

Subject: Apparel Manufacturing

Unit 3: Basics of Apparel Production Process

Quadrant 1 – e-Text

Learning Objectives

The learning objectives of this unit are:

- Understand the functions of different departments in the garment industry.
- Describe the manufacturing process.
- Identify the various equipment used in the garment industry.

3.1 Overview of Various Departments in the Garment Industry

Apparel production, also known as garment production is the process of converting fabric into garments. The term apparel production is usually used when garments are manufactured in a factory. Traditionally, apparel manufacturing factories have been divided into two sectors: domestic and export. Based on the present apparel industry, garment manufacturing processes are categorized as:

Pre-Production processes, Production processes and Post-production processes.

Pre-production process

This includes sampling, sourcing of raw materials, approvals and PP meetings.

Production process

This includes cutting and sewing.

Post-production process

This includes thread trimming, pressing, checking, folding, packing and shipment inspection.

The Pre-production Process

A factory produces bulk quantity of garments for a style or design at a time. Prior to the start of production of an order, the factory needs to go through some activities known as *pre-production*. The Pre-production process includes sampling, merchandising, sourcing of raw material and production planning. Sampling is a process where the factory develops garment samples according to a buyer's specified design. It is also known as the product development stage. Samples are required at various stages to get approval from a buyer on a particular design. As per the development stages, samples have been termed as Proto sample, Fit sample, Size set sample, Sales man sample, Production sample, Top of Production (TOP) sample and Shipment sample.

Costing

A business is all about making profit. So, correct costing of a product before finalization of an order is very important. Costing of garments is the cumulative cost of raw materials, direct labour, as well as, direct and indirect overheads.

After developing samples or directly receiving a buyer's sample the factory needs to send Freight on Board (FOB) price of the garment. To decide the FOB of a garment the factory makes a cost sheet including raw material cost, total of direct labour, cost of each process and factory overheads.

Production Planning

After receiving the order, the factory plans for the requirement of raw material. Raw materials include fabrics, sewing threads, packing materials, hang tags and other accessories.

Factory Timelines

The factory plans timelines including, when to start cutting, when to submit pre-production sample, when to finish sewing and finishing, the final inspection date and shipment date. In the production planning stage, the job responsibilities for different processes are defined.

3.2 The Production Process

The production functions are: Fabric cutting, printing, embroidery, sewing, thread trimming, washing, ironing, folding and packing.

1. Fabric Cutting

In this stage, fabrics are layered on a table layer by layer up to a certain height. Then, using a cutting machine, the fabric is cut into garment shapes or patterns and separated from the layer. Fabric layering is possible both by manual spreading and automated spreading. Cut parts are then numbered, bundled and sent to the sewing room. Cutting can help save fabric, as well as add value to the quality of a garment. The quality of the end product, (the garment) depends first, on good cutting. Secondly, the main raw material of the garment represents about 70% of the total cost of the garment. That is why, cutting is an important process.

2. Sewing or Stitching

Garment panels are stitched together by sewing machines in the sewing room.

In sewing, 2 Dimensional fabric patterns are converted to 3 Dimensional forms. An operator runs the machine and uses sewing threads to join garment parts together.

Various types of sewing machines are available for sewing. These machines are selected according to the seam and stitch requirement. In the apparel industry, traditionally, sewing machines are laid in a row. Cut parts are fed at the start of the line, passed through the line and at the end of the line a complete garment comes out.

Each machine is run by individual operators and an operator sews only one or two operations of the garment. A line consists of sewing operators and helpers to feed them with cut parts, thread and other trims, a quality checker and one fully or partially devoted supervisor.

3. Thread Trimming

After stitching, all hanging threads are cut with a hand trimmer. This can also be done using Auto thread trimming machines. All loose threads inside a garment are also removed. Garments without any loose thread and a long tail are basically quality requirements.

4. Washing

Washing is done when a buyer wants washing or special finishes to the garments. For light colour garments, washing is carried out to remove dirt and stains.

5. Finishing

Generally, this process includes checking of the garment, measurement checking, ironing, and spotting. After sewing of the garments, all pieces are checked by the quality checker to ensure that garments have been made as per buyer quality standards.

Checking is normally done for visual appearance and measurements. Spotting is required to remove stains in the pieces. Special chemicals, (solvents) are used to remove various kinds of oil stains, marks and hard stains. Each garment is then ironed with a press to remove creases.

6. Packing and Folding

Each pressed garment is now folded with tissue or cardboard. Folding varies from product to product and also from buyer to buyer. Hang tags, special tags and price stickers are attached with plastic Kimble or threads. Folded and tagged garments are then packed into poly bags. During packing, garments are randomly checked by internal quality controllers to ensure that only quality goods are being packed.

3.3 Other Processes

In current fashion trends very few garments are made without additional processes such as printing, garment dyeing and special washing. Other value added processes include embroidery and adda work, (hand embroidery with lot of bead work).

