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FACULTY OF SCIENCE AND INFORMATION TECHNOLOGY

DEPARTMENT OF TEXTILE

## THESIS REPORT ON

### FREQUENTLY OCCURRED SEWING DEFECTS & THEIR REMEDIES

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## **ABSTRACT**

Sewing process is one of the most important stages in labour intensive ready-made clothing enterprises. Quality faults occurring during this process adversely affect the product quality and product efficiency, and also increase the production cost. The aim of this study is to investigate whether the knitwear production process is under control in a knitwear production enterprise and to detect the processes with highest rates of sewing faults in sewing department and finally to make suggestions for improving the quality control. Among the Statistical Process Control methods; control list, product control chart were used in the study. “product control chart” was used to test whether the production process is controlled in the enterprise. Furthermore, the statistical methods were employed to determine the issues that need to be done in the improvement efforts and to detect the relations between the process groups supposedly effective on faults occurring in knitwear production and the amount of faults. Also, the processes with highest amounts of sewing faults and the effects of these processes on fault rates were investigated. As a result, it was concluded that the production process was statistically not under control in the ready-made clothing enterprise. In addition, this study demonstrated that the investigation of each process group by drawing their product control charts would make significant contributions to foresee the results and prepare more effective the improvement plans.

## **DECLARATION**

We hereby declare that, this work has been done by Md. Ashikur Rahman Ashik, Saimum Afrad and Sarker Mahid Kaiser under the supervision of Abdullah-Al-Mamun, Assistant Professor, Department of Textile Engineering, Daffodil International University. We also declare that neither this project nor any part of this attachment has been submitted elsewhere for award of any degree or diploma.

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By this thesis work we achieve the clear concept about sewing, their faults and remedies in garments production sector.

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## 1.0 INTRODUCTION

The word textile is from Latin word texere which means “to weave”, “to braid” or “to construction”. The simplest textile art is felting in which animal fibres are matted together using heat and moisture. Most textile arts being with twisting or spinning and plying fibres to make yarn. The yarn is then knotted, looped, braided, or woven to make clothing. All of these items – felt, yarn, fabric, and finished objects – are collectively referred as Textiles. It also includes those techniques which are used to decorate textiles – dyeing and printing to add color and pattern; embroidery and other types of needlework. Construction methods such as sewing, knitting, crochet etc.

*Quality of product plays an important role in any industry. If a consumer does not like the quality of the product then the chances of sales become very less. Today, clothes play a very important role in the society. They help in creating an impression and define the human being in some aspects. Therefore it is very important to see to it that garments are made of high quality. In textile and Apparel Industry, sewing is one of the major processes in apparel production. It plays an important role in maintaining the quality of clothes. Hence it is important that all defects have to be avoided during sewing any apparel. In this paper, various faults or defects that can take place during sewing along with different remedies or methods to solve these defects are discussed.*

## 2.0 Sewing Machine

A sewing machine is a textile machine used to stitch fabric or other material together with thread. Sewing machines were invented during the first industrial revolution. Since the invention of 1<sup>st</sup> working sewing machine, generally considered to have been the work of Englishman Thomas Saint in 1790, the machine has vastly improved the efficiency and productivity of fabric and clothing industries. Modern types of sewing machines are designed in such a way that the fabric easily glides in and out of the machine without the hassle of needles and thimbles and other such tools used in hand sewing, automating the process of stitching and saving time. Fabric shifting mechanism may be simple work guide or may be pattern-controlled. Needle guards, safety devices to prevent accidental needle-stick injuries are often found on modern sewing machines.



Figure: Plain Sewing Machine

## 2.1 History & Development of sewing machine

- 👑 The story really starts in 1755 in London when a German immigrant, Charles Weisenthal, took out a patent for a needle to be used for mechanical sewing. There was no mention of a machine to go with it, and another 34 years were to pass before Englishman Thomas Saint invented what is generally considered to be the first real sewing machine.
- 👑 In 1790 the cabinet maker patented a machine with which an awl made a hole in leather and then allowed a needle to pass through. Critics of Saint's claim to fame point out that quite possibly Saint only patented an idea and that most likely the machine was never built. It is known that when an attempt was made in the 1880s to produce a machine from Saint's drawings it would not work without considerable modification.
- 👑 In 1791 British inventor Thomas Saint was the first to patent a design for a sewing machine. His machine was to be used on leather or canvas. A working model was never built.
- 👑 The story then moves to Germany where, in around 1810, inventor Balthasar Krems developed a machine for sewing caps. No exact dates can be given for the Krems models as no patents were taken out.
- 👑 In 1814 an Austrian tailor Josef Madersperger presented his first sewing machine, the development started in 1807.
- 👑 The lock stitch sewing machine was invented by Walter Hunt in 1833. His machine was used an eye-pointed needle carrying the upper thread and shuttle carrying the lower thread.



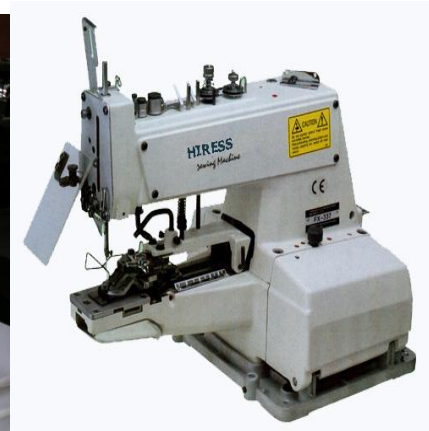
- 👑 America's first real claim to fame came in 1818 when a Vermont churchman John Adams Doge and his partner John Knowles produced a device which, although making a reasonable stitch, could only sew a very short length of material before laborious re-setting up was necessary.
  
- 👑 Isaac Merritt Singer has become synonymous with the sewing machine. Trained as an engineer, he saw a rotary sewing machine being repaired in a Boston shop. He thought it to be clumsy and promptly set out to design a better one. This machine combined elements of Thimonnier's, Hunt's and Howe's machines. He was granted an American patent in 1851 and it was suggested he patent the foot pedal use to power some of his machines. When Howe learned of Singer's machine he took him to court. Singer then took out a license under Howe's patent and paid him \$115 per machine.
  
- 👑 Though the 1850s more and more companies were being formed and were trying to sue each other. Charles Miller patented the first machine to stitch buttonholes (US10609).
  
- 👑 In the 1840s a machine shop was established at the Merrow mill to develop specialized machinery for knitting operations. The Merrow machine company went on to become one of the largest American manufacturers of over lock sewing machines.
  
- 👑 Perhaps all the essentials of a modern machine came together in early 1844 when Englishman John Fisher invented a machine which although designed for the production of lace, was essentially a working sewing machine. Probably because of miss-filing at the patent office, this invention was overlooked during the long legal arguments between Singer and Howe as to the origins of the sewing machine.

🏠 In 1946, the first TOYOTA sewing machine was built under the strict supervision of TOYOTA founder, Mr. Kiichiro Toyoda. Mr. Toyoda had a strong belief that home use products must be “functional yet beautiful”.

🏠 Modern machines may be computer controlled and use stepper motors or sequential cams to achieve very complex patterns. Most of these are now made in Asia and the market is becoming more specialized, as fewer families own a sewing machine.



