CHAPTER-1

Scope:

Needle is important for sewing. To produce a good and strong seam appearance needle plays an important role. So we have to know the characterization of various types of needle.

AIM OF THESIS

- To select of needle and thread for quality footwear.
- To developing skills in manufacturing according to the developed pattern.
- To developing skills in quality control during manufacturing.
- To make a quality footwear.

STUDIES AND CHARACTERISTICS OF NEEDLE VARIOUS TYPES

Needle:

Needle is an important tool of the sewing machine which pierces or cuts the material to be stitched and facilitates to stitch during stitching. The selection of correct needle depends upon the needle size, needle system as well as the needle point. These things have a great importance in producing a good and strong seam of good appearance. Before going in details about the needle size, system and points, let's have a look of different parts of the needle.

Different parts of the needle:

The needle has the following parts—

(I) Butt:

It facilitates easy entry of needle into the needle bar.

(II) Shank:

It is the thickest part of the needle which is inserted into the needle bar of the machine. The shank varies in shape, diameter and length.

(III) Blade/shaft:

It is in between the shank and eye of needle. It is the part that passes through the material. It has two grooves on opposite sides to one another – long and short.

(IV) Shoulder:

It is a gradual narrowing of the shank some needles have a supplementary shoulder which extends down to the eye of the needle for extra strength.

(V) Long groove:

It is on the threading side along the blade of the needle which starts at the shoulder and continues to the eye.

(VI) Short groove:

It is on the needle thread exit side of the blade. It starts above the needle eye and helps for a better setting of the needle thread on its way down and helps in gripping the thread. On needles with a clearance cut this does not exist.

(VII) Clearance:

It is a flat cut in blade of the needle above the eye on the thread exit side. The length of the clearance cuts varies upon the needle system.

(VIII) Needle eye:

It is a hole above the needle point. It is always elongated in shape to help the diagonal movement of the threads.

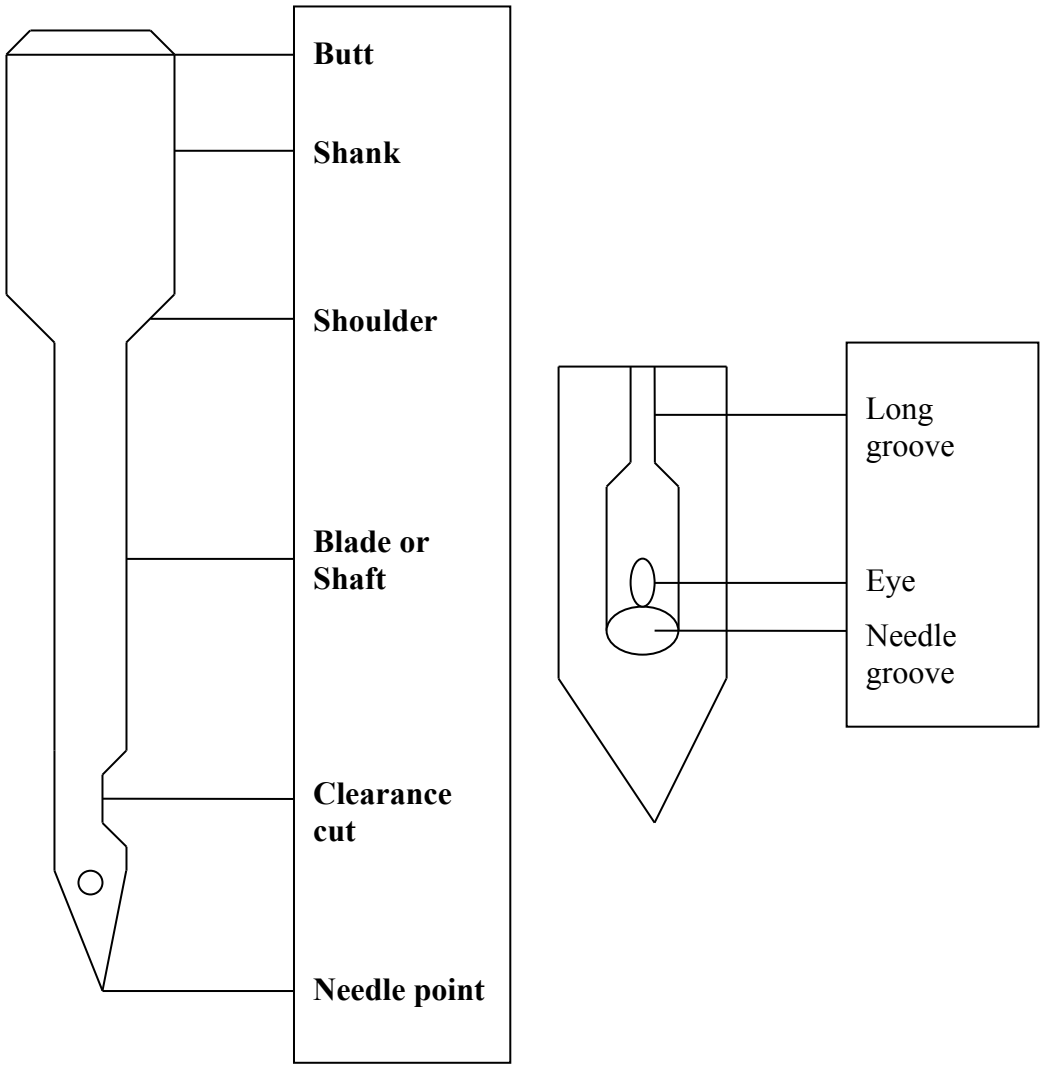


Fig: Different parts of needle.

(IX) Needle point:

It is tapered at the end in order to perforate the material by cutting or pushing side the fibre.

(X) Head groove:

It is thread groove between the eye of the needle and the point. It is actually a continuation of the long groove on the threading exit side.

Needle System:

The needle system refers to the fitting measurements of the needle which enable it to be suited for a model/type of machine. The dimensions/measurements generally stipulated are – shank length, shank diameter or thickness, blade length, needle length, threads grooves and clearance cut.

There are four general needle systems are three-

(i) 134 system
(ii) 134-35 system
(iii) 34 system
(iv) 438 system

There is another system i.e. kk system. Infact in every system kk is included having some additional or extra measurements in shank length and blade length. The basic needle system is 134 and all other systems are studied in comparison to134system.

Needle system	Needle length (mm)	Shank length (mm)	Shank diameter (mm)	Used in sewing m/c	Remarks
(i) 134 system	38.5		2	Flat bed, post bed	This type of needle is used for medium and soft material having thickness of 1 mm-1.2 mm. it is used for common stitching as well.

(ii) 134-35 system	42.0	Same as 134 system	2	Cylinder bed/Slipper binding m/c (pfaff 335)strobell m/c.	This type of needle is used for thicker hard material having thickness of 1.5 mm – 1.7 mm.
(iii) 134-kk system	38.5	Shank length gets reduced as compared to 134 system	2	It is also used for flat bed, post bed machine	As shank length gets reduced and needle length remains same as 134 systems. So blade length is increased. It was found that incase of material heavier than 1.2-1.5 mm, the higher part of the needle entered the material leaving holes which looked ugly as well as reduced the rest strength of the material. Thus kk was introduced as a subclass of 134system but kk should not be used on high speed m/c as due to longer blade and shorter shank, strength of the blade is reduced.
(iv) 34 system	38.5	Same as 134 system	1.6	Bar tacking m/c.	It is used for logo stitching and bar tacking etc. since it has less shank diameter as composed to other system it is not used high speed m/c.
(v) 438 system	38.5	Same as 134 system	2	Zig –zag m/ c. (exp-pfaff-418)	This type of needle has a longer clearance cut to enable the hook to pick up the loop better on both sides.

Needle Size:

The needle thickness or needle size refers to the diameter of the needle blade immediately above the needle eye. The needle sizes are indicated according to number metric (N.M) system, the thickness being indicated is in hundred of a mm, for example a sewing machine needle with a blade diameter of 0.80 mm corresponds to a size 80 needle and diameter 1.50 mm to size 150. The required size depends upon the type and size of sewing thread used and the amount of penetration force needle.