Final Inspection and Dispatch

Once the garments are packed (also known as shipment), quality inspection of the garments is carried out by the buyer's Quality Assurance (QA) department before dispatching. A third party quality auditor may also be hired to do this final inspection. If the packed goods meet the buyer's

quality standards, the shipment is accepted by the buyer. The factory then dispatches the goods to the buyer.

3.4 Introduction to Manufacturing Processes

Departments such as Cutting, Sewing and Finishing are the primary departments of a garment factory. The name of the departments itself explains its main functions.

Within each department, there are a number of steps through which raw materials are passed to make a finished and packed garment. These steps or sub-processes may vary from product to product.

1. The Cutting Department

The main role of a cutting department is to cut garment components from fabric rolls or fabric as per style specifications. The cut components are then sent to the sewing department in bundles.

A cutting department of a garment manufacturing unit includes the following sub-processes:

Fabric relaxation, fabric spreading and layering on a cutting table, marker making, cutting –

These are of three types : manual cutting (using scissors), machine cutting, and automatic cutting, numbering of garment plies, shorting and bundling, inspection of cut components, shorting of printing and embroidery panels, re-cutting of panels, fusing garment components.

2. The Sewing Department

The Sewing department is the heart of a manufacturing unit. Cut components are assembled in the sewing department in an assembly line. The list of sub-processes that are done in the sewing department includes: Making garment parts, sewing the full garment, making garment accessories such as dori, tabs and cords, checking of stitched garments, alteration work of defective garments. The objectives of sewing are the construction of seams, which combine the required standards of appearance and performance with an appropriate level of economy in production.

Factors of Selection

Assuming that the fabric is sewable and suitable for garments, the achievement, at an economical level, of the various requirements of appearance and performance of sewn seams, both initially and during use, is the result of the selection of five factors during manufacturing. They are: The seam type, the stitch type, the sewing machine feeding mechanism, which moves the fabric and enables a succession of stitches to be formed, the needle, which inserts the thread into the fabric, the thread which forms the stitch, which either holds the fabric together, neatens it or decorates it. These factors are closely interrelated to each other and will be discussed in this course with a view to understand the sewing process in detail.

3.5 U.S Federal Standards 751a (Seams and Stitches)

A stitch, which is the elementary basis of sewing, can be formed without fabric, within fabric or through or on fabric. For the purpose of standardization of stitches and seam formations, the U.S. government developed a guide that defines stitches and seams in current use. This guide is known as the United States, Federal Stitches and Seams Specifications (Federal Standard 751a).

Federal Standard 751a makes the following distinctions by defining these terms.

A Seam

A Seam is a joint consisting of a sequence of stitches uniting two or more pieces of material(s) and is used for assembling parts in the production of sewn items.

A Stitch

A Stitch is one unit of conformation of thread resulting from repeatedly passing a strand or strands and / or loop or loops of thread into or through a material at uniformly spaced intervals to form a series of stitches.

A Stitching

A Stitching consists of a sequence of stitches for finishing an edge or for ornamental purposes or both in preparing parts for assembling.

Seams

Seams are formed by sewing two or more pieces of fabric together. However, the basis of seam classification is the position of the pieces relative to each other. Many variations in fabric position and treatment account for the many different types of seams in each classification.

The choice of seam types is determined by aesthetic standards, strength, durability, comfort in wear and convenience in assembly in relation to the machinery available and cost. Certain seam types are more appropriate for some products and fabrics than others. Seam length and the degree of curvature of a seam are also important in choosing seam types. The best seam type is one that yields the desired performance at the lowest cost. A seam has three dimensions, length, width, and depth.

Seam Length

Seam length is the total distance covered by a continuous series of stitches, such as a side seam or shoulder seam.

Seam Width

Seam width considerations are width of a seam allowance, the seam heading of a lapped or a top stitched seam, and the width of a line of stitches relative to the seam. A seam allowance is measured from the cut edge of the fabric to the main line of stitches.

Seam Depth

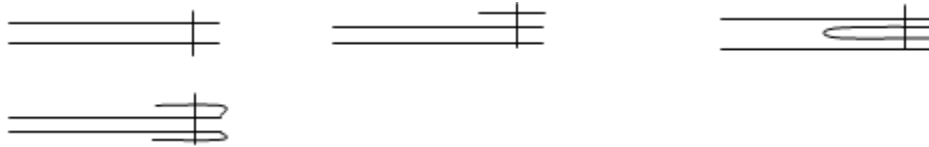
Seam depth is the thickness or compressibility (flatness) of a seam.

Seam Classes

The Federal Standard 751a, which is the basis of stitch classes identifies four seam classes and two stitching classes. They are: The Superimposed Seam, The Lapped Seam, The Bound Seam and The Flat Seam. Each class includes many seam types.

