Fabric Appearance

Ideally a fabric's appearance should remain as new throughout its life. In reality this is rarely the case with wearing and cleaning creating temporary and sometimes permanent changes to the fabric surface and appearance.

There are many aspects of fabric appearance that can contribute to a garment's overall value and consumer satisfaction but this paper will focus on four key factors:

1. Cockling/loop distortion in knits
2. Spirality
3. Facing-up
4. Wrinkling/surface smoothness

Other factors include pilling, colour fastness, lustre which are discussed in other papers within this series.

1 Cockling and Loop Distortion of Wool Knitwear

Cockling has been defined as "an irregular surface effect caused by loop distortion". In general it appears as localised groups of distorted knitted loops which have twisted out of the symmetrical configuration. The fault is usually found in the plain knit structure, which is relatively unstable, and especially in yarns spun from animal fibres such as wool or mohair.

Wool knitwear made from worsted yarns is more prone to cockling/loop distortion because, unlike woollen knitwear, no milling is carried out during finishing which helps to conceal faults under a surface fuzz.

There are three types of cockling:-

a) **Rib / plain interface cockling** caused by a difference in the relaxed widths of the two structures

b) **Panel-edge cockling** caused by a difference in the relaxed dimensions of neighbouring structures. Panel edge loops are stretched in length when fashioning takes place and this tends to result in the contraction of the adjacent plain knit fabric, allowing cockling to take place.

b) **Random all-over cockling**. Almost always this can be assigned to using unsuitable yarn. Yarns which cause random all-over loop distortion also tend to cause rib/plain and panel edge cockling as well.

1.1 Factors affecting Cockling / Loop Distortion

The main factors which have been linked to cockling/loop distortion include:

Fibre Diameter
There is a direct relationship between an increase in fibre diameter and increase in loop distortion/cockling.

Method of Dyeing
Package dyeing increases loop distortion/cockling because it creates a 'setting effect' on the
fibre and yarn, making it more rigid and hence resistant to loop formation on knitting.

Yarn Count Regularity
Although yarn count has little effect, yarn count regularity does influence loop distortion/cockling.

Yarn Twist Regularity
Generally accepted that large variations in twist can lead to loop distortion/cockling.

Yarn Rigidity
The more rigid the yarn the greater will be the tendency for loop distortion/cockling. However, the flexural rigidity of a yarn is usually dependent upon the diameter of the fibres.

Yarn Regain
Dry yarns are relatively more rigid and thus more prone to cockling.

Yarn Steaming
Steaming causes setting and increased rigidity particularly in the case of shrink-resist yarns.

Cover Factor
The lower the cover factor, the less stable the resultant fabric, and the greater possibility of loop distortion/cockling.

Fibre Crimp
Inconclusive, but it is believed that the higher the fibre crimp the less the tendency for loop distortion/cockling to occur.

Fibre Length
Little or no direct effect

Yarn Friction
Little or no effect

Top Chlorine / Hercosett Treatment
Although some opinions have been somewhat diverse, it is generally regarded that it has no significant direct effect on the tendency for the occurrence of cockling/loop distortion

1.2 Avoiding cockling / loop distortion

Where possible the above factors should be considered and if feasible:

1. Use a wool with a finer mean fibre diameter
2. Improve the regularity of the yarn
3. Avoid package dyeing – top or piece dye instead
4. Avoid steam setting the yarn on package
5. Use a wool with more crimp

Unfortunately it is not always possible to avoid the potential for cockling and thus some remedies might need to be employed

a) Anti-Cockle Treatment of the Garment

The treatment should be carried out immediately after knitting, i.e. before relaxation and cockling has begun to take place. Typically the garments are placed in very hot water with little or no agitation to allow the fibre to relax before the yarn starts to relax. Where necessary this process can be more effective if a reducing agent such as sodium metabisulphite is added to the hot water.

b) Decrease the relative tightness of the rib by increasing the number of stitches in the width and doubling on selected needles when transferring the rib to the fully-fashioned machine**.** This will result in a relaxed width closer to that of the plain area.

c) Increase the relative tightness of the plain knit area so that its relaxed width is closer to that of the rib.

2 Facing-up

Facing –up can be defined as the generation of unwanted surface fibres leading to a change in the appearance of the garment. Facing-up is normally associated with knits and wovens, made from worsted yarns, possessing a clean surface. Fabrics and knit made from Woollenspun yarns generally are finished to create a fuzzy or hairy surface and during wear/abrasion the reverse effect is sometimes an issue.
Facing up can occur all over a garment or in localised areas. It is caused by the gradual withdrawal of fibres from the surface layer of yarns (migration) and can in many cases lead to Pilling.

The migration of surface fibres from the body of the fabric to the surface is due to frictional forces applied to the fibres on contact with other surfaces which might also include the same fabric. Consequently facing up tends to occur when surface abrasion forces are high such as during tumble drying.

