

# FIBRE LENGTH

**Fibre length** is a general term describing the longitudinal dimension of a fibre.

## **Staple length:**

It is a quantity estimated by personal judgement by which a sample of fibrous raw material is characterised as regards its technically most important fibre length. *(J.E.Booth)*

A measure of fibre length of a typical and representative sample from a bulk. *( BIS published book “ the handbook of Textile Testing”)*

# IMPORTANCE OF FIBRE LENGTH

The fibre length of various fibres like cotton, wool is directly related to their spinning performance.

1. longer varieties of fibre give better performance in spinning as they can be processed more conveniently and efficiently.

- In case of cotton, the longer fibres can be spun into finer counts.
- In case of wool, the longer fibres are coarse and the shorter ones fine. Thus the longer wool fibres are spun into coarse 'woollen' yarns and the shorter, but finer, wool fibres are used for finer yarns, known as worsted yarns.

## IMPORTANCE OF FIBRE LENGTH

2. In the spinning process, the arrangement of the machinery, the machine speeds, and the settings have to be designed on the basis of length characteristics.
  - In blow room, the number of cleaning points, the setting between the beaters and the grid bars etc. would depend upon the length of the fibre in process.
  - In carding, a wider setting for higher average length and a closer one for lower mean staple length.
  - In draw frame, roving and ring frame wider nip distance for longer fibre.

## IMPORTANCE OF FIBRE LENGTH

3. A greater number of twists per inch are to be inserted to get maximum yarn strength. The longer the fibres, the greater is the number of twists that can be inserted. So, long staple fibres permit the production of yarns of the high strength.

Considering all of the above it is clear that in order to get good quality yarn, it is necessary to set and run the machinery with regard to fibre length.

# DETERMINATION OF FIBRE LENGTH

## Methods of measuring fibre length

1. The Technician and the graders method.
2. Breeders method
3. The technologist method.

**Technologist method is further classified as follows:**

### Direct method

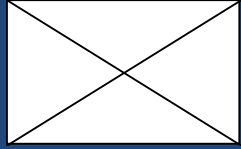
- Single fibre (Baer Sorter)
- Group fibres (Shirley Comb Sorter)

### Semi direct method

- Ball Sledge sorter

### Indirect method

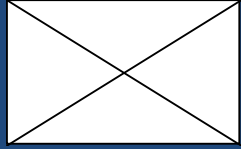
- Fibrograph,
- Uster Stapler



- **Manual Technique.**
- **Used by the spinning mill technician for a quick assessment of the mean or effective length of a sample taken from a bale of cotton.**

### **Procedure:**

- A tuft of cotton of convenient size (7-8g) is taken and held firmly between the thumb and forefinger of each hand with the thumbs placed together. The fingers of both hands are folded so as to touch the palms of the respective hands. The middle segments of the second, third and fourth fingers of each hand touch the corresponding segments of the fingers of the other hand. The thumbs and fingers of the two hands placed thus will give sufficient leverage for breaking the cotton.**
- The cotton is pulled slowly with about the same leverage of each hand on the joints of the fingers to separate the tuft of cotton into two parts.**
- The cotton remaining in the right hand is discarded.**



- f. The fibres obtained between the thumb and forefinger of the right hand are then smoothened with the thumb and forefinger of the left hand, to get a fairly well straightened tuft about  $\frac{1}{2}$  inch wide. This is laid on a flat horizontal surface with a black background.
- g. The distance between the two well defined edge of the tuft changes most rapidly is measured. This is called the staple length of cotton under test.

The staple length determined as above may be given to the nearest sixteenth of an inch.

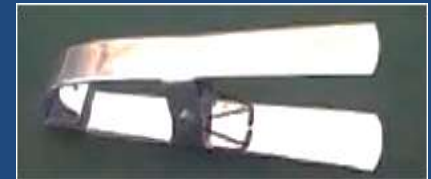
The staple length are also stated in millimetres these days.

## BAER SORTER



### Properties/Parameters Tested

- **Maximum Length.**
- **Effective Length.**
- **Mean Length.**
- **Upper Quartile.**
- **Percent Short fibers.**
- **Dispersion.**



### Instrument Description

The instrument is used to prepare the fiber array. It consists of two sets of horizontal combs, an upper and a lower set.

