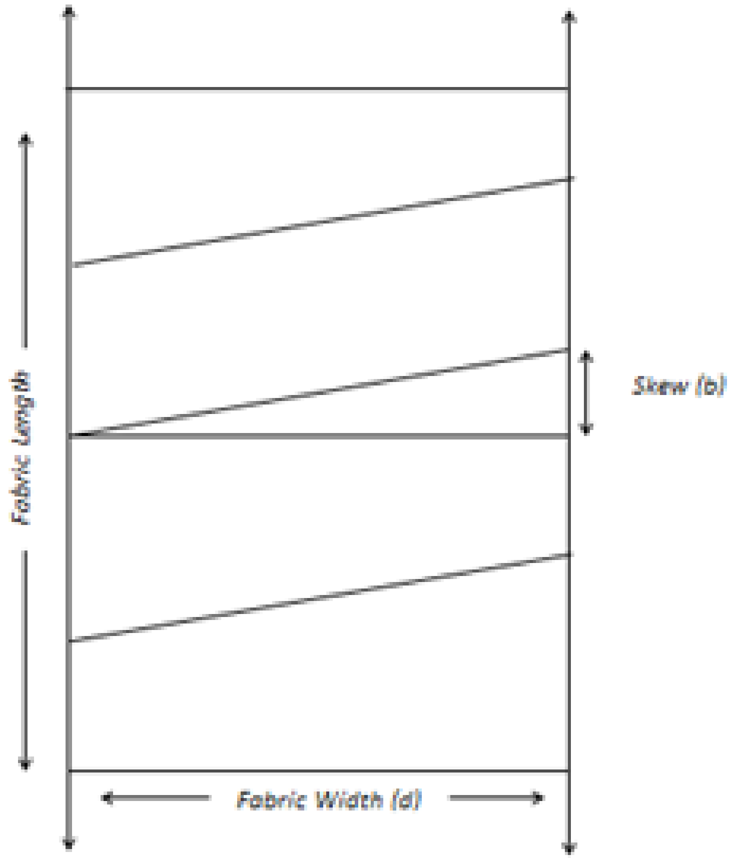


Weft straightening



$$= \frac{b}{d} \times 100$$

Expressed as percentage



We can see length distortion at the center and side of fabric marked as ‘b’ and the total fabric width is being as ‘d’.

Weft straightening

- weft straightener corrects ***diagonal or curved distortions***.
- The mobile frame carrying the rollers begins to ***oscillate horizontally*** to pull from the center to the corresponding edge to correct diagonal distortions.
- The other set of rollers has a ***curved axis*** apply a force which gradually increases from the edges to the center to enable curved distortions to be corrected.

Shrink-Proofing/ Compacting/ Sanforising/ Zero-Zero

- The fabric pre-shrinking machines, popularly known as *zero–zero and Sanforising ranges*.
- Cotton fabric swells and shrinks when the fabric is free from tension as a result of relaxation of intermolecular forces.
- To produce finished fabrics and eliminate length shrinkage the fabric is subjected to '*compressive shrinkage*'.

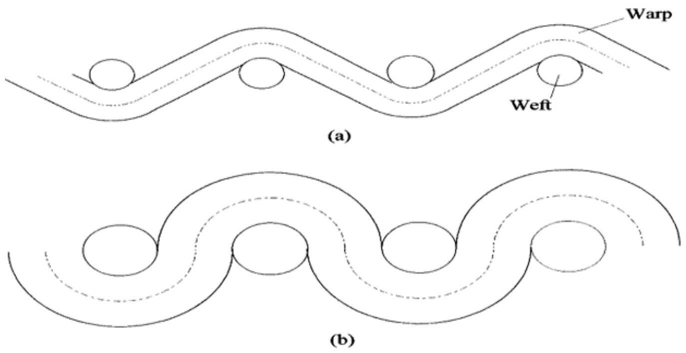
Mr. Sanford L. Cluett

For a cotton fabric, shrinkage relates to the loss of the length and/or width dimensions.

Shrink-Proofing/ Compacting/ Sanforising/ Zero-Zero

- Sanforising imparts ***dimensional stability*** to cotton fabrics.
- Fabric shrinkage is reduced by mechanically forcing the structure of the *fabric to compress upon itself*.