Button Hole Machine



Button Attach Machine



Feed of the arm Machine

























Bar tack Machine

## 2.2 Types of sewing machines

According to the operating system there are two types of sewing machines are available given below:

1. Manually operated sewing m/c.
2. Electrically operated sewing m/c.

There are various types of Industrial sewing machines named by:

-  Double chain stitch m/c (4- needle short)
-  Double chain stitch m/c (4- needle elastic inserting m/c)
-  Double chain stitch m/c (double needle with reserve feed)
-  Feed of the arm (double chain stitch m/c, 3-needle)
-  Interlock m/c (twin needle, 5-thread over lock m/c)
-  Lock stitch m/c (single needle with variable top feed with automatic thread trimmer)
-  Lock stitch m/c (single needle with automatic thread trimmer)
-  Lock stitch m/c (single needle sewing m/c)
-  Lock stitch m/c (2-needle with spilt needle bar sewing)
-  Lock stitch m/c (twin needle feed)
-  Lock stitch m/c (1-needle with vertical trimmer wiper & reverse feed)
-  Lap seaming m/c ((for back tape attaching)
-  Linking m/c
-  Over lock m/c (twin needle, 4-thread m/c)
-  Over lock m/c (1-needle, 3-thread)
-  Zigzag sewing m/c (1-needle)
-  Top & bottom cover stitch flat bed m/c (3-needle)
-  3-needle covering m/c, 5-thread flat bed top & bottom covering m/c
-  Button hole m/c (for woven fabric)
-  Button sewing m/c
-  Bar tack m/c (with automatic thread trimmer)
-  Button hole sewing m/c (for knit fabric)

- 🔧 Button covering stitch belt loop making m/c (kansai m/c)
- 🔧 Bias tape cutting m/c
- 🔧 Label sewing m/c



Figure: Overlock Machine



Figure: Plain Machine: JUKI

## 3.0 Sewing

Joining the fabric by using needle & thread is called sewing. Sewing section is the biggest section in the garments industry. It is a universal & widely used method of joining fabrics. The purpose of sewing is to produce seam. A line along which two or more fabrics are joined by fusion, gluing, sewing, stapling or alternative method is termed as seam. Usually near edges of sewn fabrics pieces.

### **History:**

Sewing has an ancient history estimated to begin during the Paleolithic Age. Sewing was used to stitch together animal hides for clothing and for shelter. The Inuit, for example, used sinew from caribou for thread and needles made of bone; the indigenous peoples of the American Plains and Canadian Prairies used sophisticated sewing methods to assemble tipi shelters. Sewing was combined with the weaving of plant leaves in Africa to create baskets, such as those made by Zulu weavers, who used thin strips of palm leaf as "thread" to stitch wider strips of palm leaf that had been woven into a coil. The weaving of cloth from natural fibres originated in the Middle East around 4000 BCE, and perhaps earlier during the Neolithic Age, and the sewing of cloth accompanied this development.

During the Middle Ages, Europeans who could afford it employed seamstresses and tailors. Sewing for the most part was a woman's occupation, and most sewing before the 19th century was practical. Clothing was an expensive investment for most people, and women had an important role in extending the longevity of items of clothing. Sewing was used for mending. Clothing that was faded would be turned inside-out so that it could continue to be worn, and sometimes had to be taken apart and reassembled in order to suit this purpose. Once clothing became worn or torn, it would be taken apart and the reusable cloth sewn together into new items of clothing, made into quilts, or otherwise put to practical use. The many steps involved in making clothing from scratch (weaving, pattern making, cutting, alterations, and so forth) meant that women often bartered their

expertise in a particular skill with one another. Decorative needlework such as embroidery was a valued skill, and young women with the time and means would practice to build their skill in this area. From the Middle Ages to the 17th century, sewing tools such as needles, pins and pincushions were included in the trousseaus of many European brides.

Decorative embroidery was valued in many cultures worldwide. Although most embroidery stitches in the Western repertoire are traditionally British, Irish or Western European in origin, stitches originating in different cultures are known throughout the world today. Some examples are the Cretan Open Filling stitch, Romanian Couching or Oriental Couching, and the Japanese stitch. The stitches associated with embroidery spread by way of the trade routes that were active during the Middle Ages. The Silk Road brought Chinese embroidery techniques to Western Asia and Eastern Europe, while techniques originating in the Middle East spread to Southern and Western Europe through Morocco and Spain. European imperial settlements also spread embroidery and sewing techniques worldwide. However, there are instances of sewing techniques indigenous to cultures in distant locations from one another, where cross-cultural communication would have been historically unlikely. For example, a method of reverse appliqué known to areas of South America is also known to Southeast Asia.



A singer model 66 made in 1922. This has the "Lotus" decoration. (From the Gravesham Collection)

### 3.1 Sewing machine feed mechanism

The means of moving the materials or fabric being stitched from one stitch position to the next is called feed mechanism. This is a very important part of sewing machine. The following are the function of a sewing machine depends on the feed mechanism:

1. Proper seam appearance.
2. Proper stitching required.
3. Controlling of SPI
4. Move forward & backward of seam fabric.
5. Sometimes crease effect is formed according to the design.

There are so many types of feed mechanisms are available according to the desired function & machine. But, common three parts are must whatever the type of feed mechanism is. The following three parts of a feed mechanism are given by heading to understand easily.

#### Different parts of a feed mechanism:

- 👉 Throat plate or needle plate o feed plate
- 👉 Feed dog
- 👉 Pressure foot

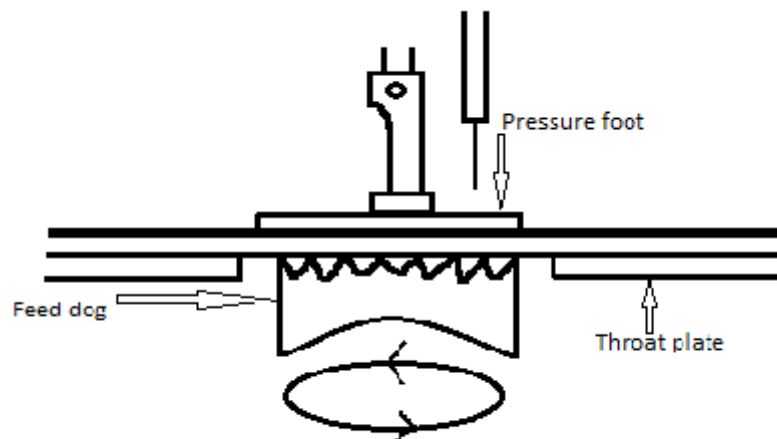


Fig: Drop feed mechanism

### **Throat plate:**

The part of the bed of the sewing machine which has openings for the needle and for feed dog penetrations and which provides localized support to the material. The openings vary in size and shape, depending on the sewing requirements. This is made of steel and its surface is very smooth. Due to the smooth surface fabric can be feed easily. It is also called needle plate. It has one or more slots through which feed dog can move forward and backward. It has a hole through which needle can move up & down with the thread. Size of this hole is not exceeding more than 30% of needle size. If it is, the fabric can be pushed into the hole with each penetration of the needle which is called Flagging. It is the type of sewn seam failure in which some yarn slip out of the seam.

### **Feed dog:**

A toothed element which acts on the surface of material is being sewn to move it in a controlled way during stitching. The action is normally on the lower surface of the material, but a mechanism which acts on the upper surface are also in use. For most of the time, the operative motion is forward but in specific cases the motion is reversed. It is most important part of feed mechanism. The main function of this part is to move sewn fabric after making individual stitch as predetermined length. To prevent the slippage of the fabric the upper part of the feed dog are made toothed. The movement of the feed dog is lateral. Feed dog moves upward & comes upward through the slot of the throat plate, containing with lower surface of the fabric, moves the fabric forward a step & then descends from the fabric & moves down again below the throat plate. In this way its lateral movement is completed. The up & down movement of the needle should be carefully handled. When fabric is moved forward the needle must be out of the action or to its maximum position.



## Pressure foot:

This is an element which is used to constrain the movement of the material during stitch formation by applying to it an adjustable downward pressure. It works in conjunction with the throat plate & feed dog to achieve controlled movement of the material & correct stitch formation. Different designs of pressure foot are in use. The most common have a solid or hinged surface which controlled the material. It is used to give an adjustable downward pressure. Lower surface of the pressure foot is very smooth to prevent less friction between fabric & pressure foot.



Figure: Feed Dog



Figure: Pressure Foot

## Drop feed mechanism:

This is the simplest & widely used feed mechanism. When two plies of fabrics are sewn by this mechanism, the feed dog moves backward & come up ward through the slot of the throat plate & contacted with lower surface of the fabric. Spring loaded pressure foot gives pressure on the upper side of the fabric. Then the fabric moves forward a step & then feed dog descends from the fabric & moves down again below the throat plate.