The Superimposed Seam (SS)

The Superimposed Seam (SS) class is formed by joining two or more pieces of fabric, usually with the seam allowance edges even and on one piece superimposed over the second. These can be sewn with a lock stitch, chain stitch, overedge stitch, or safety stitch.



The Lapped Seam (LS)

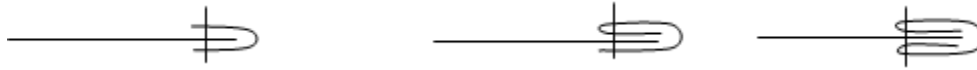
The Lapped Seam (LS) class is defined as two or more pieces of fabric joined by overlapping at the needle. This is the largest seam class, including 101 different seam types, with a great deal of variety as to where a seam is lapped and how it is lapped.

These seams are used to attach the front band to shirts, setting pockets, side seams of quality dress shirts, side seam or inseam of jeans, and so on. Lapped seams may be stitched with a lockstitch or a chain stitch, but not an overedge stitch.



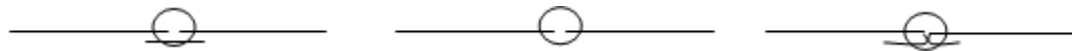
The Bound Seam (BS)

The Bound Seam (BS) Class requires a separate piece of fabric that encompasses the edge of one or more pieces of the garment. These seams are used to finish plain necklines, edges of short sleeves on some styles of T-shirts, and so on. The Bound seam may be sewn with a lock stitch, chain stitch, or cover stitch. They should never be sewn with an edge stitch as the knife will cut off the binding.



The Flat Seam (FS)

The Flat Seam (FS) class is the smallest class with only six different types. The formation of this seam occurs with the butting together of two pieces of fabric, but not overlapping them. The 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.



Seam Classes (As Per Stitching)

The two stitching classes are ornamental stitching and edge finishing.

The finishing of either of these classes is performed on a single piece of fabric. The fabric may be folded in a variety of ways. This ensures that the stitching is through more than one thickness, but still remains a single piece of fabric.

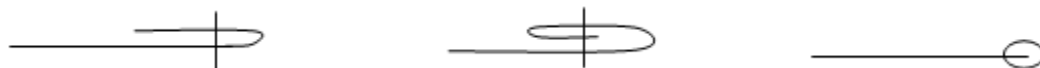
Ornamental Stitching (OS)

It may be used on a single ply for decorative purposes. It can be done anywhere on the garment except the edge. The decorative stitching may be used on jeans pockets, embroidered logos and pin tucks.



Edge Finishing (EF)

It is stitching that encompasses the cut edge or provides a finish for a single ply of fabric with a folded edge configuration. Stitches from any of the classes may be used, depending on the type of fold and placement of stitching.



Stitch Classification

Stitches are classified on the basis of the structure of the stitch and method of formation. Stitch properties such as size, balance and consistency determine stitch quality, performance and appropriateness for end use. Properties of a stitch that relates to aesthetics and performance are size, tension and consistency.

The Stitch Types

Stitches are classified based on the structure of the stitch and method of formation. Stitch size has three dimensions: length, width and depth.

Stitch Length

Stitch length is specified as the number of stitches per inch (SPI) and can be an indicator of quality. Stitch length is determined by the amount of fabric that is advanced under the needle between penetrations.

High SPI means short stitches, while low SPI means long stitches. Long stitches are usually less durable and are considered low quality as they are subjected to more abrasion and are likely to snag.

Stitch Width

Stitch width refers to the horizontal span (bight) covered in the formation of one stitch or single line of stitching. Stitches that have width dimensions require multiple needles or lateral movement of thread carriers such as needle bars, loopers or spreaders.

Stitch Depth

Stitch depth is the distance between the upper and lower surface of the stitch. For example, the depth of the blind stitch determines the amount of penetration by a curved needle.

Thread Tension

Thread tension affects stitch formation in two ways. Thread tension involves the balance of force on the threads that form the stitch, and the degree of compression on the fabric created by the threads as a stitch is formed. Tension ensures a uniform supply of thread and determines how well stitches conform to the standard formation. Too much tension causes the seam to pucker and

can cause uneven stitches, unbalanced stitches, weakened thread, and damaged fabric. Too little tension might result in loose or skipped stitches, grinning or weak seams.

Stitch Consistency

The uniformity with which each stitch is formed, in a row of stitches. Each stitch should be exactly like the previous one regardless of curves, corners or varying thickness of the fabric.

A Stitch

It can be defined as ‘one unit of conformation resulting from one or more strands or loops of thread intralooping, interlooping, or passing through material’.

3.6 The Stitch Classes

The six classes of stitches as given in Federal Standard 751a are:

- Class 100 chain stitches.
- Class 200 stitches originating as hand stitches.
- Class 300 lock stitches.
- Class 400 multi thread chain stitches.
- Class 500 over edge stitches, and
- Class 600 covering chain stitches.