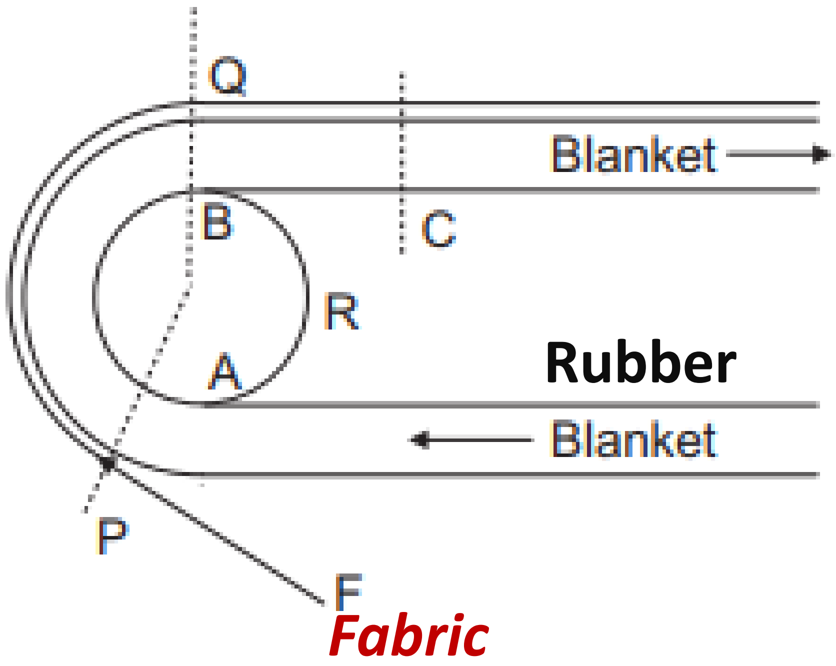
Fibre swells up to 20% when wet



- Sanforising enables residual shrinkage less than 0.75%.
- However, it is important that after preshrinking, the fabric should not be stretched further.

Principle of Preshrinking Machine

- The fabric ***F*** meet the blanket at point **P.**
- Radius of curvature – **PQ > AB**
- The length of the outer surface of the blanket between is greater than inner result in blanket extension. ***P Q > A B***.
- At point **C**, the distance **AB = BC** the outer surface of the blanket will relax and shrink.



"Bending the felt blanket around the guide roller stretches the surface of the felt and increases the circumferential speed correspondingly".

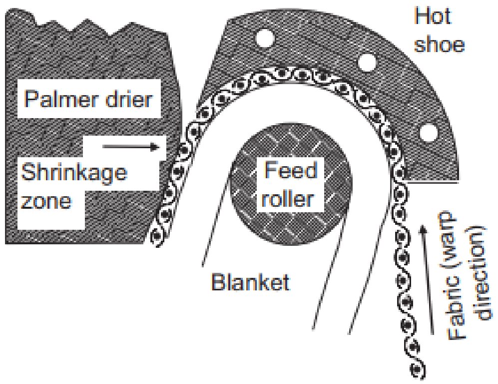
Thickness of Blanket

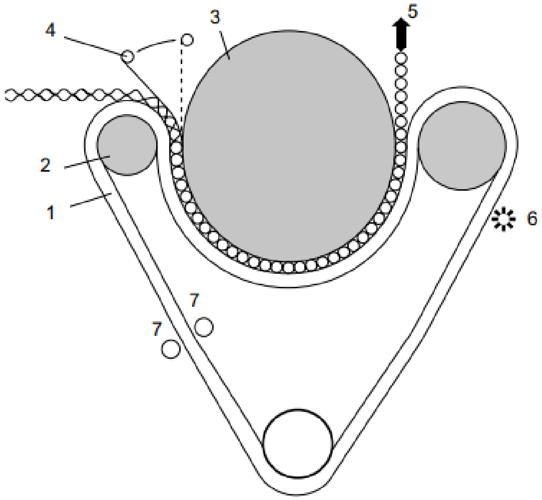
The thickness of the woolen or rubber blanket/felt determines the longitudinal contraction of fabric.

Type of blanket	Thickness (in.)	Use	Contraction possible (in./yard)
Thin	0.275	Bleached shirting	Maximum 3.5
Heavy	0.4	Medium weight fabric	3.5–5.0
Extra-heavy	0.45	Denims	3.9–5.6

