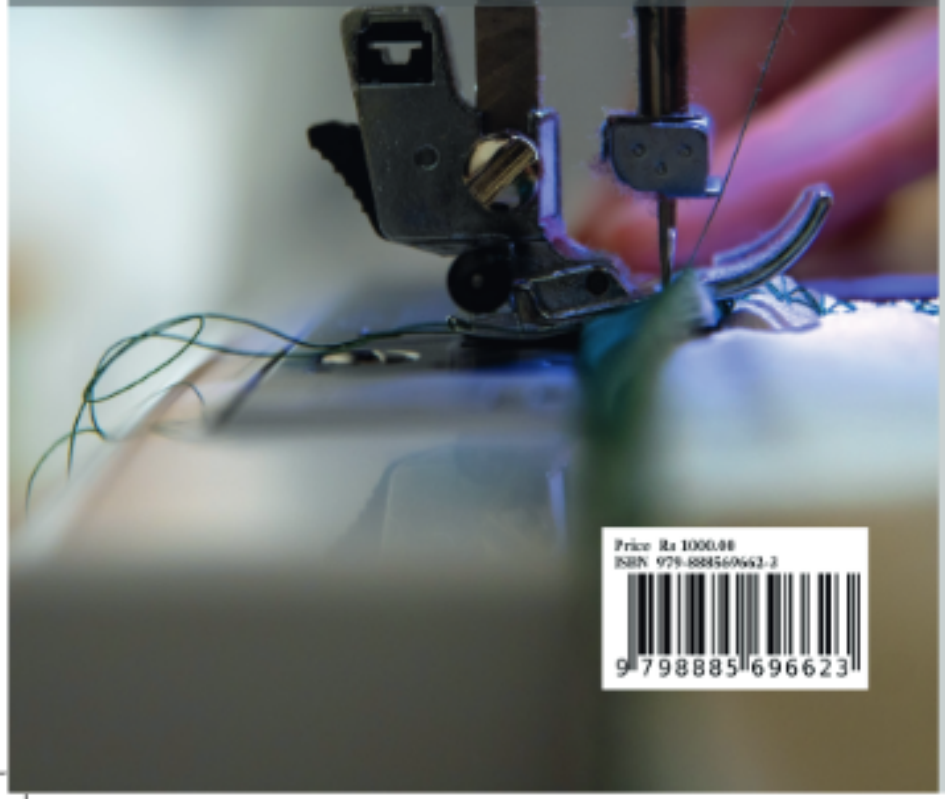
ABOUT THE BOOK

The aim of this book is to cover the fundamental concepts of Garemnt engineering techniques and descripe practical approaches presently follwed in the industry. This book is very useful for students studying Fashion Technology, Textile Technology, Apparel Technology, Garemnt Technology and costume desiign programme. This book gives an in depth knowledge about industry practices hence this book is benificial to merchandisers, marketing managers, industry persons and researchers. To enhance the teaching and learning this book solves the to the faculty and students



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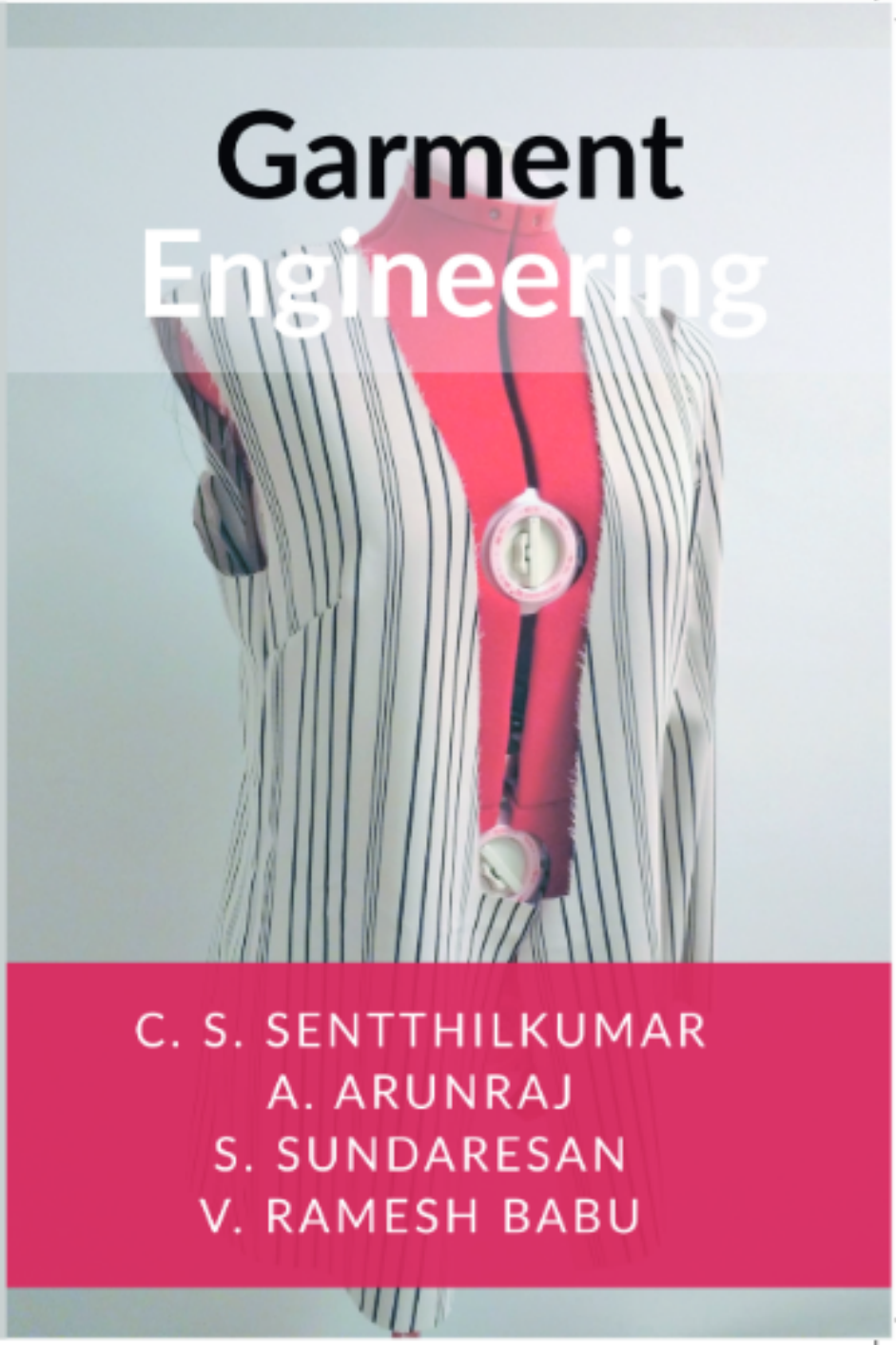
Garment Engineering

