Subject: Garment Machinery and Equipment

Unit 2: Production machines

Quadrant 1 – e-Text

Learning Objectives

The learning objectives of this unit are:

- Identify different parts of a sewing machine.
- Describe the function of each part in a sewing machine.
- Explain kinematics of a sewing machine.
- Outline how to thread different types of sewing machines.
- Describe the formation of different type of stitches.
- Classify different types of stitches and their uses.
- Classify different types of seams and their uses.
- Classify different types of sewing machines.
- Examine a sewing needle, its parts and different types of sewing needles.
- Identify different sewing defects and relate to the reasons.
- Differentiate between different bed types of sewing machines and relate to their usage in different products.
- Differentiate between different feed mechanisms of sewing machines and relate to their usage in different products.
- Describe puckering and the causes associated with it.
- Review cyclical sewing machines and their uses.

2.1 Introduction to Single Needle Lock Stitch Machine
1. **Spool Stand:** This supports the spool rests and provides the space for spool thread guides.

2. **Spool Rest:** This supports the spool, which supplies the top thread also known as needle thread. The spool rest has a spindle through which the spools of lesser length are inserted. The base of spool rest has a flexible plastic cone. This helps in securing cones of higher capacity.

3. **Spool Stand Thread Guide:** These are circular ceramic guides having a circular slot. The top thread is taken from the spool and threaded through these ceramic guides. The position of these guides are kept directly above the spools, so that the thread unwinds under tension.

4. **Bobbin Winding Tensioner:** This part is situated in the top right corner near the spool stand base. This tension device consists of steel plates and springs. Tightening the spring creates more tension in the thread, which passes between the two plates.

5. **Bobbin Winding Assembly:** This part consists of a metal tongue and a rotating shaft. Empty bobbins are slotted in the rotating shaft. Bobbin thread coming through the bobbin winding tensioner is manually wound for few turns on the empty bobbin. The metal tongue is pushed forward into the empty bobbin. When the sewing machine operates the shaft rotates pulling the thread and winding on the empty bobbin. When the bobbin is fully wound, the thread pushes the metal tongue back, disengaging the drive.

6. **Spool or Needle Thread Package:** This contains the thread, which finally goes through the needle.

7. **Oil Spray Indicator:** This shows the lubrication oil level.
8. **Pre-tensioners:** These contain two small metal discs and a small tension spring, applying little amount of tension on the needle thread.

9. **Pressure Foot Pressure Adjustment Screw:**

Rotating the screw, manipulates the tension of pressure foot as the screw is connected with the pressure bar spring. Clockwise rotation of the screw contracts the spring and increases the tension, whereas anticlockwise rotation reduces the tension.

10. **Takeup Lever:** Thread Take Up is one of the Thread Control Links. After the looper or bobbin hook contacts the needle thread at the scarf point, it pulls a loop of needle thread in order to make the stitch tie.

So, it requires the thread to be free and quick. The thread take up executes this function. It provides the thread freely to form the loop of the needle thread during one cycle of its motion, and it also pulls the loop after the hook, or looper releases the needle loop to form the stitch tie.

11. **Disk Type Tensioner:** This is the main tension element for needle thread. Tension is imparted by tightening the spring by rotating the screw. The spring compresses the discs between which the needle thread passes.

12. **The Needle Bar:** This moves perpendicularly, when the machine operates. At the end of the needle bar is a groove in which the needle butt is housed.

13. **The Needle:** is one of the main sewing elements that have an eye through which the needle thread is passed.

The function of the needle is to penetrate the fabric and take the needle thread below for stitch formation.

14. **Sliding Plate:** This is given so that the operator can slide it and visually inspect the bobbin case position.

15. **Presser Foot:** This keeps the fabric pressed while stitch formation takes place and allows the fabric to pass under after stitching.

16. **Needle Plate:** This has slots for needle hole and feed dog.

17. **The Stitch Length Regulator:** It allows us to control the stitches per inch, by either increasing or decreasing the stitch length.

18. **Back Tack Lever:** It is used at the start and end of a sewing operation, where we need the reverse motion so that stitches will fall on the same portion again to reinforce the stitching.

19. **Clutch Motor:** It provides the power for the sewing machine.
20. **Knee Lifter**: It allows us to temporarily lift the pressure foot so that the material can be manipulated. The operator has to keep pushing the lifter with his knee till the time it is required.

21. **The V Belt**: It connects the driving pulley of the clutch motor to the driven pulley connected to the main shaft that is housed in the sewing machine arm.

22. **Motor Pulley**: It is the driving pulley attached with the clutch motor shaft

23. **Pedal or Accelerator**: It controls the speed at which the clutch motor operates. This in turn affects the sewing speed.

24. **The Table**: It is where the entire machine head is housed. The table is given with a handy inbuilt scale for measuring purposes.

25. **Motor on/ off Switch**: It is beneath the table as a console.

26. **Hand Lifter**: It is generally located behind the vertical arm of sewing machine. By lifting this, the pressure foot can be lifted for the amount of time. This differs from the knee lifter, as once the lifter is lifted, the pressure bar and pressure foot will not comedown till the lifter is manually pressed down.

27. **Thread Take Up Spring**: This is also known as check spring which acts in conjecture with the thread take up lever to maintain correct tension during looping.

### 2.2 Formation of Single Thread Chain Stitch

The needle thread slacks at the position where the needle slightly goes up from its lowest position, and the looper catches the needle thread which has become like a loop. Further, the needle enters the circle of needle thread which is widened by the looper.

The needle comes off the cloth and the cloth is fed. The looper rotates and removes the thread which the looper caught before, while pulling in the needle thread. The needle bar continues
going up and the needle thread take-up lever lifts the thread. The looper continues to rotate and pulls in the thread in the center of the looper and the thread take-up lever, tightens the thread which the looper removed before.

Finally, the cloth feed is finished and a stitch is formed. The needle penetrates the cloth to continue to the next stitch (a).

2.3 Formation of Lock Stitch

This diagram is of a single needle lock stitch.

The upper thread slacks at the position where the needle slightly goes up from its lowest position and the blade point of the outer hook catches the loop-shaped upper thread and pulls in the upper thread.

The upper thread which is pulled in by the blade point of the outer hook is separated at the inner hook thread separating the portion so that the upper thread on the needle side is separated to the rear side of the inner hook and the upper thread on the cloth side is separated to the right side of the inner hook. The outer hook rotates, while pulling in the upper thread around the periphery of the bobbin case containing the lower thread set in inner hook. The thread take-up lever supplies upper thread which is necessary to rotate around the inner hook. (Suppose that the inner hook is a human being and it looks like doing rope-skipping).

Immediately, after the upper thread has rotated around the inner hook, the thread take-up lever lifts the upper thread and the upper thread is interlaced with the lower. The stitch is formed when the upper thread lifts the lower thread and the cloth is fed at the end. Next, the needle comes down and penetrates the cloth to continue to a.

2.4 Formation of 2 Thread Chain Stitch
This diagram is of a two thread chain stitch.

The needle thread comes off the looper and is tightened. Then, the looper scoops the needle thread at the position where the needle slightly goes up from its lowest position. The needle continues to go up and the looper thread comes off the needle. The looper advances in the state that it has scooped needle thread. Cloth is fed when the needle is in the highest dead point and the looper is in the most advanced state, and the final tightening of needle thread is performed. The needle comes down and the needle tip scoops the looper thread. The looper performs elliptic motion. Then, the stitch formation is continued to a.

2.5 Stitch Formation of Three Thread Overlock

The lower loop scoops needle thread loop. The upper loop thread comes off the needle and the upper looper scoops the looper thread. Cloth is fed. The needle tip scoops the upper looper thread.

2.6 Classification of Sewing Machines

There are three main types of machines are the Lock stitch, Chain stitch and Overlock machines.

LOCK STITCH (300 Class) gives a straight seam, and is most secure.

CHAIN STITCH (100 & 400 CLASS) gives a chain effect, looping. It is not as secure as the lock stitch or serging.