Class 100 Chain Stitches

The **Chain Stitch** class 100 includes stitch types 101, 102, 103, 104 and 105. It is formed with one or more needle threads that form a loop on the underside of the fabric. It has no lower thread.

Stitch Class 101

Type 101 is one of the simplest of all stitch types, formed from a single thread. It can be easily removed, and it is used for basting operations in tailored menswear and women’s wear.

It can only be used where the marks of needle penetration close up afterwards in pressing. A basting operation is a temporary stitch, allowing accurate placement of permanent stitches. It is used in positions such as edges, flaps and collars.

The Blind Stitch Version, 103

The Blind Stitch Version, 103, utilises a curved needle in order to, successively penetrate partially into the fabric, and then into the hem edge, while showing minimally or not at all on the right side of the garment.

Class 200 Stitches

Class 200 Stitches consists of hand formation of stitches done by hand with the exception of 205, which simulates a hand running stitch, but is formed by a special machine. Typical types of Class 200 stitches are basting stitches and back stitches.

Class 300 Lock Stitches

The Lock Stitch Class 300 is the most commonly used and is easiest to understand. A Lock stitch machine requires 2 threads to form a stitch, a needle thread that feeds from the top and a lower thread that feeds from a bobbin. A rotary hook or shuttle catches the needle thread loop as it passes around the bobbin and interlocks the two threads. If a lock stitch thread breaks, the two threads used to form the stitch lock and the whole line of stitches won't unravel. Lock stitch machines are versatile and can be used for a variety of operations. It is also the only stitch formation that can be backstitched.

A lock stitch machine is a good choice for a small manufacturer that produces fashion goods. A complete garment can be sewn on a lock stitch machine. Also, if versatility is needed, a lock stitch is a good choice but if speed and efficiency are the priorities, it may not be the right selection. Lock stitch machines are slower than other classes of industrial machines. Operating speeds of these machines range from 3000 to 5000 revolutions per minute, while other machines can operate at 9000 rpm or more. On short seams, an operator would not be able to reach maximum speed; therefore, it is recommended to be used on small parts, while faster stitch types should be used for larger parts and longer seams. Some of the most common type of stitches in this class are: Stitch Type 301 and Stitch Type 304.

Stitch Type 301

The 301 is referred to as a plain stitch or a straight stitch. It is the stitch type performed by the standard home sewing machine. Equal amount of needle and bobbin threads are used, and upper and lower threads interlocks in the center of the fabric. The 301 stitch uses the least amount of thread and produces the flattest stitch.

It is the tightest and most secured stitch among all stitch types. Because, this stitch formation is the same on both sides of the seams, it is reversible and used extensively for top stitching, especially along collars, cuff edges, and fronts of jackets. It is a poor choice in areas that need to stretch as it has least amount of elongation potential. The 301 is inappropriate to attach elastic, or sew knit or bias seams that are expected to stretch.

Stitch Type 304

Type 304 is the traditional zigzag stitch that is used to sew appliques, attach lace on lingerie, and produce faggotting. Other types of zigzag lock stitches are class 308 and 315, which form a longer and a wider zigzag by using several stitches before changing direction. Faggotting is a

decoration stitch used to connect two pieces of fabric, but allowing space between the pieces. It provides elongation, is smooth and will not ravel out.

Class 400 Multi-Thread Chain Stitches

The 400 class is the second most frequently used stitch type. This multi thread chain stitch requires one or more needle threads that form loops as they pass through the fabric and interloop with the looper thread on the underside. All of this feeds continuously from the cones. The 400 class stitch requires an upper and a lower thread and uses a looper to carry the lower thread and form a thread loop on the underside of the fabric. Machines producing 400 class stitch, do not back tack, although, stitches can be condensed to secure the ends of the threads.

Types of Class 400 Chain Stitches

The most common stitch types in this class Stitch are:

The 401 or two thread chain stitch.

Stitch type 402 or cording stitch.

Stitch type 404.

Stitch type 406 & 407.

The 401 or Two Thread Chain Stitch

It is also called double locked chain stitch. Its appearance is the same as the 101 stitch with a flat straight thread formation similar to a lock stitch on the face of the fabric and a loop on the underside. The 401 stitch can be unraveled, but only if the looper thread is pulled in the direction the stitches were formed. The 401 stitch machines are capable of operating at very high speeds. These chain stitch machines often use multiple needles to produce parallel rows of stitching. The loop formation of the chain stitch elongates when extended; thus it is used for seams that require elasticity, such as setting sleeves and attaching elastic. This stitch type is also well suited to automated sewing equipment, such as automatic seamers.

Stitch Type 402 or Cording Stitch

Stitch Type 402 or Cording Stitch is used primarily for stitching permanent creases. It uses two needle threads that produce two parallel rows of stitching on the face of the fabric. A looper thread travels between the two needle threads on the back of the fabric creating a ridge or crease between the needle threads on the face. This type of stitching can be found on sportswear where a crease needs to be maintained or on the back of gloves.