C. S. Senthil Kumar

Garment Engineering



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Contents

Foreword

The book “Garment Engineering” covers the garmenting techniques right apparel designing to apparel finishing process.

The concept of apparel product designing has been narrated by taking into account the psychological, societal influence and other factors. The importance of apparel product’s role as a communication tool which talks about consumer life style and societal status has been throulgly deltwith realistic aaproach.

The methods and criteria for the selection of suitable fabric which will satisfy aesthetic and functional requirements of the final product has been extensively discussed with respect to fabric physical properties and apparel product’s performance requirements.

The techniques involved in pre-assembly processes in garment manufacture starting from pattern making both manual and computerized methods has been elaborately dicussed in the aspects of material utilization. It also deals exhaustively with spreading and cutting processes.

The assembly and joining technology of fabrics adopted in garment industry plays a main role in garment production. The various types of fusing materials and its requirements has been discussed thoroughly. The sewing techniques in garment making in terms of stitches and seams, sewing equipments has been dealt extensively.

The importance of finishing and packing of manufactured products with respect point-of-sales has been discussed. Different methods of pressing and various equipments used for pressing in terms of various parameters and their impact on quality of finishing process are also explained in a well derived manner.

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Date: 21.01.2022

1. Apparel Design

Abstract: The Chapter 1 discusses the concept of apparel product designing taking into account the psychological, societal influence and other factors. This chapter also deals with apparel product's role as a communication tool which talks about consumer life style and societal status. Design can communicate strongly on a person's culture and life style.

Key words: Apparel design, psychological and social influence and impact, design function, culture, life style.

1.1 Fundamentals of design

1.1.1 Psychological and social influences of clothing

The wish to decorate or beautify the human body has been existed from the Stone Age when the early man painted his face and his body. Even though the beauty standards have changed, the desire remains constant. The evolution of clothing has been closely interlinked with the factors such as social, economical and technological progress of each period in the history of mankind.

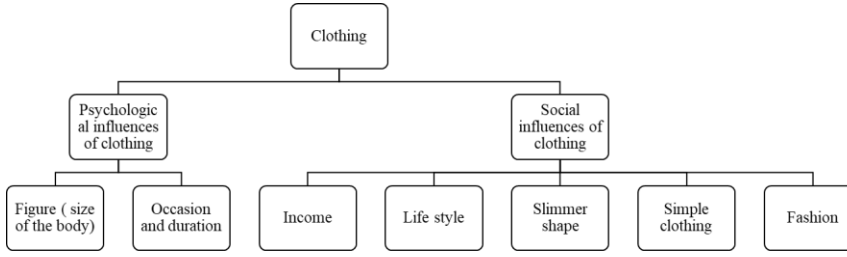

Figure.1.1 Factor influences clothing

Clothing generally, determines the age of a person, sex, nationality, occupation and socio-economical conditions. It is the symbol of the person's attitudes, values, interest and taste. By this one can easily study his or her personal characteristics. They also fulfil important psychological needs of conformity and self-confidence.

1.2 Psychological influences of clothing

It is easy to choose the type of fabric needed and judge its quality by looking at the label details. But one should know the psychological influences of clothing, so that selection of fabric is made to suit the person (i.e. dressing styles and the occasion). Some of the psychological influences of clothing that should be considered during selection are listed below.

- Selection should be made in such a way that it matches wearer's physique..

Examples:

Silk, chiffon and crepe fabrics drapes well and falls in to gentle folds to give a feminine look, so it can be used for women who wants to look delicate. Chiffon is fine transparent silk or nylon fabric. There are fabrics, which add bulk to the body such as brushed cotton, velvet and other heavy fabrics. They are suitable for the person who wishes to look bulky. People who are thin should wear fabrics, which are shinier and more lustrous because they reflect light and emphasis the body contours. Dull textures do absorb light but do not enlarge the size of the body.

- Selection should be made so that it meets the occasion.

Examples:

Basically the dresses that are worn at the evening or night should be made in dark colours and shiny fabrics. Dull and light colour will go well for day-to-day wearing. Knitted and light fabrics are ideal for sports and casual wear.

One should choose to make garments from the fabrics that are comfortable to wear for longer period of time and fashionable garment should be selected to wear for any short occasion.

It is also important to know to select fabric for the particular styled outfit.

