



DIMENSIONAL STABILITY OF SOCKS

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ABSTRACT

This article is self-study of the experience in knitting industry. Ability of a material to maintain its essential or original dimensions while being used for its intended purpose. One of the most important problems in socks manufacturing industry is change in size that affects the dimensions of final product. Dimensional Stability plays important role in the manufacturing of socks for men's, woman's and as well as for children's. Change in dimension play a vital role in achieving the required specifications of a sock. This dimensional change may be in a positive (growth) or negative (shrinkage) direction for fabric length and width. Socks are produced in various parts Make-up, Cuff, Heel, Toe, Body, etc. Socks can be produced on the Circular and Flat knitting machine. Socks and Stocking are knitted because they had to be shaped to the foot or leg. Socks are composed of different kinds of yarn like Cotton, Wool, Polyester, Spandex, Nylon, and Elastic and so on. Today customers are more aware about the quality of every small product in that case they are aware of shrinkage properties of socks from laundering. Knitted socks can lead to deformation after laundering and pressing process. It changes its physical appearance by various methods using. It is found that major shrinkage causes after washing process. This result can help the industry or knitters to predict the dimensional stability of socks. We have taken measurements of socks after every process in 24 hours & 48 hours after boarding relaxation stage. The results obtained in the study indicate that industrial washing; tumble dry, boarding parameters have a significant effect on the dimensional stability of socks. Washing and pressing duration modulate the extent of shrinkage.

Keywords: Socks, Dimension stability, Washing, Measurements

1. INTRODUCTION

Socks are specially weft-knitted garments that can have serious quality problems linked essentially to dimensional stability and comfort. Knitting Socks are found in Egypt 9 centuries ago. Socks and Stocking are knitted because they had to be shaped to the foot or leg. Socks are composed of different kinds of yarn like Cotton, Wool, Polyester, Spandex, Nylon, Elastic and so on.

Socks are produced in various parts Make-up, Cuff, Heel, Toe, Body, etc. Socks can be produced on the Circular and Flat knitting machine. Yarn twist, structure and no. of feeds and also Elongation plays important factor for dimension stability. TPI is more than spirality in yarn is more. Structure having lot of friction point then stability increases they have different behavior in physical properties. Structure contributes in the drapability properties. Socks are subjected to the everyday deformation by its daily usability. Knitted fabrics give the advantage of fit-closely next to skin.

Knitted socks can lead to deformation after laundering and pressing process. It changes its physical appearance by various methods using. Today people are aware and the demand better quality as before. Shrinkage is the major contributor of the changes in the socks dimensions. Measurements of socks after

every process are taken after 24 hours & 48 hours after boarding of relaxation.^[1,2]

1.1 Basic terminology

What is knitting?

Knitting describes the technique of constructing textile structure by forming a continuous length of yarn into column of vertically intermeshed loops.

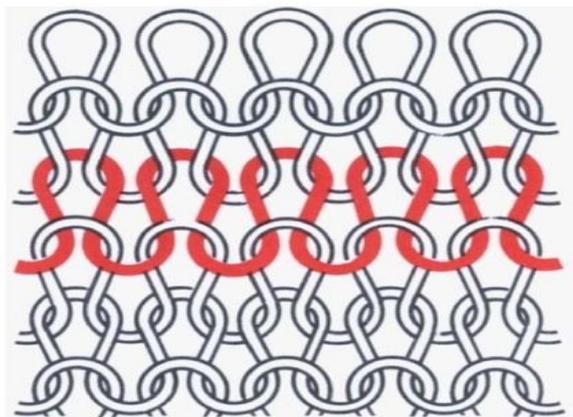


Fig-1: Interloping

What is dimension?

A measurable extent of a particular kind, such as length, width, depth or height. Cut or shape to particular measurements.

What is Dimensional Stability?

Results when a fiber or fabric will neither stretch nor shrink. Relaxation shrinkage is when fibers, when elongated during finishing, pressing and relax to their natural size after washed. Progressive shrinkage means fabrics continue to shrink after each laundering.