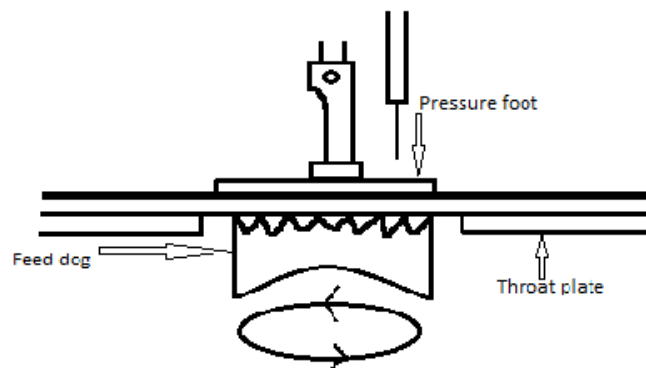


Fig: Drop feed mechanism

In this way its lateral movement is completed. Sometimes it is seen that, the lower of the fabric is more feed than the upper ply. This is called ply shifting or differential feeding pucker or feeding pucker. With the same reason, sometimes roping is occurred during making of hem. Those problems may be controlled by experienced operator.

## 3.2 Sewing needle

A sewing needle is a long slender tool with a pointed tip. The first needle was made of wood; modern ones are manufactured from high carbon steel wire, nickel or gold plate for corrosion resistance. The highest quality embroidery needles are made from platinum. Traditionally needles have been kept in needles book or needle cases which have become an object of adornment. A needle is hand sewing has a hole, called the eye, and at the non pointed end to carry thread or cord through the fabric after the pointed end pierces it. Hand sewing needles have different names depending on their purpose. Needle size is denoted by a number on the packet. The convention of sizing is that the length & thickness of a needle increase as the size of number decreases. For example, a size 1 needle will be thicker & longer, while a size 10 will shorter & finer.

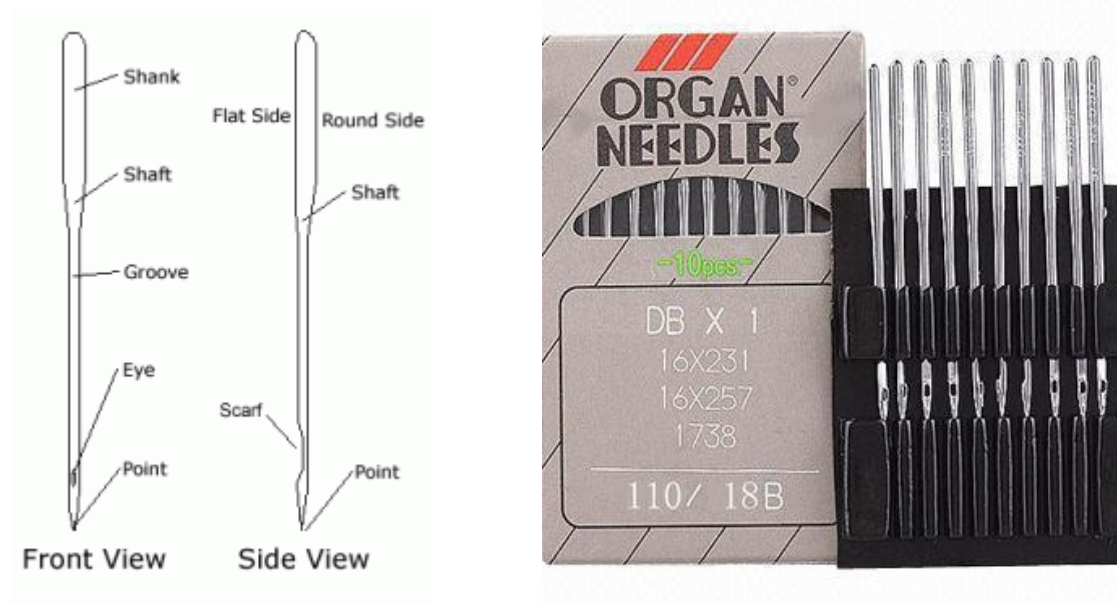


Figure: Sewing needle

## Function of a sewing needle:

- 👉 Making of holes through the fabrics without damaging the fabric which is the path of passing needle with sewing thread.
- 👉 After penetrating the needle with thread through the fabrics, make a loop of needle thread which, will pick up by the hook of bobbin case.
- 👉 With out lock stitch machine, passing of needle thread through the loop made by looper.

## Different parts of sewing machine needle:

The followings are parts of a sewing machine needle & introduce their position & activities:

- Butt:
  - The starting part of bottom edge of needle which can be made by predetermined shape.
  - It helps for easily attaching of needle with the needle bar or clamp of the sewing machine.
- Shank:
  - It is the bottom part of the needle which is tied in the needle bar.
  - It may be cylindrical or flat on one side.
  - It is wider than the remaining parts of needle & works as a support of needle.
- Shoulder:
  - It is the part between shank & blade of needle.
  - When the needle penetrates through the fabric to reach its lowest position, then the shoulder also penetrates through the fabric. As a result, it reduces the friction between needle & fabric by producing a wider hole on fabric.

- Blade:
  - It is the part from the needle eye to shoulder.
  - It is the longest part of needle & in this area maximum friction with fabric take place.
  - Blade is gradually tapered to tip.
- Long groove:
  - It is a long & thin groove in blade from shoulder to needle eye.
  - During up & down of needle through the fabric during sewing, the sewing thread take place in the groove & thus reduce the friction between fabric, needle & sewing thread.
  - There is a less possibility of damaging the thread due to friction.
- Short groove:
  - It is placed in the side of the needle in which side, the hook or looper is placed.
  - It is a small groove between needle eye & tip.
  - It helps the sewing thread to create loop.
- Needle eye:
  - The hole which is situated in the front of the needle is called eye.
  - It is a small slot between short & long grooves of the needle.
  - It holds the needle thread & help to create loop.
  - The inside edge of the needle eye is most important specially, When needle passes through the fabric there is a possibility of damage thread.
  - Some needle are found with thicker eye than blade, is called bulged eye. It works like the shoulder. But there is possibility of damaging light fabric.
- Scarf:
  - It is a curve slot at near above the eye.
  - It helps to close setting between the needle & the looper. As a result, it is easy to catch the needle loop by the looper or hook.

- Point:
  - It is the part from the needle eye to tip.
  - It helps to penetrate the needle into fabric without any damage.
  - Also, the proper care should be taken to select the needle point appropriate for fabrics.
- Tip:
  - The ending edge of needle is called tip.
  - It helps to penetrate the needle into the fabric without any damage.
  - It helps to create the hole in the fabric during sewing.

### **Selection of needle:**

There are found various sizes of needles & needles should be selected according to the types of fabric & sewing thread. The size of needle is expressed differently by the manufacturers but metric size is the simplest widely used. Shortly, it is denoted by Nm. Needle size is express by measuring diameter of the middle of the needle blade. For example, the diameter in the middle of the needle blade is 0.9mm & then the needle size would be 90Nm. If the diameter in the middle of a needle blade is 1.2mm then the needle size would be 120Nm. Generally for finer fabric, sewing thread & needle should also be finer.

### **Effect of wrong needle selection:**

1. If the needle is finer than sewing thread:
  - 👉 The thread cannot move easily through the needle eye.
  - 👉 The thread will not take position perfectly at needle long groove.
  - 👉 The result is more thread breakage & production loss.
2. If the thread is finer than needle:
  - 👉 May produced slipped stitch as the needle cannot create perfect size or loop.