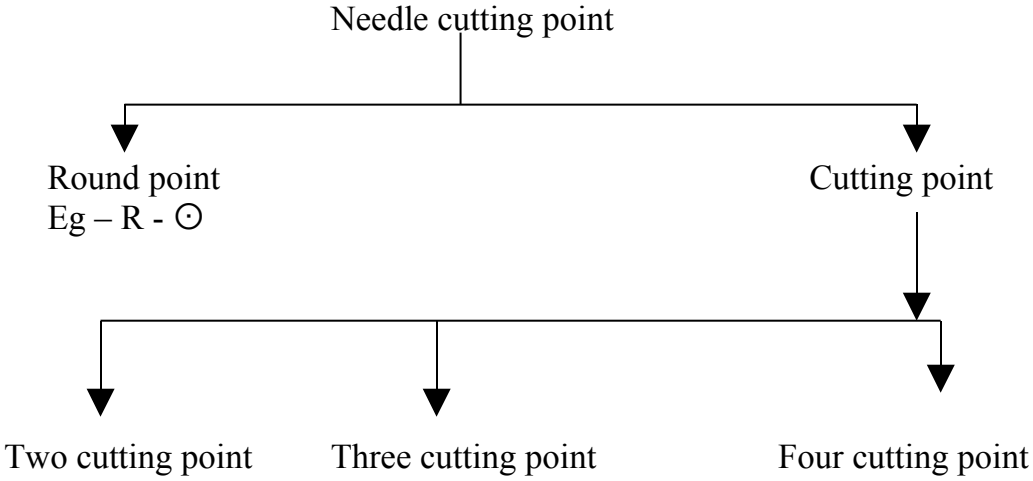
The other commonly used system of numbering needle is the Simon co. or the singer machine. The chart given below shows the equivalents. 60 metric corresponds to singer 8, 65 to 9, and 70 to 10 and so on.

Comparison table for different types of needle sizing system:

Name of sizing system	Needle Sizing Number						
Metric (Schmist)	60	65	70	75	80	85	90
Simon co.	8	9	10	11	12	13	14

Needle Point:

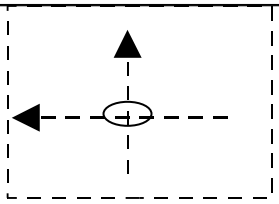
The point of needle is a very important factor to be decided upon depending upon the type of seam and its function. As for as needle is concerned, the purpose of needle point is to perforate the material either by pushing aside the fibres or by cutting through the material in order to make way for the top thread to be passed down and being taken up by the hook in process of stitch formation. Thus the needle is tapered so as to open the hole to the size of the blade diameter. So cutting points are classified according to the shape and position of the cutting edge.



Description of different types of cutting points:

O → represents cross sectional view of the hole made by the point.
– – ▶ Indicates threading direction.

 indicates seam direction

Cutting point	Point symbol with seam and threading direction	Point designation	Description
R - point		Round point	This needle point form perforates the material by pushing aside the fibres so that the fibres are not cut and damaged. It is used for synthetic/fibres stitching.

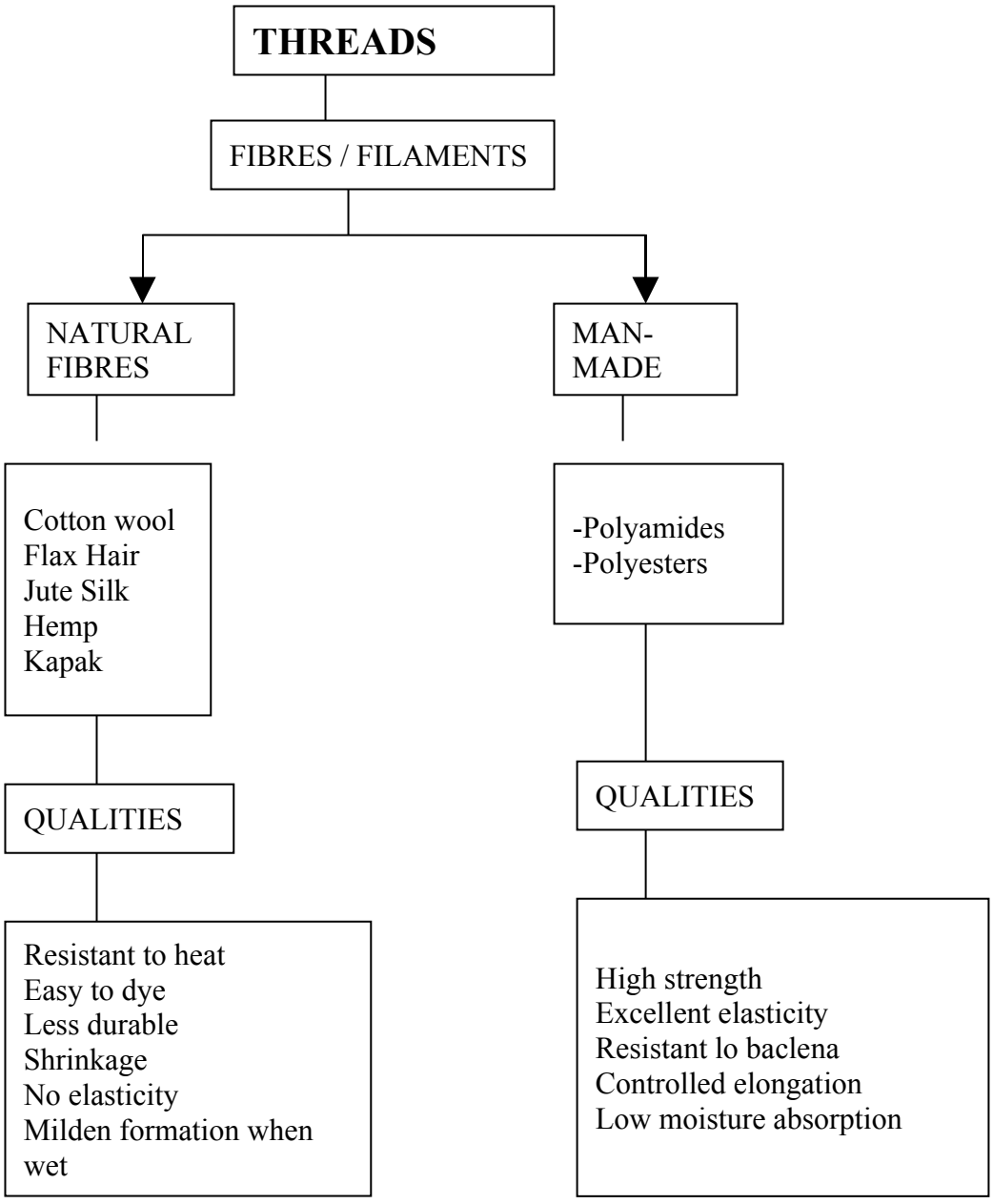
P - point		Cutting point 0° with lens shaped cross section narrow wedge point.	P – Family includes RS, PSS, PCL, PCLS, PCR, and PCRS. P points form cuts vertically to the seam direction. The distance between stitches can, therefore be smaller than with all other point forms. Stay seams, therefore are in most cases stitched with this point form as the number of stitches per inch can be high. This results in a greater number of interlacing subtaining the strain on the seam.
PCL (cut to left)		Cutting point 0º with lens shaped cross section, wedge point with right cut to left or right twist groove below eye.	These points are advantageous when stitching relatively hard types of leather. The right or left twist groove below eye prevents the upper thread from being squeezed off when the needle emerges from the material.
S - point		Cutting point 90º with lens shaped cross section cross point.	S – Family includes S, SS. These points form produce stitches parallel to the seam direction and only allows seams with a large stitch distance (where the incisions are spaced as far apart as is practical). Stitches too closely spaced may lead to an entire perforation of the leather. This point form is often used for producing heavy decorative seams where thick sewing threads are used at large stitch distance. The stitches appear in the direction of the seam, making it look

			“straight”
LR		Cutting point 45° with lens shaped cross section (narrow reverse twist point)	This incisions lie at an angle of 45° to the seam direction and produce a seam where the sewing thread is slightly turned to the left on the surface of the material. Apart from point form “P” it is the most frequently used.
LL		Cutting point 45° with lens shaped cross section (narrow twist point)	The incisions made by this point form lie at an angle of 45° to the seam direction but they lie opposite to those produced with point form “LR”. This point form is mainly used for joining two materials at the raw edges on Zigzag machine. (Threaded from the front).
LBR		Wide cutting point 45° with lens shaped cross section (wide reverse point)	This point cuts the material about 20% beyond the diameter of the needle blade. Needles with this point are used for coarse decorative seams. They are applied when the thread between the incisions should be offset to the left when multicard cotton threads (6, 9, 12 cord) or braided yarns are used.
TR1/d		Cutting point with triangular cross section. (triangular point)	This point form is used for hard dry leather (suede leather). This point form thus three cutting edges which meet even less resistance when piereing the material. Moreover this point has good centering qualities. When using this point form a somewhat larger stitch distance is necessary.