Examples:

One should select fabrics which are stiff for the outfits which stands well and which needs stiffness and less fall and drape. Where as a stiff fabric can not be used for stitching a circular skirt because it needs more falling material such as chiffon and crepe. There are different types of style in silhouette and the designer should know to select the proper type of fabric that will suit the design.

If the firmly woven fabric gives a crisp and stiff effect, knitted fabric give more ease and is comfortable but cling to the body shape and do not drape like other fabric such as chiffon and silk. The knitted fabric needs careful handling because they stretch easily so the design of the garment should be simple and should have minimum seams and should be cut with enough ease (allowance) added to avoid the cling.

The stiff fabric that looks crisp will not cling to the body so it can cover the irregularity of the figure.

Designer should see to that they select a plain weaved fabric outfit to be stitched with extra trimmings whereas if the fabric selected has some different weave the importance should be given to emphasis the weaves and reduce the use of trimmings as the weave itself can enhance the beauty of the outfit. Clothing also has psychological effects on the wearer.

Examples

- People will be crisp (firm, clean and fresh) in cotton clothes.
- People will be very delicate and feminine in chiffons.
- People will be dignified in silk.
- People will be rustic in handlooms.

The uniform of a sports team wear gives the members a feeling of unity or togetherness.

1.3 Social influences of clothing

The design of clothing primarily influences the decision to buy; but one step behind the decision to buy is the behavior of people towards clothing. For an early age children want to conform to the latest fashion. The proportion of fashion innovators in the population will probably always be small, the proportion of active followers of fashion is large and the proportion of ignorers of fashion is a still smaller group drawn from the traditionalists, the old and the poor. Our bodies and clothes constitute our physical presence in the world, and particularly the social world in which we live. They are the means by which our place and participation in that social world are signified. Clothing signs express an individual social identity. It is one of the basic conditions of social life that individuals know within whom they are dealing, they have to be able to recognize each others social identity. They need to know the roll of each person, the groups they belong to, their status within those groups and even their status within the society as a whole. The behaviour of the society towards clothing is influenced by:

Income

Hence the large factors which determines the behaviour of people towards clothing is the amount of their income available to buy clothing. It may be over simplifying to state that the newer and higher the fashion, the more expensive it is likely to be; but it must be remembered that fashion often expresses not only innovation but status. Even the street fashion which has short product life cycle is influenced by income level of the younger generation.

Lifestyle

Assuming sufficient income exercise choice, people wear clothing to suit their life style. Life style has many meanings, some of which are very general while others differentiate groups.

Slimmer shape

One important component of lifestyle over the last generation has been the movement to standardize human body to a slimmer shape by dieting and exercise. Men's wear retailers offer made to measure units, corset markers offering a home service to individual customers, and home dress making service to individual from their homes.

Now a days the made to measure market in all its aspects has declined consistently since more standardization of body measurements and fits. Moreover the made-to-measure garments tend to be more expensive

Simple clothing

Another component of lifestyle is the demand for simpler clothing which reflects both active working lives and emancipation. The most obvious evidence of this is the wearing of fewer items in an outfit, fewer petticoats, fewer vests, fewer waist coats, fewer hats and the demise of the liberty bodice. In addition the size and coverage of individual item has reduced, jackets, if worn instead of frock coats, shorter shorts, more exiguous swimwear, and brief instead of directoire knickers. Furthermore, people require that clothing be simple to doff and don with zips and press studs instead of buttons and button holes, more frequent use of

elastification, slip-on shoes, and coat skirts with attached collars, more self supporting trousers and belts with fewer brakes, tights avoiding the needs for suspended belts.

Finally, people demand clothing that is simpler to maintain, preferably by washing or otherwise by standard dry cleaning techniques. One exception which customers tolerate is an animal skin coat. This attracts the higher maintenance costs of specialized dry cleaning which people are prepared to meet only because an animal skin coat is considered to be long term investment. In relation to washing, the design of the clothing forms part of an after-care system which include the design of washing cycles in machines, the chemistry of detergents, method of drying and the attempt to eliminate or reduce the time consuming activity of ironing.

A striking exception to this general demand for simpler clothing is the wedding dress, which requires more undergarments, is full in length, is relatively difficult to put on and is not normally washed or dry cleaned. The minority who hire a wedding dress benefit from paying about half the price for an equivalent garment and the dress is usually hired many times before it is scrapped. Graduation gowns on the other hand are manufactured from disposable fabrics which gives good performance for one day at an acceptably low price. Translating this concept to wedding dresses will be very much more difficult in spite of the potential economic advantages, because the achievement of the right wedding dress images from disposable fabrics is much more unlikely. In any case the traditional demands of a wedding are reflected in a type of clothing whose costs people are willing to bear.

Fashion

It is a complex of activities and attitudes called fashion which influences the behaviour of different group in relation to clothing. Those in society who wear traditional, classic, relatively unchanging styles use clothing as symbols of continuity or changelessness, while those who wear the latest fashions use clothing as symbols of change and progress. But almost everyone buy clothing based on fashion. Even if one did not want

to be fashionable, he or she would still have to buy what was available and stores stock clothing based on fashion trends.

Fashion can be fun. New styles or "looks" make one feel attractive and on top of things. They make us feel good about ourselves. Unfortunately, few people can afford to buy a completely new wardrobe every season.

1.4 Clothing as a communicator of culture

By looking at the clothing, one can learn something about the way people think about or adhere to their culture. Clothing differs from country to country. Every culture has its unique clothing style. The styles reveal much about the people's customs and beliefs. The spread of one country's culture on its temporal side was entirely due to the country's traders and exporters who were their cultural ambassadors abroad, through the export of its famous textiles. Foreign visitors, on their departure, always carry away with them, priceless treasure and cultural clothing. As features of a culture change, so do the clothing styles. By studying the clothing of different periods in history you can understand the customs, beliefs, values, economics and technology of that time.