3. If the needle is coarse than required fabric:
  - 👉 Fabric will be locked odd due to bigger hole.
  - 👉 Seam pucker may be produced on woven fabric.
4. If the needle is finer than required fabric:
  - 👉 During sewing needle will be deflect & become curve with the action of throat plate.
  - 👉 This curve needle will produce slip stitch as the looper may not catch the loop needle thread.

### **Types of needle point:**

👉 Cutting point: Normally seat materials like leather, plastic & so on are sewn by using cutting point needle. Because, there is no gap in these types of materials, as a result the hole is made by needle point as required during sewing so that the thread can be passed through the hole. Also informed that, the side by side holes must be placed with a proper distance to gain sufficient seam strength. Mainly cutting points are divided into three types which are given below:

- a) Wedge point.
- b) Cross point
- c) Twist point.

👉 Cloth point: The pointed needles which are used for sewing fabrics are called cloth point needles. The point of needle should be round in shape but the shape of Tip depends on the fabrics like woven or knitted fabric as required. According to the fabrics cloth points needles are divided into two types:

- d) Ball point needle.
- e) Set point needle.

Ball point needle is divided into three types:

- 1) Light ball point needle.
- 2) Medium ball point needle.

3) Heavy ball point needle.

Set point needle is also divided into three types:


1) Slim set point needle.


2) Medium set point needle.


3) Heavy set point needle.


## **Types of hand sewing needle:**


These come in 10 sizes, ranging from No.1: very heavy to No.10: very fine.


 **Sharps needle:** These types of needles are used for general sewing. They have a sharp point, a round eye & area of medium length. The difference between sharps & other sewing needles can mainly be seen in their length.

 **Embroidery needle:** It also known as crewel needle, are indicated to sharps but have a longer eye to enable easier threading of multiple embroidery threads & thicker yarns.

 **Quilting needle:** Quilting needles are shorter, with a small rounded eye & are used for making fine stitches on heavy fabrics such as in tailoring, quilt making & other detailed handwork.

 **Milliner's needle:** These types of needles are longer than sharps, are useful for basting & pleating & are used in millinery work.

 **Easy or self-threading needle:** It is called Calyx eyed sharps, have a slot for thread, rather than an eye.

 **Universal needle:** Universal needle points are slightly rounded for use with knit fabrics, yet sharp enough for woven--available in sizes 60/8 through 120/19.



👑 **Denim/jeans needle:** These needles have an extra-sharp point and stiff shank for stitching denim, heavy faux leather and other densely woven fabrics. Available in sizes 70/10 through 110/18.

👑 **Metallic needles:** Metallic needles feature a longer eye, fine shaft and sharp point to eliminate thread breakage, shredding and skipped stitches. They also work well with monofilament threads. Also known as Metallica, Metafil and Metallic Machine Embroidery--available in sizes 70/10 through 90/14.

👑 **Topstitch needles:** These needles have an extra-sharp point, larger eye and groove to accommodate topstitching thread. Available in sizes 80/12 through 100/16.

### **Special purpose of needle:**

These needles come in various sizes so numbering will differ from the needles:

👑 **Ballpoints needle:** It has a rounded point & are use for knitted fabrics. Sizes 5-10.

👑 **Beading needle:** These types of needles are very fine, with a narrow eye to enable it to fit through the centers of beads & sequins. They are usually long so that a number of beads can be threaded at a time. Sizes 10-15.

👑 **Bodkin needle:** This is a long, thick needle with a ball point end & a large, elongated eye. They can be flat or round & are generally used for threading elastic, ribbon & through casings & lace opening.

👑 **Chenille needle:** It is similar to tapestry needle, but with large, long eyes & a very sharp point to penetrate close weave fabrics. Useful for ribbon embroidery. Size 13-26.

👑 **Darning needle:** It has a blunt tip & large eye, similar to tapestry needles, but are longer, with a yarn darners being the heaviest with very large eyes to thread yarn. Various types with sizes ranging from 1-18.

👑 **Doll needle:** Doll needles are long & thin are used for soft sculpturing on dolls, particularly facial detail. Size 2.5"-7".

👑 **Leather needle:** It is also known as glovers needle, have a triangular point for piercing the leather without tearing it. Used on leather, suede, vinyl & plastic. Sizes 3-10.

👑 **Sail maker needle:** It is similar to the leather needle, but the triangular point extends further up the shaft. Used for sewing thick canvas or heavy leather.

👑 **Tapestry needle:** It has a large eye & a blunt tip. They are used for working on embroidery canvas, even-weave material & other loosely woven fabrics. The blunt tip allows the needle to pass through the fabric without damaging it. Double ended tapestry needles, with the hole in the middle, are also available for the convenience of embroiderers who work with fabric mounted in a frame. Sizes from 13 (heaviest) to 28 (finest).

👑 **Tatting needle:** Tatting needles are long & the same thickness for their entire length, including at the eye, to enable thread to be pulled through the double stitches used in tatting. Tatting needles are should not be confused with tattoo needles & would be very ineffective at the task.

👑 **Upholstery needle:** It is heavy, long needle that can be straight or curved. Used for sewing heavy fabrics, upholstery work, tufting & for tying quilts. Curved needles are used for difficult situations where a straight needle is not practical & are also used in fabric box-making. Heavy duty 12” needles are used for repairing mattresses. Straight sizes: 3”-12” long, curved: 1.5”-6” long.

## **Maintenance:**

Begin by cleaning the lint from sewing machine. Remove the throatplate, using the screwdriver if necessary. Brush out all visible lint with the brush. Many people prefer to use canned air--there is some controversy as to the value-versus-harm when using canned air. Some believe it causes condensation on the machine interior, thus creating an environment for rust. Also, lint can be forced *into* the machine rather than blown out. To avoid both situations, spray canned air at an angle to the parts you're cleaning and keep the nozzle several inches away from the area to avoid condensation; or simply vacuum the lint out.


Once the machine is free of lint, lubricate it with oil. Most machines should be oiled at least every six months--three months for sergers. Be sure to follow the oiling schedule outlined in your owner's manual. Only use oil specifically made for sewing machines--don't use WD40 or other lubricants; they can harm your machine. Refer to your owner's manual for oiling locations--one drop of oil is enough in any spot.


Some of the newer sewing machines don't require lubricating, so refer to your owner's manual to see if it's necessary. If you own a Singer Featherweight or other old machine, take it to a service professional every couple of years to have the motor bushings greased.


### 3.3 Sewing thread

A Variety of yarn, regardless of fibre, that is for hand or machine sewing. May be treated with solid or semi solid waxy materials to secure a smooth, compact strand that is quite flexible but the presents no loose fibres. The yarn is usually plied. Sewing thread is the main trims of the garment. Sewing thread is directly related to the quality of seam.

Sewing threads are classified in following ways:


 **Linen:** Oldest thread & was used at a range for sewing threads during the making of garments. This type of thread has high strength & can make more strength of seam. But now it is most replaced by synthetic threads.


 **Silk thread:** This type of thread is made from booth continuous filament & broken filament silk. Comparatively, contains higher strength, extensive, lustrous & good qualities. This type of thread is expensive.


 **Cotton thread:** These types of sewing thread are widely used & productive, among the threads made from natural fibres. Generally made from better quality of cotton fibres. This is easy to sew fabrics by cotton thread but has less frictional


resistance compared with synthetic threads. This type of thread is generally three types; such as:


1. Soft cotton thread.
2. Mercerized cotton thread.
3. Glace cotton thread.


 **Viscose thread:** It may be made from continuous filament or staple fibres. The strength & durability are comparatively less but more brighten. Water can reduce viscose strength.

 **Polyester thread:** This type of thread is strong, low cot, good wash fastness & satisfactory elastic properties. It can be washed up to 150c without any shrinkage. At present it is widely used in garments among the synthetic sewing threads.

 **Nylon thread:** These types of thread are made from hexamethylene diamine & acetic acid. It may make seam pucker after sewing due to shrinkage. It may be used to sew knitted fabric, extensible seam & swimming wear.