Operation of Preshrinking Machine

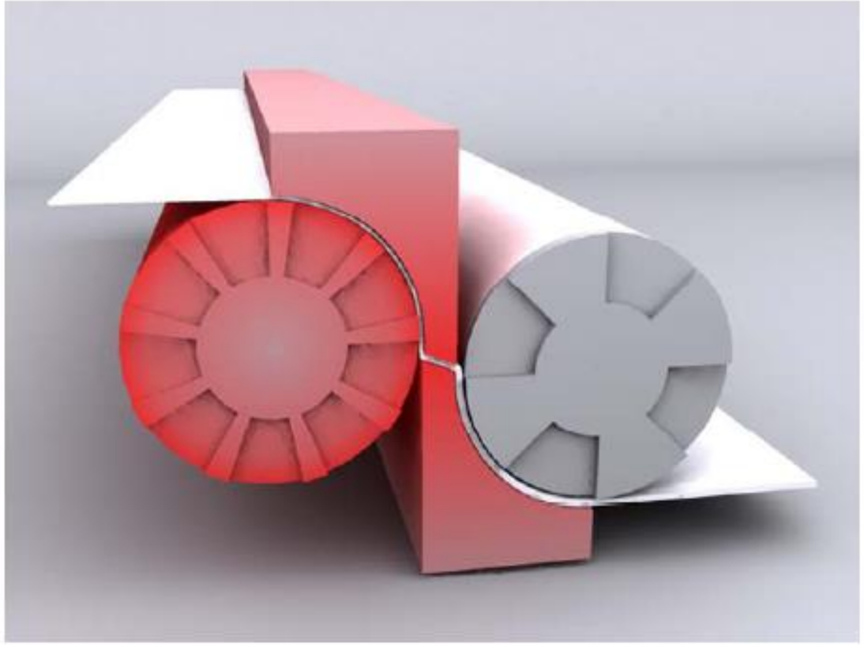
- The fabric is *dampened with steam*
- The width is adjusted by a stretching action with the help of a small stenter
- The fabric is then held firmly against a *heavy woollen blanket*, which is under controlled tension.
- As the tension of the blanket relaxes the fabric shrinks uniformly in length.
- The fabric is then carried around a heated cylinder where it is dried.
- A sample is tested again to assure that residual shrinkage on laundering to be reduced to 0.75% or less.