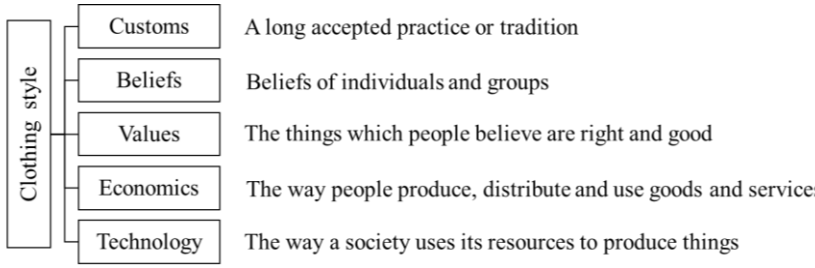

Figure:1.2. Factors influencing clothing style

1.4.1 Customs

Customs refer to a long accepted practice or tradition. The customs of a nation influences people's clothing choices. For example, the long, white wedding dress is a custom of western countries. In the east, other colours are worn. Many customs in clothing are disappearing from our society. Once it was the custom for only males to wear pants. Now it is accepted for both males and females to wear pants. It is used to be the custom for people to wear hats whenever they went out. Today hats are seldom worn.

Designers often turn to the past (recent or distant) or folk customs for ideas and themes. Customs falls in to two categories, historical and folk or ethnic custom. Historical custom is the fashion a certain historical period and folk or ethnic custom is traditional national or regional dress.

1.4.2 Beliefs

Clothing can reflect beliefs of individuals and groups. Religious groups often adopt a certain style of clothing. Beliefs about magic and luck have been held by people of any cultures. Their clothing reflects these beliefs. For example, some people wear a "lucky hat" to go fishing. That person believes wearing the hat will improve the chances of catching the fish.

1.4.3 Values

Clothing can reflect the values of individuals and groups. Values are the things which people believe are right and good. These are the things which are considered important. The basic beliefs which a person rate highly are his values. Modesty is the value of many people. During the past years women would wear low-cut dresses but would not expose their ankles, it was thought immodest for the women to show her legs.

The American colonists valued hard work and practicality by wearing clothing that was plain and sturdy. There are people today who value

practicality, they seek clothing that is comfortable, easy to care for, and long lasting. Few others value appearance and wear clothing that is of the latest fashion. They may sacrifice comfort and practicality in order to be in style.

1.4.4 Economics

The term economics relates the way people produce, distribute and use goods and services. People were once limited to the clothes the family or individual could produce, if there was a good weaver in the family the entire family had good clothes. Then people began to barter (trade) goods and skills for one else's goods and skills. Someone who was good at farming might trade some wheat for cloth made by a skilled wearer. Thus a change in economics led to a change in clothing choice. The economy of a culture also affects clothing style.

1.4.5 Technology

The way a society uses its resources to produce things is referred to as technology. The industrial revolution brought many changes in technology. With the industrial revolution came as a new middle-class people who had made their fortunes in the business world. They wanted to appear dependable and serious minded. They rejected the frills of upper-class clothing and chose the standard business suit. As more women entered the work force, they looked for clothing that was comfortable and practical.

1.5 Design

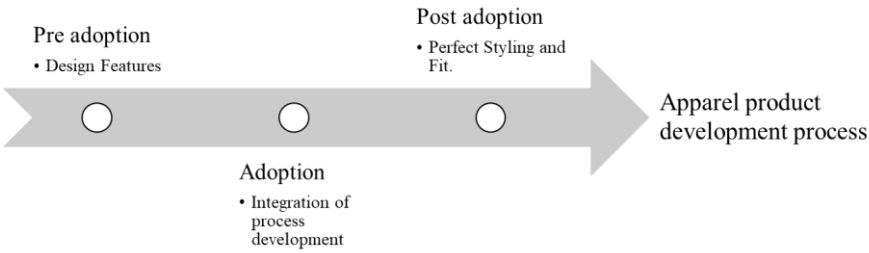

Figure: 1.3. Apparel product development process

Product development is the designing and engineering of products to be serviceable, manufactorable, stable and profitable. In apparel industry product development evolves in three phases. Namely:

1. Pre adoption
2. Adoption
3. Post adoption

The pre adoption phase of product development focuses on analysis, creativity and formation of product groups with commonalities such as piece goods, design features, or trim. The first element in the pre adoption product development is design development. Design development may involve sketching, draping or computer-aided design. Original designs are inspired by many different sources and influences, many of which are intangible. A good designer often develops a feel for fashion and the demands of the market place. Many designers use fabrics as a source of design inspiration.

Design Specifications

Design specifications developed during the pre adoption phase initially provide guide lines for the pattern maker and sample sewer to produce design samples. Design specifications consists of materials to be used in the design, information for assembly, placement of design details, cost estimation and any special treatment that may be needed.

A design is a specific or unique version of a style that has been accepted in to a product line. Designs that are accepted into a product line are known as a style. Anything is designed, is put together with same intent or goal in mind. Design is any arrangement of part, form, colour, fabric and line to create a version or a style. This definition is applicable for apparel or clothing. In general, design is arrangement or putting out creative ideas on paper or any of the three-dimensional form. There are different types of designs such as industrial design, graphic design, textile design, fashion design, etc.

Textile design

It is the design of fabrics for a variety of purposes from clothes to carpets. In this process the colour, texture and pattern are the key elements.