 **Aramide thread:** Aramide threads are not use as a rate because of more expensive. It is used in special cases. E.g. fire fighting garments. It is costly. Its commercial name is Nomex.

 **PEFE thread:** The use of PEFE thread is limited due to high cost. It is used for protecting against flame, melt & chemical garments.

 **Textured thread:** A term is used to describe the filament yarn that has been treated to change its hand, increase bulk & increase stretch. Normally it is done by texturing more continuous filaments together. This process creates crimps to the filaments. This process can be done by false twisting, air jet edge crimping etc. This type of thread fills soft, so it is used as a under thread & edge stitching. Normally it is used a looper thread.

👉 **Core spun thread:** These types of threads are manufactured with the combination of continuous filaments & staple fibres. Single yarn made by continuous filament is used as center yarn & wound with cotton fibres around the center yarn. Two or three single yarns are twisted together & sewing threads are made. Generally, polyester filament is used as core & cotton fibre is used as staple. The main advantages of this type of threads are containing same amount of strength as synthetic threads. It has less shrinkage, generate less heat, can run at higher speed if any lubricant is used to it. Dyeing cost is high due to double dyeing process is required. Finer sewing thread is produced with core spun system & fabric can be sewn easily & attractively.

### 3.4 Properties of sewing thread

➤ **Tensile strength:**

👉 The minimum load are required to break the thread is known as tensile strength of that thread.

👉 It is denoted by gm, kg or lbs & may vary depending on temperature, humidity & rate of return

👉 This is used to determine the difference of tensile strength of threads of same size or ticket number.

➤ **Tenacity:**

👉 The ratio of tensile strength & count or thickness of that thread is known as tenacity.

👉 Strength & quality of various count threads are verified by tenacity as it is the strength per unit thickness.

👉 It is expressed by gm per denier or gm per tex.

➤ **Loop strength:**

👉 Sewing thread has minimum strength in its loop position & the minimum load are required to break the loop is known as loop strength.

👉 Loop strength is deeply related with the stitch strength of a thread.

➤ **Loop strength ratio:**

👉 The ratio of thread tenacity & loop strength of that thread is known as loop strength ratio.

👉 The maximum value of loop strength ratio may be 2.

👉 It is used to determine the efficiency of thread in the stitch.

➤ **Minimum loop strength :**

👉 The loop strength of a weaker thread is known as minimum loop strength.

👉 Minimum loop strength is used to determine the performance of a thread in the stitch.

➤ **Elongation at break:**

👉 It is the extension of thread at breaking point.

👉 This is expressed as percentage.

👉 This is most important for extensibility of seam.

➤ **Stress-strain curve:**

👉 It is the drawing curve of tenacity which opposes the elongation of thread.

👉 To compare the values of two threads, it is most important.

➤ **Elasticity:**

👑 It is the property by virtue of which the thread returns back to its original position when deforming forced is released.

👑 When the thread back to its original position after extension is called elastic.

👑 Most of the threads are situated in the middle position of the elastic & plastic.

➤ **Color fastness:**

👑 The resistance of a thread to change in any of its color characteristics, to transfer of its colorant materials, or both as a result of the exposure of the thread to any environment that might be encountered during the processing, testing, storage or use of thread.

### 3.5 Relationship between thread size, needle size & material

The following table shows the relationship between thread size, needle size & material which is most necessary to know for proper sewing:

Sewing thread Metric Ticket No	Fabric	Needle size	
		Singer System	Metric (Nm)
320, 260	Light	7	55
	Medium	9	65
	Heavy	10	75
200, 180, 160, 150	Light	9	65
	Medium	10	70
	Heavy	11	75

140, 120, 100, 80	Light	11	75
	Medium	12	80
	Heavy	14	90
75, 70, 60	Light	14	90
	Medium	16	100
	Heavy	18	110
50, 40	Light	16	100
	Medium	18	110
	Heavy	19	120
15, 20	Light	19	120
	Medium	21	130
	Heavy	22	140
18, 16, 13, 12	Light	21	130
	Medium	22	140
	Heavy	23	160
10, 8,7	Light	23	160
	Medium	24	180
	Heavy	25	200

**Defect:**

A defect is characteristics of a product which impair functional quality or its salability. A defect an unwanted feature in a product or absence of a desired feature or a feature existing in distorted or wrong way.

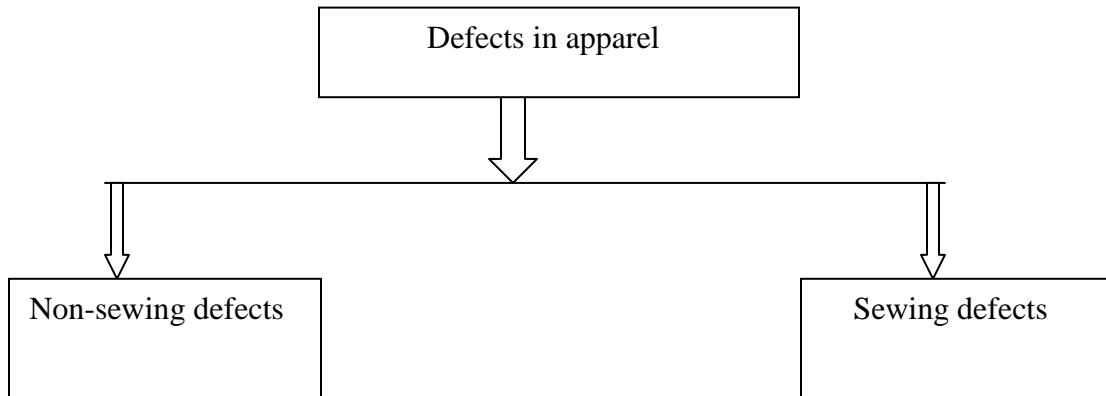
**Reject:**

A product is called reject when it's functional or service qualities are impaired due to deflection of sewing or other work, due to imperfections of materials or due to any other type of defect. A product becomes a reject when it loses salability in the market. A single defect in the most visible area of a garment may make it a reject.



## 4.0 Types of defects

There are two main types of defects:



Defects may occur in garments industry produced on mass scale. The sources of defects are given below:

### 1. Non-sewing defects:

- Defects due to cutting of fabrics, lining, interlining by wrong pattern.
- Defect occurs due faulty raw material.
- Defects due to wrong marking, wrong spreading etc.
- Defects due to oil marks.
- Defects due to wrong ironing, folding, packing, packaging etc.

### 2. Sewing defects:

- Defects due to problems of stitch formation.
- Defects due to fabric distortion or puckering.
- Defects due to fabric damage along stitch line

## 4.1 Sewing faults, causes & their remedies

Sewing defect can be classified as three groups:

- 👑 Problems of stitch formation.
- 👑 Problem of pucker.
- 👑 Damage of fabric on seam line.

### Problems of stitch formation:

👑 **Slipped stitch:** Stitches in the seam line are present in a regular wise. If the interlocking or interlacing between top & bottom thread of stitch is not take place or missed is known as slipped stitch or skipped stitch. This is more harmful in case of chain stitch than lock stitch. The followings are the causes & remedies of slipped stitch formation given by a table:



No.	Causes	Remedies
01	If hook or looper & needle are not inserted in loop of thread in time.	<ul style="list-style-type: none"> <li>• Examine the setting &amp; timing between needle &amp; hook or looper.</li> <li>• Placing of needle properly.</li> <li>• More secure needle should be used.</li> </ul>
02	Irregular thread tension on upper or lower loop.	<ul style="list-style-type: none"> <li>• The tension of the thread should again be adjusted.</li> </ul>
03	Due to needle deflection.	<ul style="list-style-type: none"> <li>• Needle to be changed.</li> </ul>
04	If needle thread loop size is too small.	<ul style="list-style-type: none"> <li>• Needle size &amp; thread size must be adjusted.</li> </ul>