OVERLOCK STITCH (500 CLASS) is the same principle as chain stitch. It gives an edge principle as well as sews the fabric together and is ideal for knits as it gives stretch.
Other Types
SAFETY OVERLOCK: This is a combination of O/L and chain stitch.

BLIND STITCH HEMMING MACHINE: This is based on chain stitch.

BUTTON MACHINE:
It sews buttons onto the garments chain stitch.

BUTTON HOLE MACHINE:
This is essentially a zigzag lock stitch. It makes a button hole and cuts it, and may also give chain stitch.

PROGRAMMABLE MACHINE:
This is where certain operations can be programmed into the machine (Semi-automatic).

2.7 Sewing Machine Needles, Stitches and Seams

The Needle

Needles are Stitching Elements. They are amongst the first tools that were devised by man. Needles are Stitching Elements.

They are amongst the first tools that were devised by man. The first needle had a split head for grasping the filers or leather strips, while they were being drawn through the material. Needles with eyes emerged about 1700 BC and around 1800 AD, the eye of the needle was moved from the head to near the point. Needles are designed to pierce the fabric and create a hole. This enables thread to be carried through the fabric. A thread loop is formed by the needle, after it passes through the fabric and begins to rise.

2.8 Different Types of Needles

Curved Needles

Curved needles are used in some overedge and safety machines and for blind hemming. Curved needles in blind hemmers do not penetrate the fabric completely. These needles are costly and do not last as long as the straight needles.
**Double Pointed Needles**

Double Pointed Needles or Centre Eye Needles or Floating Needles, are used to give a similar type of Hand Stitch with an eye in the middle.

**Stitch class 200**

Here, the double point needle consists of two points, a shaft and a needle eye in the centre of the shaft length. Each time it pierces the fabric, it is tossed completely through the fabric.

**2.9 Parts of the Needle**

A needle has different parts.

**The Shank** or upper part of the needle fits in to the needle bar. It may be cylindrical or flat. It forms a support of the needle and is larger in diameter than the rest of the needle.

**The Shoulder** is the part between the shank and blade. The Shoulder is short or long, according to the end strength of the needle that is required.

If the shoulder short blade is long, the chances of needle breakage and deflection are increased, since the needle becomes slender. When strength is required, the shoulder is longer, but care should be taken that it does not reach a point where the needle enters the fabric.

**The Blade** is the longer part of the needle. It is subjected to great amount of friction, when the needle passes through material. The Blade length varies with machine type and sewing needs. Needles used for high speed machines have a shoulder that is extended into the upper part of the blade having a thicker cross section. It thus, forms a larger hole when penetrating the fabric, strengthens the needle and also reduces the friction when the needle is withdrawing from the fabric. However, the blade can also be tapered from top to tip to reduce friction. Reducing friction is important as the heat produced creates problems while sewing synthetic fabrics. Blades are subjected to high friction as they enter and withdraw from the fabric with each stitch. The blade consists of Long groove & short groove. For best seam appearance, use the smallest needle blade possible. This is not a simple solution, as a small blade has a small eye, which could
stress the thread and cause friction. Also, needle strength decreases as the diameter of the blade decrease.

**Long Groove** provides a channel for the thread, so that it can easily pass through the material reducing friction and the abrasive action on the thread. It is important to choose needles with correctly shaped grooves that match the diameter of the thread.

**Short Groove** is on the side of the needle that faces the hook or looper. It extends a little above and below the eye. It assists in formation of needle thread loop.

**The Eye** shape on top is important in reducing thread damage and formation of good loop. Thread passes 20 - 30 times through the eye before forming a stitch. The Eye should be free from buns or sharp edges. The Eye of the needle is the hole through which the thread passes. It carries the thread which helps in loop formation.

The size of eye should match the needle thread diameter. If the size is too large the loop will not form, and if it is too small it can damage the needle or thread.

**The Scarf or Clearance cut** is just above the eye. It enables a closer setting of hook or looper to the needle. This ensures the loop of the needle thread is easily picked by the point of the hook or looper. While making the scarf, attention should be paid that it’s not cut too deep, otherwise the needle loses strength.

**The Point** of the needle is so shaped to penetrate the fabric without causing damage to the fabric. Various types of points are available according to the fabric used.

**Tip** is the extreme end of the needle.

### 2.10 Needle Points

Needle points are divided into:

1) Cloth Points: Must avoid cutting the yarns, and

2) Cutting Points: Must cut the material to form a hole.
**Cloth Needle Points**

Cloth needle points are used for sewing the textile materials. Textile materials can be divided into 2 types, that is, woven and knits. Cloth Points have no cutting edges. They are made to penetrate cloth by spreading the yarns as they pass through the cloth. Cloth Points may have set tips (slim, regular, and heavy) which are commonly used on woven fabrics. In Knit Fabrics, the yarn structure is such, that any yarn breaks, causing it to unravel.

Yarn breakage occurs due to the needle striking the yarns and breaking it or if the loop is not large enough to take the needle. The shape of the tip of the needle point should avoid these. Therefore, the requirement is such, that needle deflects the yarn slightly, but should itself not be deflected that if fails to form the stitch.

For Knits, this is best achieved using a ball point needle. The ball point tips (light, medium, and heavy) are primarily used on knit fabrics and coarse yarn wovens. Tips are available in varying degrees of bluntness for different types of fabrics. Fabrics with coarser yarns require more rounded points.

**Hook Point Needles**

Hook Point needles have hooks instead of eyes for carrying the thread through the fabric. The needles are similar to crochet needle principle. A heavy Point or Stub Point can be used for Button Stitching so that the button can be safely deflected into correct position. Ball Point Needle may also be used for Woven fabrics that contain Fine Elastic Yarns. In case of Elastic Yarns without a cover, a very Acute Point needle maybe used to avoid damage. Using Thin, Medium and Heavy Ball Points would depend on the loop structure, type and size of yarn used, density and regularity, as well as the nature of finish applied to the fabric.

**Cutting Point Needles**

There are also a variety of cutting Points designed for stitching leather and Vinyl. In sewing these materials, the needle must cut through the material, instead of pushing the yarns aside. Rocked, Flat, or Spear point needles are specifically suitable to be used on leather. These needle points make a small cut as the thread is carried through the leather. The size and direction of the
cut, affects seam strength. Selection of the wrong tip and point, can cause permanent damage to the fabric.

Selecting Cutting Point Needles

When selecting these Needles one should keep in mind:

1) The Final Effect required on the seam.
2) The thread size. Too small a needle size will give an untidy appearance and too large / thick thread though filling the incision, will be subject to excessive friction during stitching and result in thread breakage.
3) Direction of threading in relation to the type of needle is important, as the incision may not be completely filled & the effect required may not be obtained.

2.11 Needle Point

A common test for appropriate needle size is to suspend a threaded needle by holding the thread at 45 degree angle. The needle should slide down the thread, because of its own weight when the thread is moved slightly.

2.12 Needle Finishes

Needle finishes are available in four finishes:- regular or plain, extra buff, nickel and chromium. These finishes are listed in sequence of their degrees of surface smoothness with chromium finished needles having highest degrees of smooth. The type of fabric, the operation and the rpm of the operation determines the finish to be used.

Tough fabrics and high speeds require exceptionally smooth needles, to reduce heat generated by friction to a minimum. Needles for sewing cloth are often finished with a nickel, chrome plating, or Teflon, while leather needles are polished without any plating. Needle heat may be reduced by using smaller needle size, a ball eye, additional fabric and thread lubricants, a different thread type and size, or needle cooling devices. Needle coolers are built in tubes that blow air on the needle to reduce the temperature created by friction. Coolers are used primarily on machines that sew heavy fabrics, and synthetics that have a tendency to fuse at high temperature.
Effects of High Needle Heat

High needle heat will impair the quality and quantity of sewing operations by:-

1. Fusing and breaking synthetic sewing threads, or by
2. Fusing the synthetic fabrics being sewn.
3. It can also coat the needle with certain fabric finishes which fuse on the hot needle. This eventually, clogs the needle hole, and leads to breaking of sewing thread or skip stitch.

