# Effect of Weft Accumulator and Without Weft Accumulator on Fabric Properties

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**Abstract**

In this study, the fabric in weft 'with accumulator' and 'without accumulator' is produced. The count of the weft and warp is same i.e. 2/40s for 'with accumulator' and 'without accumulator'. Furthermore, the effect of with and without accumulator on fabric properties is investigated. Finally, Crimp, drape, shrinkage, thickness, cover factor, busting strength, GSM and tensile properties of the fabric studied. The results show that the significant effect on the crimp, drape, shrinkage, thickness, busting strength, GSM and cover factor.

## INTRODUCTION

Shuttle weaving technology a great revolution has occurred in terms of increased weft insertion rates, width of machine and quality of fabric woven. The conventional weaving operated with much lower weft insertion rates of 300m/min and the weft package in the form of pirn formed an integral part of shuttle

As, the weft insertion rates increased phenomenally and have today crossed over 1800m/min .In the earlier phase of shuttleless weaving technology, The major problem has been that of feeding adequate weft yarn for weaving of desired tension which is paramount to fabric quality and also to the machine efficiency. Similarly with the development of new yarns of different material, it become further crucial and important to control and monitor the weft yarn tension during the entire weaving cycle. The shuttleless m/c use cones/cheese wound on high speed modern winding machines. The weft yarn when unwound from such weft packages at high speed will definitely have different unwinding tensions at various diameters of package as well as weft tension changes even during the weft insertion process depending upon the method of weft insertion. For example in projectile system a tension peak is reached once during the insertion and thereafter weft yarn tension is reduced whereas in rapier system such tension reduction occurs twice during the weft insertion cycle as the rapiers meet and go away.

When the weft is inserted on the shuttleless weaving machines, the speed of the yarn ranges between zero to a very high value depending on the weft insertion system is used. Because during weft insertion, the weft yarns are up to 7000m/min. Further, it is quite possible that all the tension variations are passed directly to inserted pick when working without weft accumulator. Thus, weft accumulator is a device which stores in advance of insertion, a length of weft in the form that allows it to be withdrawn at a high speed comparatively at low tension. The main purpose of yarn feeder is to supply filling yarn to the weaving machine smoothly and at a constant and proper tension.

# 1. Materials and methods

## 1.1 Materials

- **Material particulars:**

The blended yarn of polyester & viscose of count 2/40$^s$ PV which is used for warp and weft – 2/40$^s$PV.

### 1.1.1. Preparation of fabric samples

Two fabric samples were prepared on a Sulzer projectile machine (Model: P-lean). Weft 'with accumulator' and weft 'without accumulator' No finishing was done on the fabric samples. All samples were tested in the gray form.

**Fabric Details**

EPI- 60, PPI- 48, Weave- Plain

## 1.2. Experimental Method

### 1.2.1. Evaluation of fabric construction parameters and cover factor

The end and pick densities were measured with a pick glass at ten randomly selected positions for each sample and cover factor was calculated by IS1963:1981 sp-15 (Part-2) 2000.

### 1.2.2 Evaluation of fabric tensile properties

The tensile behavior off all fabric samples were measured by using Instron tensile tester and the test was carried out according to ASTM D5035-95 method. Busting strength of Fabric samples were measured by ASTM D3786 standard test method.

### 1.2.2. Evaluation of fabric thickness and GSM

Fabric thickness was measured with a thickness tester as per the ASTM D1777 standard. GSM of fabric samples were measured by GSM cutter according to ASTM D3776 standard.

### 1.2.4 Evaluation of air permeability of fabrics

Air permeability of all the fabric samples was measured on air permeability tester and the test was carried out according to ASTM D737.

### 1.2.5 Evaluation of dimensional stability of fabrics (Hot Water Shrinkage %)

Hot Water Shrinkage % of all the fabric samples was measured and the test was carried out according to ASTM D6207 - 03(2011)

### 1.2.6 Evaluation of Drape of fabrics

Drapability of fabric samples was measured on drape tester and the test was carried out according to ASTM D4032 standard.

### 1.2.7 Evaluation of Crimp of fabrics

Crimp of fabric samples was measured on drape tester and the test was carried out according to ASTM D3883 standard.