SD1		Round point with triangular tip (SD1 point)	Needles with this point form are mainly used for stitching materials with a stiff backing and for this synthetic shoe upper as well as other PVC coated materials.
D1		Cutting point 90º with rhombic cross section (diamond point)	Seams produced with this point form have the same appearance as those produced with point form “S” however, it pierces leather material more easily and has better centering properties.
VR		Cutting point 45° with rhombic cross section (narrow reverse twist spear)	The seams produced with this point form largely correspond to those made with point form “LR”. However it pierces the material more easily and consequently meets both less resistance, therefore it is used for stitching hard and dry types of leather.
VL		Cutting point 45° with rhombic cross section. (narrow twist point)	The seams produced with this point form largely correspond to those made with point form “LL”. However it pierces the material more easily and consequently meets with less resistance. It is used for stitching hard and dry types of leather.
Spear point		Cutting point 0º with rhombic cross section	The seams produced with this point form largely correspond to those made with point form “P”. This point cuts vertically to the seam direction. However, it pierces the material more easily. It is used for stitching hard and dry types of leather.

Different types of needle point having different needle sizes considering different thickness of the material different types of seam:

Seam	Material thickness (mm)	Needle points with needle sizes (N. metric)
Back seam or side seam (close seam)	0.7 -0.9 1 -1.2 1.2 -1.4 1.6 -1.8	P, PS, PCL 70 P, PS, PCL 80 - 90 P, PS, PCL 100 P, PS 120
Lap seam	1 – 1.2 1.2 – 1.4 1.6 – 1.8	SD, LR 80 SD, LR 90 - 100 SD, LR 100 - 110
Top line	1 – 1.2 1.4 -1.6	LR 80 PCL PS 80 LR 90 – 100 P PS
Counter	1 – 1.2 1.4 -1.6 1.6 -1.8	LR 80 LR 90 – 100 LR 90 - 100
U – Binding (Synthetic or fabric)	1 – 1.2 1.2 -1.4	SD1 P. PS 80 SD1 R 70 -80 SD1 PS 90 - 100
Decoration	1 – 1.2 1.4 -1.6 1.8 -2.0	LR 70 -80 LR 100 LR S 120
Intacting	1 – 1.2 1.4 -1.6	P. P S 90 -100 P. PS 100 -110
Saddle	1 – 1.2 1.4 -1.6	PCL 90 LR 100
Blind seam or French binding	0.8 -1.0 1.0 -1.2	PS SD1 90 P. PS
Elastic aores or Textiles	1.0 1.0	R 70 -80 R 90 -100
Butted seam	1.0	LR 90 -100


THREADS
FIBRES / FILAMENTS
NATURAL FIBRES
MAN-MADE
Cotton wool
Flax Hair
Jute Silk
Hemp
Kapak
-Polyamides
-Polyesters
QUALITIES
QUALITIES
Resistant to heat
Easy to dye
Less durable
Shrinkage
No elasticity
Milden formation when wet
High strength
Excellent elasticity
Resistant lo baclena
Controlled elongation
Low moisture absorption

THREADS

A wide range and variety of threads is available for the FOOTWEAR industry in the market. It is very important for the Closing Room to have the right thread for proper stitch formation. The main factors to be kept in mind are:-

1. Leather or its equivalent used in the footwear industry is harsh and strong as compared to textiles, so we need strong threads to penetrate two or more layers of leathers.

2. Footwear is subject to a lot of FLEXING in wear therefore the thread must be able to take the STRAIN.

3. Footwear is exposed to ELEMENTS of NATURE e.g. water, heat, snow etc. which it must be able to withstand giving way.

4. Should be able to stand the WEAR AND TEAR of every day life of kids shoes, sports shoes.

5. WET and MUUDY SHOSE are often left without drying and cleaning.

6. Footwear is exposed in working ENVIRONMENT.

7. Footwear must LAST.

Keeping the above factors in mind the QUALITIES of a THREAD required for footwear can be summarized as:

1. High strength without being too thick i. e. TENACITY – wet and dry.

2. STRATCHABLE enough to withstand all shoe making operations without breaking. It should not stretch too easily.

3. It must also have ELASTICITY so that seams can recover well after stretching and not become loose in wear.

4. No SHRINKAGE/EXPANSION when exposed to heat or wet.

5. High FLEXIBILITY and resistance to flex cracking.

6. UNIFORM thickness to avoid snagging during stitching.

7. NON – SLIP property to prevent run back.

8. Good lop FORMATION property i.e. properly TWISTED to avoid missed stitches.

9. Good ABRASION RESISTANCE to withstand rubbing in wear and high speed stitching.

10. Resistance to NEEDLE HEAT.

11. Resistance to BACTERIA and MILDEW.

12. Resistance to damage from sun light.

13. Able to take DYES.

14. Retain a good APPERANCE in finished seams.

CLASSIFICATION

Threads are made from Fibres and are of many types. A basic understanding becomes necessary.

Threads can be made from NATURAL or MAN MADE FIBRES. The ones commonly used in SHOEMAKING are:-

NATURAL FIBRES

(A) Cotton, flax, jute, hemp, kapok, coir.
(B) Wool, hair silk.

ORGANIC

(A) Rayon (cellulose base)
(B) Synthetic fibres – polyamides, polyurethanes, polyvinyl, nylon.

INORGANIC

Gold, silver, copper.

CONSTRUCTION

Fibres are twisted together to make fine YARNS or FILAMENTS. This twist produces COHERENCE, STRENGTH and FLEXIBILITY – the essentials of a sewing thread. This twist which consolidates the fibres is the FIRST or SINGLING TWIST. This twist is balanced by a reverse twist when two or more yarns are joined together to form a THREAD. This twist is important as otherwise the individual plies would separate while sewing.

Now this twist can be inserted clockwise or anti-clockwise.

Clockwise twist produces a Z twist and an anti – clockwise twist produces on S twist. The twist of the thread is known by the FINISHING TWIST. Is defined in the number of twists inserted per cm. if the twist is too much the thread get lively and if too less the yarns will open up and fray.

Which thread to use depends upon the movement of the hook. In the CLOSING ROOM all machines have hooks with clockwise movement, so a thread with a clockwise Twist (Z) reaches equilibrium and resists further twisting while and (S) Twist will untwist and break.

THREADS are mainly produced in 2 or 3 sometimes 4 ply. i. e. 2, 3, or 4 yarns are twisted to form 2, 3, or 4 ply thread.

For heavier threads these twisted threads are further twisted to form CORDS but important point to remember is that the twist directions reverse every time, So 3, S twist yarns will be Z twisted to form a 3 ply Z twist thread.

The level of twist will depend upon the fibre.

TYPES

Threads can be made from long continuous fibres or staple fibres joined & twisted to form a yarn.

They can be:--

SPUN THREADS

Are made from staple fibres-cotton or polyester. These fibres are not very long. They have good sewing performance.

CONTINUOUS FILAMENT

Threads are made of very long filaments, silk or synthetic. These are more flexible and durable than spun. For optimum sewing performance the plied threads are given a coating of polymer for bonding.

In CORESPUN

Continuous filaments of one type of fibre forms the core which is covered with the fibres of another.

MULTIFILAMENT

(Mono Cord) threads are very fine threads of polyester filaments which have been twisted a number of these filaments are treated with a light bonding finish.

MONOFILAMENT

Monofilament is only one filament which is thick, it is usually transparent.

BRAIDED THREADS

Braided threads are plaited threads of polyester or nylon and are useful for the automatic machines.

FINISHS cotton threads can be:

(a) Of a soft finish – normal manufacturing procedure.

(b) Mercerized –the threads is passed through a carefully controlled gas flame to remove the external fibres from the thread surface and than treated with a solution of caustic soda.

(c) GLACE – after dyeing the threads are passed through a polishing mixture consisting of starch. This lays down all the external fibres and binds the plies producing a stronger, lustrous and abrasion resistant thread.

(d) Synthetic threads may be bonded or not, bonding agent is a thin coating of polymer.

In all threads lubricants are added during manufacture to prevent needle heating and thread abrasion.

QUALITY

To produce uniform flexible strong dyed and lubricated threads of different thickness is a long process which requires continuous quality control checks. These are:

- Yarn eveness.
- Yarn strength and sizing.
- Twist levels and regularity.
- Plied thread strength and elongation.
- Shade matching.
- Lubrication.
- Finished appearance.

THREAD CONSUMPTION

Consumption is the lowest in lockstitch machines. As simple formula for consumption per centimeter is.

2 x material thickness (e.g. 2 x 2 mm) = 4 mm
+
2 x stitch length (e.g. 2 x 1.43) = 2.86 mm

X stitches per centimeter 7 6.86
X 7
---
48. O2

Allow for 10% - 15% wastage.