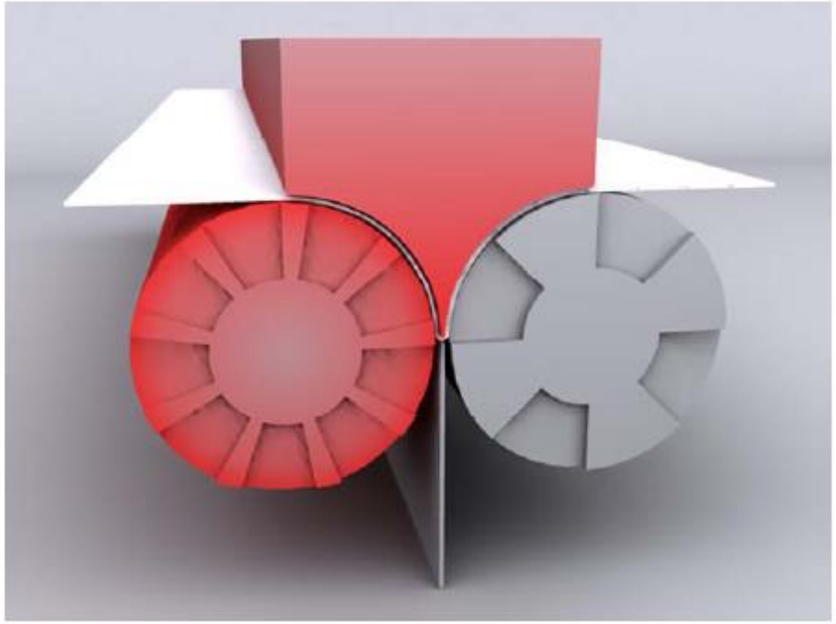


Different types of compactors

Heated Roll and Shoe Compactor

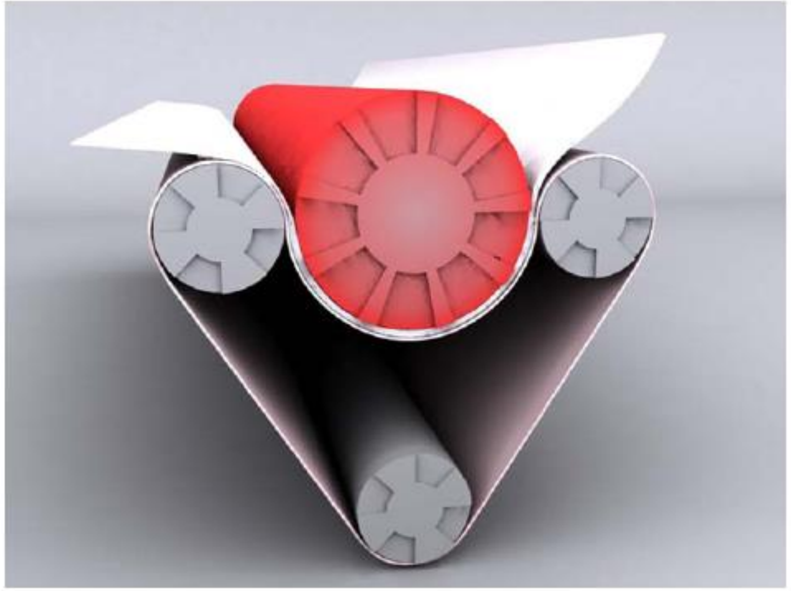


Gull Wing – Blade Compactor

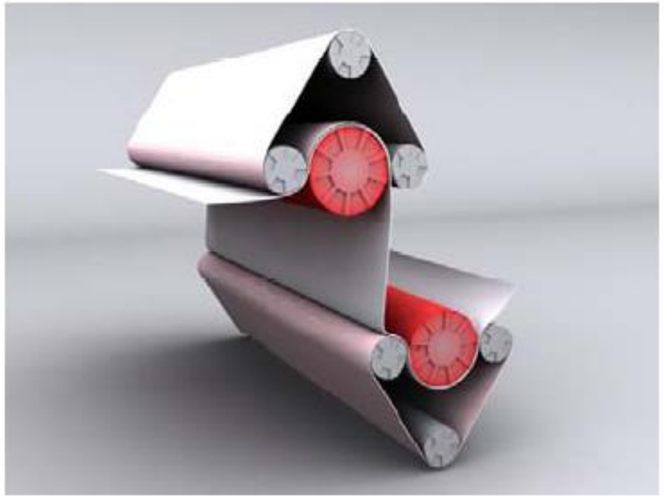


Different types of compactors

Blanket Compactor

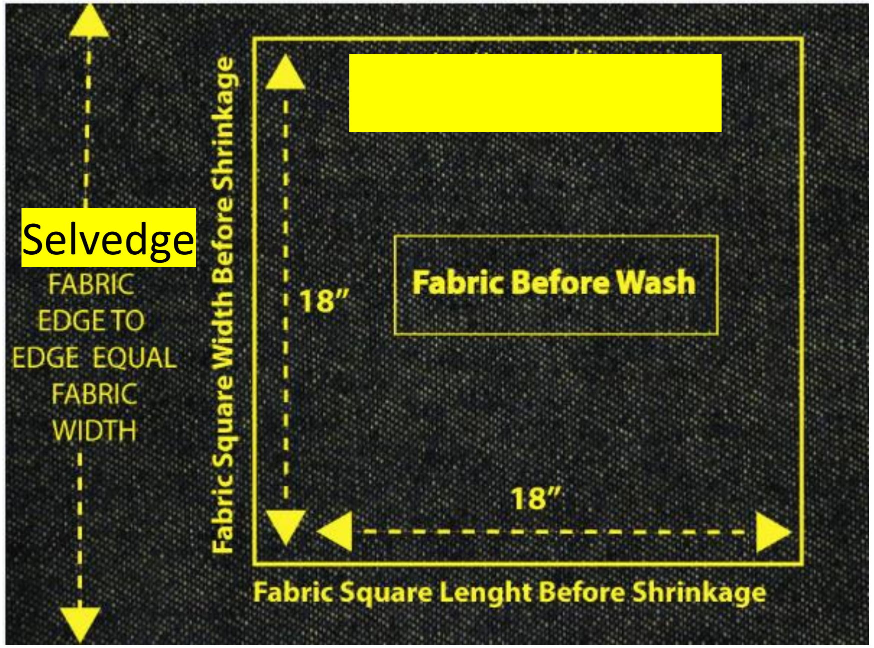


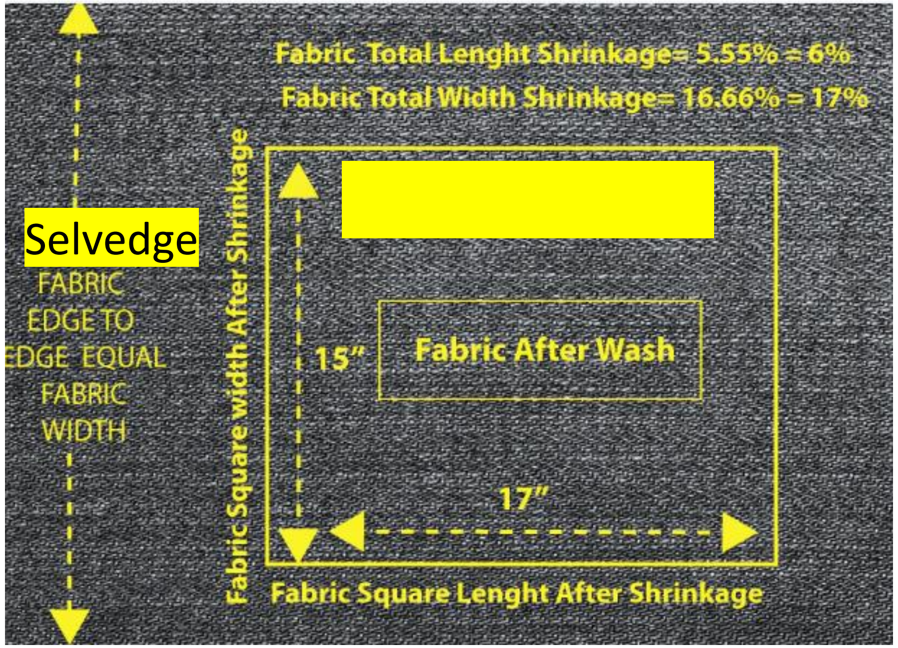
Tamdem Blanket Compactor



Different types of compactors

AATCC 135 and 150, ISO 6330, CAN/CSGB 58 are standards followed.
AATCC 150 – Home laundering





- Shrinkage <2-3% is acceptable and >3% is rejected.

[Width of the square block before shrinking] - [width of the square block after shrinking] / width of the square block before shrinking x 100

Heat Setting