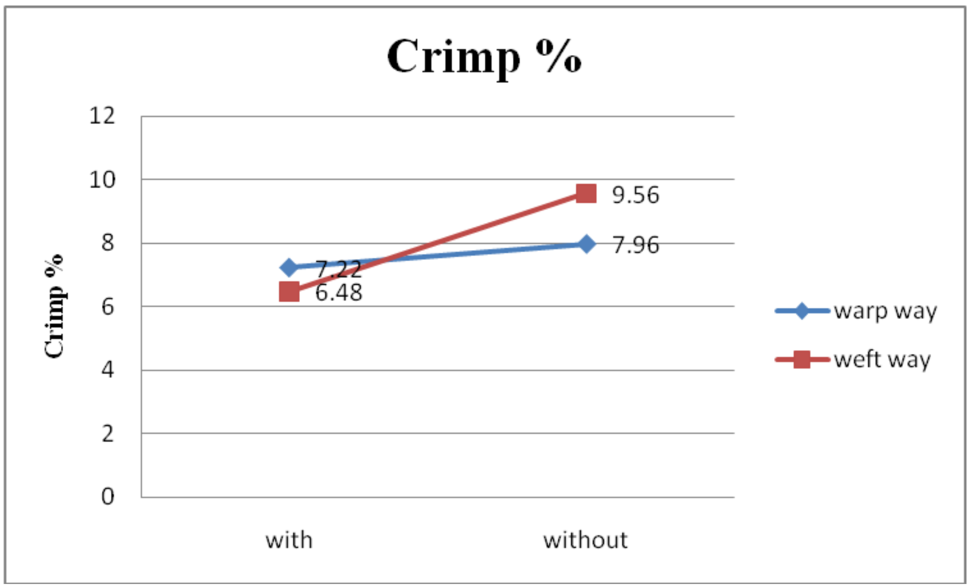
## RESULTS & DISCUSSION:

| **Sr.No.** | **Testing parameter** | **Weft 2/40s pv accumulator** | |
|---|---|---|---|
| | | **with** | **without** |
| **1** | **Cover factor** | 20.32 | 20.08 |
| **2** | **GSM** | 134.32 | 140.18 |
| **3** | **Crimp %** | | |
| | warp way | 7.22 | 7.96 |
| | weft way | 6.48 | 9.56 |
| **4** | **Hot Water Shrinkage %** | | |
| | warp way | 8.64 | 9.2 |
| | weft way | 3.5 | 4.04 |
| **5** | **Busting Strength (bar)** | 17.18 | 16.52 |
| **6** | **Strip strength (kgf)** | | |
| | warp way | 111.922 | 104.936 |
| | weft way | 82.014 | 82.12 |
| **7** | **Extension (mm)** | | |
| | warp way | 49.152 | 47.928 |
| | weft way | 39.728 | 36.432 |
| **8** | **Drape coefficient** | 26.8 | 19.128 |
| **9** | **Thickness (mm)** | 0.37 | 0.35 |

### 2.1 Crimp

As far as crimp is concern it influences fabric performance and end users. The fabric of 'without accumulator' has little more crimp% than with accumulator along the warp way. The tension on the warp during with and without accumulator is uniform but the amount of crimp% is changes. Tensioning a yarn causes its crimp to be reduced. The results of crimp along the warp way are not statically significant.

Along the weft way, the fabric of 'without accumulator' has highest crimp% than with accumulator. With accumulator the tension on the weft is uniform. So tensioning a yarn causes its crimp to be reduced however without accumulator tension on the weft yarn is not uniform (tension is lower). The percentage excess of length of the yarn axis over the cloth length is more so that there is increase in crimp %. The results of crimp found to be statistically significant

