# Sizing- Impact of process parameter on beam quality and similarly on loom performance

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**Abstract**

This project work mainly focuses on control of stretch, moisture content and hardness of beam for terry weaving. Trials were conducted to control over stretch, moisture content and beam hardness. For this trials study were conducted in such a way that, making the beam with variables in terms of stretch, moisture content and beam hardness then collect their breakage rate at loomshed. These studies were conducted for different count then collect the result with respective count.

By reducing the stretch at wet zone and cylinder zone it reduces the permanent loss of elongation and reduces the end breakage rate at loomshed by using this saved elongation in loomshed. So that it gives the 41.88% reduction in end breakage rate. Whereas, by increasing moisture content in sized beam it reduces 38.60% reduction in end breakage rate because cotton has more wet strength than its dry strength. And reducing the beam hardness up to optimum level it gives the 29.59% reduction in breakage rate.



***Key word:-***

*Stretch, Yarn elongation, Moisture, Wet strength of cotton and beam hardness.*


**Introduction**

The sizing of yarn absolutely essential to render it weavable; without sizing the end breakage rate of warp, particularly in the case of single yarns, is so high that weaving becomes impossible. The objective of sizing, however, sizing cannot be looked upon as a process that improves the basic quality of yarn. The fact is that by endowing the yarn with abrasion resistance, proper sizing bring out the full potential of a yarn to weave. The objective of sizing is to impart those property which it does not possess but which are essential to good weaving – the resistant to abrasion. This objective is achieved by applying on the yarn a uniform and smooth protective film of suitable sizing material. This improves the abrasion resistance and incidentally, also the tensile strength of the yarn. A properly sized yarn should have adequate improvement in abrasion resistance, indirectly indicated by the increase in tensile strength, minimum loss of extensibility and required amount of moisture. For satisfactory weaving the quality of the beam also important. The beam should be firm and it should not have excessive missing ends, crossed ends, taped ends (sticky ends) etc., so that it unwind smoothly in the loomshed.

The extensibility of the yarn reduces due to two reasons: a) application of size binds the fibres in the yarn more rigidly and reduces the relative slippage at the time of break, and b) even the minimum necessary tension applied during sizing results in a slight stretch that sets in permanently thereby reducing the yarn extensibility.

**Stretch:-**

It is the important factor. Stretch percentage increases with decrease in loss of yarn extensibility. So that keep the Stretch percentage as minimum as possible that will helps to reduction of elongation will less and there will be minimum loss in permanent yarn elongation.

**Moisture:-**

Moisture plays the vital role in sizing. It is one of the important factors for cotton because cotton has more strength in wet condition than dry condition. A moisture content of 8-10% should be maintained in the sized cotton yarns. With excessive drying the size film becomes brittle and harsh. Very high moisture content is also undesirable. Correct amount of moisture for cotton helps to reduction of breakage rate at loom shed.

**Beam Hardness:-**

Excessive loosely packed or excessive hardly packed beam does not work properly. There should be an optimum packing density of weavers beam. This beam density depends upon pressure exerted by beam pressing device. If pressure is more, then the beam will be hard and during unwinding yarn will be sticky and have more tension. If pressure is too lesser then beam becomes soft and gives entanglement of yarn during unwinding and causes the end breakages.

**Materials and Methods**

**Materials:**

The trials are conducted on the following type of material,

For stretch:

1. Count- 36.9 Tex ($16^s$ Ne)
2. Count-45.42 Tex ($13^s$ Ne)

For moisture:

1. Count -65.61 Tex ($9^s$ Ne)
2. Count -45.42 Tex ($13^s$ Ne)

For beam hardness:

1. Count-45.42 Tex ($13^s$ Ne)

**Methods:**

1) The studies were conducted for the three variables viz, stretch, moisture and beam hardness.
2) At first, the un-sized and sized yarn elongation has been measured.
3) Then the further adjustment made for reducing the stretch % with help of display.
4) The three variables for stretch were conducted 1.1%, 0.9% and 0.6%.
5) The elongations for above trials were taken and end breakage rate at loom shed.
6) The same procedure follows for other two variable viz, moisture and beam hardness. For these two variables, yarn elongation was not measured.