PHYSICAL PROPERTISE

COTTON THREADS

1. Good sewing performance.
2. Poor abrasion resistance.
3. More stable at higher & dry temperature.
4. Less effected by needle heat.
5. High wet shrinkage which may cause seam puckering. (soft threads)

SYNTHETIC THREADS

GENERAL

1. Not significantly affected by moisture, rot or mildew.
2. High tenacity.
3. High abrasion resistance.
4. Less shrinkage.
5. They soften from 230.

SPUN NYLON

- Elongation at break and good elasticity.
- Useful for knitwear and high stretch applications.

SPUN POLESTER

- God sewing performance.
- Good dimensional stability.
- Good stitch locking properly in seam.
- Thread to abrasion resistance is good.

CONTINUOUS FILAMENT

(NYLON OR POLYESTER)

- The structure and appearance is seam, can be recognized by burning – polyester burns giving a black smoke while nylon creates a strong smell.

- The ends must be secured firmly to prevent runback.

- High tenacity & abrasion resistance.

- Specially lubricated for protection from needle heat.

- Excellent loop forming properly.

- Good sewing performance.

- More flexible.

- Low cost.

- Partially translucent.
- Good abrasion resistance.
- As there is no internal movement of fibres they are stiff.
- Stitching tends to run back.
- Ends can be uncomfortable against skin.
- Can be used for up holstery, curtains etc.

YARN AND THREAD SIZE NUMBERING SYSTEMS

The thickness of a yarn or thread cannot be reliable measured in the conventional way using a micrometer, so some other system of expressing it must be found. The method chosen should ideally:-

a) Directly represent thread strength.

b) Be a number greater than 1.

Many different methods have been used by thread manufactures in the past, causing a great ideal of confusion. In recent years attempts have been made to produce an international standard. Some progress has been made but certain of the older systems are still widely used in the shoe trade and are explained below. They fall into two main categories:-

1) The length of a fixed weight of yarn

2) The weight of a fixed length of yarn

1) Fixed weight system

a) The English count is defined as:

The number of hanks of yarn needed to make up 1 lb in weight

It is given the symbol Ne. the hank is a unit of length which depends on the type of fibre used.

Type of fibre	Hank length (yards)
Cotton	840
Linen	300
Wool	256
Worsted	560

e.g. A cotton yarn of Ne = 40 means that 40 x 840 yards weigh 1 lb,

b) The metric count is defined as:-

The number of hanks of yarn needed to make up 1 kg in weight

It is given the symbol Nm. This is simpler because the hank length is 1000 meters for any type of fibre.

e.g. A nylon yarn of Nm = 80 means that 80 x 1000 meters weigh 1 kg in a count system the larger the number thinner is the yarn.

It has been the practice for many closing thread manufacturers in the UK to use the English cotton count for cotton upper threads, and the linen count for sole stitching threads. The metric count is used for all synthetic threads, including cotton / polyester core - spun types.

The count number usually refers to a single yarn. A thread may consist of several single yarns twisted together. In older systems the ply was indicated along with the count. E. g. 3 / 60 Ne meant that the thread was made up of 3 yarns twisted together, each yarn having an English count of 60. This does not make it immediately obvious what the overall thread thickness is.

c) Ticket numbering

The ticket number was developed from the count system. The objective was to produce a number which could be related to total thread thickness.

The metric ticket number is almost universally used now for man – made threads. It is defined as:-

The metric count number of a 3 ply equivalent thread

It is calculated as follows:-

$$\text{TOTAL METRIC COUNT} = \frac{\text{METRIC COUNT}}{\text{PLY NUMBER}}$$

METRI TICKET NUMBER = TOTAL METRIC COUNT X 3

E.g. For A 2 ply thread with a single yarn count of 40

$$\text{Total metric count} = \frac{40}{2} = 20$$

Ticket number = 20 x 3 = 60

i.e. This thread has the same overall thickness as a 3 ply thread with each ply having a count of 60.

Cotton ticket numbers may be calculated in the same way as in the metric system but they not been so widely adopted by thread makers. This may be because the use of cotton threads for stitching has diminished in favour of synthetics in recent years.

2) <u>Fixed length system-</u>

a) The denier system is defined as:-

The weight in grams of 9000 meters of yarn

It may refer to a single fibre, to a single yarn or to the overall (resultant) thickness of a pled thread. The system originated in the silk industry. A single silk filament typically has a denier of about 1. i. e. 9000 meters of silk filament weighs about 1 gram. Later its use was extended to cover artificial silk (acetate rayon) and nylon in the hosiery industry.

b) The tex system is defined as:-

The weight in grams of 1000 meters of yarn

This is the latest system and is the easiest to use. The intention is that it should replace all previous sizing methods for all types of fibre.

In fixed length systems, the thicker the yarn or thread, the higher the number.

$$\text{TOTAL THREAD THICKNESS} = \text{DENIER OR TEX OF SINGLE YARN} \times \text{PLY NUMBER}$$

Conversion between systems

At the present time the UK footwear industry still prefers to use metric ticket numbers. However, the total tex number is easy to measure in the laboratory and it is useful to be able to convert tex into a ticket num in order to compare with the value printed on the bobbin.

$$\text{METRIC TICKET NUMBER} = \frac{3000}{\text{TOTAL THREAD TEX}}$$

$$\text{COTTON TICKET NUMBER} = \frac{1772}{\text{TOTAL THREAD TEX}}$$

Rounding of ticket numbers

When ticket numbers have been calculated from count numbers or from tex numbers, it is normal to round them down as follows:-

CALCULATED TICKET NUMBER	ROUND TO
Below 10	Next lower whole number
10 – 40	Next lower even number
40 – 100	Next lower multiple of 5
100 – 160	Next lower multiple of 10
above 160	Next lower multiple of 20

Size conversion factors

The following table shows how to convert between the various systems for a single yarn.

1.69	x	Ne cotton	=	Nm
5315	÷	Ne cotton	=	den
590.5	÷	Ne cotton	=	tex
0.605	x	Ne linen	=	Nm
14880	÷	Ne linen	=	den
1654	÷	Ne linen	=	tex
9000	÷	Nm	=	den
1000	÷	Nm	=	tex
9000	÷	den	=	Nm
den	÷	9	=	tex
1000	÷	tex	=	Nm
9	x	tex	=	den

Preferred thread sizes

In theory the number of possible thread sizes is infinite. In practice the shoe industry is offered a small number of preferred sizes which for most purpose it finds completely satisfactory. Uniformity in thickness is normally very good for a synthetic thread of given size from a given manufacturer, but there may be greater variation from one manufacturer to another for the same nominal size.

CHECKLIST FOR ENSURING AGAINST THREAD FAILURE

Continuous and persistent breaking of thread does not always mean that the thread is at fault. It can be due to many other reasons. Following factors must be taken into consideration.

- The thread stand must be seated centrally to the guide allowing a smooth pull off freely.

- The thread packing must be tight and the spool should not be like the domestic machine thread spool otherwise the thread will get caught and break.

- The tension discs and check spring must be free from burrs or dirt.

- All the parts involved in the complete passage of the thread must be free from burrs.

- The needle must be correctly inserted (short groove facing the hook)

- The needle and thread must be matching i. e. the thread size must be in relation to the needle size.

- The needle must not be damaged or bend

If after checking thread breaking still persists then the following can be tried:-

- Lubricate the top thread via a pad between the take up lever and the needle bar, (The lubricant must be silicon based)

- Use a one size longer needle.

- Reduce the stitching speed especially on heavy / difficult materials. If all above fail then the thread or material is at fault, they should be tested.

CHAPTER-2

1. DEFINITION OF FOOTWEAR

From which the term "shoe" is originated:-

In English, the term "shoe" dates back to many centuries beginning with the Anglo – Sexon. "Sceo" meaning a foot covering and evolving into "Schewis", then "Schooys" and finally "shoe". The German "Schuh" has the name origin. Through the centuries the word "shoe" has evolved with at least 17 different spelling and some 36 variations of the plural.

Definition:

Any foot covering in the form of shoes, boots, slippers or hose used for utility and dress wear.

Any form of footwear made of various kinds of materials or combination of materials like leather, canvas, rubber, textiles, wood and synthetics to protect the foot from cold, heat, thorns, hazards etc. and to serve as a costume in the form of sandal, shoe or boot. These shall include walking shoes, dress shoes, occasional footwear, sports footwear, occupational footwear, orthopedic and surgical footwear meant for the use of babies, children, ladies or gents.