05	When flagging of fabrics during sewing is happened.	<ul style="list-style-type: none"> <li>• The pressure of pressure foot must be adjusted accurately.</li> <li>• The hole of throat plate &amp; needle size must be adjusted.</li> </ul>
06	If the sewing thread is not capable to form loop.	<ul style="list-style-type: none"> <li>• Thread to be changed</li> </ul>

🏠 **Staggered stitch:** If the stitches produced by needle are not parallel or become curvy to sewing line is known as staggered stitch. The followings are the causes & remedies of staggered stitch formation given by a table:

No.	Causes	Remedies
01	Needle deflection.	<ul style="list-style-type: none"> <li>• Increase the needle size</li> <li>• Tapered needle should be used.</li> </ul>
02	Due to wrong blunt needle point.	<ul style="list-style-type: none"> <li>• Needle to be changed.</li> </ul>
03	Wrong adjustment of needle & thread size.	<ul style="list-style-type: none"> <li>• Needle size &amp; thread size to be changed.</li> </ul>
04	Deflected motion of feed dog.	<ul style="list-style-type: none"> <li>• Motion of feed dog to be adjusted.</li> </ul>
05	If fabrics are not controlled properly in the feed mechanism.	<ul style="list-style-type: none"> <li>• The pressure of pressure foot must be adjusted accurately.</li> <li>• Feed mechanism to be changed.</li> </ul>

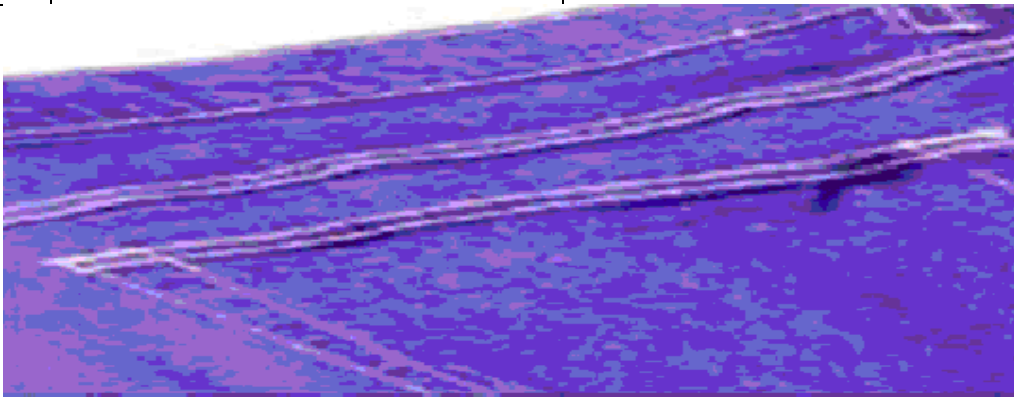



Figure: Staggered stitch

👑 **Unbalance stitch:** This type of defect is found in lock stitch machine. If the interlacement of threads are not take place in the middle (i.e. if the interlacement is taken place in the upper or lower position from the middle) of two layers of fabrics then it is known as unbalance stitch. The following are the causes & remedies of unbalanced stitch formation given by a table:

No.	Causes	Remedies
01	Wrong tension of sewing thread.	<ul style="list-style-type: none"> <li>• Setting of proper tension to the sewing thread.</li> <li>• Proper care to the twisting of the thread during sewing.</li> </ul>
02	Used wrong thread path	<ul style="list-style-type: none"> <li>• Use of right thread path.</li> </ul>
03	Wrong adjustment of needle thread path.	<ul style="list-style-type: none"> <li>• Use of right thread path.</li> </ul>
04	Snagging of needle with bobbin case & positioning finger.	<ul style="list-style-type: none"> <li>• Bobbin case to be smooth.</li> <li>• The positioning finger to be set again.</li> </ul>
05	If the thread are not lubricated.	<ul style="list-style-type: none"> <li>• Better qualities of thread must be used.</li> <li>• Thread must be lubricated.</li> </ul>




Figure: Unbalanced Stitch

 **Variable stitch density:** It must need to be the same amount of stitches per unit length. If it is not, then it is called variable stitch density. The main cause of variable stitch density is irregular feed of fabric due to insufficient pressure of pressure foot. The following are the cause & remedies of variable stitch density formation given by a table:

No.	Causes	Remedies
01	Improper unwinding of thread from package during sewing.	<ul style="list-style-type: none"> <li>The position of thread guide must be 2.5 times higher than the position of thread package. Also proper care should be kept to the thread package not to tiling</li> </ul>
02	Twisting of needle thread in the bottom of the thread package.	<ul style="list-style-type: none"> <li>Foam pad must be used to the bottom of the thread package.</li> </ul>
03	Snarling of thread before tension disk.	<ul style="list-style-type: none"> <li>Winding of more threads in the thread guide &amp; to be kept less tension to the tensioning disk.</li> </ul>
04	Twisting of thread in the thread guide.	<ul style="list-style-type: none"> <li>Proper threading of sewing thread during sewing.</li> </ul>
05	More tension to the thread.	<ul style="list-style-type: none"> <li>The tension of thread should be less or use of high strength threads.</li> </ul>
06	Use of broken check spring.	<ul style="list-style-type: none"> <li>Check spring to be changed.</li> </ul>
07	If the edge of the throat plate, hook point, needle guard, bobbin case, needle groove, needle eye & so on are sharpened.	<ul style="list-style-type: none"> <li>The edges must be smooth &amp; needle must be changed as needed.</li> </ul>
08	Fraying of thread in the needle.	<ul style="list-style-type: none"> <li>Fine thread must be used or to be used heavy needle.</li> </ul>
09	Becoming more heated of thread.	<ul style="list-style-type: none"> <li>High quality needle must be used.</li> <li>Needle lubricant must be used.</li> </ul>

		<ul style="list-style-type: none"> <li>• Needle cooler must be used.</li> </ul>
10	Becoming more heated of hook.	<ul style="list-style-type: none"> <li>• Lubricant must be available.</li> <li>• Examine the distance between the needles &amp; hook.</li> </ul>
11	Use of low quality threads.	<ul style="list-style-type: none"> <li>• Thread to be changed.</li> </ul>

 **Frequent thread breakage:** This breakage of thread again & again during sewing & also, there needs more time & which is harmful for production. Specially, when there needs to open out of sewing to solve the problem. The following are the causes & remedies of frequent thread breakage formation given by a table:

No.	Causes	Remedies
01	Wrong winding of threads on to the bobbin.	<ul style="list-style-type: none"> <li>• Proper winding of threads on to the bobbin.</li> <li>• Pre-wound bobbin may be used.</li> </ul>
02	More tension to the bobbin threads or more rotating of bobbin.	<ul style="list-style-type: none"> <li>• The tension must be adjusted to the bobbin threads.</li> <li>• Use of washer to prevent the more rotating of bobbin.</li> </ul>
03	If the edges bobbin case, looper eye & so on are more sharpened.	<ul style="list-style-type: none"> <li>• The edges to be smooth.</li> </ul>
04	Wrong fitting of bobbin case.	<ul style="list-style-type: none"> <li>• Examine the size &amp; type of bobbin.</li> <li>• Examine the damaging of bobbin case.</li> </ul>

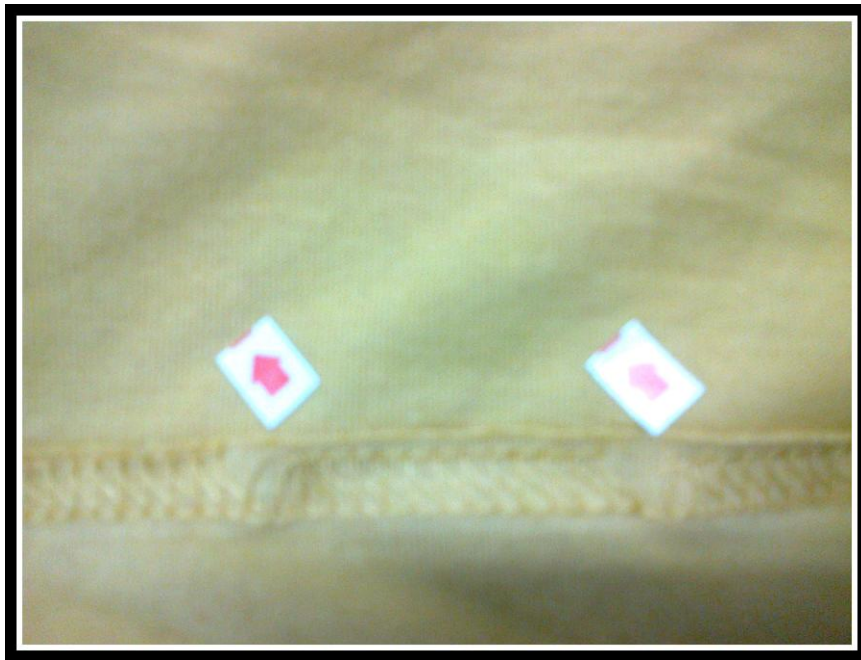
👑 **Broken Stitches:** When stitches are broken during sewing is called broken stitch.