Fashion design

It is concerned with how clothing needs are identified and related and in some cases it is stimulated. It affects the ways in which our materials, energy, skills and other resources are employed to satisfy the needs fully, it calls up on enterprise enthusiasm, inventiveness and ingenuity, scientific discovery and technical knowledge, power of visualisation together with knowledge of human capabilities and aesthetic sensibility. Designing requires patience and planning. Creating or styling the appearance of a person with reference to clothing, accessories beauty in corresponding

with the personality of any individual is fashion designing. Fashion designing involves knowledge of basic elements of designing, understanding colour cycle, brief study of history of clothing, knowledge of fibres and different fabrics.

Fashion can be defined as a design that is accepted by a given segment of population. Fashion is constantly changing and as a new design becomes popular a new standard of beauty becomes desirable. Often a new fashion begins when the proportion of a garment is altered, for example, a silhouette is changed in width or a skirt is lengthened. Usually when a truly innovative fashion begins, it takes a long time for the general public to retain its eye and develop an appreciation for a new look. As more and more people wearing the item interpret it in many different ways, the mass of people find it easier to accept the fashion, as beautiful. Designing means moving from a random state of to a higher state of organisation so as to create an impression or to communicate an important or innovative idea. On the highest-level design is the careful and knowledgeable manipulation of art elements to produce an expressive personal idea. There are two basic divisions of designing in the filed of garment technology.

1. Structural designing

2. Decorative designing

1.5.1 Structural Design

Structural designs are intrinsic parts of materials. They are created through manipulation of fabric formation by interloping as in knitted fabrics and interlacing as in woven fabric and also in terms of colour, or texture. The knitting machines or looms must also have the provisions or technology for varying the fabric structure. Structural design is formed as the material

is made. The form and shape plus all the details involved in assembling the sections of the garment such as darts, pleats, tucks, etc are also part of the structural design. It may add a decorative quality if emphasized by colour contrast or row of topstitching to outline the basic garment parts. In apparel, structural design is more important because it is the fundamental component of design.

To draw a structural design a form or human croquet is not necessary. The designers in the buying house do these designs. In this category the designs are drawn on the specification chart where many trimmings are not used. This design will be simple and well defined about their construction, colour, thread and trimmings to be used. It will not be draped on the form. It will be speeded so that the pattern master can create a proper sample according to the specifications mentions such as its measurements, its sweep line (Hem line) its neckline and any other type of cuts used.

1.5.2. Decorative Design

Here it refers to the design, which is drawn by the learners as well as the boutique designers. These drawn designs will be draped over 3-D figures. It is not produced in bulk so it will have more trimmings, prints, embroidery, buttons (that do not fasten) and tacked on bows. The customer will select the garment that is designed, then it will be very costly, in these designs the fabric, style and colour combinations are described so that one can select the design. In this design category specification charts are either not prepared or it is stitched for standard measurement. It is the design and outfit made for an individual costumer.

Decorative design is created by printing, embroidery, quilting, appliqué, or other forms of fabric decoration. Some decorative designs are mass produced and very economical. Others are individual creations that are highly labour intensive. Roller and screen printing are probably the most commonly used forms of decorative design. Problems that are some times associated with printed designs are fuzzy patterns.

In general, structural designs are more permanent, better quality; and more durable than decorative designs. Structural designs are more expensive to produce than decorative designs due to slower production and longer set up time.

1.6 Elements of design

In creating a design one of the components that interact is the element of design. The element and principles of design are flexible and should be interpreted within the context of current fashion. A design can be defined as an arrangement of lines, shape, colours and texture that create a visual image. The principles of design are the rates that govern how elements are combined. The elements are therefore the raw materials that must be combined successfully.

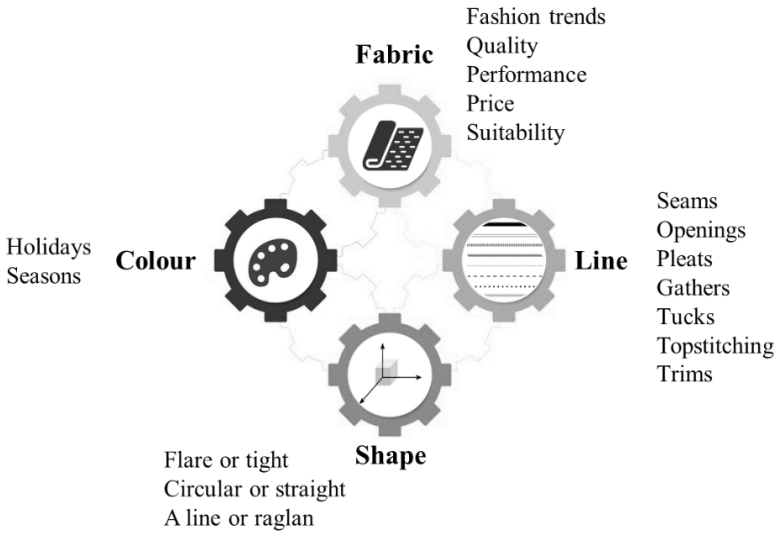

Figure: 1.4. Elements of design

1.6.1 Colour

Colour is the first element to which consumers respond, often selecting or rejecting a garment because of its colour appeal. Therefore, designers must consider their customers and provide colours that are both appealing and flattering. People connect certain colours with holidays and seasons. They expect to see earth tones in fall clothing, jewel colours for the holidays, the pastels of flowers in the early spring, and refreshing white for the summer. All manufacturers include some of these colours in their lines.

