Management of Quality in Knitting

Part 1: Fabric Appearance & Knitting Efficiency

Fabric Appearance

is influenced by

- Fibre Quality
- Yarn Type
- Count Variation & Evenness
- Imperfections & Faults
- Twist Variation
- Hairiness

Fibre Properties

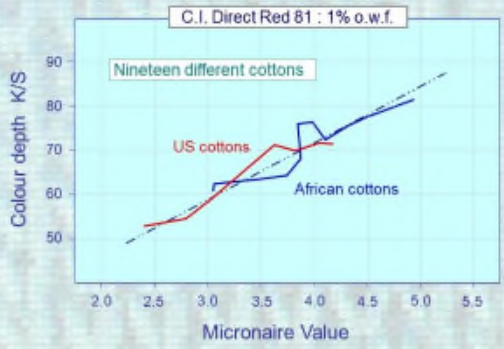
The two most important are

- Fibre Fineness
  - average linear density
- Fibre Maturity
  - relative degree of thickening of the fibre wall

Micronaire Value

- is a function of Fineness and Maturity
- indicates fibre specific surface area
- is governed by
  - Fibre Perimeter (surface area)
  - Cell Wall Thickness (amount of cellulose)
- indicates dyeing performance

Micronaire & Dyeing Efficiency



Barré in Weft Knitted Fabrics

due to variation in Micronaire

Source: Uster® Technologies AG

Effect of Micronaire

Fibre Micronaire affects

- Colour Yield
- Cost of Dyeing
- Uniformity of Dyeing

NEVER MIX YARN DELIVERIES

Yarn Count Variation

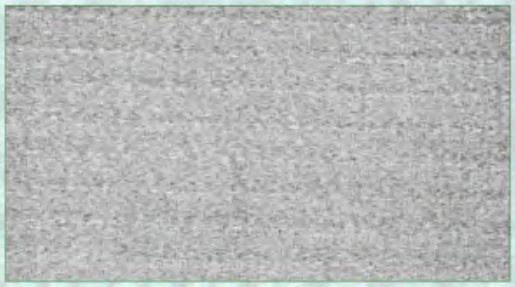
within and between packages, can cause

- Stripes
- Bars
- Streakiness

across the fabric width

Variation Within Packages

Variation Between Packages



USTER® World Statistics 2007

Count Variation CVc_b% : Ne 30
between bobbin variation

	50%	25%
combed ring	~1.5	~1.1
carded ring	~1.6	~1.2
carded rotor	~1.2	~0.9

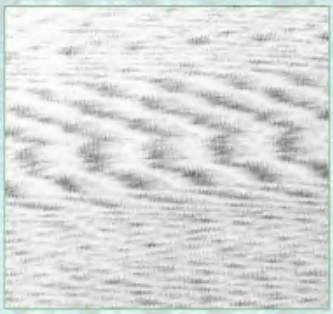
ISO 2060

Mass Variation (Yarn Irregularity)

within package variation causes

- all-over effects
- moiré effects
- cloudiness

Periodic Mass Variation



USTER® World Statistics 2007

Mass Variation CVm% : Ne 30
measured on bobbins

	50%	25%
combed ring	~12.3	~11.4
carded ring	~15.2	~14.3
carded rotor	~14.9	~13.8

CV% = 1.25 x U% (approx)

Yarn Imperfections

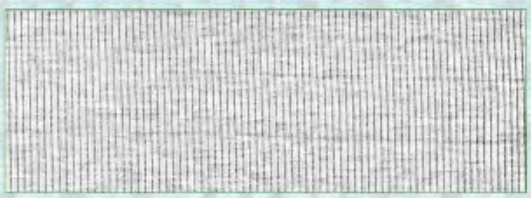
are defined as

- Thin places (-50%)
- Thick places (+50%)
- Neps (+200%)

can cause

- Blemishes on fabric surface
- White specks in dyed fabrics

Thin Places



Thick Places

Source: Uster® Technologies AG

Fibre Nep

Source: Uster® Technologies AG

Seed Coat Nep

Source: Uster® Technologies AG

Biological Nep

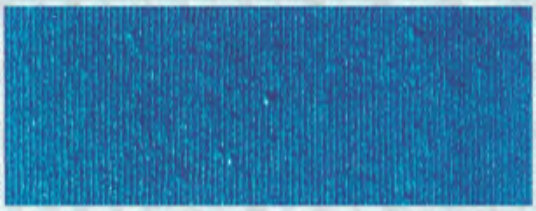
Undyed white specs caused by
clumps of immature (dead) cotton fibres

