

**Management of Quality
in Finishing
Part 2: Practical Considerations**

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Define Objectives

It is important to distinguish between

- * Performance Targets
- * Finishing Control Targets

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Performance Targets

Are what the customer demands

- * Fabric weight per unit area
- * Fabric width
- * Maximum shrinkage levels

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Finishing Control Targets

Are what the finisher has to control in order to guarantee performance

- as few as possible
- can be measured on-line

Not necessarily the same properties as the performance targets

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Choice of Control Targets

Shrinkages can not be monitored directly
Weight is difficult to monitor accurately

Practical control targets are

- Fabric Length (course density)
- Fabric Width (wale density)

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Rule One

It is not practical to control all of the performance targets at the same time

Select two fabric properties
- one for length and one for width -
and concentrate on them

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Confirm Shrinkage Targets

Check customer's definition of shrinkage

- Average or maximum
- Line dry or Tumble dry
- Expected level of variation

Control can only be in terms of the average

To know the maximum, we need to know the Standard Deviation

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Tubular or Open Width?

Experience shows that
TUBULAR processing
usually gives a better chance
of hitting finishing targets

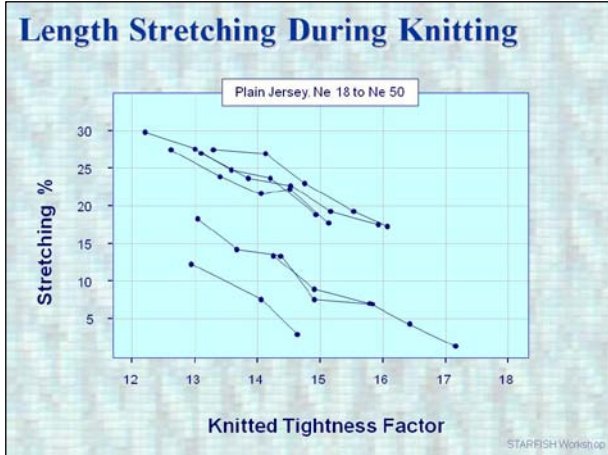
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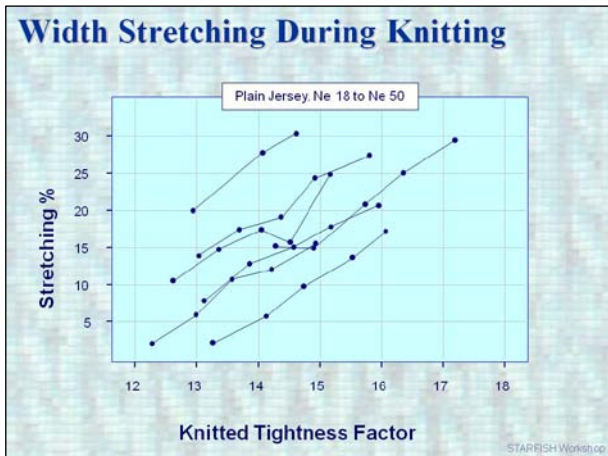
Achieving the Targets

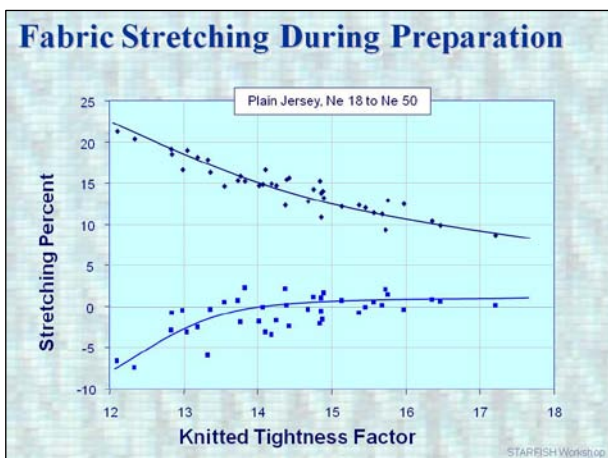
Drying and compacting
is where the
Finished Dimensions are achieved