**Top comb (3)**

**Bottom comb (11/12)**

**Depressor**

**Tweezer**

**Pin**

**Velvet pad**

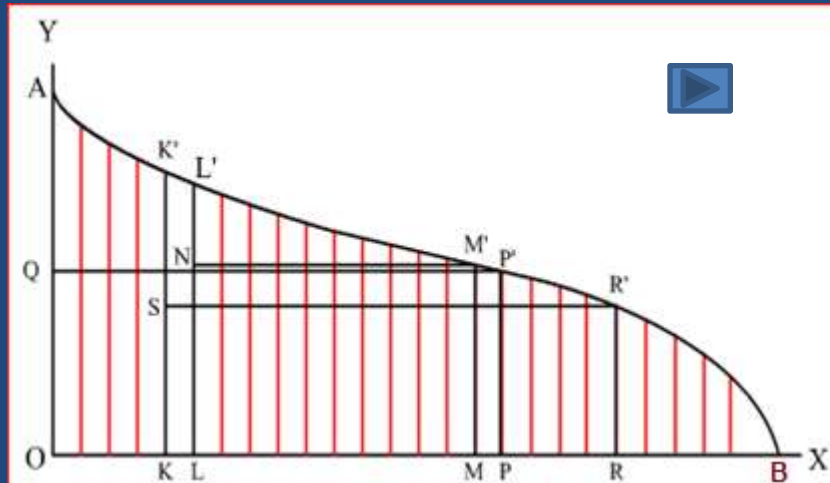
**Plastic Scale**

- Teeth only at one end, can be removed.
- Fixed at one end and can be dropped at another end by a knob.
- To press fibers in the bottom comb.
- To pull fibers from the comb.
- To handle fibre
- To arrange fibers in order.
- To trace baer sorter diagram.





## BAER SORTER



### Analysis of Sorter Diagram

In the diagram

$$OQ = 1/2 OA$$

$$OK = 1/4 OP$$

$$KS = 1/2 KK'$$

$$OL = 1/4 OR$$

$$OM = 3/4 OR$$

### CALCULATION & RESULT

$$\text{Effective length} = LL'$$

$$\% \text{mean length} = (\text{area of OAB} / \text{length of OB})$$

$$\text{Dispersion} = (NL' / LL') \times 100$$

$$\% \text{ of short fibers} = (RB/OB) \times 100$$

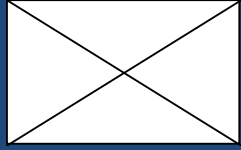
**Modal Length** = Length of the group of fibres where more number of fibres will be having equal length.

**Effective length is a characteristic of the bulk of the longer fibres.**

## STAPLE LENGTH VS EFFECTIVE LENGTH

For American Cottons, Staple Length =  $0.91 \times$  effective length

For Egyptian Cottons, Staple Length = Effective length



## USTER STAPLER

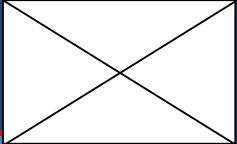
### Principle

The fringe of cotton is transferred into a tuft by means of tuft forming device which produces the tuft clamped in a holder. The right hand ends of the fibres are gripped and the thickness of the tuft at intervals between the point of grip and the tip of the tuft is measured. Then the percentage of fibres at the respective intervals are calculated and the uster staple diagram is drawn.

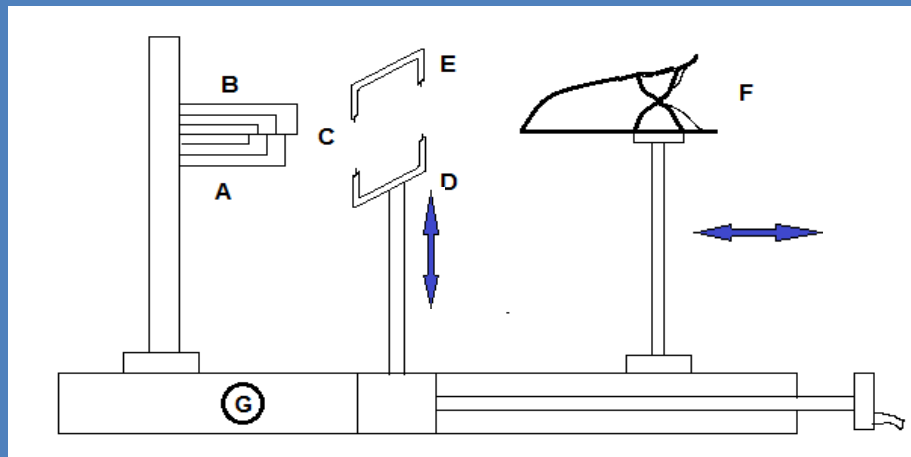
### USTER STAPLER

**It is a semi-automatic and indirect method of measuring the fibre length. It consists of three main parts:**

- 1. Mechanical comb sorter**
- 2. The tuft forming apparatus**
- 3. The gauging unit or tuft thickness measuring gauge.**