Low magnification

High magnification

Source: Uster® Technologies AG

Neps



Source: Uster® Technologies AG

USTER® World Statistics 2007

Imperfections : Ne 30 (50% level)
measured on bobbins

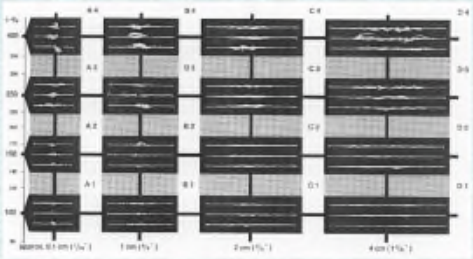
	Thin	Thick	Neps
combed ring	~0.9	~20.3	~36.7
carded ring	~11.9	~191	~232.8
carded rotor	~28.5	~116.2	~30.4

NB For Rotor Yarns Neps +280%

Source: Uster® Technologies AG

Classimat Defects

are classified according to length & diameter



Source: Uster® Technologies AG

Classimat Defects

Exceptionally long thick and thin places cause

- Periodic stripes
- Blemishes
- Needle damage
  - holes
  - needle lines

Classimat Defects

Classimat defects are removed during

winding & clearing

according to a clearing profile

A3, B3, C2, D1 profile

will remove the most serious faults

Hairiness and Twist

Variation is the problem

- Surface appearance
- Abrasion resistance
- Colour variation
- Stitch clarity

Effect of Difference in Twist

Band of "rogue" yarns with high twist

Source: Uster® Technologies AG

USTER® World Statistics 2007

Hairiness : Ne 30
measured on bobbins

	50%		25%	
	H	S_H	H	S_H
combed ring	5.0	1.1	4.6	1.0
carded ring	5.8	1.4	5.0	1.2
carded rotor	4.7	1.3	4.1	1.1

NB measurements on packages may be higher

Source: Uster® Technologies AG

TESTEX Twist Statistics 1997

Twist Variation CV%: Ne 30
measured on bobbins

	50%	25%
combed ring	~3.3	~2.9
carded ring	~3.5	~3.0
carded rotor	~2.8	~2.3

ASTM D -1422 Untwist-Retwist

Source: Testex

Hairiness and Yarn Type

- Combed yarns less hairy than carded
- Rotor yarns less hairy than ring
- Rotor yarns develop less hairiness during wear and laundering

Knitting Efficiency

Can be affected by

- Strength Uniformity
- Irregularity
- Imperfections
- Faults
- Fibre Fly
- Friction
- Twist Liveliness

Strength Uniformity

- Average strength
  is usually good enough
- Variation is the key
  weak places cause the problems
- Elongation must be adequate
  at least 5% extension at break

USTER® World Statistics 20077

Yarn Strength : Ne 30 (50% level)
measured on bobbins

	cN/tex	CV%	El%
combed ring	~17.2	~7.3	~5.1
carded ring	~17.8	~8.0	~5.95
carded rotor	~12.1	~8.7	~5.8

Source: Uster® Technologies AG

Yarn Uniformity

- Slubs and Knots cause
  - Needle damage
  - Fabric holes
  - Yarn breaks
- Yarn should be properly cleared
- Spliced yarn better than knotted

Fibre Fly

Can reduce knitting efficiency

by up to 25%

Control is Important

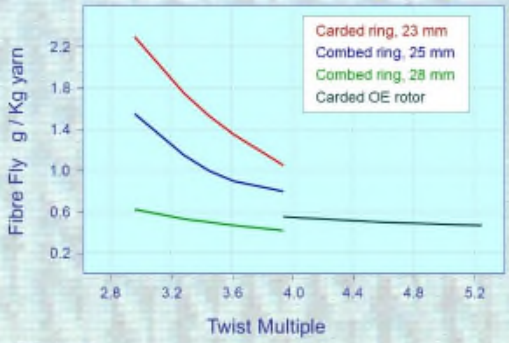
Amount of Fibre Fly

Depends on

- Fibre quality
- Yarn structure
- Twist multiple
- Yarn finishing
- Moisture content
- Yarn friction

and, especially, the speed of knitting

Fibre Fly: Effect of Yarn Construction

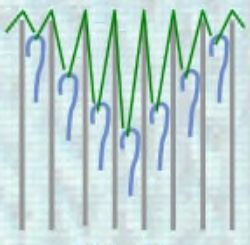


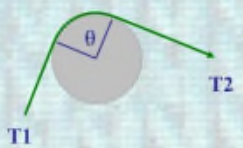
Source: ITV Denkendorf

Yarn Friction

- Large tensions can be generated because of friction
- Low Friction is essential for efficient knitting
- Coefficient of friction against steel must be below 0.2
- Knitting yarns must be waxed