- Synthetic filaments such as *nylon and polyester* are extruded as continuous filaments and drawn to impart strength and stability.
- These fibers are semicrystalline and oriented and *exhibit thermal shrinkage* when they are heated *to temperatures above the glass transition Tg due to increased molecular vibrations.*
- The decrease in length arises mainly from the *relaxation of molecular chains.*
- Drawn but *unset fibres cannot be used* for most textiledue to lack of dimensional stability. An unset polyester filament yam shrinks about *7-10 %* when allowed to relax in boiling water.

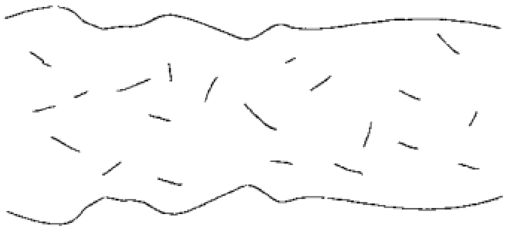


Figure 8-1. Probable disarray of polymer after spinning.

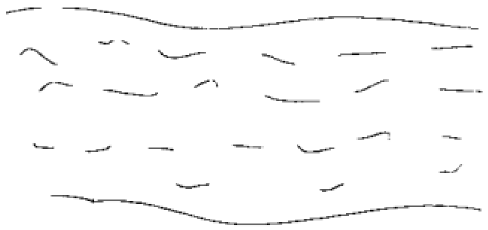
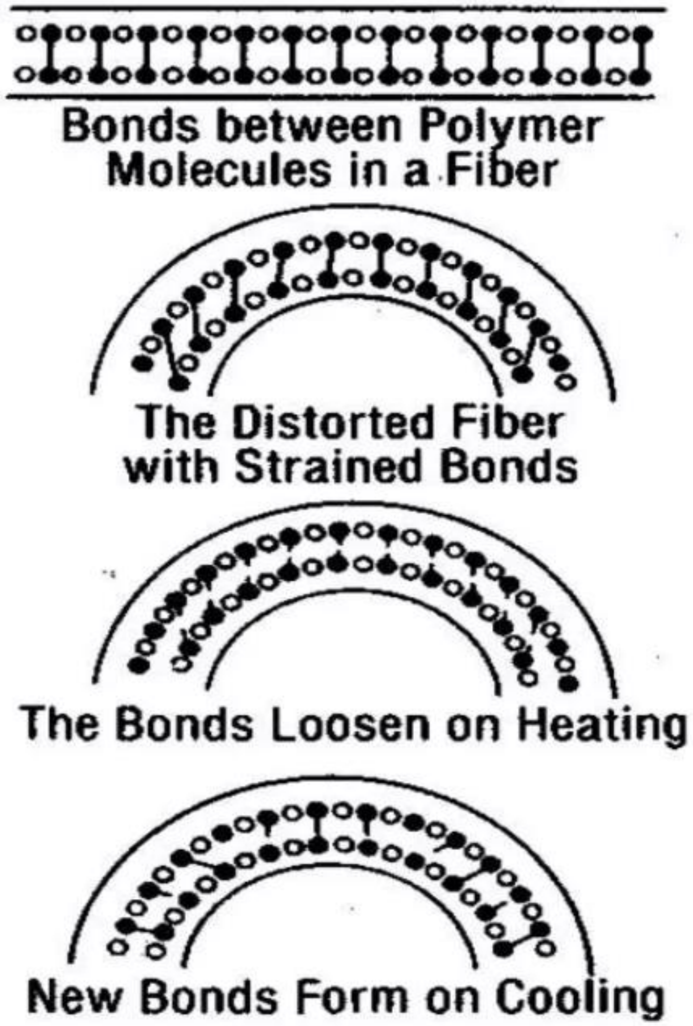


Figure 8-2. Parallel orientation of chain molecules in drawn fibre.