Stitch Type 404

Stitch Type 404 stitch is similar in appearance to a 304 stitch, in the sense, that it is also a zigzag stitch, except the difference that it is formed as a chain stitch and contains loops on one side.

Stitch Type 406

Stitch Type 406 are known as bottom cover stitches. They are used to cover seam or unfinished edges on the inside of garments and to keep them flat. They appear as 2 or 3 rows of parallel “lock stitching” on the face of the fabric while a looper thread connects the rows on the back. The 406 stitch uses 2 needle threads and 1 looper thread like a 402 except that it does not ridge up. Stitch type 406 is used to produce flat, comfortable seams on necklines of t-shirts bottom felling of t-shirts, or on binding of men’s briefs.

Stitch Type 407

Stitch type 407 is very much similar to 406 stitch except that it uses three needle threads and has even more stretch. The primary use of 407 stitch is to attach elastic to undergarments, which require maximum stretch.

Class 500 over Edge Stitches

The stitch types in this class are formed with one or more groups of threads. These are characterized by loops from at least one group of threads passing around the edge of the material. The loops form a narrow band of stitching along the edge of the fabric, with threads intersecting at the edge. This prevents the fabric from fraying. These stitches have high elasticity, do not unravel easily, and a trimming knife on the machine ensures a neat edge prior to sewing. They are often called overedge, overcast, overlock, serge or merrow. Overedge machines, must have 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 material on the bottom, and a looper or spreader to carry thread up and over the edge of the material on the top. The various stitch types use various combinations of these three devices.

The odd numbered stitch types 501, 503, 505 and 521 are known as “*break open*” stitches, because they act similar to the spiral back of a notebook.

The fabric is held tight together, but not secure along the inner edge of the stitching. This allows the stitch to break open. These stitches are best used for edge finishes and hem. These stitches are characterized by a loose thread on the bottom, that is pulled to the edge of the fabric, where it interloops the looper thread. This creates a purl stitch or interlooping of thread that wraps and protects the edge of the fabric. 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. These stitches do not “grin through” or become exposed between the layers of fabric. These stitches also have a much smoother appearance and are more durable.

Serging

Serging is the process of finishing a single ply of fabric to prevent ravelling. This is often one of the first processes in sewing a garment, if another edge finish is not to be given later in production.

Edge Stitches

Types 503, 504 and 505 stitch are overedge stitch types that are used for serging.

Type 502

Stitch type 202 are formed by two threads, a needle and looper thread. It is a tight stitch that is used primarily for seaming the outer edge of bags.

Type 503

Type 503 is also formed by two threads, a needle and looper thread. It is used for blind hemming and serging. It is used mainly for hems in T-shirts and other knit garments and serging seams of dress slacks, because the two-thread construction is less likely to press through the garment.

Type 504 & 505

Stitch type 504 and 505 are three thread overedge stitches that are formed with one needle thread and two looper threads. They require more thread in the formation, but they also have more stretch. Type 504 is a highly extensible, but secure stitch that makes an excellent seam for knit garments, such as seams of cut and sewn sweaters. It is the most common of 500 class.

Mock Safety Stitches

Stitch **types 512 and 514** are sometimes called mock safety stitches. They are four thread overedge stitches that are formed with two needle threads and two looper threads. Type 514 stitch is stronger and more elastic than 512 stitch, but both may be used for seaming knits and wovens. However, 514 stitch makes a wider seam and may be desirable for some knit garments. Stitch types 515, 516, and 519 are a combination of an overedge stitch and a 401 chain stitch.

These types are called safety stitches, because the chain stitch that closes the seam is backed by another row of tight overedge stitches. Both rows of stitches are formed at the same time. This type of seaming is widely used by manufacturers of shirts, jackets, blouses and jeans.

Class 600 Covering Chain Stitches

The cover stitch or 600 class stitch, often called a flat lock or a flat seam stitch, is an advanced version of the 400 class stitch and is used primarily on knits and lingerie. These stitches, referred to as **top and bottom cover stitches**, are commonly used to cover both sides of the seam with thread.

Threads must be chained off and be crossed by another seam. This stitch class uses a lot of thread, but provides excellent top and bottom cover and flat seams.

Stitches in this class are most complex of all and may have up to nine threads in total including four needle threads. Machines producing the 600 class stitch are extremely fast and efficient, operating at 9000 rpms.

The stitch is formed by two or more needle loops passing through the material, interlooping on the underside and interlocking on the upper side. A spreader or cover thread finger carries the cover thread across the surface of the fabric between the needles.

Stitch Types 602, 605 And 607

Type 602

Cover stitch 602 is a very strong and elastic stitch used extensively by manufacturers of knit garments to cover raw edges and prevent raveling.

Class 602 is a 4-thread stitch with 2 needle threads, 1 looper thread, and 1 top covering thread.