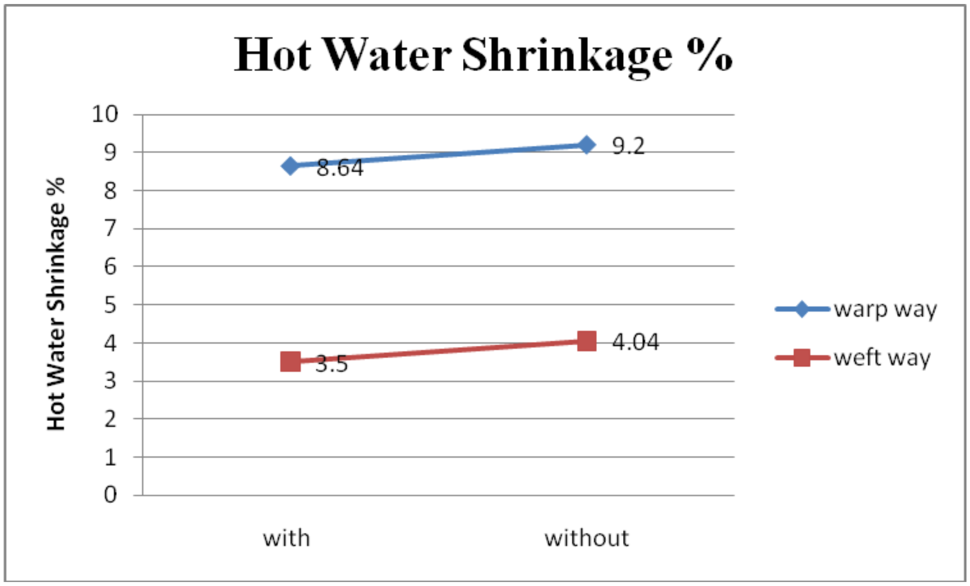



### 2.2 Hot water shrinkage

Percentage shrinkage is an indication of dimensional stability. As seen in the graph there is increase in shrinkage from with accumulator to without accumulator for warp way as well as weft way.

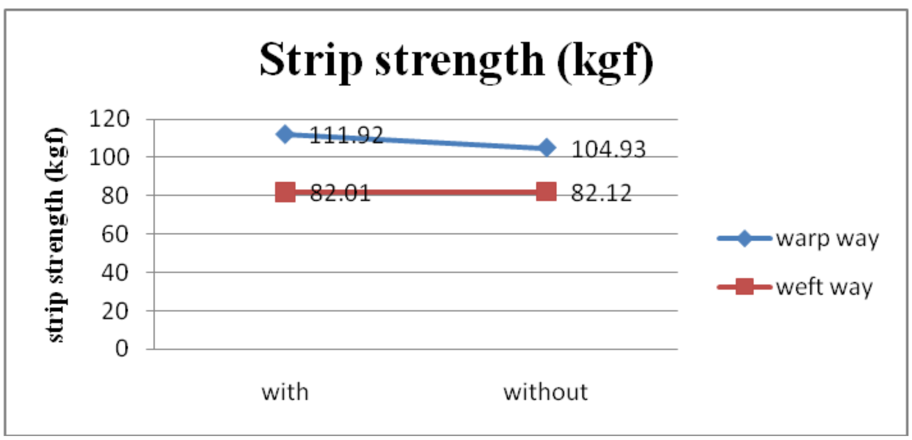
This is because of as in the case of warp yarns, they wets and swell, consequently warp thread has a longer path to take round on a swollen weft thread as well as weft way the fabric of 'without accumulator' crimp is more. The results of shrinkage found to be statistically significant