Machinery and Technique are decisive

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Rule Two

After preparation and dyeing
the fabric will be highly stretched

Therefore
Equalize length and width tensions

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Tubular Wet Spreading



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Tubular Wet Spreading

Width stretched to greater than Target

- plain jersey: 15 – 25%
- 1 x 1 rib : ~ 40%

NB: - not close to a squeeze mangle
- preferably before a relax dryer

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Relax Dryers

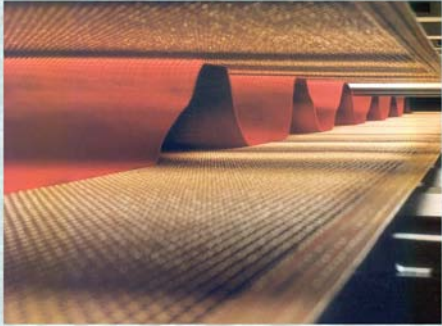
Attempt to imitate tumble drying

- vibrating carriers
- perforated drums
- staggered, opposed air jets

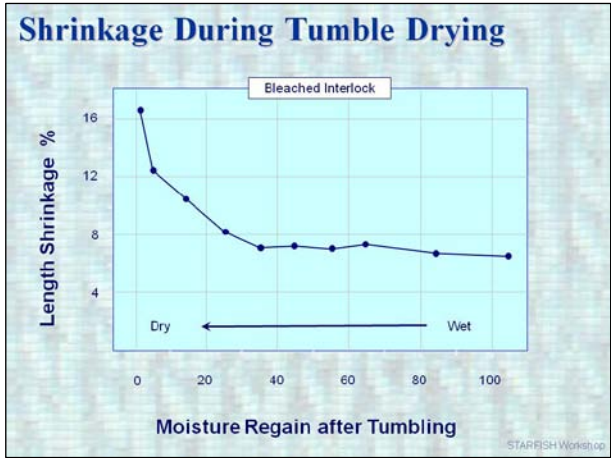
NB: proper overfeed and space between belts

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Relax Dryer Interior



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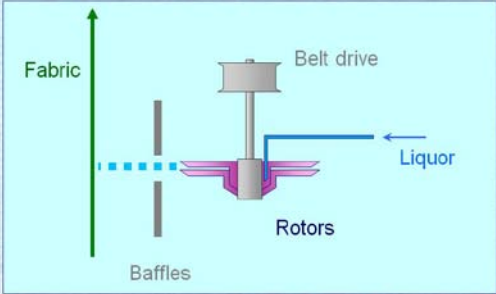
Rule Three

Mechanical action will induce relaxation
only when the fabric contains
less than about 35% moisture

A technique used with very difficult fabrics,
such as brushed fleece, is to spray on 40%
of water directly in front of a relax dryer

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Weko Rotor Spray: Principle



Liquor delivery according to fabric weight and speed

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Weko Rotor Spray: Implementation



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Consolidation

Tumble drying can cause an increase in fabric THICKNESS of up to 40%

Low-shrink fabrics must have maximum thickness

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Rule Four

Develop and Maintain Fabric Thickness

Effect of calenders is to reduce thickness and increase length

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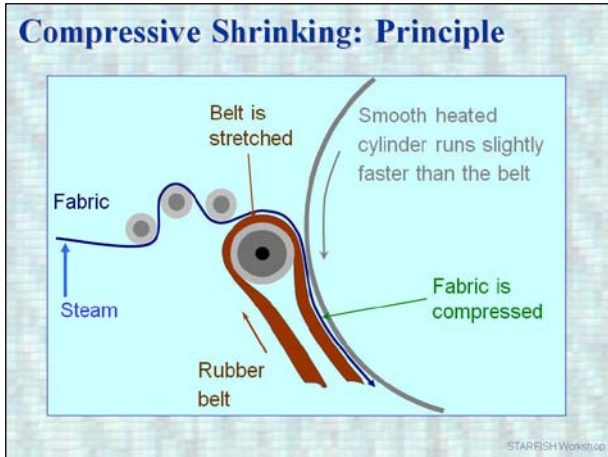
Compressive Shrinking

Compacting forcibly reduces fabric length

- * rubber belts
- * felt blankets
- * polished steel shoe

Moisture and frictional conditions are important

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Steam Condensation: Theory

Specific heat of dry cellulose ~ 0.3
Latent heat of steam 540 Cal /g

Heating 100 g of cotton from 20 to 100 °C
takes $100 * 0.3 * 80 / 540 = 4.4\text{g steam}$