2.MATERIAL & METHODS

The yarn packages are placed on the lonati circular knitting machine by operator. Sock comes out by the suction pipe in the collector box place besides. It is measured with measuring scale given on machine. In different types of measurements are taken in flat and stretch measurements. Measurements of socks after every process are taken after 24 hours of relaxation.

Then samples of 20 socks and 10 pairs are send to the linking department where the rosso line is get stitched. Then samples send to the scouring process which works as antibiotics for the material.The socks samples are then send to the washing zone there are various different washing process varies as per construction of yarn in socks.

Cleaning the machine and take water as per socks weight. Check PH of water by its indication or PH stripe & add chemical into water of washing machine as per socks weight for scouring process. Then drain all the water from washing machine, clean machine again and take water as per wt of socks at room temp., check PH of water. Add chemicals in washing machine for washing cycle & after that unload socks from washing machine and load socks in Hydro Extract machine for spinning cycle. And take measurements after this process to know the variability in samples. All chemicals and softners varies per type of socks in this process.^[4]

2.1 Concentration of Chemicals &Temperature of Machine for Crew Half Terry Socks

- Chemical for scouring process Hostapal MRN 0.5% (100 ml)
- Chemicals for washing Silvadur 0.5% (100 ml) & Softener Resiwick Super 2.5% (500 ml) & HPJC 2.5% (500 ml)
- Water level for 20 kg socks is 200 Liter
- PH value range 5-6
- Washing process for 10 min at 70° C (Tolerance ± 2°C)
- Hydro Extract process for 5 min at Room Temp.
- Tumble Dry process for 10 min at 70°C (Tolerance ±2°C)^[3,4]

2.2 Concentration of Chemicals &Temperature of Machine for Low Cut Socks

- Chemicals for washing Sirix as per requirement & Softener Terry Sill WK 3% (600 ml)
- Water level for 20 kg socks is 200 Liter
- PH value range 5-6
- Washing process for 10 min at Room Temp.
- Hydro Extract process for 5 min at Room Temp.
- Tumble Dry process for 7 min at 70°C (Tolerance ±2°C)

Load socks in tumbling machine for drying cycle of samples then unload socks from machine and keep tumble dry socks separately for boarding process before that measure samples for stability check.^[2,3,4]

2.3 Measurements after Knitting

Sock Type: Crew Sock (Half Terry)
 Machine Type: Lonati Circular Knitting Machine
 Needle's: 108Needle
 Welt Type: 1 *1 RIB
 Type of Linking: Rosso

Table.1: Details of Yarn

Part of Sock	Material	Colour
Welt +Leg Gum	10/1.X 2 Poly	White LT 1773 Colour
Heel/Toe + Leg/Foot	10/1. Poly	White LT 1773
Heel & Toe	20/75/2 Spandex	Raw White
Elastic	130/44/2Lycra	R White
Body	20/75/2 Spdx	Raw White
Makeup + Rosso	75/2 Nylon	R White
Linking	33/2	Royal Blue

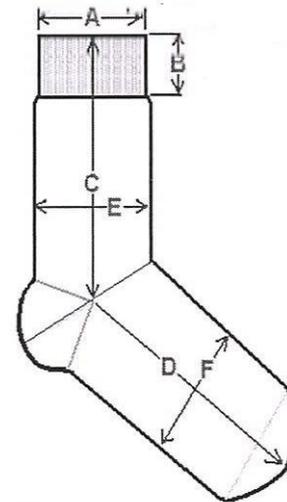


Fig. 2: Type of Measurement

3. RESULTS & DISCUSSION

Table-2:It shows the measurements are given by the customer's and also the measurements which are taken physically after knitting of socks.