Types of footwear:

Footwear is broadly classified into seven basic styles:

(1) Derby

(2) Oxford

(3) Sandals

(4) Court shoe

(5) Slip on

(6) Boot

(7) Moccacine

1. DERBY:

Most commonly used formal and casual shoes.

a) A very wide range of styles can be derived from a derby design

b) Unisex

c) Can be identified from the following points:

1. Lock stitch or stay stitch

2. The quarter can be opened till half of the tread line.

3. The vamp and tongue will be on the same line.

4. In most of the cases quarter will be on the vamp.

2. OXFORD:

d) Most widely used as formal shoes.

e) Unisex

f) Quarter is locked at the vamp point and hence opening of the quarter is limited.

g) Has an independent tongue which is stitched at the final stage of the upper.

h) In most of the case vamp will be on the quarter.

3. SANDALS:

i) A popular unisex footwear which is very comfortable

j) The foot is free at the toe and heel

k) The sandals serves according to the specific needs as the length can be adjusted with the help of buckle.

4. COURT SHOE:

l) Shoes for ladies formal and casual wear

m) The top line will be below the vamp point

n) Can be made in different heel heights.

5. SLIP ON:

o) Slip on is also called as pantafola & loafer.

p) As the name indicates these shoes can be slipped in and slipped out very easily.

q) Does not have lace.

r) Can be with or without elastic

s) Saddle is present in most of these designs.

6. BOOT:

t) Casual shoes popular among kids and Teenagers
u) Different types of boots are Ankle Boot, High boot, Knee boot & Thigh boot.

7. MOCCACINE:

v) The most comfortable shoe to wear
w) Expensive as more leather is consumed
x) Formal& casual shoe
y) Bottom will be covered with upper leather at the fore part
z) Hand stitching gives a good appearance.

Different raw materials of footwear:

We know that a footwear has different components such as sole, insole, shank, upper, lace, eyelet, toepuff, stiffener etc. So we will have to mention the name of different materials used for different components.

Upper materials:-

Upper materials can be of following types:-

- Leather: cow, buffalo, goat etc.
- Fabrics: woven fabrics, knitted fabrics, non woven fabrics etc.
- Synthetic or Artificial leather: PVC coated fabrics, PU coated fabrics, poromerics etc.

Lining materials:-

Lining materials are as follows:-

- Sheep skin
- Split leather
- Woven fabrics
- Non woven fabrics

Insole materials:-

The following are used as insole material:-

- Leather
- Leather board
- Fibre board

Soling materials:-

Soling materials are as follow:-

- PVC
- PU
- EVA
- TPR
- VR
- Crepe Rubber
- Leather
- Resin Rubber
- Microcellular Rubber.

Toe puff materials:-

Toe puff materials are as follow:-

- Vegetable tanned leather
- Nitro cellulose impregnated fabric
- Poly styrene impregnated fabric
- Thermoplastic toe puffs

Stiffener materials:-

Stiffener materials are as follow:-

- Vegetable tanned leather
- Leather board
- Fibre board
- Solvent activated plastics
- Thermo plastic counters

Shank materials:-

Shank materials are as follow:-

- High grade carbon steel
- Wood
- Mill board
- Plastic
- Fibre board

Fasteners materials:-

Fasteners materials are as follow:-

- Zips
- Lace
- Buckles and straps
- Trims
- Elastics

Adhesive materials:-

Adhesives materials are as follow:-

- Natural Rubber/latex
- Polychloroprene adhesive
- PU adhesive
- Hot melt adhesive
- Single and two component PU adhesives
- Self adhesive tapes

Heels and Top pieces:-

- build Heels
- Wood Heels
- Veneers
- Top – pieces

Different types of seam:

Different types of seam used in footwear department. There are given below:

(1) Plain closed seam

2) Open or Reversed closed seam

(3) Brooklyn seam

(4) French or Silked seam

(5) Piped seam

(6) Welted seam

(7) Blind seam

(8) Lapped seam with raw edge

(9) Welted Lapped

(10) Piped Lapped

(11) Lapped seam with gimping & punching

(12) Butted seam without back strap

(13) Butted seam with back strap

(14) Cording

(15) Cable stitching

Manufacturing process :

To produce a complete footwear we have to do some operation, such as; First complete the final drawing of the footwear and then make pattern by the previously mentioned sequential way and make the upper as the same way and then we have to do the following works;

1. Assembly : First need to collect or assemble the various components. These are,
    (a) Last (metal plated bottom to rivet the tacks)
    (b) Completed upper
    (c) Insoles
    (d) Toe puff & Stiffener
    (e) Adhesives,

2.Insole attaching:

In the bottom of the last there are three holes in the metal plate, usually filled with a rubber plug. The insole is accurately laid to the bottom of the last and attaching to the last using special tacks driver through in to the rubber plug.

3. Stiffener insertation :

Stiffeners were made from fibre board or leather board and were moulded to the shape of the back part of the last by the stiffener manufacturer. The stiffener was then dipped in to a specially compounded latex or dextrin liquid adhesive and placed on a wire tray drain. When the surplus adhesive had drained off the stiffener was inserted in to the “stiffener pocket” and positioned accurately so that the edge of the stiffener was level with the edge of the upper.

Modern shoemakers put in stiffener in different ways :- Moulded 2/R board , fibre board on fabric coated with thermoplastic material is used for the stiffener & this is either inserted in to a stiffener pooret as in the old method or combined with the lining & sewn on in the closing room .

4. Back part Moulding :

After the insertation of stiffener the back part should be moulded by the my m/c. In this case the seat sinking is really on important subject . Seat sinking really meant positioning the upper at the seat so that just the correct amount of upper material would fold over the insole at the seat to give the correct back height . the back seam was also centralized .

5.Toe puff Attaching :

The Toe puff nude to be positioned between the upper & lining level with the edge of the upper . the puff is ironed or fused on by heat & pressure in the closing room & is made soft ready for lasting by the application of heat, sufficient to softer the puff , but not the adhesive which attaches it to the upper . Heat is applied either by a toe steamer which also softens the leather .

6. Toe lasting :

This could be done by using the twisting pincers to create the pleats which had to be formed to last the tock area. The larger factories had tock luster which wiped all the pleats at one time & unsorted all the tacks at one go. The process of wiping the tock area with hinged wiping plates & securing the upper to the insole has new been taken over by the forepart lasting m/c .Adhesive or hot melt adhesive is used to secure the upper instead of tacks.

7. Seat & side lasting :

The final lasting operation is seat & side lasting & the same tack lasting prouss is still used . The seat & the upper is placed on a peg ,which is then pushed in to the m/c. The upstanding upper material is wiped once or twice , with metal plates , & then held in compression whilst up to required amount tacks are driven simultaneously to secure the upper to the insole .

8. Heat setting :

Heat setting helps lasted uppers their shape by relaxing the internal that would other wise tend to pull them back to their original flat shape. The presence of moisture may assist this prouss for same materials , particularly leather . There our two maintypes of heat sitting machine they are ,

a. conventional moist heat setters (Such as rotary machine)

b. High velocity air Jet machine .

Points to check:

i. Check the heat setter temperatures & dwell times .
ii. When using a moist heat m/c, check the water reservoir & filling system regularly
iii. Heat setting is never 100 percent efficient and some loss of shape must be expected.
iv. Keep heat setters as clean as possible . Rusty or oily m/c may cause irreparable damage to sensitive uppers .
v. Exposure to heat may back in some stitch marking inks making them much larder to remove , check to see if this sort of ink has been used & if so ensure that any remaining marks are removed before heat setting .

Recommended temp & minimum dwell times for conventional moist heat setters .

Material	Temperature	Dwell times
Grain leathers	Dry air at 120-130 c`/moist air at 80`c	8.5 mins/1-5 min
PU coated L/R finished	Dry air at 140-150`c	5 mins
Pv patents	Dry air at 120`c	5 mins
PVC coated fabries synthetics suede		

Recommended temp & minimum dwell times for high valocity air jet machine

Grain L/R	Dry air at 120-130`c	2.5min
PU coated L/R finished split	Dry air at 120-130`c	2.5min
PU patents		
PVC coated fabries synthetic suede	Dry air at 100`c	2.5min

Roughing & scouring :

The foundation of the sole bond.

a. Minimum width 12mm
b. Minimum pleating.
c. Watch for contamination of margin with hot melt adhesive.
d. Watch for excessive build up of lasting tacks .

Toc & seat scouring:

i. 40 grit band vocally used
ii. Scouring bands cause burring of 2/R .
iii. Worn bonds cause burring of 2/R .
iv. Removal of deep pleats may cause serious holing.

Preparation of Leather :

1.=> Grain L/R Nubuck Patent –
Rough or scour away any finish and grain layer from full width of margin.

2.=> PVC coated L/R –
Rough or scour to roughen PVC coating but not removed it. Solvent wiping is an alternative to rough.

3.=> Suede-
Tease up flattened margin by light roughing or scouring.

4.=> Finished splits-
Roughing or scour any finish from full width of lasting margin.

