

Processing of weft-stretch spandex woven fabrics

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Fabrics containing Spandex elastane yarn require careful control of processing conditions to preserve the intrinsic elastic properties of the fibre while obtaining the required fabric characteristics. These dyeing and finishing conditions should be chosen with care because the performance of Spandex elastane can be changed by prolonged hot/wet treatments, certain chemicals excessive tension and high temperature. It is, therefore, necessary to be fully aware of the physical changes required to develop the desired weight, width, stability and stretch.^[1]

As compared with ordinary 100% cotton fabric, the width of weft-stretch SPANDEX fabric should be shrunk in the weft direction during the processing and therefore it is recommended to carry out the processing of fabric properly after

grasping the relationship among the three, namely, grey fabric width, finishing width and weft stretchability (generally, about 20%-30% shrinkage in the weft direction).^[3,4]

Tension, temperature, the concentration of process chemicals and the duration of treatments must be kept to a minimum because they affect the elastic properties and the appearance of the finished goods. In particular, the tension must be kept to a minimum during those steps which are carried out at an elevated temperature, i.e. relaxation, hot wet processing, drying and curing. Although the use of high temperatures and tensions does not degrade Spandex, fabrics containing it lose some power/stretch when they are hot-stretched and this loses cannot be recovered.^[2]

Chemical Resistance

Fabrics containing Spandex are sensitive to unsaturated oils, greases, fatty acids and their derivatives, which tend to discolour and degrade elastane yarns. Such compounds sometimes serve as lubricants for hard fibres and they vary from one yarn producer to another. Pine oil, used in printing, cutting or boarding, can also affect stretch fabrics. It is essential to make sure that these lubricate, if present, will not discolour or degrade Spandex during the usual course of processing.^[6]

In general, the duration of treatments and the concentration of chemicals applied in the wet process should not exceed the minimum necessary to attain the best performance of the treated goods. The duration and concentration of bleaching baths, the duration and pH of dye baths, the duration of solvent scouring, the treatments which involve caustic soda or acids, the selection of carries for Spandex/polyester dyeing, as well as resin curing catalysts and conditions, need particular attention.^[5]

Process Steps

The selection of a particular processing route depends on the desired appearance, the required performance of the fabric in use and fabric composition. Stretch fabrics include a large variety of



fabrics, each with their particular features, and it is impossible to advise one general process route for all of them [7].

A standard discontinuous process suitable for most stretch fabrics comprises:

- ❖ Relaxation.
- ❖ Scouring.
- ❖ Bleaching/dyeing/printing.
- ❖ Finishing.

The first two steps involve Spandex elastane directly and govern the future performance of the stretch fabric or garment, while the remaining steps must take into account the specific features of Spandex to retain the best benefits. The above standard sequence may not apply to certain woven fabrics. Different procedures also apply to continuous processes.

Relaxation

A grey fabric containing Spandex must be exposed in a relaxed condition to steam, hot water or warm organic solvent before dyeing and finishing. Relaxation of the grey fabric relieves residual stresses caused by the tension of the Spandex yarns during weaving.

These stresses can distort the structure, deform the design, and cause puckering of the fabric. Such effects show up especially in clear faced or regularly patterned woven and knitted fabrics.

The potential shrinkage in the grey fabric should also be removed to obtain an evenly dyed and uniformly finished product.

A stretch fabric is therefore relaxes at an early stage of its finishing by one of the following methods:

- ❖ Passing over a stem table.
- ❖ Steam framing.
- ❖ Solvent scouring.
- ❖ Hot water treatment.

Steam table relaxation is preferred because complete relaxation can be achieved. The time of relaxation will depend upon fabric construction and rate of steam generation.

Steam farming consists of overfeeding a fabric over a steam box fixed at the stenter inlet. The stenter should then only dry the steam relaxed fabric. Combined steam relaxation and heat setting give less uniform results than relaxation and heat-setting in separate steps.

The continuous solvent scouring services to relax and dry clean fabrics at the same time. It provides a good width wise relaxation and a controlled length-wise relaxation of treated fabrics.

Relaxation by hot water occurs when a non-heat-set grey fabric is washed or dyed without stress. This is an efficient way to relax the fabric, but it may leave permanent creases or interfere with the subsequent heat-setting of the relaxed textile. The fully relaxed fabrics are stable for washing.

Care is needed to maintain and control fabric:

- ❖ Elongation.
- ❖ Recovery.
- ❖ Dimensional stability.

Spandex under tension will be set when

- ❖ Given time (cold set).
- ❖ Steamed above 120°C.
- ❖ Processed in water above 100°C.
- ❖ Exposed to dry heat above 180°C.

Advantages

- ❖ Contributes to fabric stability.
- ❖ Better crease resistance.
- ❖ Can achieve wider width/lower weight.

Disadvantage

- ❖ Lower recovery power.
- ❖ Potential and elongation loss and change of handle.

Relaxation

- ❖ Vibrating steam table.
- ❖ Steam framing.
- ❖ Solvent scouring.
- ❖ Tensionless hot washing.

Heat setting and drying

- ❖ Temperature, overfeed and width control.

Dyeing

As appropriate:

- ❖ Beams.
- ❖ Jets.
- ❖ Jigs.
- ❖ Winches.
- ❖ Continuous range.