The largest amount of shrinkage is that represented by increase of crimp



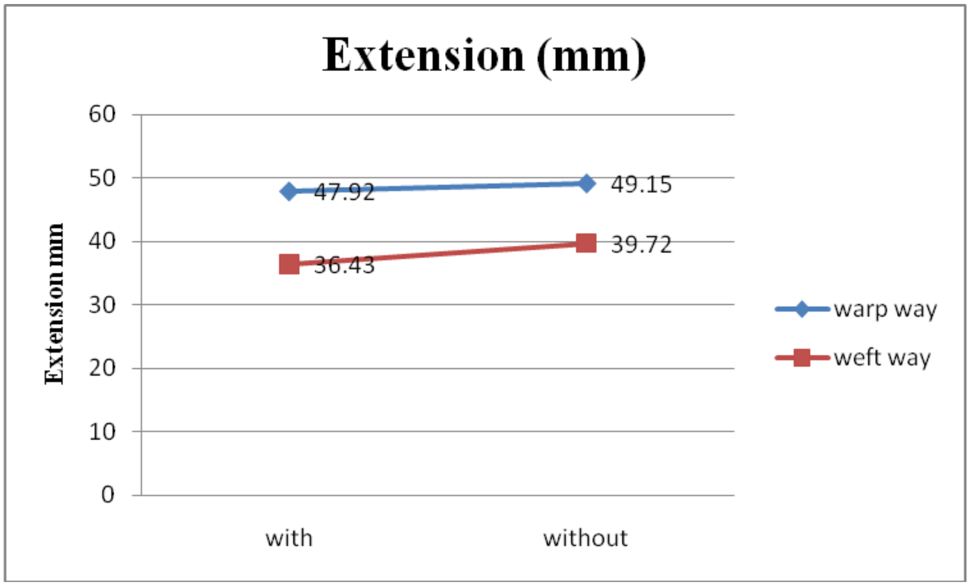

## 2.3 Strip strength

The strip strength of the fabric is decreases from with accumulator to without accumulator warp way as well as weft way as shown in graph. Because of when a strip of fabric is extended in one direction, crimp is removed and the threads straighten out. Crimp is more in without accumulator so most of the load is contribute to removal of crimp. But the result of the strip strength is not found statistically significant.



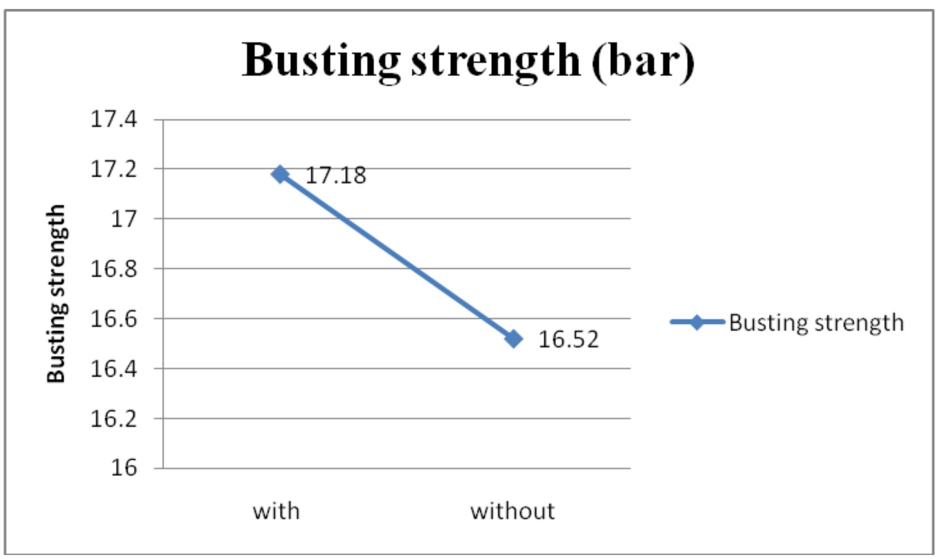

## 2.4 Extension

The warp way and weft way there is increase in extension from with accumulator and without accumulator. Due to the removal of crimp the load-elongation curve will show relatively high extension per unit increase in load in the early stages of strength testing of a fabric strip. But the result of the extension is not found statistically significant.