**Cause:**

Where the thread is being broken where one seam crosses another seam (ex: bar tacks on top of waistband stitching, seat seam on top of riser seam.)

**Remedies:**

- 👑 Where the thread is being cut, use a large diameter thread on operations.
- 👑 Make sure the proper stitch balance is being used.
- 👑 Use needles with appropriate needle point.
- 👑 At regular intervals on operations change the needles where they are occurring frequently.



**Figure: Broken stitch**

**Problems of pucker:**

Puckering is a wrinkle appearance along a seam line in a smooth fabric. It is one of the frequently occurring defects. Puckering shows that as if there is too much fabric & not

enough thread in the seam & as if the thread is drawing the seam in. This is the reason why sewing thread is often blamed for causing puckering though there are other factors as well as for promotion of puckering. They are given below:

- 1) Fabric structure.
- 2) Seam construction.
- 3) Needle size.
- 4) Material feeding problem.
- 5) Wrong thread tension &
- 6) Unsuitable thread.



**Figure: Seam puckering**

Puckering may be visible as soon as sewing is complete but some appear later when the garment is ironed or washed. It is generally said that stitching on a fabric always leads to some amount of puckering fabric distortion. Fabrics from synthetic fibres generally have a tendency to show up puckering. A puckering is the most frequently occurring sewing defect & commonest of all defects. The problem was seriously investigated by researchers who found five reasons of puckering.

- 👉 Variable or uneven stretch on fabric plies.
- 👉 Fabric dimensional instability.



- 👉 Extension of sewing thread.
- 👉 Sewing threads shrinkage.
- 👉 Structural jamming of fabric.
- 👉 Mismatched patterns.

❖ **Variable or uneven stretch on fabric plies:**

**Causes:**

- 👉 There is a great possibility of seeing seam pucker in case of more plied of fabrics sewing together.
- 👉 Due to variable stretch on fabric plies they will not feed equally to sewing m/c & create seam pucker.
- 👉 This type of pucker is seen for limitation of feed mechanism.

**Remedies:**

- 👉 Proper care during sewing.
- 👉 Use proper feed mechanism.

❖ **Fabric dimensional instability:**

**Causes:**

- 👉 If the shrinkage of sewn fabric plies are not same or equal than Seam pucker will create after washing.
- 👉 If the shrinkage percentage of area of two pieces fabrics is more than 2, then seam pucker will occur after sewing the fabric together.

### **Remedies:**

- 👉 Use suitable feed mechanism.
- 👉 Maintain shrinkage.
- 👉 Take more care during sewing.

### ❖ **Extension of sewing thread:**

### **Causes:**

- 👉 If the tension on needle thread is higher than under thread then seam pucker will be produced or relaxed.
- 👉 Due to tension, the length of thread is extended a slight. When the fabric is displaced or descend from the machine after sewing shrinkage of thread & fabric are occurred due to tendency of coming to their original position.
- 👉 If the shrinkage percentage of thread is higher than the fabric there is happened seam pucker.

### **Remedies:**

- 👉 To give sufficient thread tension.
- 👉 To maintain shrinkage.

### ❖ **Unraveling Seams:**

### **Cause:**

Generally occurs on 401 chain stitch seams where either the stitch has been broken or a skipped stitch has occurred. Unless the seam is re-stitched, this will cause seam failure.

### Remedies:

- 👉 Proper machine maintenance and sewing machine adjustments have to be insured;
- 👉 For correct material handling techniques, observe sewing operators.
- ❖ **Re-stitched Seams:** Where there is a "splice" on the stitch line. The seam does not appear to be 1st quality merchandise, if this occurs on topstitching.

### Causes:

- 👉 Thread breaks or thread run-out during sewing.
- 👉 Cut or broken stitches during a subsequent treatment of the finished product (i.e., stone washing).





### Remedies:

- 👉 Use a better quality sewing thread. To minimize sewing interruptions, this may include going to a higher performance thread specifically designed for that purpose.
- 👉 Insure sewing machine adjustments and proper machine maintenance.
- 👉 Make sure sewing machines are properly maintained and adjusted for the fabric and sewing operation.
- 👉 Observe sewing operators for correct material handling techniques.







### Damage of fabric on seam line:

A garment can be rejected due to damage of fabrics or yarn of fabrics in the seam line. This is happened due to wrong needle selection or needle damage. The fabrics are damage due to sew defected needle. But it may be happened in case of new or fine needles. There are two types of fabric damaging are available given below:

1) **Mechanical damage:** Damaging of fibres or yarns in the fabrics by needle is the entire defects of mechanical damage. The followings are the steps to be taken to keep the fabrics free from this type of defect:

-  By using perfect size & shape of the needle & needle point without any defect.
-  By reducing the speed of sewing machine.
-  By using lubricant.
-  By testing sew ability before sewing fabrics.

2) **Needle heating damage:** The damage of fabric due to friction occurred between the needle & fabrics. The producing temperature in the needle is very high. The fabric can be damaged with that temperature. There is a less possibility of damaging in case of fabrics made from natural fibres. The following are the steps to be taken to keep the fabrics free from this type of defect:

-  By reducing sewing speed so that there is less generating heat to the needle. But it is harmful for large production.
-  By changing needle Size & shape so that there is less generating of heat to the needle.
-  By sewing smaller length at higher speed.
-  By flown cool air on the needle during sewing so that the temperature can be controlled.
-  By using lubricant to the needle.
-  By using Teflon coated needle.

## 4.2 Non Sewing faults, causes & their remedies

- 👑 Defects occurred due to handling, for instance spoilage, staining etc.
- 👑 Defects occurring due to oil mark.
- 👑 Defects occurring due to dirty spot.

### **Size Measurement Faults:**

During manufacturing of garments size of some parts are measured as requirement. After assembling full garments is also measured so that the dimension of garments is ok. Faults occur in this time is very rare.

During size measurement the parts which are measured are –



- 1) Chest
- 2) Waist
- 3) Shoulder
- 4) Sleeve length
- 5) Sleeve opening
- 6) Body length
- 7) Neck width
- 8) Front neck drop
- 9) Back neck drop
- 10) Collar Height
- 11) Arm hole
- 12) Placket length
- 13) Pocket length
- 14) Pocket width
- 15) Bottom part
- 16) Hem opening

## **Garment Twist**



A rotation, usually lateral, between different panels of a garment resulting from the release of latent stresses during laundering of the woven or knitted fabric forming the garment. Torque or spirally may also be used to refer a twist.

### **❖ Sewing thread shrinkage:**

#### **Causes:**


-  Due to variable shrinkage % of sewing thread & fabric, Seam pucker will create after washing or ironing.
-  Cotton threads develop puckering when wet or after wash.

#### **Remedies:**






-  To use synthetic thread.
-  To protect this, it must know about the shrinkage % of fabric & thread before selection to sew.

