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Study of Shuttle Less Loom Performance with reference to Warp Preparation

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Abstract: Warping and Sizing are the two important weaving preparatory processes. Performance of these machines and the yarn behavior during these processes decides the loom performance and the fabric quality. With the increasing speeds of the weaving machines it has become more important to concentrate on the loom efficiency and to reduce the second quality fabric. In this study three different yarns are studied for their performance in weaving preparatory and the performance at weaving shed. During this study yarns were tested for warp tension, end breaks, preparatory machine speed, moisture content and the stretch at sizing.

Keywords: Air Jet, Warp Preparatory, Warping, Sizing, Stretch, Pick-up.

I. INTRODUCTION

It is said that Good Preparation will reduce the load at weaving. It is known that a pair of warping machines and a single sizing machine will feed hundreds of looms. A well-prepared warp at sizing will reduce the work load of a weaver and related persons. The objectives of warping and sizing is to make the warp yarn weavable. Weavability of the warp is decided by the performance of the warp yarn during weaving. It is measured by the end breaks, Size material droppings below the loom and the efficiency of the weaving machine. The weaving preparatory process parameters and the yarn properties have an important effect on the warp yarn weaving behavior. Weaving process being complex in nature, there are lot of forces acting on the warp yarns during weaving, which will affect the warp performance during weaving. There are tensile forces, Abrasion and friction between the warp yarns and yarn to metal friction too, which reflects the warp performance.

II. MATERIAL AND METHODS

Table 1: Yarn Quality Testing Results

Parameters	**Yarn A**	**Yarn B**	**Yarn C**
Yarn Tex	11 Tex	15 Tex	20 Tex
Nominal English count	53.69	39.37	29.53
Actual Tex (Avg)	11.89	14.72	19.62
Actual English Count (Avg)	49.67	40.12	30.10
Count CV%	1.92	1.76	1.71
Strength (g/tex)	70.4	71.3	69.3
Strength CV%	3.8	4.12	4.23
CSP	3080	3196	2985
Elongation %	4.7	4.2	3.9
Elongation CV %	7.5	7.9	7.6
Yarn Evenness (U%)	12.5	10.78	11.35
Imperfections (-50, +50, +200)	256	234	247
Twists per meter	945.44	957.08	929.14
TPM CV%	1.8	1.6	1.6

There are the three yarns selected as a warp for three different sorts. Some initial testing of these yarns was done to assess the initial basic values of the yarns. The yarn counts selected were 11,15 and 20 tex carded cotton (named as A, B and C). Same warping and sizing machines were used for preparation of warp with the same process parameters. The yarn quality parameters are listed in the table 1. The yarns were tested in the standard atmosphere with yarn conditioning for 24 hrs. at the standard atmospheric conditions. Standard procedure and instruments were followed for testing the yarn properties.

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The warp preparatory machines used and their technical parameters are as under –
Warping Machine –
Make – Benninger
Warping Speed(maximum) – 1200 mpm
Creel capacity – 1080

Sizing Machine –
Make – Ben Direct (Karl Mayer)
Creel Capacity – 8
Sizing Speed – 125 mpm
Sow Boxes – 2 (2 deep 2 nip)
Size Pick up - 16% $\pm$ 1

Size Paste Content –
CTMV – 140 Kg
Sico12 – 6 Kg
PVA – 3.7 Kg
Water – 36 Liters

The details of loom on which these warp yarns were woven are as under –
Make of Loom – PICANOL Air Jet loom
Speed – 850 rpm
Weave used – Plain
Reed Space – 152 cm (60inch)

III. RESULTS AND DISCUSSION

a) Warping Performance – Table 2 given below shows the observations during the warping process for all the three types of warp yarns.

Table 2: Warping Process and Performance Parameters

Yarn	Yarn A	Yarn B	Yarn C
Warping machine speed (mpm)	650	650	650
Yarn Count (nominal)	11 Tex	15 Tex	20 Tex
Yarn Tension(cN)	4.2	4.0	4.3
Drum Pressure (daN)	350	350	350
Total Breaks	93	71	69
Breaks /1000 ends/1000m	0.43	0.41	0.54

b) Sizing Performance – Table 3 shows the observations during the sizing process for all three sorts

Table 3: Sizing Beam Performance

Yarn	Yarn A	Yarn B	Yarn C
Avg RF%	8	10	9
Size paste viscosity (Sec)	7	7	8
Size Pick Up %	14.9	18.1	17.9
Sow box Temperatures (^{0} C)	84.5	85.6	87
Moisture Content%	5.8	6.1	5.9
Squeezing pressure (KN)	17	17	17
Stretch %	0.9	0.85	1.1
Size beam Length(m)	3100	3600	2800
Number of lappers	3	3	3

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Table 4 shows the observations during weaving process for all three sorts

Table 4: Weaving Machine Performance Parameters

Yarn	Yarn A	Yarn B	Yarn C
Speed of Air jet machine (rpm)	720	720	720
Warp Tension (KN)	2.45	2.52	2.40
Picks per shift	259200	279936	262656
Efficiency%	75	81	76
Total Breaks/shift	15	11	14
CMPX	5.8	4.2	5.4

Observation of table 4 shows the air jet weaving machine performance for three different yarns. From table it is observed that the performance of warp yarn B showed highest efficiency than other two yarns. This is reflected due to the performance of yarn B in Sizing where the stretch percentage is least among the all yarns. Also, the size pick-up percentage of the warp yarn B is more than the remaining two yarns.
At weaving stage, the total number of yarn breaks per shift in case of Yarn B are least and reasons are stretch percentage in sizing is minimum consequently the loss in elongation is less and therefore improving the performance of warp in weaving.

Table 3 shows that the moisture content of the warp yarn B is 6.1% which is higher as compared to other two yarns which might have improved the performance of this cotton yarn during weaving.

Table 2 shows that the performance of yarn in warping machine. From table it is observed that the Yarn C has minimum breaks in warping and Yarn A has maximum breaks, even then the yarn B performed better than other two yarns in weaving. It can be said therefor that the Sizing process will improve or reduce the performance of warp during weaving. Additional care is therefore required to be taken during the selection of the size ingredients and the sizing machine parameters

IV. CONCLUSION

From the study broadly, it can be concluded that the performance of the weaving machine largely depends upon the weaving preparatory processes. As the warp breaks and other breaks in high speed weaving machines are affecting the efficiency and productivity, it is important to control the weaving preparatory processes. Control over Sizing machine parameters and selection of proper size paste ingredient will affect the weaving performance. The percentage stretch in the sizing should be minimum and maintaining the moisture content of the sized warp are the two important things to be achieved in sizing. The size pick-up is another sizing parameters which affects the performance of the warp during weaving.

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