Type 605

Cover stitch 605 is also a very strong and elastic stitch used extensively by manufacturers of knit garments to cover raw edges and prevent raveling.

Class 605 is similar to the 602 stitch but with 3 needle threads, 1 looper thread, and 1 top covering thread.

Type 607

The flat seaming stitch, 607, trims and seams simultaneously. It is a 9-thread stitch with 4 needle threads, 4 looper threads, and 1 top covering thread.

Thread Consumption for Stitches

We can estimate the quantity of thread which will be consumed in manufacturing a certain style of garment, either by measuring the seam lengths sewn in each stitch type and calculating the total amount from published ratios of thread usage, or by unpicking and measuring the thread used in the sample garment. The latter is more accurate, because it allows for fabric thickness and stitch density.

3.7 Net Thread Consumption Ratios

Stitch type	Thread usage, in cm, per cm of seam
301 lock stitch	2.5
101 chain stitch	4.0
401 2-thread chain stitch	5.5
504 3-thread overedge stitch	14.0
512 4-thread overedge	18.0
(401. 504) safety stitch	20.0
606 flatlock	32.0

3.8 The Post-production Process

Washing

Garment washing is normally done after stitching. According to fashion trends and consumer demands, buyers ask for garment washing. For washing, apparel buyers mention exactly what types of washing they need for the order. For example, a buyer - Tom Tailor asked for washes such as – Vintage wash, Cloud wash, softener wash or Acid wash. Each wash has a different type of appearance on the fabric surface. Wash types mainly depends on the product types. For denim products, heavy enzyme is required, whereas for knitted Tee light softener wash may be suitable. The primary objectives of washing garments is to remove starch that was applied during fabric manufacturing, soften the garment hand feel and improve bulkiness, remove dirt, spots and oil stains that accumulate on the garment during the manufacturing process, remove chemicals used during the printing and embroidery process, fulfill customer demand, ensure that clothes can be worn directly after purchasing, give a faded look or any other colour tinted look to the garment and stabilise garment shrinkage and dimensional instability.

Heavy Enzyme or Vintage Wash

Vintage means old look. To get an old or used appearance, garments are washed inside a washing machine with enzymes. Fleece sweatshirts are washed with heavy enzyme.

Cloud Wash

Cloud wash gives white patches on the garment surface making it appear like clouds in the sky.

Stone Wash

To get a faded look on the garment surface white stones with enzymes are used during washing. During washing, the fabric comes in contact with stones and the rubbing effect causes colour to fade. Stone wash is generally used for washing denim products.

Acid Wash

For acid wash, the base colour of the garment is removed by spraying acid on the specified areas.

The Finishing Department

In the Finishing department, garments are nicely pressed and packed into poly bags. A finishing department has the following sub-processes. Washing of garment, (Some factories may have separate washing department), buttoning and buttonholing, trimming threads, checking of washed or unwashed garments, removing stains, ironing or pressing, final checking of garments after ironing, mending or repair work, tagging, folding and packing.

Garment manufacturing includes a number of processes, from receiving orders to dispatching of the finished garments. A process flow chart helps to understand how raw materials are moved from one process to another process, until raw materials are transformed into the desired product, namely the garments. It is important to note that a process flow chart of the garment manufacturing processes varies based on manufacturing facility and product types. Some companies complete the whole process in a single plant, while others outsource production jobs and other auxiliary processes.

Finishing

Finishing is the last step of the garment production. All mistakes made during the process accrue and can become a huge problem at this stage. The Quality Department also has a huge potential to improve products, and thus requires special attention. In almost every factory surveyed, it has been proven that the costs involved in this department are excessive. It is vital that this department is given importance, since there is a great potential to make financial savings. The material here illustrates the priorities of the finishing and quality departments.

Surveys have shown that the time taken to finish garments is surprisingly high. Some companies examine the garment as many as 5 times, and the number of repairs is excessive. Further,

Finishing departments are over-staffed in most of the factories studied. This is obviously driven by the fear of rejection of orders or re-works. Work content can be reduced by installing a proper work control system and a culture for quality production.

Surveys have shown that the layout and workflow in garment factories was generally poor and disorganized. Not one of the finishing departments have adequate systems of control. Rather, the emphasis is only directed to delivery and not productivity. This is understandable in the present circumstances, but must be re-thought since it is excessively expensive.

Studies have found, that finishing times are excessive in almost every company; with the average finishing time per garment varying from 11.2 minutes to 57.6 minutes. It has also been found that none of the finishing departments use bundle systems for control, nor do any of them have any form of scientific performance measuring techniques. There are no monitoring controls except to record the number of repairs.

3.9 Overview of Equipment

The equipments used in the apparel manufacturing industry are the cutting, sewing and finishing machines.

Notcher

Many garments require notches to be cut into the edges of them to enable alignment during sewing with other garment parts. Specialized notching equipment provides greater accuracy because a guide lines up the notcher with the cut edge. This gives a consistent depth of notch at a consistent right angle to the edge.