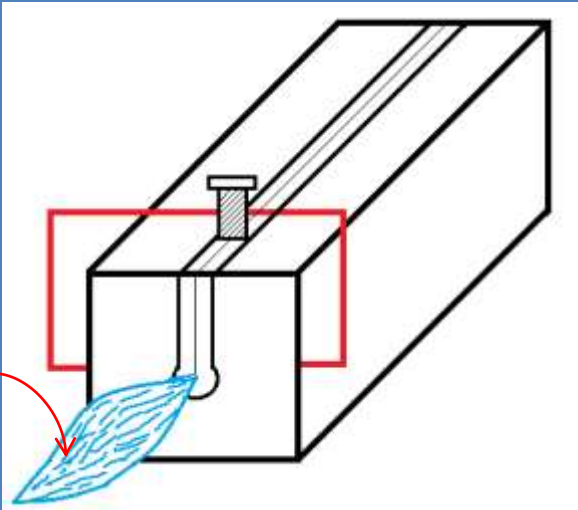


Mechanical comb sorter

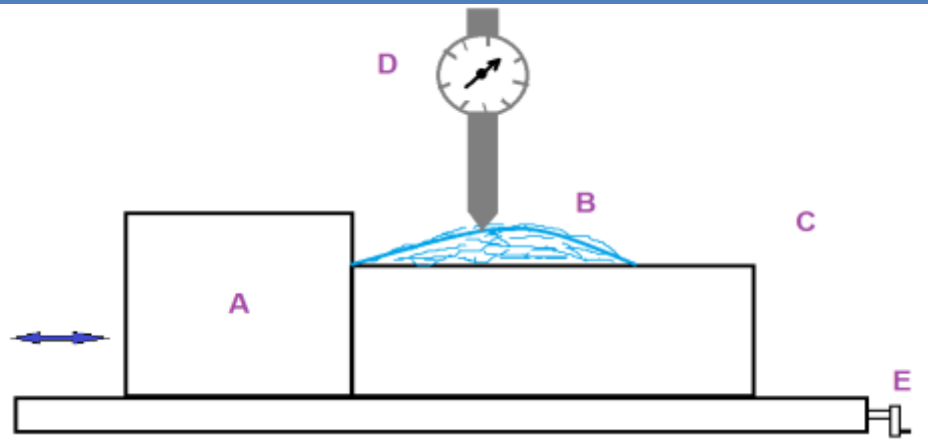


- A - Bottom Comb, B - Top Comb
- C - Fibre Fringe, D - Transport Comb
- E - Presser, F - Tweezers

Fibre Tuft



Tuft holding block

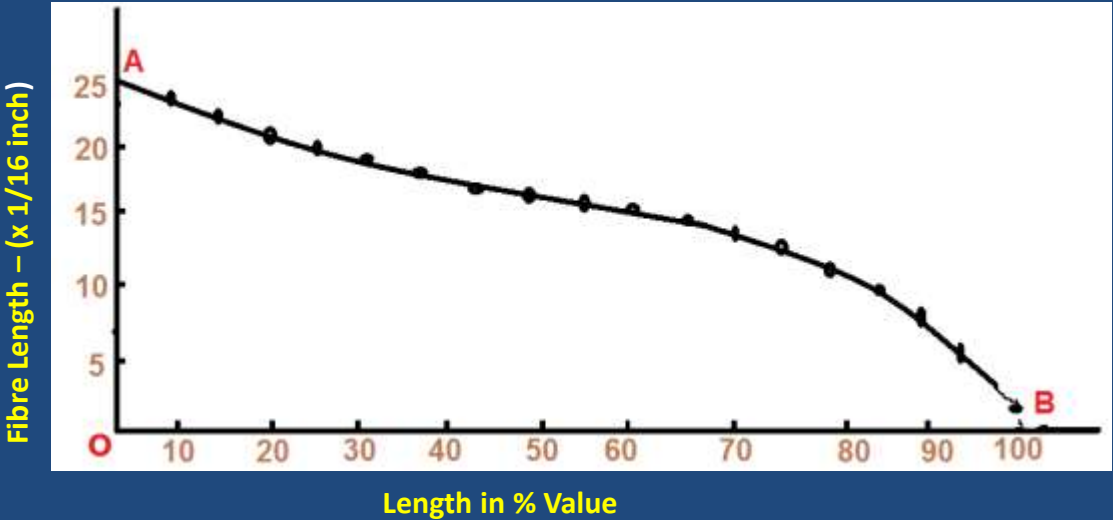


- A - Tuft Holding Block, B - Tuft
- C - Slot, E - Handle,
- D - Thickness Gauge

Thickness Measuring Gauge

USTER STAPLER

<u>Uster Staple Diagram</u>		
<u>Observation Reading</u>		
Distance from end of tuft (x 1/16")	Dial Reading	% of highest Reading
3	880	100
4	853	97
5	836	95
6	801	91
7	774	88
8	748	85
9	713	81
10	669	76
11	625	71
.	.	.
.	.	.
23	22	2.5
24	4	0.5