Heat is the result of friction. It occurs when sewing heavy fabric at high speeds or when stitching several fabrics. If needle temperature exceeds the melting point of the thread, the thread is likely to melt when sewing stops. Heat appears to increase with speeds at a rate of 0.08 degree Fahrenheit per rpm. Lowering the speed from 4500 to 2500 stitches per minute produces a drop of 160 degrees. In fabric and threads made of natural fibers, the heat can rise to about 600 degrees without causing damage.

2.13 Needle Sizes

The size of the needle refers to the diameter of the blade above the eye. There are about 30 needle size systems. The most commonly used ones are the metric & Singer system. In the metric or Nm system, the diameter measures in mm is x by 100. This refers the metric #. For example, Diameter of 1.1 mm x 100 is the Nm 110. Selecting the needle size and thread size depends on the type of material that is to be used and the seam to be stitched. A balance has to be maintained between seam strength with minimum damage and pucker.

2.14 Positioning the Needle

Needle position in the needle bar is specified best by referring to the clock position of the needle scarf. The needle hole in the throat plate is the centre of an imaginary clock face. The 6 o’clock position on this clock face is the spot at the beginning end of the sewing feed line. The 12 o’clock position is the spot at the finish end of the feed line.

The 6 o’clock spot on most machines is directly in front of the operator. In such cases, the 3 o’clock position is at the operator’s right hand side and 9 o’clock is at the operator’s left hand side.

When incorrect needles are used it causes:
Skipped stitches, Fabric damage, Needle deflection (in the case of thin needles), Needle heat thread breakage, Uneven stitching, and Weak seams.

2.15 Stitch Definition

A Stitch is the loop structure of the threads. A stitch is the configuration of the interlacing of sewing thread in a specific repeated unit. Stitching is a series of stitches. A stitching consists of a series of stitches embodied in a material for ornamental purpose or finishing an edge or both.

2.16 Stitch Classification

There are two standards that give stitch classifications namely British Standard 3870 pant 1:1991: classification and terminology of stitch types, and the United States Federal Standard No 751 A, which was the first classified in March 1926. This was followed by revisions in 1930, 1959, 1965, 1983 and is now replaced by ASTM D 6139 standards. These standards, classify seams and stitches into various classes.

As per British Standards, a STITCH is defined as one unit of conformation resulting from one or more strands or loops of threads intralooping, interloping interlacing or passing into or through the material. A series of recurring stitches of one configuration is defined as stitch type. The difference between the two stitch classification standards is that the British system has total six classifications, whereas, the Federal standard has 700 classifications.

Intralooping is passing of a loop thread through another loop formed by the same thread.

Interlooping is the passing of a loop of thread through another loop formed by a different thread.

Interlacing is passing of a thread over or around another thread or loop of another thread.

2.17 Classes of Stitches

The major classes of stitches are:

- Class 100 : Chain stitch
- Class 200 : Stitches originated by hand stitches
- Class 300 : Lockstitch
Class 400: Multi thread Chain stitches

Class 500: Overedge Chain stitch

Class 600: Covering Chain stitch

Class 700: Single thread stitch

Class 100: Chain Stitch

The chain stitch type is formed from one or more needle threads and is characterized by intralooping. One or more loops of thread are passed through the material and secured by intralooping, with a succeeding loop or loops, after they are passed through the material. Since each loop is dependent on the succeeding one, stitches in this class are insecure, and can unravel easily if the finishing end of thread is not passed through the last loop, or separately through the fabric, or if a stitch is broken.

The single thread chain stitch is an intralooping formation, that can be recognized by a flat straight thread formation, similar in appearance to the lock stitch on the face of the fabric, and a loop on the underside.

The needle carries the thread through the fabric and the looper holds the thread and forms a loop for the needle thread to enter, as it descends for the next stitch.

Types of Class 100 Stitches

Stitch class includes stitch types 101, 102, 103, 104 and 105.

The more widely used stitch types in this class are the single thread chain stitch 101, single thread blind stitch 103, and saddle stitch 104. Each stitch type in this class requires a special machine to form the stitches.

101 Chain Stitch

The 101 chain stitch is frequently used for closing bags of sugar and pet food. As the stitch is not secured, it can be removed easily, and is thus used for basting operations in tailored menswear and women’s wear. Temporary stitching of edges, flaps, collar can be done, before it is stitched permanently. Other uses of the 101 stitch include shirring, attaching paper tags, buttons, and sewing some types of button holes. If elastic thread is used in the needles, it can be sewn in
garment features, such as elasticated waist and cuffs that are to be created. Multi-needle elastication can be done using elastic thread.

103 Chain Stitch
The 103 chain stitch is one of several types of blind stitches used for machine hemming. Blind stitches form on the fabric surface, but do not penetrate to the face of the fabric when stitch depth is properly adjusted. The 103 stitch type is formed by blind stitch machine that uses a curved needle. 1 Needle, 1 Thread and 1 Blind Looper.

Machine saddle stitching 104 is used primarily for ornamental stitching, often found on western wear, or to stitch down a series of release pleats that may be used on pleated skirts.

Class 200: Hand Stitch
The stitch types in this class originated as hand stitches, and are characterized by a single thread which is passed through the material as a single line of thread, and secures the stitch by a single line of thread, passing in and out of the material. These stitches are used to achieve perfect finishes in high fashion garments.

Stitch class 200 includes stitch types 201, 202, 203, 204 and 205. Stitch class 200 consists of stitch formations done by hand with a single strand of thread with the exception of 205. Class 200 stitches are used most on lined jackets and tailored garments. The machine is not as fast as the lock stitch machine, but faster than hand stitching and consistent in quality.

Stitch Type 205
Stitch type 205 was added with the last revision of Federal Standard and stitch class 209, as per British Standards, because it simulates a hand running stitch formed by a special machine, and is used occasionally, on the front edges of men’s jackets and coats for aesthetic purpose. This is referred as pick stitching. The term pick and saddle are used to describe certain stitches, the pick stitches are ones in which the exposed thread lengths are very small (dot) and the saddle stitch are longer. A double pointed center eyed needle is used.

Class 300: Lockstitch
The stitch types in this class are formed with two or more groups of threads, by interlacing of the two or more groups. One group of thread is the needle thread, and other group of thread is bobbin thread. As the threads interlace, stitches of this class are well secured and difficult to unravel.

The most common of these class and most widely used is 301. It is also referred as plain stitch or straight stitch. It has the same appearance on both sides, and is the only stitch formation that can be backtacked, if the ends of a seam need to be secured. It is a poor choice in areas that need to stretch, as it has the least amount of elongation potential. It is used for topstitching of collars and cuffs and fronts of jackets.

**Stitch type 304, 308 and 315 are the zigzags.**

304 is the traditional one stitch zigzag, that is used to sew appliqués, attach lace on lingerie, and produce faggotting. It is a decorative stitching used to connect two pieces of fabric but allowing space between the pieces. Stitch type 308 and 315 are two and three successive stitches, which form a longer and wider zigzag by using several stitches to attach elastics.

**Stitch type 306, 313, and 314 are lock stitch blind stitches.**

These types are used primarily by men’s suit manufactures for attaching lining and the inside components of waistbands for men’s dress slacks.

**Stitch Type 309**

Stitch type 309 uses 2 needle threads and one bobbin thread, and is used as decorative stitch in shoes. If versatility is required, a lock stitch machine is a good choice, but if speed and efficiency are the priorities, it is not the right selection. Operating speeds range from 3,000 to 5,000 rpm, while other classes of machines can operate at 9,000 rpm or more.

**Lockstitch Machine – Disadvantage**

The Lockstitch machines, generally have a down time, because they operate with a limited thread supply from bobbins that have to be replaced as they run out.
The main disadvantage of the lock stitch is that it uses a bobbin to provide the lower thread and this bobbin can only contain a limited length of that thread. The other disadvantage of lockstitch is its limited stretch for today’s high stretch fabrics, and its unsuitability for edge neatening.