Note:-

All trialed weavers beam were made from the benninger (Ben-sizetech) machine which equipped with the stretch indicator, moisture indicator, hydraulic pressure system, moisture controller. And all weavers beam were run on same loom for ex. The beam have stretch of 1.1%, 0.9% and 0.6% were load on same loom.

**Setting carried for the required changes:**

**For stretch:-**

**A) For 36.90 Tex (16$^s$ Ne) B) For 45.42 (13$^s$ Ne)**

| Parameters | Stretch% | | |
|---|---|---|---|
| | 1.1% | 0.9% | 0.6% |
| Creel zone | 500N | 500N | 500N |
| **Wet zone** | **0.0%** | **-0.1%** | **-0.2%** |
| **Cylinder zone** | **0.0%** | **-0.2%** | **-0.3%** |
| Spilt zone | 1000N | 1000N | 1000N |
| Drag roll | 1200N | 1200N | 1200N |
| Pressure roll | 1500N | 1500N | 1500N |

| Parameters | Stretch% | | |
|---|---|---|---|
| | 1.1% | 0.9% | 0.6% |
| Creel zone | 550N | 550N | 550N |
| **Wet zone** | **0.0%** | **-0.1%** | **-0.2%** |
| **Cylinder zone** | **0.0%** | **-0.2%** | **-0.3%** |
| Spilt zone | 1200N | 1200N | 1200N |
| Drag roll | 1300N | 1300N | 1300N |
| Pressure roll | 1600N | 1600N | 1600N |

major changes only in wet zone and cylinder zone.

**Impact of setting:-**

Above table shows that all other parameters are same only the wet and cylinder zone setting changes for studying the impact of dry zone and cylinder zone. This change in 0.0% to -0.1% means the tension apply on warp sheet is lower in -0.1% than 0.0%. There are two load cell rollers those are sense the tension on warp sheet when we reduce this tension by putting the setting at wet zone area then this load cell rollers are exerted less tension on warp sheet and causes the less stretch at wet zone and this same for the cylinder zone.

**For moisture:-**

For the change in moisture in both quality 45.42 Tex ($13^s$ Ne) cotton and 65.61 Tex ($9^s$ Ne). Change the moisture percentage in display, keep the moisture percentage 4.5%, 5.5%, and 6.5% in touch screen it will adjust automatically.

**Impact of setting:-**

When we change the moisture from 4.5% to 6.5% then machine increases its speed and reduces the time of contact of wet warp sheet and cylinder zone so it causes the increase in moisture content of warp sheet at same time it also reduces the squeeze roller pressure slightly for increase in the moisture content of the sized warp sheet.

**for beam hardness:-**

Beam hardness trials takes on $13^s$ Ne count. For reducing the beam hardness reduces the beam pressure will reduce the packing density of beam. So that keeps all other parameter as it is and only reduces the press roller pressure.

**For 45.42 Tex ($13^s$ Ne)**

| Tension | Beam Hardness | |
|---|---|---|
| | Avg. 58 degree shore | Avg. 51 degree shore |
| Creel zone | 500N | 500N |
| Wet zone | 0.0% | 0.0% |
| Cylinder zone | 0.0% | 0.0% |
| Split zone | 800N | 800N |
| Drag roll | 1000N | 1000N |

| Press roll | 1150N | 1000N |
| --- | --- | --- |

As per required beam hardness change the press roll pressure.

**Impact of setting:-**

Benninger sizing machine has the hydraulic pressure system at winding zone which apply the pressure to the press roller which compactly with the weavers beam so that hydraulic pressure system work more efficiently than other so that only by changing the pressure roll tension on display machine will automatically exerted that much of pressure to the press roll pressure.