5.=> Synthetics-
Solid PVC coated fabrics ; Lightly rough to remove finish but not whole coating.

Solvent wiping is an alternative to rough.

6.=> Softly PVC coated fabrics-
Solvent wipe to remove finish.
Roughing is not recommended.

7.=> Synthetic Suedes-
Roughing or solvent wiping to disturb surface may be beneficial.

8.=> PU coated fabrics-

Rough to remove PU coating.

Leave narrow strip (3 mm) around the feather edge.

Solvent wipe can be used in waist only where preshanked insoles make roughing difficult (In case of Court Shoe)

9.=> Poromerics-

Rough in to surface layer unless recommended otherwise by the materials supplier.

Upper materials	Adhesive
** Leather : Gtain leather (Resin finish or aniline etc) NUBUCK	Poly chloroprene/PU
PU patent	Poly chloroprene/PU
PVC coated	PU
Suede Leather	Poly chloroprene/PU
** PVC coated fabrics: solid or semi-expended	PU
Cellular	PU
** synthetic suede's	PU
** PV coated fabrics	PU
** promises Homogeneous	PU
Two layer	PU
** textile natural & certain synthetic fibers	Poly chloroprene/PU
Other synthetic including nylon	Poly chloroprene/PU

Sole preparation :

1. collect right size sole .
2. clean to remove any dust , physically attached ,
3. Limit time bets preparation & cementing to within working day .
4. watch for areas of sole missed by priming treatment , fluorescent additives in primes may be helpful .
5. Change priming cloths regularly . this may be necessary every 12 pairs .

Halogenations :

1. container & brushes should be metal free .
2. pour out small quantity of primer at one time & rescale stock container .
3. Avoid build up if contaminants in container .
4. A soft brush should always be used or TR .
5. Turn cored units upside down to dry .
6. Allow at least 15 mins between halogenations & cementing . Longer timer may be recommended in some instances .

Sole cementing (After priming) :

1. Avoid using large open adhesive containers to reduce evaporation of solvent .
2. Check for continues coat if adhesive over the bonding surface .
3. Keep the interval between cementing & bonding to that recommended by adhesive supplier
4. Avoid contamination if cemented soles during storage . contamination may arise from dust , dirt or from mould release agents etc.

Upper Cementing:

1. Aim for a visible coating of adhesive on the lasted margin.
2. Check for areas missed or large blobs if adhesive.
3. Consider whether two coats are required on absorbent materials.

Bottom fillers & shanks:

1. Check that any bottom filling is of correct size & does not over lop the bonding margin.
2. Shank should not protrude above the bonding margin.

Adhesive for soling materials :

Soling materials			Adhesive
L/R			PU or poly chloroprene
Rubber (Resin)			poly chloroprene
Rubber (Natural creape)			PU or poly chloroprene
Rubber (Thermoplastic)		Halogenated	PU
		Solvent wipe	PU or poly chloroprene
EVA	Scour/solvent wipe		Poly chloroprene
	Isocyanate primer		PU
	Special EVA primer		PU
Poly Urethane			PU
Nylon			PU or poly chloroprene
Polyester			PU

Adhesive drying:

In drying the solvent or H2o is evaporated & the % of the adhesive molecules increase & the bond formed is stronger.

1. Ensure that the adhesive film is dried, when the upper reacles the sole press.
2. Do not force dry at high temperature then skinning may occur.
3. 10 minutes at 50-60`c is likely to give adequate drying.

Heat Activation :

Points to check:

1. Check reactivators daily for any faulty elements .
2. Keep refectors clean
3. Regularly check surface temperature at toe , waist & seat of each type of sole to ensure 80-85`c is reached .
4. Adequate heat activation is particularly important if adhesive open time is long .
5. Remember that light coloured soles require more heat than dark ones.
6. Be aware/Remove of cold spots in the activators.
7. Avoid delay between activation & pressing.
8. Note that over heating can be as bad for the sole bond as underheating .
9. Avoid stretching soles excessively.

Pressing:

Points to check:

1. Check that the correct pad boxes are in use.
2. Pressure to suit sole material should be applied for as long as practice able (a minimum of 10 seconds is recommended) hard soling can be bonded at high pressure soft soling need less pressure.
3. Look for excessive squabbling of a sole due to high overall localized pressure.
4. Display a record of pressure settings to be used for each sole unit on the m/c.

Recommended Pressure-

L/R	550-600 psi	12-15 sec
PUC/PU/TPR	250-300 psi	12-15 sec
ERA/MCR	250-500 psi	12-15 sec

Delasting-

The last is then removed from the complete shoe.

CHAPTER-3

Making different types of seam by different types of needle and thread:

(1) LAP PIPED:

Uses of needle		Uses of threads
point	Size	
PCL	100	Top – 40/3
		Bottom – 60/3
S	100	Top – 40/3
		Bottom – 60/3
LL	120	Top – 40/3
		Bottom – 60/3
LR	100	Top – 40/3
		Bottom – 60/3
R	100	Top – 40/3
		Bottom – 60/3
KKS	100	Top – 40/3
		Bottom – 60/3

(2) FRENCH SEAM:

Uses of needle		Uses of threads
Point	Size	
PCL	100	Top – 40/3
		Bottom – 60/3
S	100	Top – 40/3
		Bottom – 60/3
LL	120	Top – 40/3
		Bottom – 60/3
LR	100	Top – 40/3
		Bottom – 60/3
R	100	Top – 40/3
		Bottom – 60/3
KKS	100	Top – 40/3
		Bottom – 60/3

(3) BROOK SEAM:

Uses of needle		Uses of threads
Point	Size	
PCL	100	Top – 40/3
		Bottom – 60/3
S	100	Top – 40/3
		Bottom – 60/3
LL	120	Top – 40/3
		Bottom – 60/3
LR	100	Top – 40/3
		Bottom – 60/3
R	100	Top – 40/3
		Bottom – 60/3
KKS	100	Top – 40/3
		Bottom – 60/3

(4) ZIG-ZAG SEAM:

Uses of needle		Uses of threads
Point	Size	
PCL	100	Top – 40/3
		Bottom – 60/3
S	100	Top – 40/3
		Bottom – 60/3
LL	120	Top – 40/3
		Bottom – 60/3
LR	100	Top – 40/3
		Bottom – 60/3
R	100	Top – 40/3
		Bottom – 60/3
KKS	100	Top – 40/3
		Bottom – 60/3

(5) CLOSE SEAM:

Uses of needle		Uses of threads
Point	Size	
PCL	100	Top – 40/3
		Bottom – 60/3
S	100	Top – 40/3
		Bottom – 60/3
LL	120	Top – 40/3
		Bottom – 60/3
LR	100	Top – 40/3
		Bottom – 60/3
R	100	Top – 40/3
		Bottom – 60/3
KKS	100	Top – 40/3
		Bottom – 60/3

(6) OPEN SEAM:

Uses of needle		Uses of threads
Point	Size	
PCL	100	Top – 40/3
		Bottom – 60/3
S	100	Top – 40/3
		Bottom – 60/3
LL	120	Top – 40/3
		Bottom – 60/3
LR	100	Top – 40/3
		Bottom – 60/3
R	100	Top – 40/3
		Bottom – 60/3
KKS	100	Top – 40/3
		Bottom – 60/3

Manufacturing procedure:

TYPE: CLOSE SEAM

Machine used: Single needle flat bed (PFAFF-1183)

Skiving

TYPE	DEPTH	WIDTH	MACHINE USED
CLOSED RAW EDGE	⅔rd of material thickness	3 mm	Fortuna single step

STITCH

LENGTH	DENSITY	FORMATION	MARGIN FROM EDGE
2 mm	5 stitch/cm	Lock stitch	1.5 mm

NOTES: in simple st. density is more.

MATERIALS: Leather

THICKNESS: 1.0 mm color – black

OTHER COMPONENT (Not applicable)

REINFORCEMENT (No0t applicable)

* NOTES: Most of the time close seam is reinforced by self adhesive reinforcement tape.

Starting and ending point should be locked.

After stitching seam is rubbed by seam rubbing machine or hammered down.

TYPE: OPEN SEAM

MACHINE USED: Single needle flat bed (PFAFF-1183)

SKIVING (Skiving is not needed)

* NOTES skiving is avoided to give a bold look. With the upward standard seam.

STITCH

LENGTH	DENSITY	FORMATION	MARGIN FROM EDGE
2.5 mm	4 st/cm	Lock st.	2 mm

* NOTES

MATERIALS: Leather

Thickness 1.5 mm. color-black

OTHER COMPONENT: Not applicable

* Edge ink-black.