Class 400 Multithread Chain Stitch

The stitch types in this class are formed with two or more groups of threads, and are generally characterized by the interloping of the two groups. Loops of one group of threads are passed through the material, and are secured by interlacing and interlooping with loops of another group. One group of threads is needle thread and the other group is looper thread. Stitch class includes stitch types 401, 402, 403, 404, 405, 406, and 407.

Stitch Type 401

The most common stitch types in this class are the two thread straight line chain stitch 401. It resembles a lockstitch on top and a double chain stitch effect formed by the looper thread on the underside. This stitch does not cause pucker, as the threads do not interlock between the fabric plies as found in class 300. Both the threads are supplied by large packages, and therefore frequent changes are not required. It is used on long seams, such as trousers. This stitch is often used in combination with an overedge stitch. This enables economical production, where joining of the seam, as well as neat edges can be achieved in one operation.

Stitch Type 402

Stitch type 402 it is cording stitch. It is primarily for stitching permanent creases. It uses 2 needle and bottom looper creating a ridge/crease, and is found in sportswear and the back of gloves.

Stitch Type 404

Stitch type 404 is more elastic than 401. It was designed for use on men’s slacks to attach makers, and to attach curtains to the inside of the waistband. This stitch is used for infant wear and children wear. Modifications of this stitch type are also used for ornamental stitching, such as some types of faggotting and picot edges. It is similar to 304, except that it is formed as a chain stitch.
**Stitch Type 406 And 407**

Stitch types 406 and 407 are known as bottom cover stitches. They are used to cover seams or unfinished edges on the inside of garments and to keep them flat. They appear as two or three rows of parallel lock stitching on the face of a fabric, while a looper thread connects the rows on the back.

Stitch type 406 is used to form hems on knit garments, produce flat comfortable seams on necklines of T-shirts, and attach bindings on men’s brief. It is also used for making belt loops on jeans. It has 2N, 3T, 1L. Stitch type 407 is very similar, except that it uses 3N, 2T, 1L and has even more stretch. The primary use of the 407 is attaching elastic to undergarments that require maximum stretch.

**Stitch Type 408**

Stitch type 408 is not listed in federal standards. It is used for attaching pocket facings to jeans and Chino casual pants. The stitch is formed by 2 needle threads passing through the material and interloping with 2 looper threads with the stitches set on the underside of the seam. A top spreader thread is interlaced on the top side of the seam between the two needle threads.

The straight or zig zag version of 401 can be chained off the edge of the fabric, and further decorative effects can be created by this means. If 411 is sewn along a garment edge, which has previously been neatened or hemmed in some way, and it is sewn with the chain effect to the right side of the garment, an effect similar to a crocheted picot edge can be achieved.

**Class 500: Overedge Stitch**

The stitch types in this class are formed with one or more groups of threads, and have as a general characteristic, loops from at least one group of threads that pass around the edge of the material. It is often called as overedge, overlock, serge, overcast, or merrow. All 500 class machines, trim the edge of the cut fabric just in front of the needle. Stitch class 500 includes, stitch types 501, 502, 503, 504, 505, 506, 507, 508, 509, 510 511, 512, 513, 514, 515, 516, 517, 519, 520, 521, and 522.

**Overedge Stitches**
Overedge stitches are high thread users and stretchy, and can be used on almost all types and weights of fabric. Seams stitched with overedge stitches must be pressed to one side, rather than being pressed open and flat. Overedge machines must have a pair of knives for trimming fabric and three stitch forming devices, a needle to carry the thread through the fabric, a looper or spreader to carry the thread from the needle to the edge of the material on the bottom, and a looper or spreader to carry thread up and over the edge of the material on the top.

501, 503, 505 and 521 Stitches

The odd numbered overedge stitch types 501, 503, 505 and 521 are known as “break open” stitches, as they are similar to the spiral back of a notebook. The fabric is held tight together, but not secure along the inner edge of the stitching, which allows the seam to break open. These stitches are best used for edge finishes and hems, rather than for seams.

502, 504, 512 and 514 Stitches

The even numbered stitch types in this class 502, 504, 512, and 514, have a much tighter needle thread that holds the two layers of fabric together at the actual seam line. If stress is placed on these seams, the stitches do not “grin through” or become exposed between the layers of fabric. These stitches have a smoother appearance and more durable.

502, 503, 504 or 505 Stitches

Stitch types 503, 504, or 505 are overedge stitches used for “serging”. Serging is the process of stitching along the cut edge of a single ply of fabric to prevent unraveling. Stitch Type 502 and 503 are formed by 2T, 1N, 1L (2Thread O/L). The 502 type is a tight stitch that is used for seaming the outer edges of bags, while 503 is used for blind hemming and serging on men’s trousers. 503 type is also used for hemming on T-shirts and other knitted garments, where careful fabric folding ensures a neatened edge, as well as, a sewn hem with a minimum of stitching, shown the right side. It is often called as “overlock welting”. Bight can be 18”, 3/16” ¼”.
Stitch types 504 and 505 are formed by 3T, 1N, 2L (3Thread O/L). They require more thread in the formation, but they also have more stretch.

Type 504 is a highly extensible, but a secure stitch. It makes an excellent seam for knit garments, such as seams of cut and sewn sweaters, T-shirt, and knit caps. It is most common of the stitch class 500. When joining fabric with this stitch, a thread chain end must be left, and the seam is then secured by some means, either by a short lockstitch tack, or bar-tack, or a short zig zag of stitching of fixed length. A special machine attachment is available which can “latchback” the chain end at the starting end of the seam, and recently finishing end attachments have also been developed. This stitch type can also be used to provide a decorative neatened edge, if sewn with high stitch density and a narrow bight over an edge which, after the usual trimming has been rolled under, to the width of the stitch, usually 2mm.

Stitch type 505 stitch type is more satisfactory for serging, than seaming, since it produces a break-open type of seam. It is sometimes referred to as the “box edge stitch” or “square edge stitch”, which provides excellent coverage of raw edges.

**Stitch Types 512 And 514**

Stitch types 512 and 514 are sometimes called “mock safety stitch”. It is formed by 4T, 2N, 2L (4Thread O/L). Type 514 is stronger and more elastic than 512, but both may be used for seaming knits and woven. However, 514 makes a wider seam than may be desirable for some knit garments. Stitch type 514 is used on light and medium weight woven fabrics, especially lingerie and shirts. This stitch is wider than 504.

**Stitch Types 515, 516 and 519**

Stitches type 515, 516, and 519 are called as “Safety stitches” as the chain stitch that closes the seam is backed up, by another row of tight overedge stitches. Both rows of stitches are formed at the same time. 5T, 2N 3L (5Thread O/L). They are a combination of an overedge stitch and a 401 chain stitch.

515 is a combination of (401.503) and 516 is a combination of (401.504), the dot indicating a combination stitch and the bracket denoting simultaneity of sewing. 516 is used by manufacturers of shirts, jackets, blouses and jeans. A 516 is also used on moderate and budget woven sportswear and polyester blouses at all price levels.
Stitch Types 521

Type 521 is a three thread stitch with excellent elasticity and strength and is used primarily for seaming hosiery. It is formed with two needles, a looper, and a spreader. Socks may be knitted as a tube and sewn together with a 521 stitch at the toe.

Class 600: Cover Stitch

With the exception of the very first type, stitch types in this class are formed with three groups of threads. Generally, in this class, two of the groups cover both surfaces of the material. Loops of the first group of threads (needle threads) are passed through loops of the third group already cast on the surface of the material and then through the material, where they are interloped with loops of the second group of thread on the underside of the material.

The second and the third groups are usually referred to as the top cover threads and the bottom cover or looper threads. Threads must be chained off and be crossed by another seam. Stitches in this class are the most complex of all and may have up to nine threads in total including four needle threads. These stitches are complex version of the 400 class and used on knits and lingerie. Cover stitches are also called as “Flat-lock or flat-seam” stitches.