If the cotton contains 7% moisture, then
a further 1g of steam is condensed

Steam Condensation: Examples

Fabric starting condition		After steaming
Temp °C	Moisture %	Moisture %
20	7	12.4
50	2	4.5

Optimum moisture content for compacting
is 10 to 15 %

Rule Five

**Steam will NOT condense
on a hot, dry fabric**

Fabric must be cool
and have uniform moisture content
before the calender or compactor

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Limitations of Compacting

Can change surface appearance

- polishing
- apparent colour depth
- surface irregularities

Does not develop proper consolidation

- easily pulled out

Problems are most apparent at
high levels of compaction

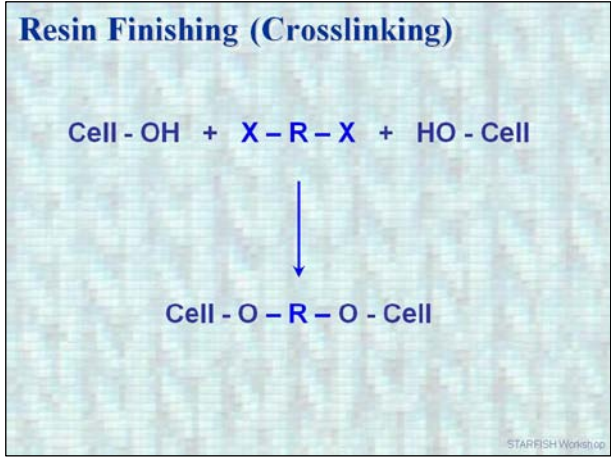
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Rule Six

**COMPACTORS
should be used to give only
small amounts of
compressive shrinking**

Their primary function is
to deliver a precisely controlled
density of courses

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Effect of Resin Finish

On Reference Dimensions

- * Usually significantly longer
- * Usually slightly wider
- * Usually lighter

- lower shrinkage at target weight
- slightly lower spirality

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Resin Finishing: Advantages

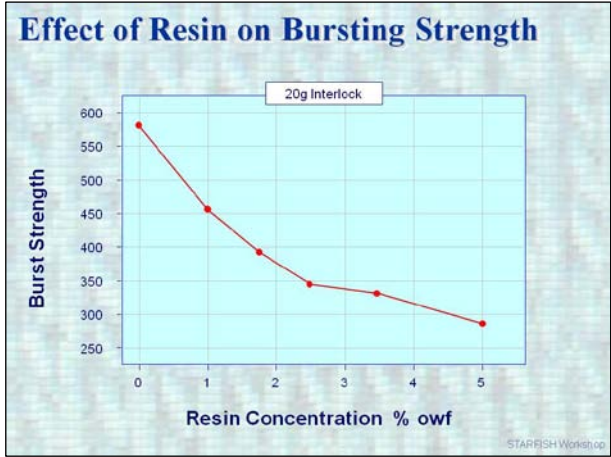
- * Lower shrinkage at the same weight
- * Slightly lower spirality
- * Better appearance retention
- * Better easy care performance

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Resin Finishing: Problems

- * Change in Reference Dimensions
- * Effect on colour and handle
- * Free formaldehyde emission
- * Strength and abrasion resistance
- * Stitching damage and dusting

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Rule Seven

**Resin Finishing
needs considerable expertise**

**It should be avoided
if at all possible**

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On-line Measurements

- * Moisture content at dryers
- * Weight at stenters / compactors
- * Course density at stenters / compactors

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Moisture Content

For optimum drying cost and to ensure cool fabric for compacting

- control moisture at 8 – 10%

To develop maximum shrinkage and consolidation in relax dryers

- control moisture at 2 – 4%

Moisture meters must be very carefully calibrated

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Fabric Weight

Monitoring weight for on-line process control is useful only if ...

- ... moisture content and course density and width are also monitored ...
- ... and included in the control software.

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Course Density

On-line monitoring of course density
with feedback control for the overfeed ...

... is the only way to guarantee delivery
of the target fabric length

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On-line Control of Course Density



Automation Partners

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On-line Control of Course Density



Mahlo Strandberg

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Rule Eight

Variations in fabric weight and shrinkage due to ...

- variations in grey yarn count
- differences in process weight loss
- almost all other random effects

... are minimized by delivering the fabric with constant width and course density

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