1.6.2 Fabric

Colour is interpreted in the medium of the fabric. Fabrics are the designer's artistic medium, in that fashion design is essentially sculpture in fabric in relation to the body.

Fabric selection: Is the selection or creation of an appropriate style for a fabric, or the reverse, the selection of the right fabric for the design? Next to understanding the needs of the customer and interpreting trends for them, choosing the fabric suitable for a particular style is one of the most important aspects of designing. The designer chooses fabrics on the basis of fashion trends, quality, performance, price and suitability.

Fabrics themselves inspire garment design. For example, the softness and drivability of jersey might inspire gather in a dress. Other designers work the other way around, first getting an idea, perhaps developing it in a sketch, and then finding the appropriate fabric for it. However the designer works, he or she must ultimately decide which fabric will work best with a design, or vice versa. Designers must develop the ability to picture a design already made up in the fabric, this ability comes through observation and experience.

Many firms build a line or even an entire reputation on one fabric such as denim or stonewashed silk. In sports wear, a base fabric is selected fore jacket and lowers. In jeans wear, for example the base fabric is always denim. An assortment of fabrics, solid and patterns, is chosen to go with the base fabric. The designer or merchandiser must be sure to include a variety of weight, textures, and patterns in a line, as well as a balance of fashion and classic fabrics.

1.6.3 Line

After selecting the fabric, the designer must consider the other elements of good design. In this section, the term line refers to the direction of visual interest in a garment created by construction details such as seams,

openings, pleats, gathers, tucks, topstitching, and trims. When lines combine, space is enclosed and forms and shapes are defined. Lines offered a path of vision for the eyes when wearing an object/outfit. The arrangement of lines in clothing design can cause to one to appear heavier or thinner than what actually he or she is.

Lines within a garment are created by darts seams and decorative details. Each kind of line produces its own special effect. Straight lines and shapes denote force and strength and have a masculine quality; curved lines are the line of nature, they are graceful give a feminine effect. Lines are the greatest devices of fashion designers. Since line creates illusion of height and width, they can be used to one's requirement to tone down or exaggerate a particular figure type

1.6.4 Shape

It describes the outer dimensions or contour of an object. Shape also encloses space and imparts a certain character to the object viewed. Through clothing design, the shape of the human body is often revealed in a natural way, but some times even distorted. The shape of clothing on a human body, communicates silently, the messages about the wearer. Every fashion period, a shape emerges slowly or evolved suddenly, whatever it is, every period has a specific shape of garment which once determined can be modified and re-styled for variation in design with out changing the basic shape of the garment, it is either flare or tight, circular or straight, a line or raglan. It has been observed that an easy fitting shape of the garment is easily accepted and largely vitiated as well as has a longevity of style, where as a tight-fitting garment is generally short lived since it is suitable to only perfected figure types. It is therefore advisable that the designer chooses an easy silhouette to keep on creating for a longer duration.

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2. Fabric Selection

Abstract: The Chapter 2 deals in detail methods and criteria for the selection of suitable fabric which will satisfy aesthetic and functional requirements of the final product. The chapter extensively deals with correlation between fabric physical properties and apparel product's performance requirements. The chapter classifies the fabric properties into various categories – style, utility, durability and manufacturability. characteristics. It deals with factors that influence fabric selection for an apparel product's performance requirements

Key words: aesthetic, functional, fabric selection and sourcing, utility, durability manufacturability characteristics, comfort, hand You can enter the text of the second chapter here.

2.1 Introduction

Selecting the appropriate fabric is only the first step in providing serviceable fabrics for apparel manufacturing. Fabrics used in garment manufacturing can be categorized based on properties and characteristics. A characteristic is a static physical dimension such as yards per pound; whereas, property is the reaction of the fabrics when a force is imposed up on it. Elongation, elasticity, shrinkage and seam strength are examples of property. These are measure of reactions to dynamic conditions. Characteristics are physical or chemical changes in the fabric resulting from the application of outside forces.

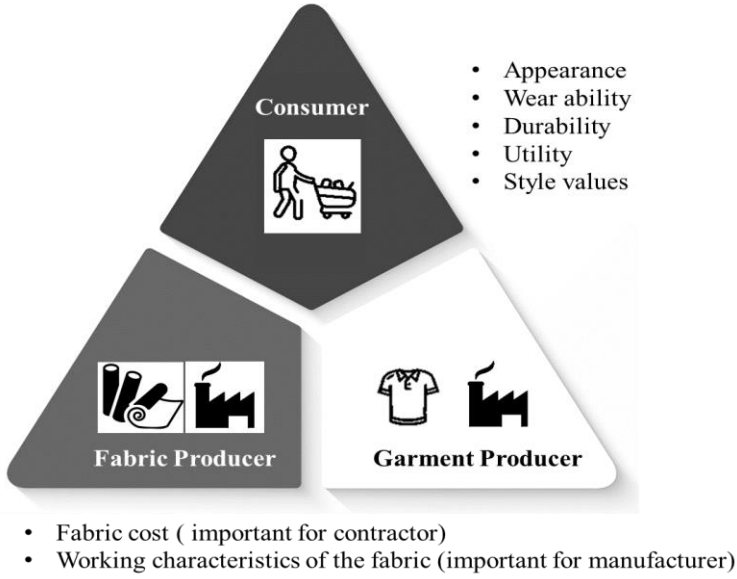

Figure.2.1. Different perspective of fabric selection

The apparel producer is interested primarily in the characteristics of a fabric. Although fabric characteristics are related to fabric properties, a fabric property is of no interest to the apparel manufacture unless it controls garment characteristic or cost, a factor vital to him, or unless the property itself such as thickness or weight, has definite utility or style value. There are three viewpoints to stipulating fabric selection:

1. The consumer's viewpoint

2. The fabric producer's viewpoint

3. The garment producer's viewpoint

The consumer's interests lies solely in the appearance and wear ability characteristics of the fabric; the durability, utility and style values. The garment producer is interested in the garment production working characteristics of the fabric, the cost of producing a given garment with the fabric. If the garment producer is a jobber or manufacturer who sells the garment directly or indirectly to consumers, he will be interested, also,

in all the consumer values. If the garment producer is a contractor his interest lies only in the field of the production cost aspect of the working characteristics.