**Result and Discussion**

**Stretch:-**

**Impact of stretch percentage on sized yarn elongation:-**

For 36.90 Tex ($16^s$ Ne):-

| Parameter | Stretch% | | |
| --- | --- | --- | --- |
| | 1.1% | 0.9% | 0.6% |
| Original yarn elongation | 5.19% | 5.36% | 5.19% |
| Sized yarn elongation | 4.11% | 4.41% | 4.50% |
| Total reduction in yarn elongation | 20.80% | 17.72% | 13.29% |

**Table 1: Impact of stretch on sized yarn elongation for 36.90 Tex ($16^s$ Ne)**

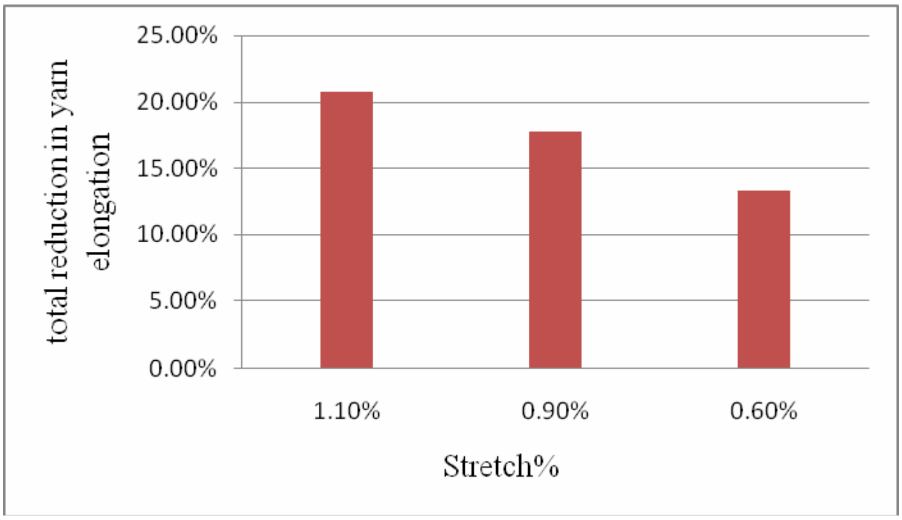


**Fig. 1: Stretch% Vs total reduction in yarn elongation for 36.90 Tex (16$^s$ Ne)**

From this results it shown that the as there is reduction in stretch percentage there is reduction in yarn elongation, so that at the 1.1% stretch level there is 20.80% deterioration in yarn elongation where as at 0.6% level of stretch there is only 13.29% deterioration of yarn elongation.

**Impact of stretch percentage on loom performance:-**

For 36.90 Tex (16$^s$ Ne):-

| Stretch% | Breaks/shift | Breakage reduction in % |
|---|---|---|
| 1.1% | 8.2 | ~ |
| 0.9% | 5.62 | 31% |
| 0.6% | 5.22 | 36% |