Stitch Types 601, 602, 603, 604 and 605

Stitch types 602 and 605 are strong, elastic stitches used extensively by manufacturers of knit garments to cover raw edges and prevent raveling. They may be used for attaching flat knit or ribbed knit collars. When the upper spreader thread is not used, these stitches become 406 and 407 types. 602 has 4T, 2N 1L, 1CT. 605 has 5T, 3N, 1L, 1CL.

Stitch type 606 is known as flatlock and it is the most complicated stitch type. It has 9T, 4N, 4L, 1CL.

It provides a smooth join with good extensibility and is used on knitted fabric, especially underwear fabrics, to give a seam with low bulk that can be worn comfortably against the skin.

The flat, seaming, stitch, 607 is used to produce the flat, butted seams on infants panties, men’s briefs, and other knitted garments. For every inch of needle thread, this machine requires 1.5 – 3 inches of looper thread, depending on the type of stitch. Advantages of this stitch are high speed and seams that are stretchy, flat, and smooth. 607 has 6T, 4N, 1L, 1CL.

Class 700: Single Thread Stitch

The Class 700, single thread stitch is found only in the federal standards. It is formed with a single continuous needle thread. At the first penetration, the needle threads a portion of the needle thread. This is wound onto a reel in the lower mechanism of the machine. The stitches are formed by the interlacing of the needle thread, with the thread wound on the reel. The interlacing is similar to the stitch class 300, except for the initial stitch. The only stitch of this class is 701.
Seam Definition

A seam is a line where two or more fabrics are joined. It is a joint consisting of a sequence of stitches, joining two or more plies of fabric, and is used for assembling parts in the production of sewn parts.

Seam Dimensions

Seams have three dimensions, length, width, and depth.

Let us learn about each of these now.

1) Seam Length
It is the total distance covered by a continuous series of stitches, such as a side seam or shoulder seam. It is determined by the garment size and design. Exact measurement of seam length is used for costing, calculating thread usage, writing specifications and monitoring quality standards.

2) Seam Width
Seam width considerations are width of a seam allowance, stitch width relative to the seam, and the seam heading of a lapped or top stitched seam.

3) Seam Depth
Seam depth is the thickness or compressibility (flatness) of a seam. Seam depth is affected by fabric weight, fabrication and selection of seam type. For example, the seam of overlapping layers may be thicker and bulkier, but more durable than pressed open.

Seam Allowance

Seam Allowance is measured from the cut edge of fabric to the main line of stitches. This is the amount of fabric that extends beyond the actual seam line. Width of a seam allowance is often a factor in judging garment quality, reducing yarn slippage, and providing fabric for alterations. A wider line of stitches has more holding power and strength than a narrow line of stitches. Wider seam allowance may increase costs, because of the fabric required. They may also need to be serged before seaming to prevent raveling.

Seam Heading
Seam heading is the distance from the folded edge of the top ply to the first line of stitches. On a patch pocket, the seam heading is the distance between the stitches and the folded edge of the pocket. A header reduces the strain on the cut edge of the fabric and makes the seam stronger.

**The Width of the Stitches**

It is relative to the seam, and varies with stitch type. The wider the line of stitches, the more holding power and strength the stitches have. This results in a stronger seam. Seam width is the distance between the outer most line of stitches as determined by the space the needles on the needle bar. It is also called as gauge. The gauge for two needle cover stitch may be ¼, 3/16.

**2.18 Classification of Seams**

Seams can be classified mainly into four categories, as per Federal Standards on the basis of position of pieces relative to each other, at functions where they are sewn.

These are:

<table>
<thead>
<tr>
<th>Seam Class</th>
<th>SS</th>
<th>Superimposed Seam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seam Class</td>
<td>LS</td>
<td>Lapped Seam</td>
</tr>
<tr>
<td>Seam Class</td>
<td>BS</td>
<td>Bound Seam</td>
</tr>
<tr>
<td>Seam Class</td>
<td>FS</td>
<td>Flat Seam</td>
</tr>
</tbody>
</table>

These classifications are also found in British Standards. Apart from these four, there are an additional four classes.

**Class I Superimpose Seam**

There are 57 seam types. The simplest is by Superimposing the edge of the material on the other. Any stitch type can be used for joining the fabric or neatening the edges or both. All diagrams show the final version of the seams. However, from theses diagrams it is clear about the position of the needles and folding of fabric. The seam diagram, also makes it clear, whether the same seam is made in more than one step or made in one operation using the folder and or multi needle machine. The seams could be used for side seams of skirts and blouses depending on fabric choices and quality level.

An example of this seam is the type of superimposed seam known as French Seam, which is done in two stages or in one operation. Another example of this seam, is with an additional component, which is one that contains an inserted piping, and even here, more than one construction is possible.
<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Seaming</td>
<td>SSa</td>
<td>Most common seam method for both wovens and knitted fabrics.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seaming &amp; Taping</td>
<td>SSab</td>
<td>Shoulder join of a T shirt with stay tape, Facing and jacket front panel attach with stay tape.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td><img src="image1.jpg" alt="Attaching Tape to Edge" /></td>
<td>SSaa</td>
<td>Attaching stay tape to armhole, attaching zipper tape to fly facing.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2.jpg" alt="Runstitch &amp; Topstitch" /></td>
<td>SSe</td>
<td>Collar and cuff making in shirts, Pocket bag run and top stitch.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>French Seaming</td>
<td>SSae</td>
<td>Generally used for edge stitching of front facings of jackets, side seams of light weight fabric blouses.</td>
</tr>
<tr>
<td></td>
<td>SSj</td>
<td>Attaching a zipper between facing and shell.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td></td>
<td>SSk</td>
<td>Piped seams in dresses and furniture.</td>
</tr>
</tbody>
</table>

**Seam with Piping**

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SSax</td>
<td>Seaming and piping either with cord or without cord.</td>
</tr>
</tbody>
</table>

**Seam, Fold, & Topstitch**
<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seam, Fold, &amp; Topstitch</td>
<td>SSaw</td>
<td>Variation of piped seam.</td>
</tr>
<tr>
<td>Hem Seam</td>
<td>SSn</td>
<td>Used for fabrics which are susceptible to seam damage.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>[Image of SSq seam]</td>
<td>SSq</td>
<td>Commonly used for back yoke attaching of men’s shirt.</td>
</tr>
<tr>
<td>[Image of Butt Seam &amp; Tape]</td>
<td>SSf</td>
<td>For butt seaming and taping heel seams of shoe.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td><img src="image1" alt="Seam Drawing" /></td>
<td>SSs</td>
<td>For attaching tape along with hemming. Generally found in casual clothing.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2" alt="Seam Drawing" /></td>
<td>SSh</td>
<td>Cover seaming undergarments and knitted tops to reinforce and give decorative appeal.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td><img src="image1" alt="Attaching Elastic" /></td>
<td>SSst</td>
<td>Attaching elastic at waistband for shorts, boxers.</td>
</tr>
<tr>
<td><img src="image2" alt="Seaming, then Taping Seam" /></td>
<td>SSag</td>
<td>Taping the shoulder and neck of T-shirts.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td><img src="image" alt="Lining Cuffs" /></td>
<td>SSbc</td>
<td>Attaching lining to cuff for shirts and blouses.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Setting Stripes Shirts, Shorts, etc." /></td>
<td>SSat</td>
<td>Attaching strips for decorative purpose.</td>
</tr>
</tbody>
</table>
### Seam Drawing

<table>
<thead>
<tr>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSw</td>
<td>Side seams of shirts and blouses.</td>
</tr>
</tbody>
</table>

**Mock Felled Seam**

<table>
<thead>
<tr>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSaz</td>
<td>Making of straps and belts.</td>
</tr>
</tbody>
</table>

### Lapped Seam

There are 101 seam types. The simplest seam type in this class is formed by lapping two pieces of material. In lapped seam there is overlapping of fabric as at the needle point. It is not common in clothing, because it causes problems with raw edges and at least one of the edges must be neatened in a decorative manner. It is commonly used in joining of panels in sails, where a strong seam is achieved by using two or three rows of zig – zag stitching. Sail fabrics are very
finely woven and do not fray much. Lapped Seams are used to reduce the amount of bulk, others are selected, because of the durability they provide or the appearance they contribute.