The same applies to the fabric producer. If he fabricates cloth for garment manufactures, he must consider garment production work characteristics. However, if the fabric producer makes cloth for over the counter retail sales, he does not have to consider whether the working characteristics are good enough to produce the garment with industrial equipment and methods.

2.2 Physical properties of fabrics

Physical properties are the static physical dimensions of fabric. The following physical properties are used to define the static physical dimensions of strand fabrics which is shown in the table below.

Table.2.1. Physical properties of fabrics

Components	Properties to be considered
Fibre or filament	Type, size, length
Yarn	Diameter, twist, weight or size, count, fiber content for mixed yarns, ply
Weight	Ounces per squared or yards per pound, GSM
Thickness	Cm or mm
Fabric structure	• Woven fabrics: weave type, warp and filling yarn count per linear inch • Knitted fabric: knit type, wale and course count per inch
Finishes	Chemicals such as resins, starches, waxes and mechanical effects such as calendaring and

	napping applied to the woven fabric to yield or enhance style, durability, and utility values.
Fabric width	The length of the weft or course
Colour	Hue, value and intensity (degree of brilliance)
Fabric density	Weight per unit volume
Surface contour	The geometric dimension of the surface plane.

2.3 Physical characteristics of fabrics

Physical characteristics are the dynamic physical parameters of fabric. They are physical changes in the fabric that result from applying outside forces on the fabric. Most of the durability and utility values of fabric are characteristics and not properties. There are four major categories of fabric characteristics that interest the apparel manufacturer. They are:

1. Style characteristics
2. Utility characteristics
3. Durability characteristics
4. Product production characteristics.

There are often correlations among the four types of characteristics. A utility characteristic such as fabric elongation will be correlated to a working characteristic such as sewing without stretching.

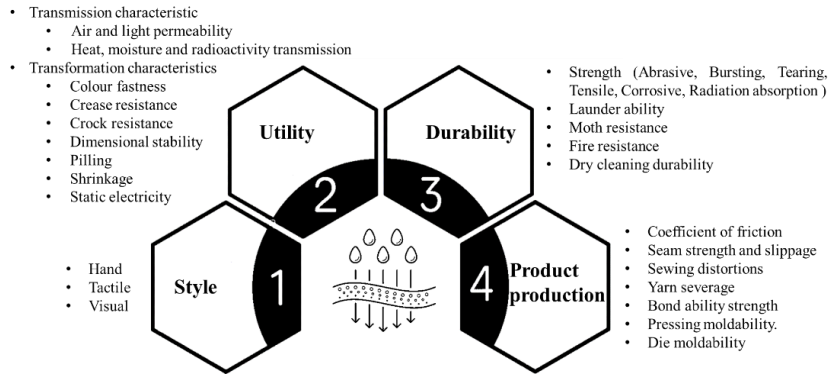

Figure.2.2. Physical characteristics of fabrics

2.3.1 Style Characteristics

Style characteristics are those changes which affect the emotional appeal, the fabric imports to the consumer. This is exemplified when a consumer handles a fabric and refers to the fabric with adjectives such as stiff, soft, hand, etc. The three basic categories for style characteristics are:

1. Hand

2. Tactile and

3. Visual

Hand characteristic are the changes of the fabric plane with hand manipulations, which exert tensile compression, molding, or supporting forces on the fabric. The hand characteristics include some of the utility characteristics, such as elongation, elasticity, flexibility, etc.

Tactile characteristics refer to the changes in surface contour that result from a mechanical force exerted on or against the surface structure. These changes apply to the surface contour aspects of the fabric surface and not the fabric plane. The surface contour changes dimension under tactile pressure (no matter how small the pressure) this is a tactile characteristic. Pile, napped, and any fabric whose surface contour can be varied by tactile pressure, have obvious tactile characteristics. Designers specify tactile

characteristics with terms such as soft, coarse, rough, hard, smooth, sticky, oily and greasy.

Visual characteristics are the changes in the colour values when either the fabric or light is moved. End – to – end shading, side - to – side shading and mark – off are three colour quality problems in addition to metamoric fabrics.

End – to – end shading refers to changes in shade throughout the length; the shade of one end of the bolt differs from the shade of other end.

Side – to – side shading refers to changes in shade from selvage to selvage; the shade of the fabric along one selvage differs from the shade of the fabric along the other selvage.

Mark – off in fabric is the phenomena of changing the shade and/of intensity of the fabric surface by rubbing it.

Metamoric fabrics exhibit colour difference with change in the spectral distribution (characteristics) of the illuminant.

2.3.2 Utility Characteristics

Utility characteristics are changes in the fit, comfort, and wearing functions of the garment when the fabric engages a mechanical thermal, electrical, or chemical force during the utilization of the garment. The two major types of utility characteristics are transmission and transformation. A transmission characteristic transmits mass or energy through the fabric. Transmission characteristics include:

- Air permeability (includes all gases and vapour)
- Heat transmission (thermal conductivity)
- Light permeability
- Moisture transmission
- Radioactivity transmission (the degree with which radioactive energy such as x – ray and gamma rays can penetrate fabrics).