Drills and Thread Markers

Where reference marks are needed away from the edge of a garment part, such as for the position of the pockets, darts and similar features, a hole is often drilled through all the plies of fabric in the lay. The drill mounting includes a motor, a base plate with a hole to allow the drill to pass through, and a spirit level to ensure that the base is horizontal and the drill vertical.

On many fabrics, the drill is used cold and the hole remains visible until the sewing operator comes to use it. On looser weave fabrics, where the hole may close up, a hot drill is used which will slightly scorch or fuse the edges of the hole.

A hypodermic drill may be used which leaves a small deposit of paint on each ply of fabric. If it is important that no mark remains on the fabric, a long thread may be passed through the lay which is then cut with a pair of scissors between each ply, leaving a few centimeters visible on each garment panel. All drill holes must eventually be concealed, by the construction of the garment.

Straight Knife

A straight knife is used where the quantities for cutting do not justify purchase of a computer-controlled cutter. The elements of a straight knife consist of a base plate, usually on rollers for ease of movement, an upright or a standard carrying a straight, vertical blade with varying edge characteristics and an electric motor above it, a handle for the cutter to direct the blade, and a sharpening device. The base plate on its rollers slides under the glazed paper which is spread below the bottom ply of fabric in a lay.

Normally, available blade heights vary from 10 cm to 33 cm. Usually, available strokes vary from 2.5 cm to 4.5 cm. The greater the blade movement, the faster the blade cuts the fabric. This enables the operator to rapidly and easily increase production.

The straight knife is a common means of cutting lays in conventional cutting rooms because it is versatile, portable, cheaper than a band knife, more accurate on curves than a round knife and relatively reliable and easy to maintain. Even if a band knife is used for the main cutting operation, a straight knife would be used to separate the lay into sections for easier handling.

Band Knife

A band knife comprises a series of three or more pulleys, powered by an electric motor, with a continuously rotating steel blade mounted on them. One edge of the blade is sharpened. The band knife passes through a slot in the cutting table in a fixed position and the section of the lay to be cut is moved past it. Band knives are used when a higher standard of cutting accuracy is required than can be obtained with a straight knife. The pieces that are to be cut, are first cut on a block, and then cut exactly on a band knife.

Round Knife

The elements of a round knife are a base plate, above which is mounted an electric motor, a handle for the cutter to direct the blade and a circular blade rotating so that the leading edge cuts downwards into the fabric. Blade diameters vary from 6 cm to 20 cm. Round knives are not suitable for cutting curved lines in high lays because the blade does not strike all the plies simultaneously at the same point as a vertical point does. Therefore, a round knife is used only for straight lines or lower lays of relatively few plies.

Computer Controlled Cutting Knives

This method provides the most accurate possible cutting and at high speeds.

To keep the larger systems fully occupied they are frequently used in a central cutting facility that supplies a number of separate sewing factories. A typical computer cutting system has a table with a cutting surface consisting of nylon bristles that support the fabric lays, but are flexible enough to permit penetration and movement of the knife blade, which is supported only at the top. The bristles also allow the passage of air through the table to create a vacuum, reducing the height of the lay and holding it in place. The carriage supporting the cutting head has two synchronised servomotors, which drive it on tracks on the edges of the table. The cutting head contains a knife, automatic sharpener and a servo motor which rotates the knife to position

it at a tangent to the line of cut on curves. A sheet of airtight polyethylene covers the top of the lay, which assists the creation of a vacuum and allows significant compression of the lay.

The control cabinet houses the computer and the electrical components required to drive the cutter, its carriage and the vacuum motor. The spreader spreads the lay on a conventional cutting table equipped with air floatation. Paper is spread below the bottom ply, so that the lay can be moved onto the cutting table without distortion and so that the bottom plies are supported during the cutting operation. This paper is perforated to enable the vacuum on the cutting table to operate to compress the lay. The cutting table does not need to be as long as the lay and its bristle surface can consist of a conveyer which assists in the transfer of the lay, in sections, from the spreading table and the cut work onto the bundling tables.

Die Cutting

Die cutting involves pressing of a rigid blade through the layed fabric.

The die (called a clicker in the shoe industry) is a knife in the shape of the pattern periphery, including notches. Freestanding dies generally fall into two categories. They can be of strip steel, manufactured by bending the strip to the shape required and welding the joint. These cannot be sharpened, and must be replaced when worn.

Alternatively, they can be heavier gauge, forged dies which can be re-sharpened, but which are five times the price of strip steel. They provide a high standard of accuracy of cutting, but because of the cost of the dies, they are only appropriate to situations where large quantities of the same pattern are to be cut. Die cutting also offers much faster cutting than knife cutting for the same depth of cut. It is proportionally more economic for small parts, which have a greater periphery in relation to their area.