2.1 Factors affecting Facing Up

The tendency to facing up depends on several factors, very similar to those associated with pilling, and include:

Fibre length
Short or broken fibres are less well anchored in the yarn structure and migrate more easily

Fibre diameter
Finer fibres tend to be shorter and thus more likely to migrate

Yarn twist
Low or irregular twist permits fibre migration

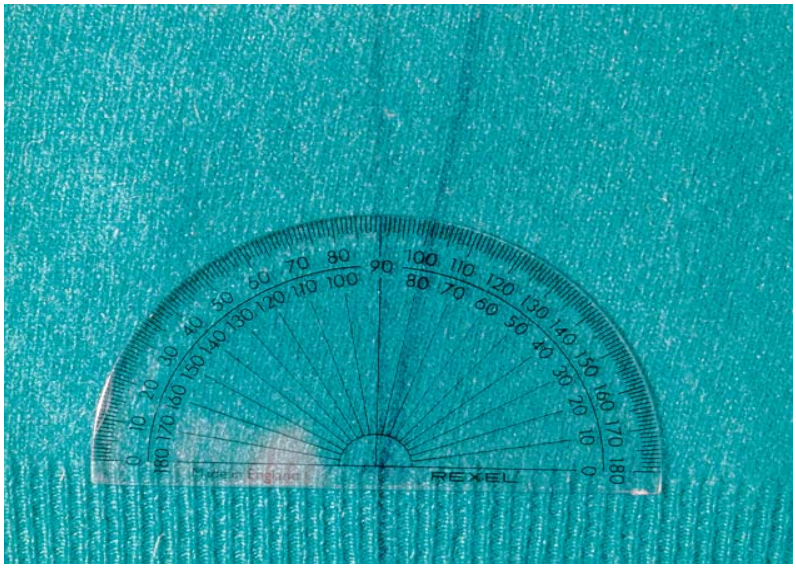
Cover factor
Higher densities increase inter-fibre friction and slow down fibre migration

Fabric Softener
Too much softener reduces inter -fibre friction and permits fibre migration

To avoid the potential for facing up the above factors should be considered in the design of the fabric/garment. If this is not possible then the simplest remedy involves decreasing fibre migration either through applying a polymer which acts as a glue or applying colloidal silica which increases inter-fibre friction. Both these approaches can have a negative effect on softness and are usually applied as a last resort.

3 Spirality

Spirality is a regular deformation (skewing) of the knit structure due to the yarn twisting within the structure, so that the vertical lines of stitches (the wales) are no longer at right angles to the horizontal lines of stitches (the courses).



Spirality in knitwear is caused by using an “unbalanced” yarn ie. a singles yarn or a two fold yarn where the incorrect ratio of singles to folding twist has been used.

When spirality occurs in a fabric there is little or nothing which can be done in finishing to alleviate it and usually the only option is to use replacement yarn having balanced twist. However, sometimes spirality can be prevented by steam setting an unbalanced yarn when knitted in a single bed structure, and also some yarns which cause spirality can usually be knitted in a rib structure, since skewing tendency on the front and back beds should cancel out.

4 Wrinkling / surface smoothness.

The appearance of a woven wool fabric is best assessed from two different perspectives, namely that of the finished fabric itself and the appearance of the garment after making up.

In practice, woven fabrics are inspected (perched) before being rolled and despatched, and in general, most visually detected faults are associated with variations in either yarn tension, yarn count, or weaving density. However, dry finishing processes such as raising, singeing and cropping may also be implicated, as can wet finishing processes such as scouring and setting. Irregular, non parallel patterns, described as “running marks”, may also be observed on occasion and are associated with creases forming during the transport of the wet fabric through the machines.

The setting procedures used during finishing have the most impact in terms of the appearance of the fabric. Woven fabric setting has the same function as in the anti-cockle treatment used in knitwear in that it stabilises the fabric in a flat configuration, effectively neutralising the stresses and strains imparted to the yarns during both spinning and weaving. Setting is achieved by steaming the fabric under specified conditions, although under certain circumstances boiling water and/or a reducing agent may be used to enhance the effect still further.

Before fabrics are submitted for making up they are assessed in terms of their likely performance. This invariably involves fabric swatches being steamed to assess the potential for shrinkage i.e. relaxation shrinkage. If the fabric has been inadequately set during finishing the fabric surface may deteriorate. This can be particularly apparent where high twist yarns have been used i.e. crepe fabric, and is often accompanied by significant levels of shrinkage. Similarly, Lycra containing fabrics which have not been set at a sufficiently high temperature may relax to produce a fabric which resembles the surface of an orange.

During steaming creases may form which were not visible when the fabric was inspected, and depending on the conditions under which they were formed the creases may be ‘permanent’. Although these unwanted creases may be removed by pressing, they will invariably re-occur in the finished garment at some stage.

5 Assessment of Fabric Performance

The modern garment making process is very sophisticated and flexible, but the final appearance of the garment, and its performance in wear, will depend on how the fabric performs during making up, or more specifically, its tailorability. A system has been developed by CSIRO (**FAST**-Fabric Assurance by Simple Testing) which allows those properties which impact upon the making up performance to be quantitatively determined, and predictions made concerning those elements which would require specific care and attention during making up.

Aside from the appearance of the garment after making up, there are numerous factors which relate to its performance during wear, but chief amongst these is the issue of wrinkling and creasing, The performance of wool in this respect is superior to other natural fibres, due to its inherent ability to shed creases when the garment is hung up. There is no doubt that the progressive move towards lighter weight fabrics does tend to exacerbate creasing/wrinkling, but significant improvements may be achieved via different fabric structures and/or blending, with particularly good results in the latter respect being achieved with Lycra.

6 References

JS Haigh, Wool Science Review No 64