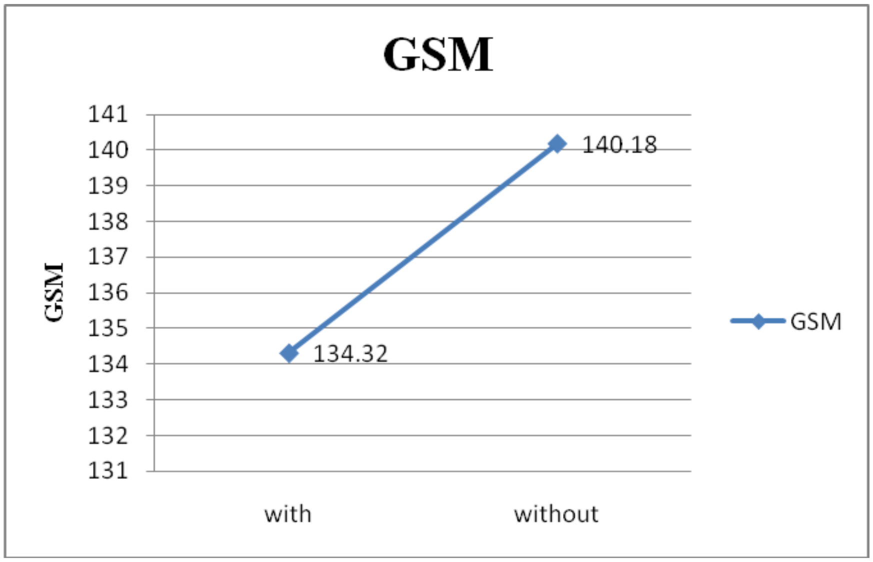

## 2.5 Busting strength

The busting strength of fabric with accumulator shows higher than fabric of without accumulator as shown in graph. Because of the fabric structure of with accumulator is more compact means the tension on the warp and weft is uniform as compared to without accumulator. The cover factor is also more in case of with accumulator. The results of busting strength found to be statistically significant



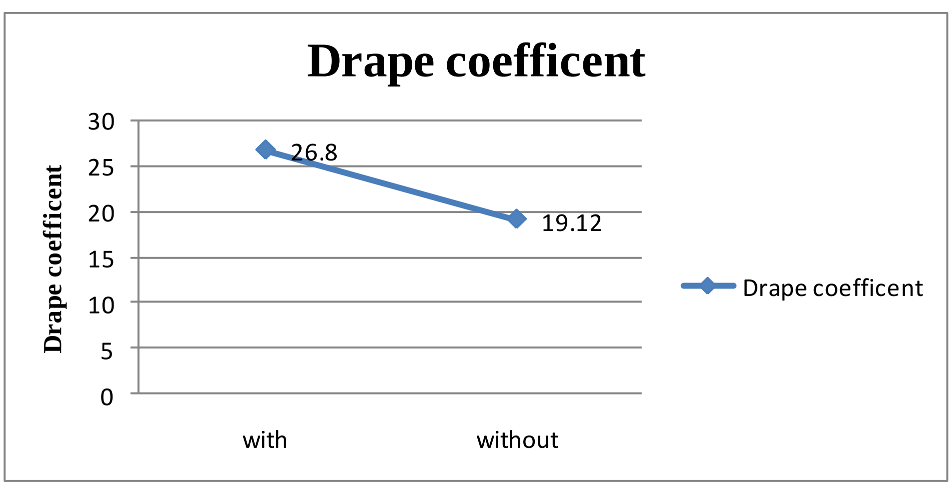
## 2.6 GSM

The highest GSM is found in the case of without accumulator and this is also statistically significant. This is because of the crimp% which is more in without accumulator fabric. The percentage excess of length of the yarn axis over the cloth length is more.