### **❖ Structural jamming of fabric:**

#### **Causes:**



-  When sewing is done by needle to densely woven fabrics or in which no. of warp & weft yarns are more in one inch, there is happened seam pucker due to shrinkage of fabric.

### **Remedies:**



-  By using finer thread & needle.
-  By minimize stitch density.
-  By cutting & sewing on bias angle.
-  By using chain stitch instead of lock stitch.
-  To change fabric (if necessary).

### **❖ Mismatched patterns:**

### **Causes:**

-  Seam pucker will create when two different size of patterns are sewn together.
-  The designer is responsible for this. But can be occurred due to wrong selection of patterns.

### **Remedies:**





-  Experienced pattern designer is needed.
-  Change or rectify the pattern.

## 5.0 CONCLUSION

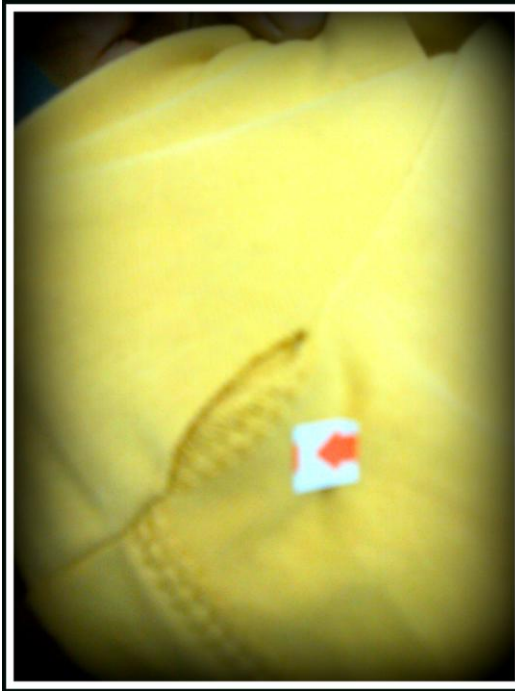
Finally we have completed our thesis after lots of inspection, experiment & discussion. We have gathered a large experience about this project. We have increased our knowledge about how sewing is done, problems of sewing & how those problems are minimize. This study investigated knitwear sewing process in a ready-made clothing Enterprise manufacturing men's suit in terms of quality; in addition, the reasons increasing quality faults and the priorities were determined for the improvement studies. During data collection, the sewing faults were determined in 4.5% products. As a result, the knitwear production process was concluded statistically not under control in the enterprise. In addition, there was a statistically significant relation between the quality fault amounts. In the present study, it is established that Statistical Process Control Methods could be suggested for planning improvement studies and analyzing whether the quality is under control in a ready-made clothing enterprise. In addition, it can be suggested to prepare separate (p) control charts for all process groups contributing to fault reasons and to investigate hypothetically the effects of improvement studies on quality level. Within the scope of quality improvement studies, it could be recommended to make regular quality control education, to investigate permanent solutions instead of daily solutions, to keep the workers' motivation high, and to make regular maintenance of machines. To enable a good quality system in enterprises, there should be adequate number of quality staff and the quality consciousness of workers should be increased. Quality system includes all the phases of production from the input of materials to product output, and quality standards should be created. Material quality should be controlled by performing input controls, while production quality should be provided by intermediary controls during production, and product quality should be provided by making output controls in the enterprise. Quality level should be constantly improved by using SPC methods, and for this purpose, regular trainings should be prepared in the enterprise.



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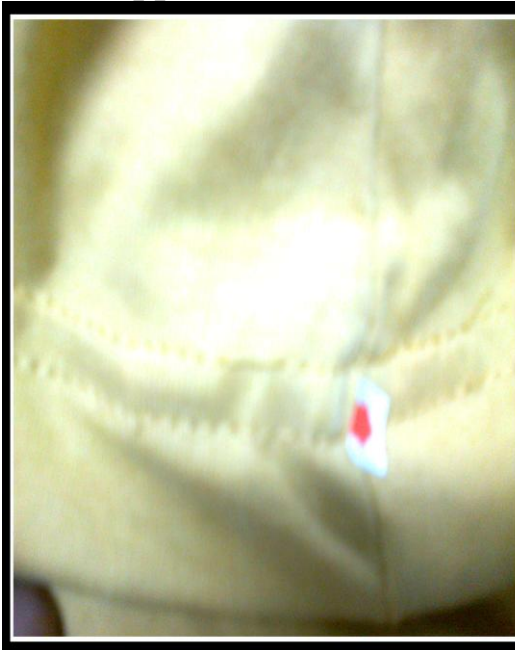
APPENDIX



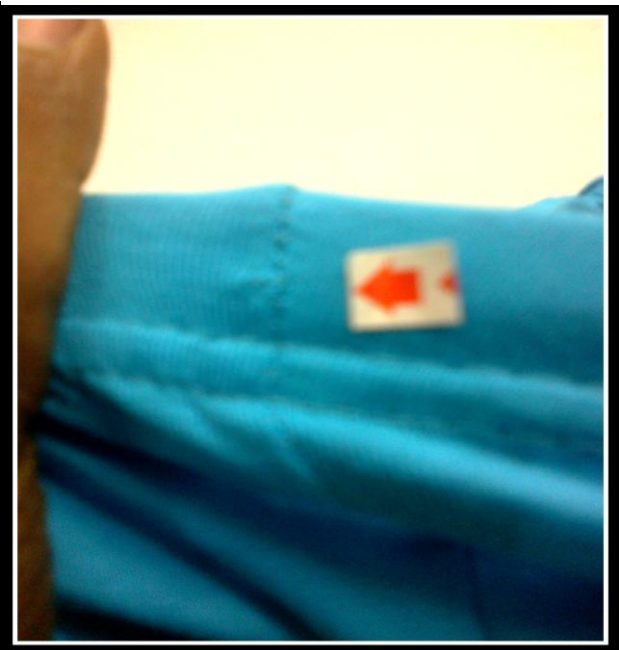
Skipped Stitch



Broken Stitch



Puckering



Tension Loose

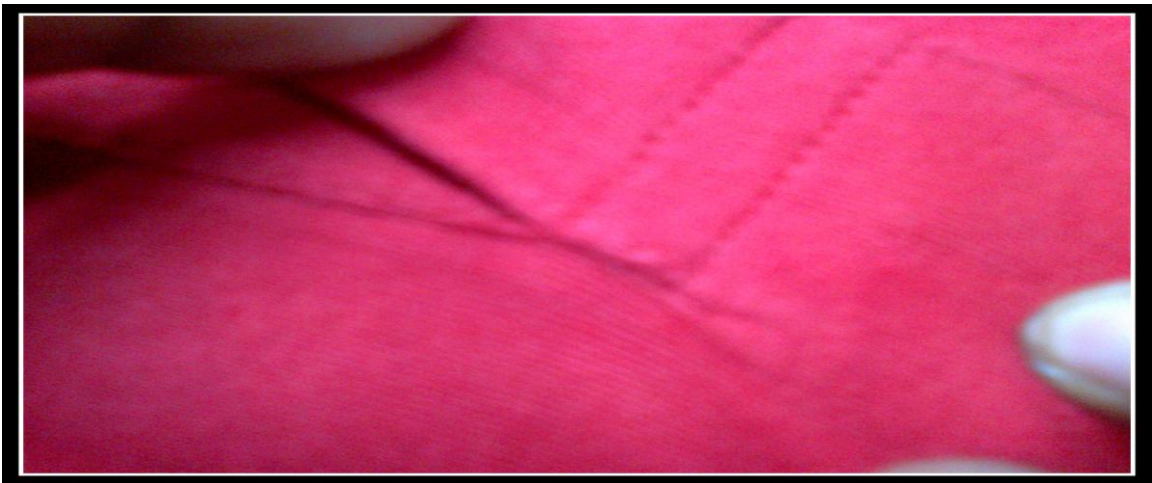


Figure: Mismatched & Unbalance Stitch