It is used for attaching front bands to shirts, setting pockets, side seams of quality dress shirts, side seams or inseams of jeans. The type of raised, topstitched seam often used down skirt panels, is also technically a lapped seam. It is often referred to as a welted or raised and welted seam. Another type of Lapped Seam is Flat and felled. It is stitched with two rows of stitches on a twin needle machine, equipped with a folder device. This provides a very strong seam in garments that will take a lot of wear. Lapped seams may be sewn with a lock stitch or chain stitch, but not with an overedge stitch.

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Lap Seaming" /></td>
<td>LSa</td>
<td>Generally constructed with a coverstitch and used for attaching cuffs in knitted styles.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Lap Seaming" /></td>
<td>LSb</td>
<td>Attach and turn and topstitch.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>LSq</td>
<td>Attach and insert cord with topstitch.</td>
</tr>
<tr>
<td>Seem &amp; Cord Seam</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LSc</td>
<td>Generally constructed with 2 or 3 lines of 401. It is found in jeans and side seam of shirts.</td>
</tr>
<tr>
<td>Felled Seam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td><img src="image1.png" alt="Seam Drawing" /></td>
<td>LSk</td>
<td>Waistbanding on pyjamas.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Seam Drawing" /></td>
<td>LSd</td>
<td>Generally constructed with stitch type 301 for setting of patch pocket, flaps and pocket facings.</td>
</tr>
</tbody>
</table>

**Patch Pocket Setting**
<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Two piece Waistband" /></td>
<td>LSg</td>
<td>Generally constructed with a multineedle chain stitch or twin needle lock stitch machine. Two pieces of waistband attached to waist of a trouser.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Seam Drawing" /></td>
<td>LSs</td>
<td>Varies from Lsd because of the setting and top stitch. Used for large pockets.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td><img src="image1.png" alt="Seam Drawing" /></td>
<td>LSj</td>
<td>Differs from LSg, because of extra layer of lining.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2.png" alt="Seam Drawing" /></td>
<td>LSM</td>
<td>Set on plackets/ center plaits. Generally constructed with either 2 rows of 401 or 2 rows of 301.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td></td>
<td>LSas</td>
<td>Seaming of crotch in jeans and chinos.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LSbj</td>
<td>Jet piece and facing setting on jeans.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td><img src="image1.png" alt="Joining &amp; Taping" /></td>
<td>LSz</td>
<td>Generally used in knitted briefs and thermal underwear for simultaneous joining and taping of front panels.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Sleeve Set" /></td>
<td>LSr</td>
<td>Setting of sleeves onto armhole in dress shirts.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td></td>
<td>LSi</td>
<td>Attaching strips like bibs.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LSar</td>
<td>Joining bibs to pants in bibs overall.</td>
</tr>
</tbody>
</table>

**Classed 3 Bound Seam**

There are 18 seam types. It is formed by sewing one piece of fabric or binding as it encompasses the edge of one or more pieces of fabric. A bound seam is often used as a decorative edge, and the binding may continue off the edge of the garment to provide toe ends. These seams are used to finish edges of garments or components.
It is mostly used on Necklines, short sleeves on some styles of T-shirts, and sleeveless tops may be finished with a binding. It is also commonly used on underwear and leisure wear and on skirts, jeans and ladies’ trousers. On all these seams, a stitch type would be used which has two needles and incorporate a thread passing between the needle threads on the underside and covering the raw edge of the fabric. Self-fabric in the same color or another color is usually cut into strips for the bindings and the fabrics are normally knitted. In a waistband, usually with an interlining fused to it, it is bound onto top of a skirt, jeans or trousers using a folder and twin needle machine.

Bound seams may be sewn with a lock stitch, chain stitch, or cover stitch. They would be never be sewn with an overedge stitch as the knife would cut off the binding.

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BSa</td>
<td>Selvedge edge binding, for example in Carpet edge binding.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>BSb</td>
<td></td>
<td>Usually constructed with stitch type 406 (bottom cover stitch) for binding of legs and fly on knit briefs.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSb</td>
<td>BSc</td>
<td>Can be sewn with either 301 or 401 stitch types. Generally found in sleeve placket construction of shirts.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td>BSe</td>
<td>Seaming and binding on outerwear.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>BSf</td>
<td>Also known as stitch in Ditch. Generally found in waistband finish operation of formal trousers.</td>
<td></td>
</tr>
<tr>
<td>BSg</td>
<td>This is done in two steps. Mock clean finish of binding.</td>
<td></td>
</tr>
</tbody>
</table>
Classed 4 Flat Seam

It is the smallest class with only 6 different types. Seams are referred as flat seam, because the fabric edges do not overlap. They may be butted together without a gap and joined across by a stitch which has two needles sewing into each fabric and covering threads, passing back and forth between these two needles on both sides of the fabric. The stitches used are from 600 class, and are wide due to number of needles used.

Stitches extend across the seam, holding both pieces together and covering the seam on one or both sides. Flat seams are constructed to remain flat through care and wear. They are commonly used for seams of sweatshirts, lingerie, and underwear. Knitted fabrics are most commonly used because the advantage of this seam is that it provides a join that is free from bulk in garments worn close to the skin such as knitted underwear. The machine trims both fabric edges so that they form a neat join. Alternatively, various zig-zag stitches could sew back and forth between the fabrics which might then have a decorative gap between them.

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FSa</td>
<td>Generally sewn with stitch type 607 for attaching two panels in underwear. It is also called butt seaming.</td>
</tr>
</tbody>
</table>
Classed 5 Ornamental Stitching / Decorative Stitching

The next two classes of seams are classified in the Federal Standards as stitching and not Seams. This is the first of the two classes of seam which were not regarded as seams. Decorative stitching is also called as Ornamental Stitching. The main use of the seam is for decorative sewing on garments, where single or multiple rows of stitches are sewn through one or more layers of fabric. It can be done anywhere on a garment, except the edge. Ornamental stitching includes decorative stitching on jeans pocket, embroidered logos, and pintucks down the front of a shirt.

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Seam Drawing" /></td>
<td>OSa</td>
<td>Decorative stitching is done on the back pocket of jeans and for saddle stitching.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2" alt="Seam Drawing" /></td>
<td>OSf</td>
<td>Dart panel on slacks, chinos, blouses etc.,</td>
</tr>
</tbody>
</table>
Classed 6 Edge Finishing / Edge Neatening

This is the other seam class that was called a stitching. Seam types in this class include, those where fabric edges are neatened by means of stitches, as well as folded hems and edges. The simplest is the fabric edge inside a garment, which has been neatened with an overedge stitch. Other examples are, Blind hemming, different types hems, on the sleeves and lower edges of garments. Edge Finishing is stitching that encompasses a cut edge or provides a finish for a single ply of fabric with a folded configuration. Stitches from any of the classes may be used, depending on the type of fold and placement of the stitching.