Sewing Equipment

There are four main types of industrial sewing machines. The differentiation between them is based on the design of the arm and needle post. These four types are: Flatbed, Cylinder-bed, Post-bed and Off-the-arm.

Flatbed

These are the most common type and these machines resemble traditional sewing machines in that the arm and needle extend to the flat base of the machine. Workers typically use this machine for sewing flat pieces of fabric together.

Cylinder-bed

These machines feature a narrow, horizontal column as opposed to a flat base. This allows fabric to pass around and under the column. The diameter of the cylinder-bed varies from 5 cm to 16 cm. Workers employ the cylinder-bed machine for sewing cylindrical pieces such as cuffs, but it is also useful for bulky items such as saddles and shoes.

Post-bed

These machines feature bobbins, feed dogs and / or loopers in a vertical column that rises above the flat base of the machine. The height of this column ranges from 10 cm to 45 cm. The post-bed machine is used in applications that make access to the sewing area difficult, such as attaching emblems, making boots and gloves.

Feed-Off-the-arm

They are the least common machines and require workers to feed material along the axis of a horizontal column. The design limits the length of the seam sewn to the length of the column, but is useful for applications such as sleeve and shoulder seams.

Kinds of Feed Mechanisms

The main types of feed mechanisms are: Drop feed, Needle feed, Walking foot, Puller feed and Manual feed.

Drop feed

The feed mechanism lies below the machine's sewing surface. This is probably the most common feed type.

Needle feed

The needle itself acts as the feed mechanism, which minimizes slippage and allows workers to sew multiple layers of fabric.

Walking foot

The immobile presser foot is replaced with a foot that moves with the feed. This allows easier performance on thick, spongy or cushioned materials.

Puller feed

The machine grips and pulls straight-seamed material as it is sewn. It can perform on large, heavy-duty items such as canvas tents.

Manual feed

The feed is controlled entirely by the worker, who can do delicate, personal work such as shoe repair, embroidery and quilting.

On industrial sewing machines, it is sometimes necessary to remove the feed dogs to obtain a manual feed.

Application of an Industrial Sewing Machine

The application of an industrial sewing machine is also an important factor to consider. For example, some machines come with an automatic pocket setter, while others include pattern programmability or electronic eyelet buttonholers. Furthermore, the strength and design of the machine needs to complement the type of material you will be using.

Industrial Sewing Machines

Industrial sewing machines are used for different purposes.

Higher quality machines - medium to heavy materials, such as denim.

Base level industrial machines - lighter materials, such as cotton.

A particular machine's stitch type should also be noted prior to making a purchase. There are several dozen distinct types of stitches, each requiring between one and seven threads. Plain stitches are the most commonly used stitches in industrial sewing and include lock, chain, overlock and cover stitch. Yet another important feature to look into is the size and speed of the industrial sewing machine. Expensive machines will be able to sew more stitches per minute. Larger machines provide a larger clearance area under the foot and bigger bed size. You will need to ensure that the size and speed of the machine you ultimately purchase will adequately meet your needs and expectations.

Overhead Rail

Much like any other industry, technological advances, globalization and changing business practices are affecting the apparel industry, shifting the emphasis to quick decision making through tools such as real time data monitoring of the manufacturing floor.

Progressive Bundle Unit

Traditionally, bundle cards were used in Progressive Bundle Unit (PBU) systems to track movement of bundles in the line and the integration of bar-codes in bundle tags facilitated tracking of components and finished pieces in sewing line.

The Overhead Material Handling System

The Overhead Material Handling System (OMHS) in Unit Production System (UPS) made significant progress in integrating the bar code scanner or RFID scanner to monitor the progress of each hanger that is tracking of each piece thereof. While brands like Eton, INA, and Smart MRT popularized the adoption of OMHS, global mechanization of material handling in PBU system still lags behind.

Work-aids and Attachments

To facilitate workers to do their jobs efficiently a number of readymade and customized work aids and equipment are being used in the garment industry. Work aids are specially designed for activities such as material handling and folding. We will now review some of the basic work aids that are used in the shirt-making factory such as Raw material warehouse, cutting department, sewing floor and finishing department. Raw Material Warehouse uses a Fabric trolley and a Fabric roll fork lift. The Cutting Department uses a Fabric roll Stand, both movable and fixed, Layer weight, Cloth Clamp, Bakers Trolley, Waste disposal trolley and Bins. The Sewing Room uses a Disposal basket, Sewing machine table extension, Hunch back, Single slopping table, Profile for collar and cuff run stitch as well as various types of Attachments, folders, hemmers and guides. The Finishing Department uses a Wire mesh WIP trolley, Z-stands, Bins, Hanger stand, Hanger trolley and Carton transfer trolley.

3.10 Conclusion

To summarize, in this unit, you have received an overview of the various departments in the Garment Industry and been introduced to the cutting, sewing and finishing processes. You have also been given an overview of various equipment including cutting, sewing and finishing machines.