**Table 2: Impact of stretch on end breakage rate for 36.90 Tex (16$^s$ Ne)**

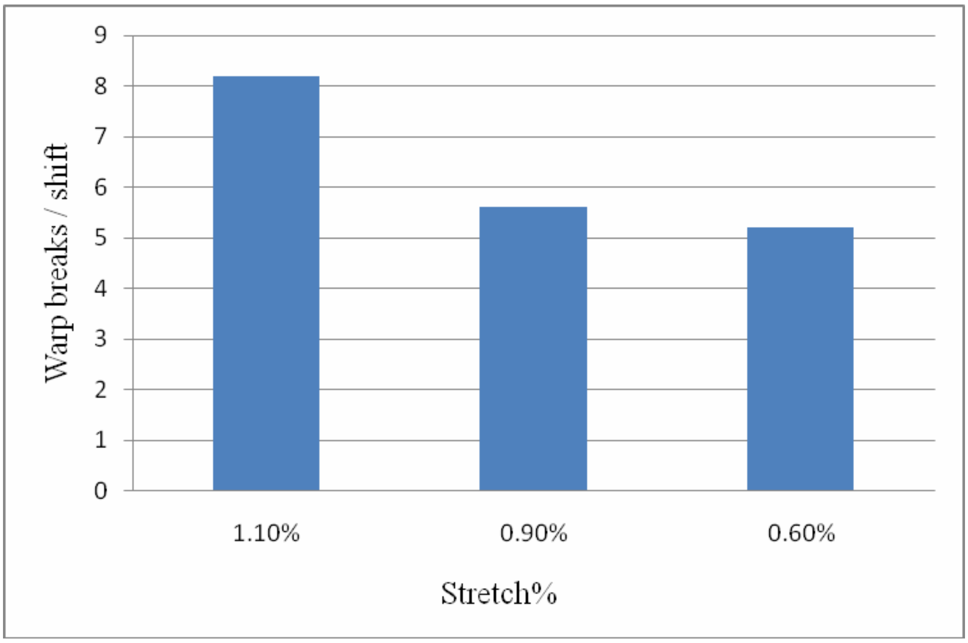


**Fig. 3: Stretch% Vs warp breaks/ shift for 36.90 Tex ($16^s$ Ne)**

After reducing the stretch percentage, these beams are load on loom and it gives the above results that as there is reduction in yarn stretch there is reduction in breakage rate at loom shed, so that at 1.1% of stretch level there is total 8.2 breaks/shift where as at 0.6% of stretch level there is only 5.22 breaks/ shift.

**Impact of stretch percentage on sized yarn elongation:-**

For 45.42 Tex ($13^s$ Ne):-

| Parameter | Stretch% | | |
|---|---|---|---|
| | 1.1% | 0.9% | 0.6% |
| Original yarn elongation | 4.99% | 5.12% | 4.99% |
| Sized yarn elongation | 4.09% | 4.39% | 4.50% |
| Total reduction in yarn elongation | 18.03% | 14.25% | 9.81% |

**Table 3: Impact of stretch on sized yarn elongation 45.42 Tex ($13^s$ Ne)**

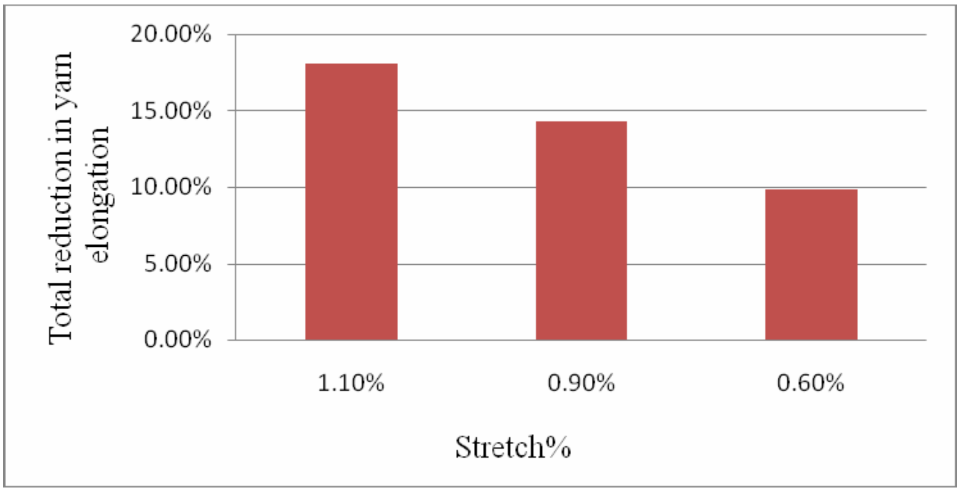


**Fig. 4: Stretch% Vs total reduction in yarn elongation for 45.42 Tex (13$^{s}$ Ne)**

From above results it shown that the as there is reduction in stretch percentage there is reduction in yarn elongation, so that at the 1.1% stretch level there is 18.03% deterioration in yarn elongation where as at 0.6% level of stretch there is only 9.81% deterioration of yarn elongation that means there is total 8.22% saving in reduction of yarn elongation.