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EFa</td>
<td>Hemming of selvedge on the shirt front.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EFa Inv</td>
<td>Bottom hemming of T shirts, Polos using stitch type 406.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td><img src="image" alt="Clean Finish Hem" /></td>
<td>EFb</td>
<td>Most widely used edge-finishing seam. Frayed edges get folded in and gives a neat look.</td>
</tr>
<tr>
<td></td>
<td>EFc</td>
<td>This is not so widely used. Generally constructed with stitch type 503.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Blindhemming</td>
<td>EFd</td>
<td>Widely used. No frayed edges as the edge is caught in overlock. In formal trousers the panels are serged, joined and press opened to get a closer to body seam.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
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<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td></td>
<td>EFe</td>
<td>Edges of napkin and curtains get</td>
</tr>
<tr>
<td></td>
<td></td>
<td>serged and hemmed.</td>
</tr>
<tr>
<td></td>
<td>EFFf</td>
<td>Hem and elastic inserts in infants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>panties etc.,</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Blindstitch Hem</td>
<td>EFi</td>
<td>Generally done with stitch type 103 combined with a colourless monofilament thread. Formal skirts and trousers are hemmed in this manner.</td>
</tr>
<tr>
<td>Belt Loops</td>
<td>EFh</td>
<td>Usually constructed with two-needle bottom cover stitch. Belt loops of jeans and trousers have this construction.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Centerplaiting</strong></td>
<td>EFv</td>
<td>Usually constructed with an extra piece of lining inside. Used to construct buttonhole placket of men’s formal shirts.</td>
</tr>
<tr>
<td><strong>Making Spaghetti</strong></td>
<td>EFu</td>
<td>Usually constructed by turning the tubular structure inside out after sewing. For extra strength a cord can be inserted using a specialized folder.</td>
</tr>
<tr>
<td>Seam Drawing</td>
<td>Seam Number</td>
<td>Application</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td></td>
<td>EFn</td>
<td>Making straps or belts with a clean finish.</td>
</tr>
<tr>
<td>Number</td>
<td>Application</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------</td>
<td></td>
</tr>
<tr>
<td>EFp</td>
<td>One more construction of clean finish strap.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seam Drawing</th>
<th>Seam Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EFad</td>
<td>Clean finished strap with interlining.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Elastic is tunneled between the spaces created between two needles. This construction is commonly seen in waist band of infant pants. Usually constructed with stitch type 406.

Bed Types and Feed Types

Machine bed is that part of the sewing machine on which the fabric rests while it is being sewn. The types of beds in the machine are: Flat, Cylinder, Feed of the arm, Post Bed, Raised Bed and Side Bed.

Flat Bed

It is found on Lock stitch and certain chain stitch machines. Here, the bed of the machine is mounted on the table of the machine, which is suitable surface for flat sewing. A cloth plate is mounted horizontally on the bed, the part of the machine on which the fabric rests while being sewn. This is the work surface. The material can easily be guided around the needle and the presser foot. The flat bed is used in most flat sewing techniques, where a large and open garment part can easily be handled past the needle. It provides a suitable surface for much flat sewing and also facilitates the use of markers to control the position of garment parts.

The machine allows manipulation of fabric on both sides of the needle for top stitching and lapped seaming. For example, a patch pocket on a shirt front.

Cylinder Bed

Here, the cloth plate is located horizontally at the upper end of a horizontal cylinder. Cylinder or “open arm” beds are used to sew tubular items, such as sleeve circumferences or tubular neck bands. The fabric is turned around the arm while seaming. It permits one to sew a cylindrically shaped item. This shape allows easy rotation of the item that is to be stitched.

The Feed Off the Arm
This is also a type of cylinder bed machine. The bed of the machine is U shaped. These machines are used where a lapped seam has to be closed in such a way, that the garment part becomes a tube. The stitching is along the length of the cylinder. It is common in jeans production for Inseam.

**Post Bed**

Post bed machines have the cloth plate attached horizontally to the top of a narrow post or small platform above the table surface. These types of machines are commonly used for footwear, where the parts to be sewn are small, curved or awkward in shape. The sewing area is very small, and therefore permits the item to be turned without difficulty. For example, bars and shoes.

**Raised Bed**

Here, the bed plate is in the form of a plinth. It facilitates the assembly of pre-sewn parts and is especially suitable for the fitting of accessories and special attachments. This is the basic form for various specialized machines, such as button hole machine.

**Side Bed**

It trims the edge of the fabric in front of the needle just as it is sewn. Machines which are specialized for sewing at edges need only a small working area. Example are, Overlock Machine.

### 2.19 Principle Role of the Feed Mechanism

The feed mechanism is essentially a transportation device for repeatedly moving the material being stitched from one stitch position to the next at regular intervals. The feed system is made up of the following components, which are often referred to as the 'fittings' because they fit together as a component set.

- Feed dog
- Presser foot
Feed Dog

The feed dog has raised lines of hardened steel, each with multiple rows of steel 'teeth' that grip and move the material during stitching.

Presser Foot
The presser foot is a solid or hinged flat surface that holds the material against the needle plate or lower feed during sewing. It provides stability around the needle point, which helps the correct loop formation of the stitch, beneath the fabric.

Needle Plate

The needle plate is designed to support the material being sewn and ensure it passes smoothly through the machine. It has a needle hole to allow the needle (and thread) to penetrate the fabric and there are slots for the feed dog to rise through and meet the underside of the fabric.
Various Feed Systems

Drop Feed

This four motion feed system is probably the most widely used feed type in the clothing industry today.

Description: The lower feed dog works with the pressure of the sewing machine foot to feed the material over the needle plate and through the machine.

Applications: This type of feed is found in all general sewing operations. However, the operator must be highly skilled in order to maintain stitch quality at acceptable working speeds.
**Compound Feed**

**Description:** Compound feed is a four motion feed system in which the drop feed and needle move forward in unison in the material during the feeding movement.

**Applications:** This type of feed reduces seam pucker on light, slippery fabrics and will reduce needle breakage on thick materials, especially on multiple thickness such as cross seams. It is also ideal for stitching denim, protective clothing and in top stitching applications.

![Compound Feed Diagram]

**Differential Feed**

Almost every overlock and chainstitch machine uses this four motion tandem feed system.

**Description:** The feed system uses two separate lower feed mechanisms that move together in tandem.

**Adjustments:** The feed system can be adjusted by using different stitch regulators to control the timing of each of the lower feed mechanisms. Altering one regulator moves the feed dog at a different rate, and this is often used for stretching or gathering the material being sewn.

**Applications:** Overlock and chainstitch machines are found extensively, throughout the knitwear industry.

The lingerie industry relies on lockstitch machines for operations, such as attaching lace to slips and nightwear, and lockstitch zigzag machines for making bra’s.
Unison Feed

This feed system has a lifting foot with a feeding foot (connected to the needle drive) and feed dog, and these move together in the material (walking foot).

**Description:** The feed dog, feeding foot and needle bar all move together along the line of stitching. The lifting foot then contacts the material, holding it firmly while the needle and the feeding foot rise and, with the feed dog, returns to the start of the next stitch.

**Applications:** This feed system is useful for stitching rigid materials, such as upholstery, leather and plastic, which often have extra heavy cross seams.
**Drop Feed and Variable Top Feed**

This four motion drop feed has an adjustable top feed system.

**Description:** There are two separate feed mechanisms (one above the presser foot and one below) each moving at the same or different rate of speed to produce a completely flat seam.

With adjustments, this feed system can be used for stretching or gathering material and is used on difficult fabrics where seam pucker is apparent.

**Applications:** It is particularly well suited for joining two plies of fabric so they finish evenly, especially on difficult, hard to handle materials.

It is used for collars, cuffs and hems on shirts and blouses, joining side seams on knitwear, hemming linings and sleeve setting on lightweight jackets.
Differential Drop Feed and Variable Top Feed

This four motion tandem feed has an adjustable top feed system that is used by almost every top feed overlock machine.

**Description:** It features three separate feed mechanisms (one above the presser foot and two below) each moving at the same or different rate of speed to produce a flat seam. The feed can be adjusted to stretch or gather the material.

**Applications:** This feed system is used to ensure an even finish when joining three plies of fabric and is used for piping operations on sportswear, tracksuits, pyjamas, light weight jackets, cushions and upholstery.
**Wheel Feed**

This feed design replaces the feed dog and presser foot with two wheels that contact and move the material.

**Description:** Rotating cylinders (either upper, lower or both) drive the feed. These are usually in constant contact with the material during sewing.

**Applications:** Wheel feed systems are found extensively in the boot and shoes industries, where they are used for joining and topstitching operations. They are also used in the clothing industry for sleeve setting in ladies and gents outerwear.