Heat Setting

- Due to strain created in spinning, drawing and twisting process, linkages between the molecular chains or the crystallites are *frozen-in under tension* .
- *Greater freedom for molecular motion* gives the bonds an opportunity to '*snap*' into the *sites of least energy* (sites free from stress) to provide strain relief.
- The higher the temperature the more interchain bond breaks and greater the relaxation.



Heat Setting

- Heat setting can be achieved by the *action of heat* in the absence or presence of swelling agents, with or without tension. *In practice, hot water, saturated vapour or dry heat treatments are used*.
- Heat-setting enables *shape retention, crease resistance, resilience and elasticity* are imparted to the fibres.

The sequence of events that occurs in the thermosetting processes (around 200 ^{o}C)

- *Weakening of intermolecular bonds* and increasing the segmental mobility of structural elements at higher temperatures
- *thermal relaxation*
- *stabilization* of the structure and *re-formation* of bonds at new places on cooling the yarn.

Methods of Heat Setting

- *Contact Heat-Setting* - Fabric is run in contact with a heated metal surface.
- *Steam-Setting* is carried out in an autoclave fitted with vacuum pump, at 125-135 ° C with intermediate evacuation for 60 minutes with saturated steam.
  - Sewing threads, polyester garments, nylon fabrics.
- *Hydro-setting method* - done with hot water in a high temperature liquor circulating machine at about 130°C. A typical cycle may require 30 min.
  - Nylon fabric can be hydro-set in hot water since the swelling action assists in weakening or breaking intermolecular bonds

Methods of Heat Setting

- *Heat-setting using Stenter frame* – Fabric speed ranges from 10-45 m/min with a maximum setting time in the setting zone 30 sec at temperature ranging from *175 to 250 °C* depending upon the thickness and type of the material.
  - Suitable for all kinds of fabricss

- *Infrared Setting -* the absorbed infrared energy 1-4 µm produced by infra-red burners, is redistributed within the structure of the fibre to cause disruption of H-bonds and Van der Waals' forces binding the molecules together amd rearrangement themselves into positions of lowest energy (least stress). Temperatures - *100 -120 °C*.

Effect of Heat Setting in Shinkage

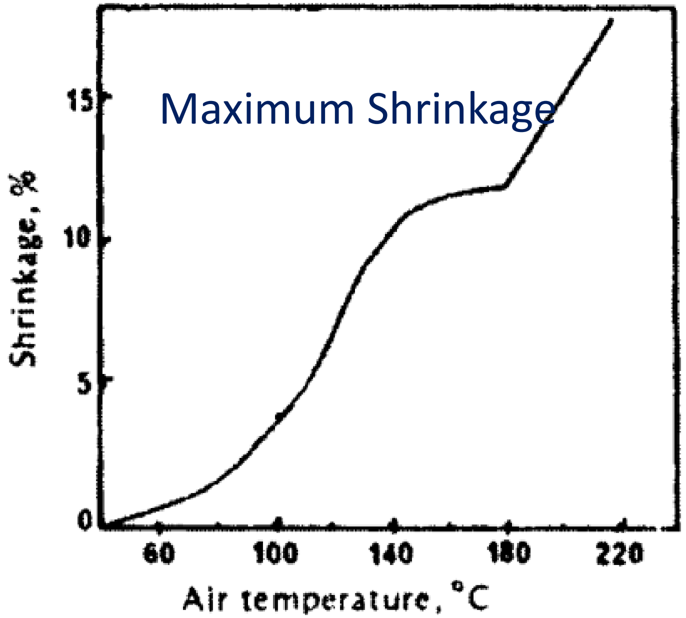


Figure 8-5. Free shrinkage of polyester yarn (medium tenacity), in hot air.