REINFORCEMENT

MATERIAL	TYPE	WIDTH	COLOR	PLACEMENT
WOVEN	Self adhesive	20 mm	White	Beneath the seam (flesh size of the leather)

* NOTES: After tapped it is advised to make seam like French seam. /A tape or backer must be used.

Stitch starting and ending point should be locked.

The edge should be inked.

TYPE: BROOKLYN

MACHINE USED: Single needle flat bed (PFAFF-1183)

SKIVING

Type	Depth	Width	Machine used
Close d raw edge.	2/3 OF material thickness.	3mm.	Single step cylinder knife

STITCH

LENGTH	DENSITY	FORMATION	MARGIN FROM EDGE
2 mm	5 st./cm	Lock st.	2 mm

* NOTES: In simple st. density is more

MATERIALS: Leather

Thickness 1.omm color-black

OTHER COMPONENT

REINFORCEMENT

MATERIAL	TYPE	WIDTH	COLOR	PLACEMENT
WOVEN	Self adhesive	20mm	White	Beneath the seam (flesh side of the leather

* NOTES Seam is rubbed down by seam rubbing machine and tapped.

TYPE: FRENCE SEAM

MACHNE USED: Single needle flat bed (PFAFF-1183)

SKIVING

Type	Depth	Width	Machine used
Closed raw edge.	2/3 OF material thickness.	3mm.	Single step cylinder knife.

STITCHING

Length	Density	Formation	Margin from edge
2mm 2mm	5 st/cm 5 st/cm	Lock st	1.5 mm (For close seam) 2 mm (from both size of close seam)

* NOTES:

Two rows of stitching one on each side of the seam is the feature of silking.

MATERIALS: Leather

Thickness 1.0mm color-black.

OTHER COMPONENT (Not applicable)

REINFORCMENT

MATERIAL	TYPE	WIDTH	COLOR	PLACEMENT
WOVEN	Self adhesive	20 mm	White	Beneath the seam (flesh side of the leather)

* NOTES: There is a special m/c for this a twin needle two thread chain stitch machine.

Starting and ending point of all stitch should be locked.

After stitching seam is rubbed by seam rubbing machine.

TYPE: PIPPED LAPPED

MACHIJNE USED: Single needle flat bed (PFAFF-1183)

SKIVING

STITCH

Type	Depth	Width	Machine used
Open raw edge. Underlay	1/3 OF material thickness. Tapper down gradually	2mm. 8mm	Fortuna single needle. 1.5 mm

Length	Density	Formation	Margin from edge
2.5 mm	4 st/cm	Lock st	

Length * NOTES	Density	Formation	Margin from edge
2.5 mm	4 st/cm	Lock st	1.5 mm

MATERIALS: Leather

Thickness 1.0mm color-Black

OTHER COMPONENT (Pipe strap)

Thickness 0.5mm color-pink.

REINFORCEMENT Not applicable.

* NOTES: starting and ending of stitches should be locked.

TYPE: BUTTED SEAM

MACHINE USED: Zig-Zag (PFAFF-418)

SKIVING: Not applicable.

STITCH

Width	Density	Formation
6 mm	3 st/cm	Lock st

* NOTES: Stitch width 6 is preferable for leather. 8 for synthetic 10for fabric.

MATERIALS: Leather

Thickness 1.0mm color-Black

OTHER COMPONENT (Not applicable)

REINFORCEMENT

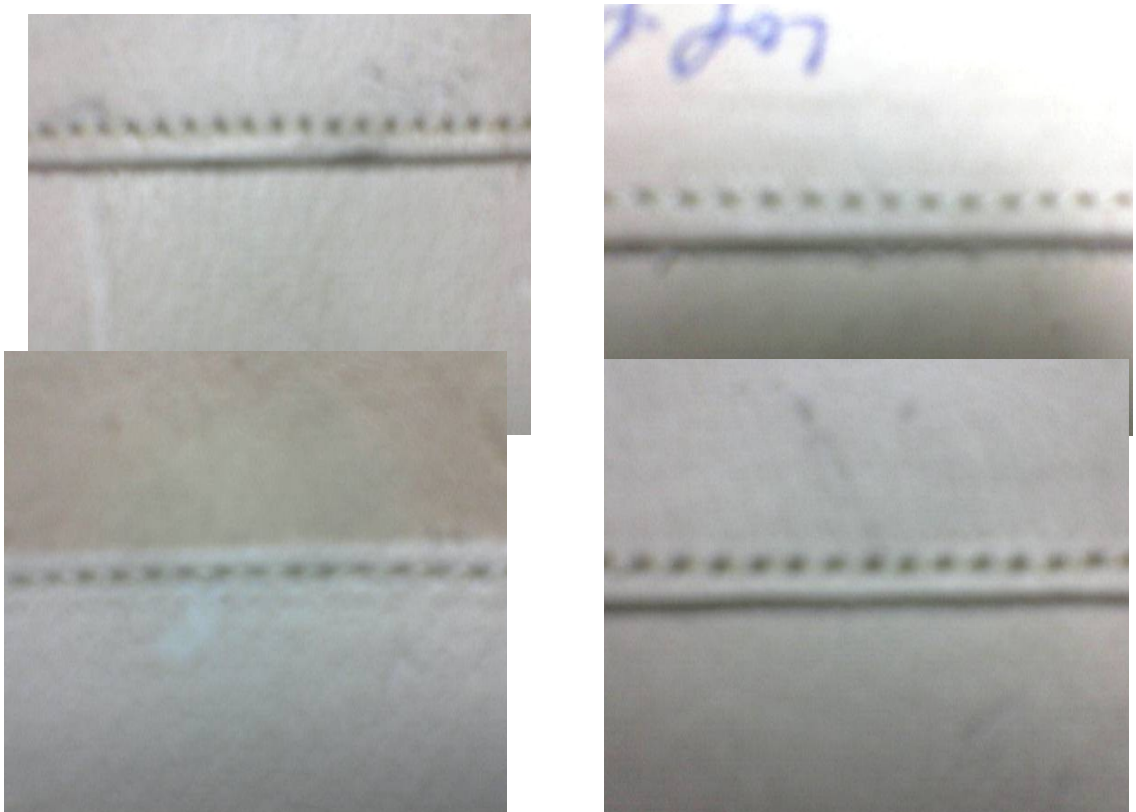
MATERIAL	TYPE	WIDTH	COLOR	PLACEMENT
WOVEN	Self adhesive	90 mm	White	Beneath the seam (flesh side of the leather.

* NOTES

Starting and ending point should lock.

Stitching should form equal distance (or centered) from both side.

BROGE SEAM:



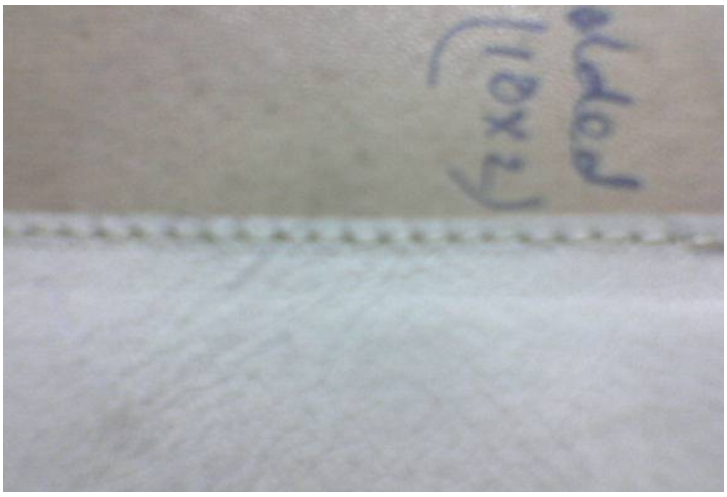
Needle-LR; Size-100

Needle-R; Size-100

Needle-S; Size-100

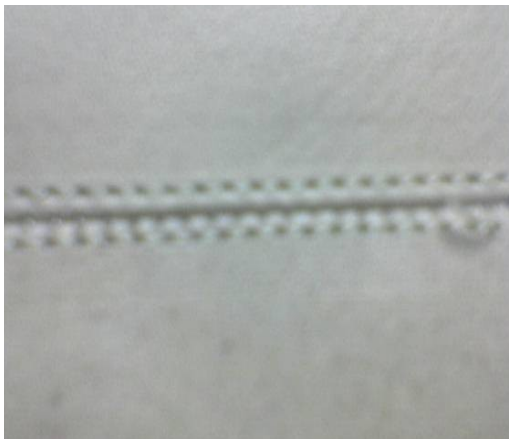
Needle-LL; Size-120

Needle-PCL; Size-90



Needle-KKS; Size-110

FRENCE SEAM:



Needle-LR Size100

Needle-S; Size-100

Needle-KKS; Size-110

Needle-LL; Size120

Needle-R; Size-100

Needle-PCL; Size-90

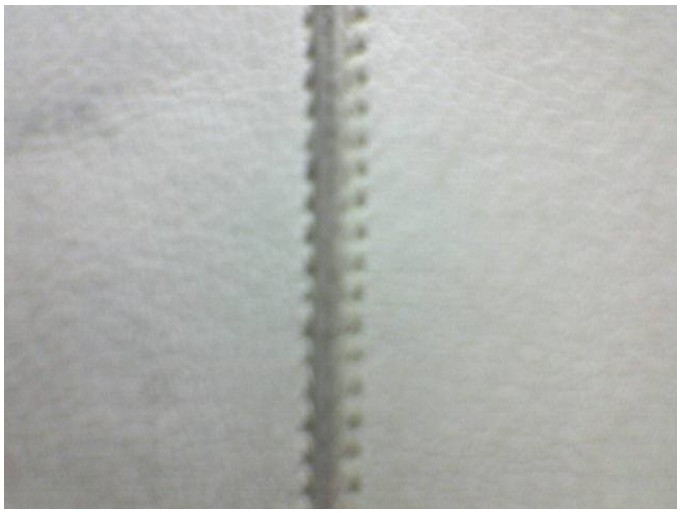
OPEN SEAM:

Needle-S; Size-100

Needle-PCL; Size-90

Needle-LL; Size-120

Needle-R; size-100



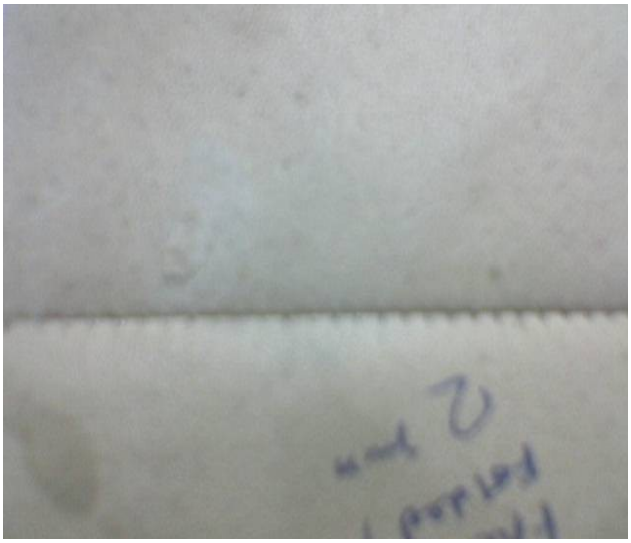
Needle-LR; Size-100

Needle-KKS; Size-110

CLOSE SEAM:

Needle-R Size-100

Needle-KKS Size-110



Needle-LL Size-120

Needle-PCL Size-90

Size-100

Needle-S

Needle-LR Size-100

LAP PIPED:

Needle- R- Size-100

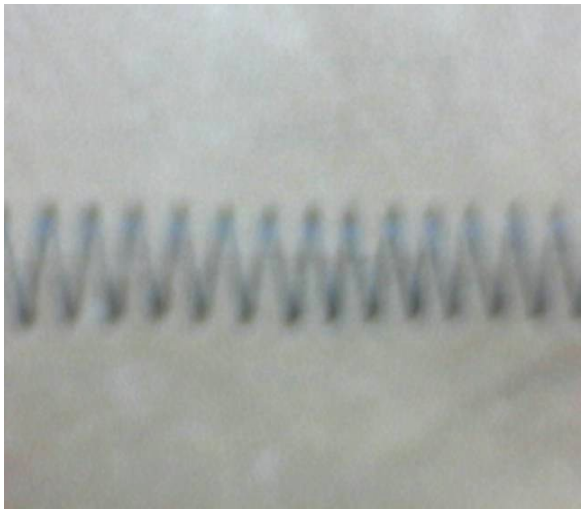
Needle- KKS- Size-110

Needle-PCL Size-90 Needle-S –Size-100

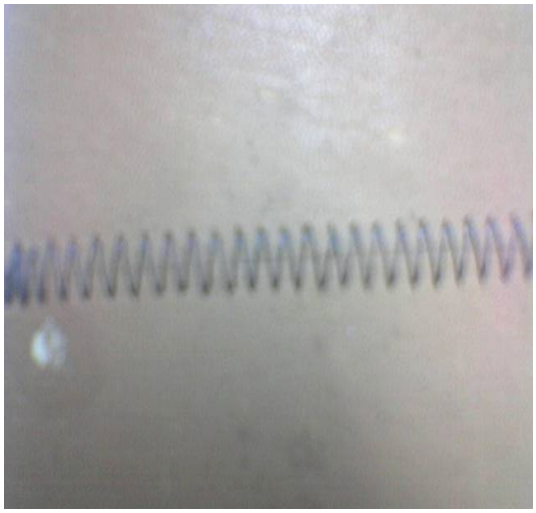
Needle-LR Size-100

Needle-LL Size-120

ZIG-ZAG:



Needle-KKS Size-110



Needle-R Size-100

Needle-PCL Size-90 Needle-LL Size-120

Needle-PCL Size-90

Needle-LR Size-100

CHAPTER - 4

Test results and analysis of the results:

1. Closed seam

Needle→ Can be used PCL

Threads→ 60/3 can be used as a bottom threads. Havier thread (more than 90) is avoided.

2. Open seam

Needle→ Can be used PCL

Threads→ Through top and bottom threads both are visible so same threads used.

3. Brook seam

Needle→ PCL can be used.

Thread→ 60/3 bottom thread can be used. Havier thread should be avoided.

4. French seam

Needle→ P can be used.

Thread→ In sample for close seam 40/3 used.

5. Lapped seam

Needle→ P can be used.

Thread→ 60/3as a bottom thread is preferable.

6. Zig-zag

Needle → LR is can be used never used P.

Thread→ 60/3 is preferable.

CHAPTER - 5

Conclusion & Recommendation

** Right needle & Right thread should be used to increase the longevity & strength of a goods. it will also make the product decorative . As a whole, a product can be qualified by choosing & using suitable needle & thread.

** If we use the following table, we may get qualified footwear.

RELATION BETWEEN NEEDLE, THREAD & MATERIAL.

TABLE: 1

THREAD THICKNESS	LIGHT MATERIAL NEEDLE SIZE		MEDIUM TO HEAVY MATERIAL NEEDLE SIZE	
	NM	SIZE	NM	SIZE
80	65-70	9-10	70-80	10-12
60	80-90	12-14	90-100	14-16
40	90-100	14-16	100-110	16-18
30	110-120	18-19	120-130	19-21
35	110-120	18-19	120-130	19-21
20	120-130	19-21	130-140	21-22
25	130-140	21-22	140-160	22-23
15	130-140	21-22	140-160	22-23

10	140-160	22-23	160-180	23-24
8	160-170	23-24	180-200	24-25

RELATIONSHIP BETWEEN SEAMS, NEEDLE & THREAD.

TABLE: 2.

SEAMING OPERATION	EQUIVALENT THREAD NO			NEEDLE GAUGE NM		
	POLYSTER	SILK	COTTON			
FINE DECORATIVE SEAMS	80/3	70/3	40	65	70	80
	70/3	60/3	30	70	75	
	60/3	50/3	30	70	75	

HEAVY DECORATIVE SEAMS	30/3	30/3	12	110	120	
	20/3	20/3	12 YARN	120	130	
	10/3	10/3	6 PLY fancy yarn	140		
			9 ,, ,, ,,	160		
			12 ,, ,, ,,	180		
STITCKED SEAM	70/3	60/3	36	75	80	
	60/3	50/3	30	80	90	
	50/3	40/3	24	90	100	
	40/3	40/3	20	100	110	
	30/3	30/3	12	110	120	
STAY SEAMS	60/3	50/3	30	80	90	
	40/3	40/3	20	100	110	
	30/3	30/3	12	110	120	
	20/3	20/3	12	120		

References :

1. Footwear Materials & Process Technology ,
-A. J. Harvey.
2. Handout – South Fields College .
- Leicester , U.K.
3. Manual of Shoe Making
–Clarks
4. Modern Shoe Making
– Satra
5. Testing & Quality Assessment of Footwear & Footwear Materials
- B. Venkatappaiah
6. Introduction The Modern Footwear Technology
- B. Venkatappaiah
7. Manual of Shoe Designing
– S.Mahon Kumar & Md . Sadiq .

8. Footwear Design & Development Institute (FDDI) Closing
–Handouts

9. Product Knowledge
– Swayam Siddha.

10. Class Lecture - by
– Noor Mohammad.

11. Class Lecture - by
– Tajul Islam .