Estimated Knitting Dimensional Details								
Samp le No	Flat Measurements				Stretch Measurements			
	Cuff Wid th-A	Cuff+ Leg Gum -B+E	Foot Length ngth	Leg Length ngth	Cuff Width -A	Leg Width -C	Foot Width -D	He el Str etc h
	8.8	2.5+1 7=19. 5	24. 6	24. 5	26	22. 5	22. 5	22. 5
Actual Measurements after knitting								
1.	8.5	18.7	24.	24.	22	22	21	20

			3	5				
2.	8	18.5	24.2	25.6	23	22	21	18
3.	8.5	19	24	23.3	22	23	20.5	18
4.	8.5	20	24.1	23.5	23	23	19.5	20
5.	8.3	19.3	24.2	23.3	22.5	22.5	19.5	20
6.	8.8	19.3	24	24	25.5	22.5	19.5	20
7.	8.8	19	24	24	25	22	21	20
8.	8.8	19	23.5	24	24	22.5	19	19
9.	8.3	19.5	24	23.8	25	22	21.5	21.3
10.	8.5	19.3	24.6	24.5	25.5	21.5	22	21.5

All dimensions are in CM

Table-3:After washing measurements after 24Hours relaxation are as follows

Washing Dimensional Details								
Sa mpl e No	Flat Measurements				Stretch Measurements			
	Cuf f Wi dth - A	Cuff +Leg Gum - B+E	Foo t Len gth	Leg Len gth	Cu ff Wi dth -A	Leg Wi dth -C	Foo t Wi dth -D	He el Str etc h
1.	8.3	19.2	20.5	22.5	21.5	21.5	21	19.5
2.	7.9	20	20.5	22.3	22.5	21.5	19.5	18
3.	8	19.5	20.6	22.3	24.5	21.5	20	19
4.	8	19	20.5	22.1	23.5	19	19.3	19.5
5.	8.5	20.5	20.5	22.4	22.5	22	19	19
6.	8.6	20	20.6	22.2	24.5	21.5	19	19
7.	8	19.3	20.3	21.9	23.5	21	20	19
8.	7.5	20	20.6	22.9	24	21	18.5	20
9.	8.2	19.2	20.3	21.8	24	21.5	20	18.5
10.	8	19.9	20.5	24.4	25	21	19	19.5

It shows the measurements after washing process and it is taken after 24 hours of washing to determine the accurate value of the shrinkage.

Table-4:After Tumble Dry measurements after 24Hours relaxation are as follows

Tumble Dry Dimensional Details								
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Sa mpl e No	Flat Measurements				Stretch Measurements			
	Cuf f Wi dth - A	Cuff +Leg Gum - B+E	Foo t Len gth	Leg Len gth	Cu ff Wi dth -A	Leg Wi dth -C	Foo t Wi dth -D	He el Str etc h
1.	7.8	18.9	20.5	22.5	21.4	21.3	19.4	19.5
2.	7.8	20	20.5	22.3	22.3	21.4	18.5	19
3.	7.2	18.9	20.6	22.3	24.3	21.5	19.5	18.2
4.	7.5	19.3	20.5	22.1	23.5	19.5	19.5	19.5
5.	7.9	20.5	20.5	22.4	22.5	20.5	18	19.3
6.	7.9	19.5	20.6	22.2	24	21.5	19	18.9
7.	7.8	19.2	20.3	21.9	23.5	20	17.9	18
8.	7.5	19.4	20.6	22.9	23.9	21.5	19	16.9
9.	7.2	19.1	20.3	21.8	23.2	21	18.5	18.5
10.	7.9	19.9	20.5	24.4	23	20.5	18.9	19

It shows the measurements after tumble dry and relaxation of 24hrs. It represents the changes after drying the samples.

Table-5:After Boarding measurements after 48Hours relaxation are as follows

Boarding Knitting Dimensional Details								
Sa mpl e No	Flat Measurements				Stretch Measurements			
	Cuf f Wi dth - A	Cuff +Leg Gum - B+E	Foo t Len gth	Leg Len gth	Cu ff Wi dth -A	Leg Wi dth -C	Foo t Wi dth -D	He el Str etc h
1.	7.4	20.2	20.5	22.5	20.5	20	19.3	19
2.	7.5	19.9	20.5	22.3	22	21.1	19.5	19.1
3.	7.6	20	20.6	22.3	22	21.5	19.5	19
4.	7.5	19.2	20.5	22.1	21.3	20	19.4	19
5.	7.7	20.9	20.5	22.4	22.5	21.5	19	19
6.	7.8	20.3	20.6	22.2	22	20.1	18.2	17.5
7.	7.5	20.2	20.3	21.9	21.5	19.9	18.6	18.5
8.	7.7	21.6	20.6	22.9	21.5	22	19	19
9.	7.6	20.6	20.	21.	21.	20.	18.	18.