The curve is analysed as per Miss Clegg’s construction and following fibre parameters are found out:

- 1. Effective length
- 2. Mean length
- 3. Modal length
- 4. % of short fibres
- 5. % of dispersion

### FIBROGRAPH

In this device cumulative frequency diagram of the fibre sample is prepared and following fibre parameters are determined:

- Mean Length
- Upper mean length
- Uniformity Ratio.
- Span length

### Principle of Working

Fibrograph operates on null principle with an electrical indications and suitable recording elements. In this optical instrument a light sensitive cells is used for scanning cotton fibres and simultaneously drawing a length frequency curve.

Two Types:

- **Conventional Fibrograph**
- Digital Fibrograph

## SPAN LENGTH

A span length is that length which a certain percentage of fibres from the original fibre population would span when caught at random along their length.

Span length is a distance from a line where the fibres are caught randomly to a point where only a certain percentage of fibres extend.

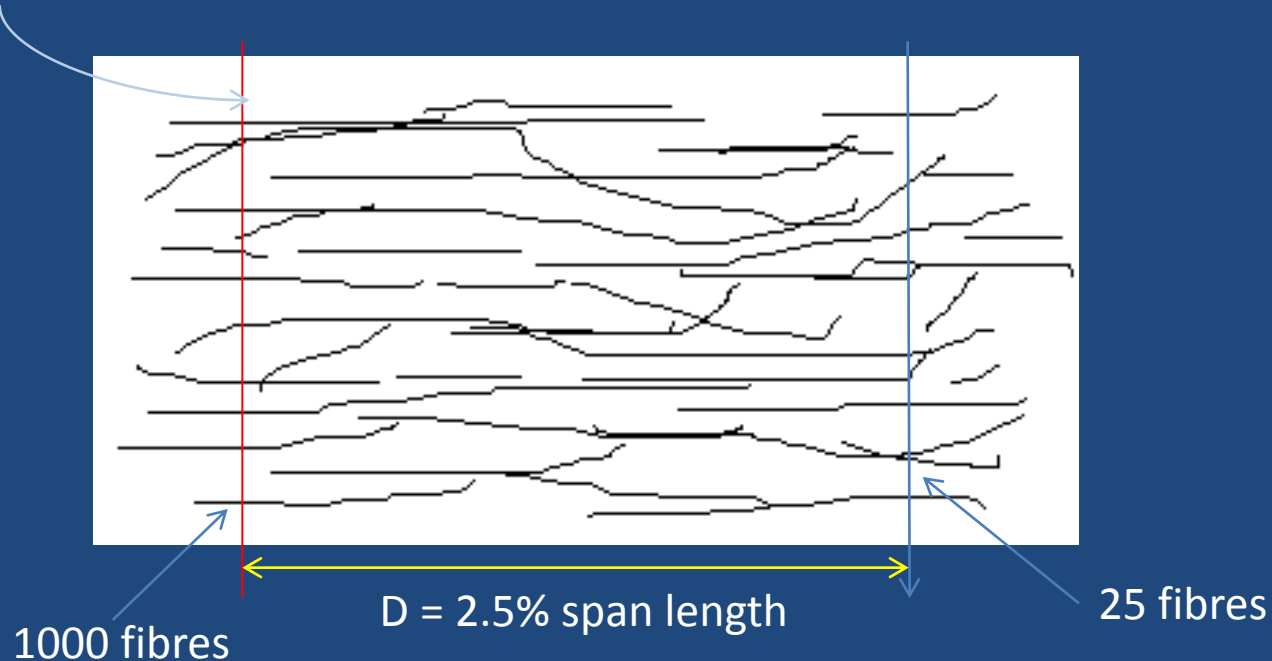
Thus, 2.5% span length is that length which  $1/40$ th of the fibres would span when randomly caught along their length.





## SPAN LENGTH

Initial position of clamp



**SITRA Gives the empirical relationship**

$$EL = 1.013 \times 2.5\% \text{ SPAN LENGTH} + 4.39 \text{ mm}$$

$$ML = 1.242 \times 50\% \text{ SPAN LENGTH} + 9.78 \text{ mm}$$

# REVIEW QUESTIONS

1. Write the name of different methods used for measuring fibre length.
2. Explain the working of baer sorter and analysing procedure for finding out different fibre parameters.
3. Differentiate between span length and fibre length.
4. Explain the principle of Fibrograph.
5. Elaborate a comparison in terms of reliability and precision of the instrument Baer sorter, Uster stapler and Fibrograph