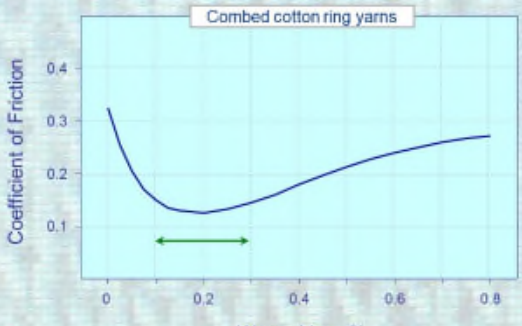
Friction and Yarn Tension





$$T2 = T1 \cdot e^{\mu\theta}$$

Wax Application & Coefficient of Friction



Source: Savio

Yarn Waxing

- Optimum level
- Uniform application
- Wax quality
- Yarn storage
- Easy removal

High Yarn Twist Liveliness Causes

- Snarling
- Fabric Faults
- Yarn Breaks

Good yarn control required

Minimising Knitting Faults

- Yarn Quality
- Machine Set Up
- Fibre Fly
- Machinery Maintenance
- Good Housekeeping

Yarn Quality

- Yarns properly waxed
- Damaged cones
- Yarn storage
  temperature & moisture content
- Yarn identification
  no mixing of yarn lots

Yarn Input Tension

- Should be monitored using appropriate instrumentation

- Excessive tensions can cause
  - stitch distortions
  - fly generation
  - yarn breaks

Yarn Input Tension

Excessive tensions can be caused by

- badly adjusted or sticking stitch cams
- damaged yarn packages
- creeling
- faulty waxing
- faulty feeding units

Fibre Fly

is generated at

- Yarn package
- Yarn guide elements
- Yarn furnishing installation
- Knitting point

25% of all knitting faults can be attributed to fibre fly

Control of Fibre Fly

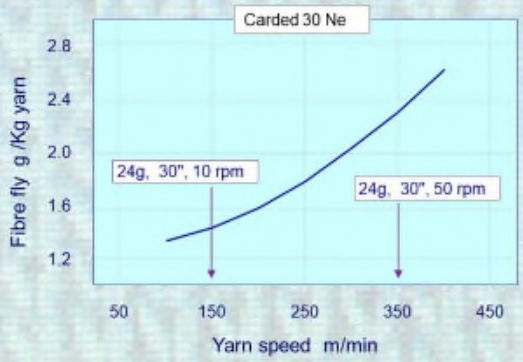
- Enclosed creels
  to humidify and filter air
- Feeder tubes
- Yarn speed
- Regular cleaning

Control of Fibre Fly

Enclosed creel with lint filters and tube feeds

Source: Memminger-IRO

Effect of Yarn Speed on Fibre Fly



Source: ITV Denkendorf

Knitting Faults

- Holes
- Stains
- Missed stitches
- Needle lines
- Sinker lines

Control of Knitting Faults

- Yarn detectors

Memminger-Iro: UFW

Control of Knitting Faults

- Yarn detectors
- Knot & Slub catchers

Memminger-Iro: MPF_L

Control of Knitting Faults

- Yarn detectors
- Knot & Slub catchers
- Needle detectors
- Latch openers

Memminger-Iro: Needle detector

Control of Knitting Faults

- Yarn detectors
- Knot & Slub catchers
- Needle detectors
- Latch openers
- Fabric fault detectors

Memminger-Iro: LMW-3

Record and analyse faults, identify sources e.g. yarn supply or machinery maintenance

Preventive Maintenance

- Regular cleaning of machines
- Clean working areas
- Efficient lubrication systems
- Regular flushing of needle bed
- Checks for wear and rough places
- Service positive feed units