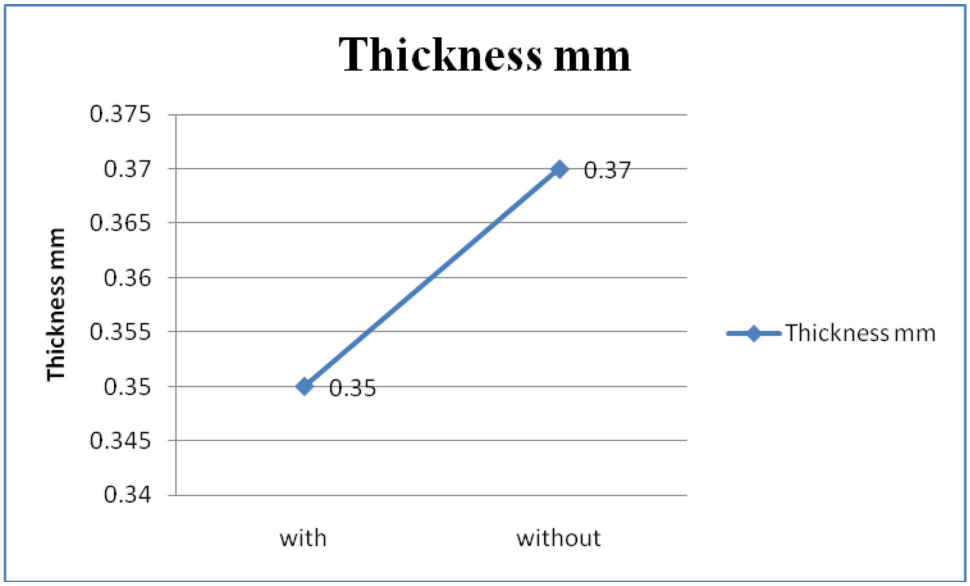

## 2.7 Drape coefficient

As in the graph shows lower drape coefficient for without accumulator it means that the fabric of 'without accumulator' shows the highest drape ability than fabric of 'with accumulator'. Fabrics with high fabric weight have better drape than those with low fabric weight (as compared with and without accumulator). The results of Drape coefficient found to be statistically significant



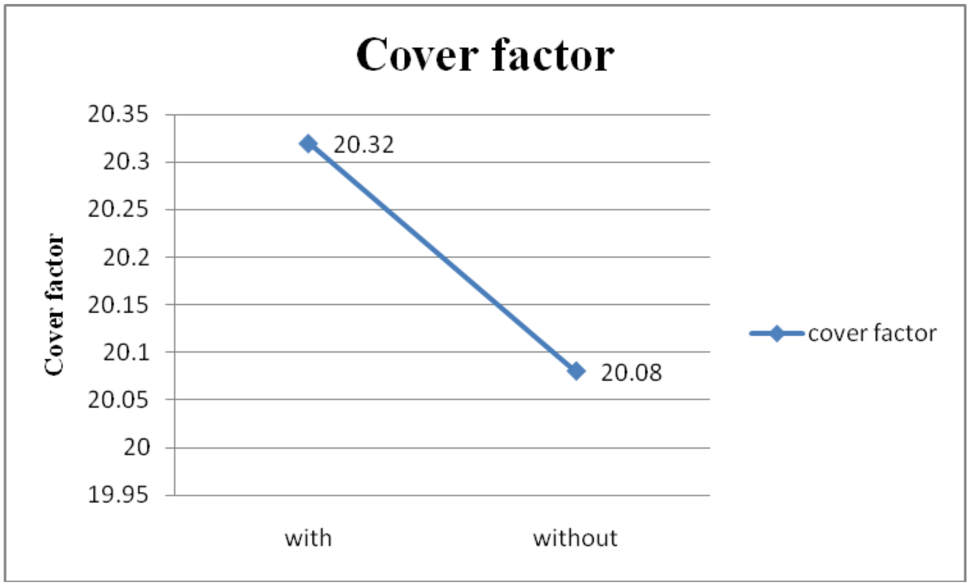
## 2.8 Thickness

The thickness of the fabric without accumulator is more than fabric of with accumulator. Because of crimp is more in the fabric of without accumulator. The results of thickness found to be statistically significant




## 2.9 Cover factor

The cover factor is decreases from the fabric of with accumulator to without accumulator. Because of more fabric crimp in case of without accumulator. The results of cover factor found to be statistically significant




## Conclusion

- ✓ In this study the crimp property is affected because of the tension which is uniform incase of with accumulator and variation in without accumulator this difference is statistically significant. The crimp has influence on the tensile properties, shrinkage, GSM, drape, thickness and cover factor.
- ✓ The GSM and drapability is more in case of without accumulator.
- ✓ The shrinkage is more in weft way in case of without accumulator it means that the dimensional stability is not good.
- ✓ The results shows fabric strength is also lower but extension is more in case of without accumulator. But the results are not statistically significant.
- ✓ The effect of accumulator and without accumulator on the results of fabric properties like shrinkage, GSM, drape, thickness, busting strength and cover factor found statistically significant except tensile properties.

## References:

1. 'Handbook of Weaving' by Sabit Adanur, B.S., M.S., Ph.D. published by CRC press.

2. 'Weft Accumulator Technology' by S.R. Desai, published by NCUTE 1999.

## Image Courtesy:

1. Knittingindustry.com

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