**Impact of stretch percentage on loom performance:-**

For 45.42 Tex (13$^{s}$ Ne):-

| Stretch% | Breaks/shift | Breakage reduction in % |
|---|---|---|
| 1.1% | 12.33 | ~ |
| 0.9% | 8.66 | 30% |
| 0.6% | 6.44 | 48% |

**Table 4: Impact of stretch on end breakage rate 45.42 Tex (13$^{s}$ Ne)**

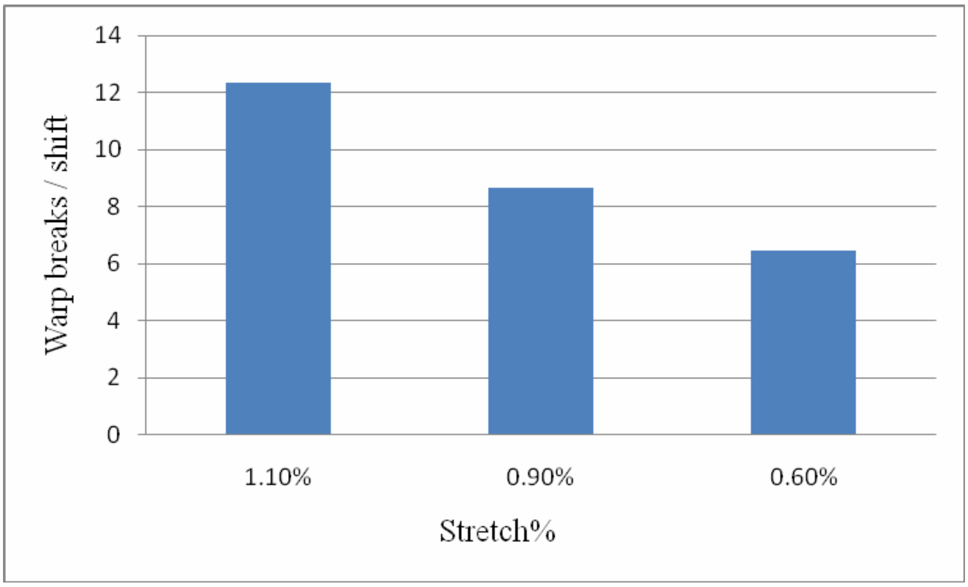


**Fig. 5: Stretch% Vs warp breaks/ shift for 45.42 Tex (13$^s$ Ne)**

Makes the beam with reduced stretch percentage and load on loom then collect their breakage data which shown above, from above data it shown that as there reduction in stretch percentage it gives the reduction in end breakage rate, so that at 1.1. % level of stretch it gives 12.33 breaks/shift where as at 0.6% of stretch it reduces and gives up to 6.44 breaks/shift.

**Moisture:-**

**Impact of Moisture percentage on loom performance:-**

For 65.61 Tex (9$^s$ Ne):-

| Loom performance | Moisture% | | |
|---|---|---|---|
| | 4.5% | 5.5% | 6.5% |
| Total breaks | 45 | 52 | 43 |
| Breaks / shift | 5 | 4.72 | 3.07 |
| Total reduction in breakage rate | ~ | 5.60% | 38.60% |