Shrinking treatment in width

The width shrinking treatment of grey fabric is carried out by using an open soaper. This treatment is necessary to give the fabric a stabilized width by hot



water treatment (80 – 90°C) and a proper elasticity, thereby making the succeeding process go smoothly. This treatment, by using an activator, can serve also as washing and desizing.

Scouring and Bleaching

A continuous desizing, scouring, bleaching range can be used in this context. It is safe to carry out scouring and bleaching by stages, using a tensionless jigger. However, as mentioned before, a treatment by strong alkali or at high temperature and high pressure must be avoided.

Dyeing

Continuous dyeing by using a pad steamer, for example, is possible. Dyeing of cotton or polyester can safely be applied.

Conditions and facilities used for dyeing ordinary polyester/cotton mix woven (disperse/reactive, disperse/vat) can safely be adopted. However, when using a high temperature/high-pressure dyeing machine, attention should be paid to possible damage on SPANDEX. If any damage is found, the use of a carrier is recommended. Using high temperature is not recommended.

Stripping

The Spandex fabrics sometimes need stain removal or stripping, if they are dyed unevenly, too dark or are stained during finishing. The elastane component of the fabric imposes restraints on the selection of suitable stripping agents.

Reducing agents do not degrade "SPANDEX" elastane fiber and are therefore recommended. Alkaline reducing baths are preferred, whenever compatible with the type of "SPANDEX" and the hard fibre in the fabric.

Dye stripping by compounds that release chlorine, such as hypochlorite or chlorite, will weaken and degrade the elastane fibre and therefore unsuitable for the processing.

Some recommended procedures are given below.

1. Color correction or light stain removal.

- ❖ 1 g/l non-ionic surfactant.
- ❖ 1-2 g/l trisodium phosphate.
- ❖ 15-20 minutes at 85°C.

2. Partial stripping or removal of medium stains.

- ❖ 1-3 g/l sodium dithionite (hydrosulfite).
- ❖ 1-2 g/l tri sodium phosphate.
- ❖ 15-20 minutes at 85°C.

3. Alkaline stripping.

- ❖ 5% sodium sulphoxylate formaldehyde.
- ❖ 1% amphoteric dispersing agent.
- ❖ Sodium hydroxide to pH 10-11.

15 minutes at 90-95°C, then soap and rinse the fabric to neutral pH.

4. Acid stripping

- ❖ 1% zinc sulphoxylate formaldehyde
- ❖ 1% amphoteric dispersing agent
- ❖ Adjust bath to pH 5 if needed
- ❖ Treat 15 minutes at 85 °C, then soap and rinse till fabric pH is neutral.
- ❖ A complete color strip, usually followed by redyeing represents extra processing of the stretch fabric which may weaken it and impair its subsequent performance in use.

Finishing

Depending upon the use, resin finish, softening finish and so on are carried out. The finishing also concerns handle, look and dimensions, and can impart special properties to fabrics containing SPANDEX.

It comprises both mechanical and chemical treatments which all require careful control of applied tension, temperature, time and chemicals.

Mechanical finishing

The mechanical finishing includes the steps either before or after dyeing and printing which change the physical features of a fabric. The methods chosen to finish a fabric containing SPANDEX should, in general, involve little or no tension, particularly when the treated fabric is hot.

The joint action of high tension and heat may reset or overset the fabric and cause loss of its final relativity. Low tension allows the best relaxation, improves dimensional stability, and gives a supple handle to the goods.

Fabrics that have been overstretched in processing tend to relax afterwards causing difficulties in cutting, and high or irregular shrinkage of garments.

SPANDEX will withstand without undue damage most of the mechanical finishes applied to rigid textiles, namely;

- ❖ Mangle or spin dry.
- ❖ Dry.
- ❖ Steam relax or shrink.
- ❖ Compressive-shrink.
- ❖ Semidecate or decate.
- ❖ Press or Palmer-press.
- ❖ Raise, send or suede.
- ❖ Crop.
- ❖ Calendar or emboss.

Key rules to follow are "do not stretch hot fabric" and "no tension for long periods".

Drying

Hot air drying, usually on pin stenters with overfeed, removes non-extracted water and establishes the final width and weight of the fabric.

Temperatures should not exceed 110°C when drying stretch fabrics. The time of drying and the resultant speed of fabric passage, will depend on the weight and structure of the fabric, but should not be longer than the minimum needed to dry it.

Heating should be uniform over the entire fabric and over drying must be avoided as it may slightly yellow the fabric. The risk of yellowing is increased when the drying air is heated directly with oil or gas burners.

The same advice also applies to drying required to fix or develop any chemical finishes of fabrics of Spandex.



Chemical finishing

Fabrics containing SPANDEX withstand many chemical treatments or finishes which serve to change or improve their look, surface, handle, performance or properties. SPANDEX is compatible with many.

- ❖ Antistatic.
- ❖ Softeners
- ❖ Water repellents
- ❖ Resin finishes for easy care, when used with organic catalysts
- ❖ Resin finishes to impart body, when used with organic catalysts.
- ❖ Rot-proofing agent.
- ❖ Coating finishing in emulsion.

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