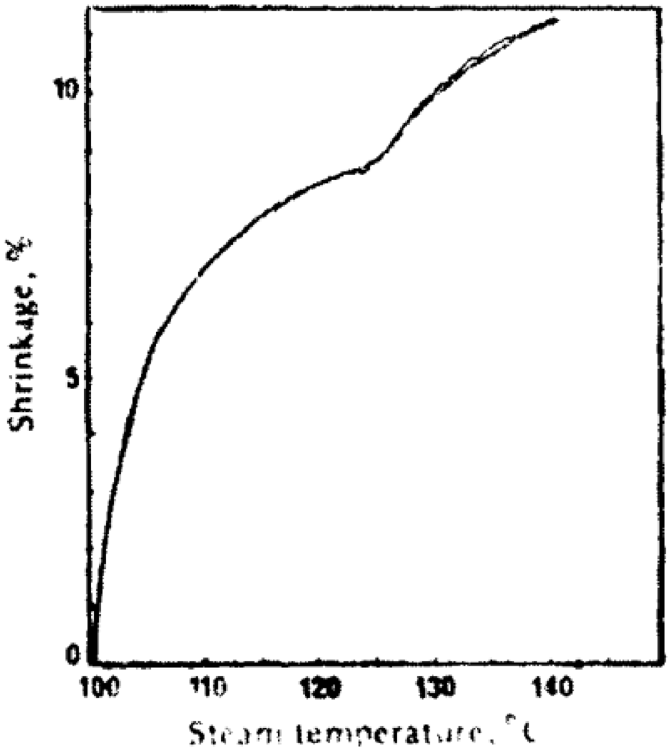


Figure 8-6. Free shrinkage of polyester filament yarn (medium tenacity), in saturated steam.

The higher the temperature to which the yarn or fabric is exposed, the higher the resultant shrinkage over the temperature range of 100-200 ^{o}C

Influence of Heat Setting in Mechanical Properties

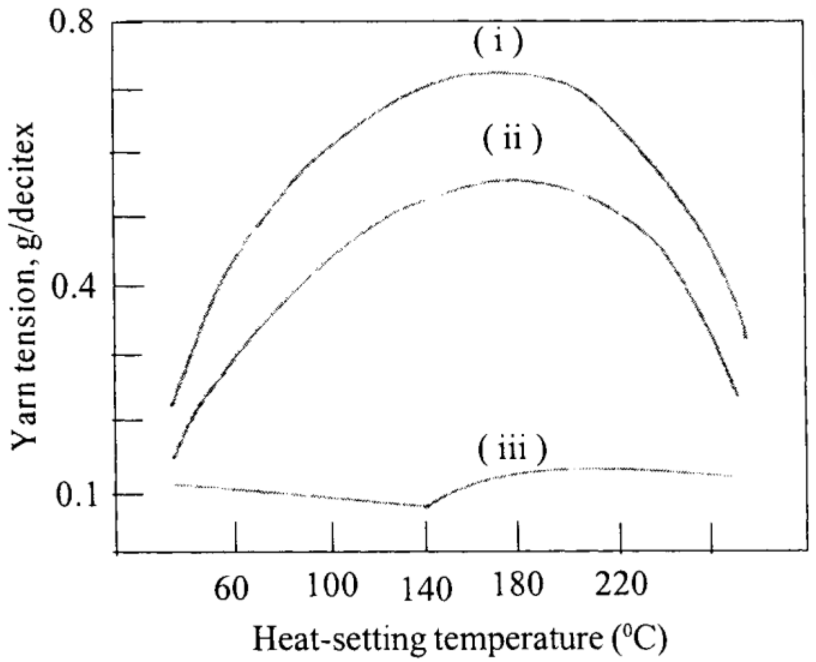
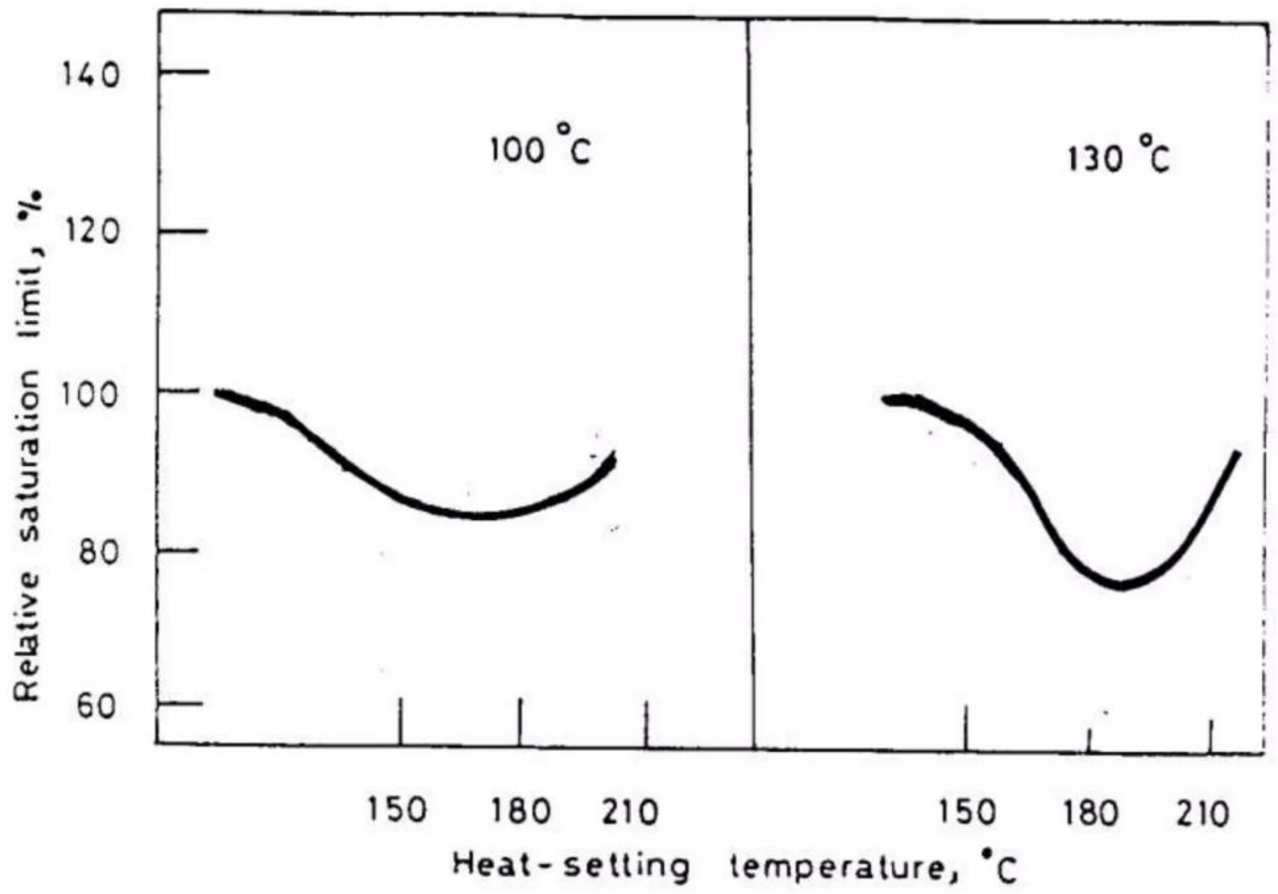