			3	8	3	5	3	5
10.	7.8	20.6	20.5	24.4	20.6	20.1	18.5	18.9

It shows the data which is determined after boarding that also after 48hrs relaxation it shows that the changes occurred after boarding in samples.

$$\text{Shrinkage \%} = \frac{\text{Length before washing} - \text{Length after washing}}{\text{Length after washing}} * 100$$

Table-6: Lengthwise Shrinkage % of Crew Half Cushion Samples

Sample No	Leg Length %	Foot Width %	Average %
1.	8.88	18.53	13.70 %
2.	14.79	18.04	16.41 %
3.	4.48	16.50	10.49 %
4.	6.33	17.56	11.94 %
5.	4.01	18.04	11.02 %
6.	8.10	16.50	12.3 %
7.	10.04	18.22	14.13 %
8.	4.80	14.07	9.43 %
9.	9.17	18.22	13.69 %
10.	0.40	20	10.2 %
Average	7.1	17.56	12.33

It shows the data which is determined from the process which had been done. It shows that shrinkage values from the process.

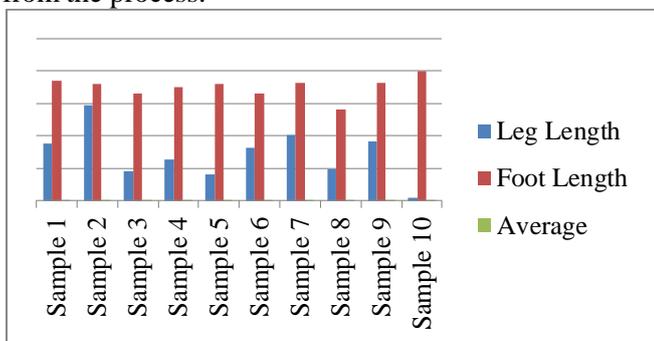


Fig-3: Shrinkage % Representation

This shows the graphical representation of the measurements which occurred from the analysis it shows that shrinkage occurred most in the foot length of the socks body.

$$\text{Tightness Factor Of Crew Socks} = \sqrt{\text{Yarn Count in Tex} / \text{Stitch Length in CM}} = \sqrt{29.525/1.1}$$

$$\text{Tightness Factor} = 4.93$$

4. CONCLUSION

The results obtained in the study indicate that industrial washing, tumble dry, boarding parameters have a significant effect on the dimensional stability of socks. Washing and pressing duration modulate the extent of shrinkage. The first wash cycle causes major shrinkage. This causes serious size-mismatching,

which is one of the main quality problems of sock production.

The relation between shrinkage and final sock dimensions has to be rigorously taken into account by knitting to avoid mismatching problems. High temperature and long pressing duration seem to have a positive effect on sock dimensional stability but it will get shrink after certain interval which we have given above in the process to observe more results and as well as long exposure to high temperature can cause serious damage to textile fibre such as cotton yellowing. Pressing at low temperature preserves textile fibre but leads to incomplete relaxation and stabilisation of the sock.

A simple pressing is not sufficient to obtain a completely relaxed sock. These treatments are particularly beneficial to fabric relaxation because, in a humid environment, fibres move more easily in the yarn and fabric reaches a more relaxed state. Washing socks systematically after pressing is obviously the best solution to dimensional stability. Future work will focus on the effect of severe pressing conditions on the comfort of socks and mechanical performances such as tensile strength and elasticity. This will permit better finishing to the socks. Shrinkage is more after pressing process.

Recommendation for Shrinkage

- For reducing shrinkage % we can give an extra allowance before knitting of socks.
- In this yarn parameters also play vital role for shrinkage, so that we can use a yarn of better quality which will not give shrinkage property to the finished product.

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