**Table 5.Impact of moisture on breakage rate for 65.61 Tex (9$^s$ Ne)**

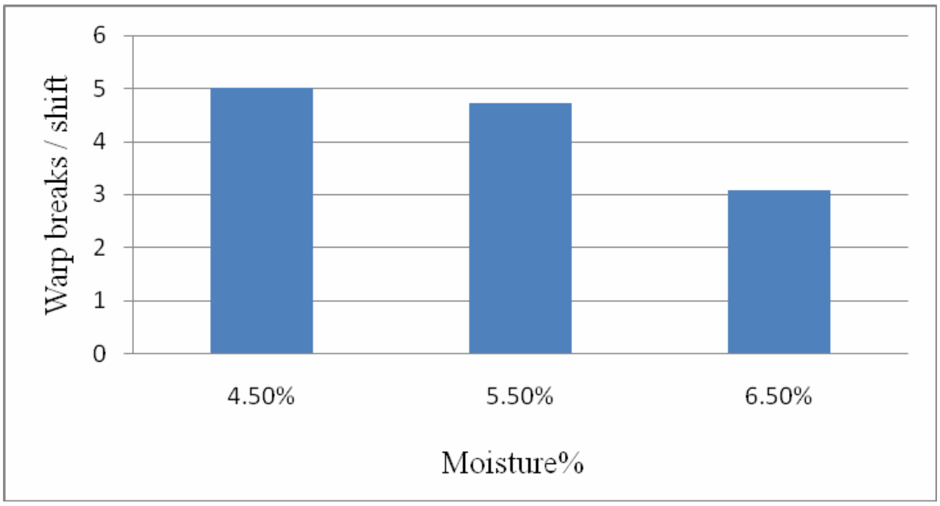


**Fig. 6: Moisture % Vs warp breaks/ shift for 65.61 Tex (9^s Ne)**

Make the beam by making changes on sizing machine, have different moisture content and then load on loom, and then collect the breakage rate from this it conclude that as we increase the moisture content of the beam there is reduction of end breakage rate , so that at 4.5% of moisture content it gives the 5 breaks/shift where as at 6.5% of moisture content it gives the 3.07 breaks/shift that means total 38.60% reduction in end breakage rate as increasing in moisture content from 4.5% to 6.5%.

**Impact of Moisture percentage on loom performance:-**

For 45.42 Tex (13^s Ne):-

| Loom performance | Moisture% | | |
|---|---|---|---|
| | 4.5% | 5.5% | 6.5% |
| Total breaks | 70 | 78 | 68 |
| Breaks / shift | 7.7 | 7.82 | 7.5 |
| Total reduction in breakage rate | ~ | ~ | ~ |

**Table 6: Impact of moisture on breakage rate for 45.42 Tex (13^s Ne)**

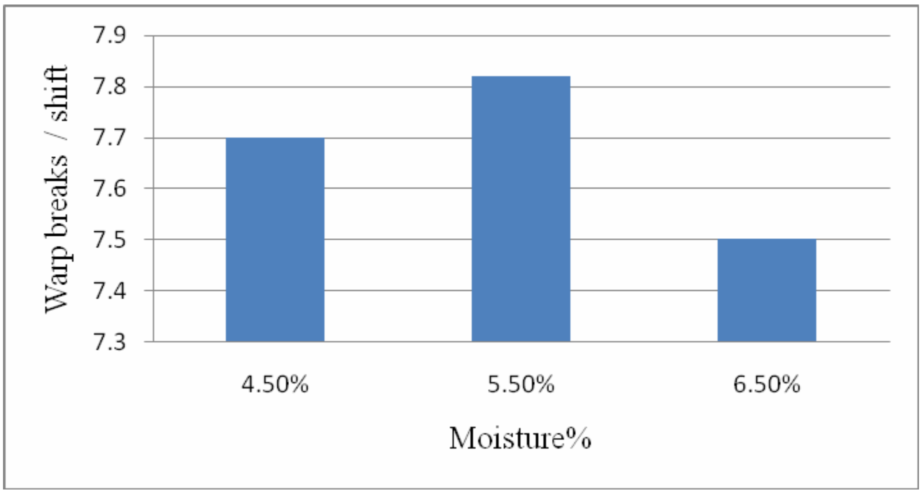


**Fig. 7: Moisture % Vs warp breaks/ shift for 45.42 Tex ($13^s$ Ne)**

By increasing moisture content in $13^s$ Ne count there is no major change in the end breakage rate at loom shed, but at same time it increases the running speed of sizing machine from 70 mpm to 85 mpm.