**Puller Feed**

This is an additional feed mechanism used to assist the regular feed in carrying the stitched material away from the needle.
Description: A puller feed takes the form of a continuously or intermittently turning roller wheel positioned at the rear of the needle. Both lockstitch and chainstitch versions are used on difficult fabrics, where seam pucker is apparent.

Applications: Puller feed is particularly well suited for ensuring an even finish when joining two plies of fabric, especially on difficult and hard to handle materials. It is ideal for long seam operations, trouser legs, sleeve and back seams on jackets, and hemming applications where quality is paramount.

Seam Puckering

Puckering is a corrugated sewing line whose finished sewed length is equal to, or more, its original cut length. It is often confused with gathering.

Puckering is caused by the stitching action, feed action, or both. It is actually the result of a ratio resulting from the integration of the following dimensions and characteristics 1) yarn count, 2) yarn diameter, 3) yarn tension, 4) thread diameter, 5) thread elasticity, 6) stitch size, 7) stitch tension, 8) needle diameter, 9) needle contact velocity, 10) feed tooth dimension and feed velocity.

Four probable causes of seam pucker are:

Feed pucker, tension pucker, displacement pucker of jamming and moisture pucker.

Feed Pucker
Feed Pucker is due to the resistance or drag of the presser foot on the top ply, as two plies of fabric are sewn together. If the fabric on the bottom is fed more rapidly than the top ply, the bottom fabric puckers. Using a top feeding device may be one resolution to the problem.

A top-feeding mechanism that moves the top ply of fabric through the stitching process at approximately the same rate as the bottom feed, eliminates much of the resistance on the top ply. Differential stretching of the two plies being sewn may also cause only one side of a seam to pucker. This might occur when braid or trim is sewn to a blouse or jacket. If one piece has a greater degree of bias, it will be more susceptible to stretch.

**Tension Pucker**

Tension pucker may be caused by too much tension on the sewing thread, which causes the thread to elongate as stitches are formed. Tight tension setting on upper or lower threads during stitching or bobbin winding, or damaged thread guides, may be other causes. Tension pucker is primarily a problem with synthetic thread, which has greater elongation capabilities than other thread. As the thread relaxes, it can cause the fabric to draw together and pucker. Thread that is poor quality or the wrong size or type and incorrect settings are other probable causes of tension pucker. Tension pucker may be eliminated with properly adjusted machines and use of consistent quality thread. Fine threads and well lubricated threads can be sewn with light tension due to its looped formation.

**Displacement Pucker or Jamming**

Displacement Pucker or Jamming, is due to yarn displacement and crowding as the needle and thread pass through the fabric. Yarns are pushed together as threads forms stitches in the fabric. Displacement pucker is most common on high count fabrics with long seams cut parallel to warp yarns. The tendency of jamming increases with more stitches per inch, higher count fabrics, finer fabrics, and thicker sewing threads. Possible solutions for jamming are the use of a two thread chain stitch, instead of a lock stitch machine.

Other solutions include, use of finer sewing threads and a smaller needle, fewer stitches per inch, and cutting adjoining garment pieces with a slight degree of bias so there is more room for yarn displacement.
**Moisture Pucker**

Moisture Pucker is not the result of the sewing process, but is of concern to the lasting appearance of a garment. Moisture pucker is due to differential shrinkage of the shell fabric, thread, or other attached materials such as trims and interlinings. Differential shrinkage of components may be avoided by early product testing during the development stage, to ensure all materials are compatible during sewing and care.

**Seam Grin**

Seam grin is a separation of a sewn seam as a result of transverse stress that allows the stitches and thread to show. It is a condition that is likely to occur with a low stitch count, insufficient tension on threads, or improper stitch and seam selection. It affects both the aesthetics and performance.

**Cyclical Sewing Machines**

Cyclical sewing machines are automatic machines which can perform a short automatic cycles like button sew, buttonhole, bartack and label sew. In olden days, the cyclical sewing machines were of limited configuration, but whereas, current cyclical sewing machines have microprocessor controls, which allow for a greater variety of stitching configuration.

**Buttonhole Machines**

Buttonhole machines operations depend upon the characteristics of the buttonhole to be sewn. The variables are:

- Stitch density
- Stitch bight
- Stitch type (Lock stitch or single or two thread chain stitch)
- Form and size
- Whether buttonhole is cut before or after sewing
- Presence or absence of a gimp

Generally, buttonhole machines have a clamp feed with the clamp being able to move in a horizontal plane. In microprocessor controlled buttonhole machines, a console is provided on the side. The operator can use this to choose the pattern, stitch density and buttonhole size.

**Buttonhole**
A buttonhole can be a Welt buttonhole, loop buttonhole, straight buttonhole and a keyhole buttonhole.

**Welt buttonhole**

This looks like a welt pocket. It is normally used in leather apparels.

**Loop buttonhole**

In a loop buttonhole, a loop is formed using either thread or fabric to allow button to fasten. It is considered as a style element in ladies garments.

**Straight buttonhole**

In straight buttonhole, a slit with cut edges encases in thread and ends with wide stitching or bartack.

**Keyhole buttonhole**

A keyhole buttonhole has an enlarged, round shape at the end closest to the garment opening. It is normally seen in jackets and coats and jeans. When a raised purl effect is required in keyhole, an extra stiff thread called gimp, is laid at the very end of the buttonhole, to reinforce it before the buttonhole is stitched. Cut and sew button holes are generally used for heavy weight fabrics, where the fabric does not flag too much. These are called as cut before buttonholes also. These give a neat appearance, as the cut is covered by threads, but once a cut is made, the buttonhole position cannot be changed.

Sew and cut buttonholes or cut after buttonholes, offer more stability while stitching, but the cut edges can be frayed. Further, if the lining and body fabric are present in the same part, with different colors, then the cut exposes both colours.

The fraying of cut edge gives a faded worn look, which is desirable in jeans. Lockstitch buttonholes are secure, but chainstich buttonholes give an attractive purl effect to the buttonholes.

| Buttonhole sewn with stitch type 101 (front view) | Buttonhole sewn with stitch type 101 (back view) |
Buttonhole sewn with stitch type 301 (front view)

Buttonhole sewn with stitch type 301 (back view)

2.20 Buttonsew Machines

The operation of buttonsew machines depend on:

- Size shape of the button
  - The clamp design is influenced by this
- The number and disposition of holes
- The form of stitching where there are four holes (crossover or parallel (swiss kiss))
- Number of stitches
- Type of stitch used
- Whether the button has a shank or a neck

When the button is flat, while sewing the button, a spacing finger is used to create space for thread shank. In shank buttons, the button is clamped on its side, during sewing, and the needle passes alternatively into the garment, and into the hole in the shank and into the garment. Button sewing with lock stitch is secure, but it leaves an untidy look on the stitching on the other side of the fabric from button.

Whereas, chain stitch button sewing gives a cleaner appearance at the back, but less secure. A handsew appearance can be obtained by using stitch type 209. Use of button hoppers, which automatically sort and line the button at the clamp, reducing the positioning work of operator can be used for long runs of same button type and size.
2.21 Bartack Machines

Bartacks are used for reinforcing the ends of pocket openings and the bottom of flies and sewing on belt loops where more stress is given while usage of the garment. They are also used for reinforcing any stress points of bags. Bartack machines sew a number of stitches across the distance set, and then start stitching covering stitches over and at right angles to the first stitches. Essentially, a tight Zig-Zag stitching which repeats itself back and forth over itself.

Using microprocessor control panel it is possible to set the width of the bartack, the pattern and the stitch density. Also it is possible to do a limited number of patterns by using a EPROM (Electronically Programmable Random Memory).

2.22 Label Sewers
A simple label sewer will perform zig-zag stitches to a predetermined length on one or two edges of a label.

Advanced machines are programmable profile stitchers, that can sew a wide range of shapes and sizes of label.

When a label has to be sewn over the inside pocket of a jacket, a special label sewer with cylinder bed is used.

2.23 Conclusion

To summarize, in this unit you have been given an overview of Single Needle Lock Stitch Machine.