Figure 8-7. Tension produced in heat-setting at constant length. [(i) unset yarn, producer twist, 30 t.p.m.; (ii) unset, thrown, 300 t.p.m.; (iii) steam-set, thrown 300 t.p.m.].

- In general, the tension in the yam at first increases but temperatures over about 180 °C it decreases steeply.
- The shrinkage of unset polyester fabric at 175 °C is about 15% as compared to 1% for the same fabric set at 220 °C

Influence of Heat Setting before dyeing



- The initial decrease in the uptake suggests that new crystals are formed and amorphous volume per crystal decreases.

- In the later stages of crystallisation, the crystallites increase in size and also become more perfect. Thus, at the higher temperature of setting, the amorphous volume per crystal increases.

Heat setting reduces polyester dyeuptake.

Heat set fabrics dye lighter than unset.

Crystallinity Increase

Other effect of heat setting

- ***Stiffening*** is casued due to the formation of continuous film on the fibre surface and high tension developed during setting. The stiffening effect is lost if the fabric is further dyed in loose form.
- ***High setting temperature*** which creates a degree of stiffness in the fabric does not recover well from creasing of dry polyester fabrics.

Other effect of heat setting

Fibre	Min T. °C	Max. T. °C	Time (in seconds)
Polyester (PE)	170	210	15-50
Polyamide PA 6.6	170	210	15-40
Polyamide PA 6	160	180	15-40
Triacetate	160	180	15-40
Acrylic (PAC)	160	180-200	15-40
Elastomers	170	180-200	15-40

Heat Setting

Upto what temperatures that heat set fibres can withstand without shrinking?

- The newly formed bonds are more difficult to break and the fibres are dimensionally stable and will not shrink at approximately 10~ C below the temperature of setting.

Heat Setting

Heat-setting can be carried out at three different stages in a processing sequence
i.e. in *grey condition*; after scouring; after dyeing/finishing.

What may be the problem if done for bleached goods and dyeing operations?

- Yellow colour developed cannot be removed any more by bleaching, handle of the cloth may get altered and there is a risk of colours or optical brighteners be faded somewhat.

After Dyeing

- Sublimation of disperse dyes.
- Post set fabrics show considerable resistance to stripping for colour correction compared with the same dyeing on unset fabric.

Heat Setting

What may be the problem heat setting at grey stage?

- Stains present in grey stage may get fixed
- PVA sizing agents dehydrate and create permanent yellowness. Desizing must be done prior to heat setting.