**Beam Hardness:-**

**Impact of Beam hardness on loom performance:-**

For 45.42 Tex ($13^s$ Ne):-

| Beam Hardness | Breaks /shift | Total reduction in breakage rate |
|---|---|---|
| $58^o$ shore | 8.7 | ~ |
| $51^o$ shore | 6.17 | 29.59% |

**Table 7: Impact of beam hardness on end breakage rate for 45.42 Tex ($13^s$ Ne)**

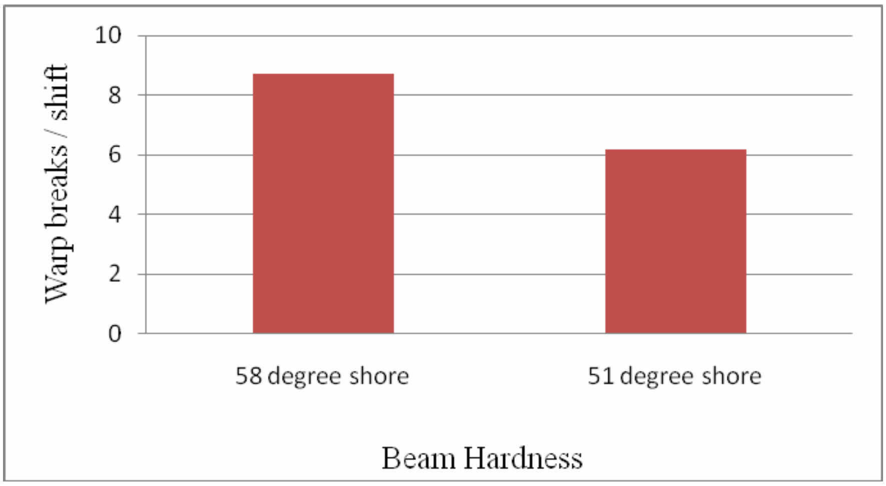


**Fig. 8: Beam Hardness Vs warp breaks/ shift for 45.42 Tex (13$^s$ Ne)**

In above result it shown that the end breakage rate at the 58 degree shore of hardness it gives the 8.7 breaks/shift where as at 51 degree shore of hardness it gives, the 6.17 breaks/shift, means as there is reduction in beam hardness it gives the reduction in end breakage rate, from this result it gives total 29.59% reduction in breakage rate.

## Conclusion:-

By reducing the stretch percentage from 1.1% to 0.6% there is reduction of breakage rate from 8.2 to 5.2 breaks/shift in 36.90 Tex (16$^s$ Ne) and 12.33 to 6.44 breaks/shift in 45.42 Tex (13$^s$ Ne) means total 36% and 47.76% reduction in breakage rate in 36.90 Tex (16$^s$ ne) and 45.42 Tex (13$^s$ Ne) cotton count respectively.

By increasing the moisture percentage in 65.61 Tex (9$^s$ Ne wool mixing) from 4.5% to 6.5% there is reduction of breaks/shift from 5 to 3.07 breaks/shift that is total 38.6% reduction of breakage rate as well as increase in running speed from 70 to 85 mpm.

But there is no major change in breakage rate by changing moisture in 45.42 Tex (13$^s$ Ne) increase in running speed from 125 to 135 mpm.

By reducing the beam hardness from 58 degree shore to 51 degree shore in 45.42 Tex (13$^s$ Ne)there is reduction in breakage rate from 8.17 to 6.17 breaks/shift means total 29.59% reduction in breakage rate.

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