Transformation characteristics charge a physical property of the fabric. The property dimension(s) is altered without destroying the fabric. Changes which disintegrate the fabric are durability characteristics. Transformation characteristics include:

1. Colour fastness
2. Crease resistance
3. Crock resistance
4. Dimensional stability
5. Pilling
6. Shrinkage
7. Static electricity etc.

2.3.3 Durability Characteristics

Durability characteristics are the capacities of fabric to maintain the style and utility characteristics during wear. It is the measure of stress which destroys the fabric or the fabrics ability to repeat a desired style or utility characteristic. The durability characteristics are:

1. Abrasive strength (measure of rubbing action)
2. Bursting strength (measure of vertical pressure)
3. Launder ability (measure of washing)
4. Tearing strength
5. Moth resistance
6. Tensile strength
7. Radiation absorption strength (the rate at which radiation energy either disintegrate a fabric or destroys utility characteristics).

8. Fire resistance

9. Corrosive strength (the measure of chemical action, acid or alkaline)

10. Dry cleaning durability (the measure of dry cleaning performance)

2.3.4 Production Characteristics

Production characteristics are those characteristics which affect the quality of production with respect to quality values and the cost of production method. The working characteristics of a fabric include:

1. Coefficient of friction (cutting, sewing, pressing and packing)

2. Seam strength

3. Seam slippage (yarn slippage)

4. Sewing distortions

5. Yarn severage

6. Bond ability strength (fused, cemented, and heat – sealed seams).

7. Pressing moldability (to what degree a flat piece of fabric may be skewed during pressing with hand and /press buck).

8. Die moldability – how well a flat seamless piece of fabric may be molded with dies into a given from such as a bra cup or a hat.

2.4 Fabric Sourcing

Designers and merchandisers may go to major fabric markets to collect ideas, check trends, examine few products, and seek sample yardage. Fabrics may be designed and developed by apparel designers or merchandisers and ordered from mills or converters according to the apparel manufacture's specification. Acquisition of piece goods is accomplished after fabric samples and product specifications have been

examined and lead times. Minimums, delivery dates, put – up, and price have been negotiated.

Identification of appropriate fabrics is based on product information and testing provided by fabric vendors and/or testing and product development conducted by apparel manufacturers. Sources of information include fabric samples, specifications, and certification.

2.4.1 Fabric samples

Sample lengths of 5 yards are frequently provided to apparel manufacturers, sometimes without charge, so designers and merchandisers can test and work with the material. Fabric samples are frequently accompanied by specifications and other product information as identification of product quality, aesthetics and suitability to end use. When styling and innovation are high priority criteria, samples are essential.

2.4.2 Fabric specifications

The amount of information included in fabric specifications varies from basic fibre content to complete descriptions of the material, which includes analysis based on standard performance tests. Specifications may include product name, style number, fibre content, finishes, dyes, performance evaluation, methods of manufacturing, and quality standards.

2.4.3 Fabric certification

Some vendors also provide certifications of product quality. Fabric certification is a statement of compliance to product specifications. Certification is intended to provide assurance to the buyer of the quality of fabrics shipped and eliminated the need for receiving inspection. In these days of quick response and just – in – time production, certification of the quality of piece fabrics can cut days or weeks from the apparel manufacturer's production process by eliminating the need for fabric inspection and reducing production delays because of inconsistent materials. Certification data include:

Reports of evaluation of compliance to specifications including types of tests performed, methods used, and the result. Identification of the laboratory or facility, operators and dates when the evaluations and testes were performed, and Documentation of tradability of purchase order numbers, lots, markings on the materials.

2.4.4 Lead time and minimum yardage

Lead times required for delivery from a fabric supplier can vary from as little as 2 weeks to as much as 9 months. Minimum yardage requirements or minimums may range from a few hundred to thousands of yards. Factors that affect lead times and minimums are place of origin, distance of shipping, production capabilities of the supplier, and whether the piece fabrics is selected from open stick or dyed or printed to order. Imported fabrics may require longer lead time but often have lower minimums, than domestically produced materials. Open-stock materials have shorter lead times, smaller minimums, and are usually lower priced than goods made to the apparel firm's specifications. Special – order piece fabrics usually have large minimums, more exclusivity, longer lead times, and are often higher priced.

2.4.5 Fabric package form

Fabric package form is the manner in which the fabric is folded or rolled by the vendor. An apparel firm usually buys woven fabric that is rolled full width on a cardboard tube. Tubular knits may be put up in rolls or flat folded. Flat knit fabrics are usually rolled. High – pile fabrics such as velvets may be wound and hung from a creel that keeps pressure off the surface of the fabric. Fabric characteristics and package form determine the type markers that are used and how the piece goods is spread and cut. A full roll is usually 60 – 100 yards in length. Some firms may specify that fabric be put up on large rolls up to 300 or more yards in total length. The firm may also specify the maximum number of pieces, perhaps no more than three that can make up total yardage in the roll. This minimizes the number of fabric splices, amount of waste, and amount of handling in the spreading process. Shorts, tailings, and remnants are lengths of piece goods less than forty yards in length. Shorts and tailings may result from

experimental fabric runs, removal defects, ends of rolls, and overruns. Remnants are less than 10 yards in length and may be sold by the pound.

2.5 Selection of Fabric

2.5 1. Fabrics for women and children

In the purchase of their apparel most women seek primarily for "look rightness and serviceability". For outer apparel look – rightness is probably the first consideration. In the purchase of underclothing and children's wear, serviceability is commonly the first consideration, although look – rightness is nearly always a factor, too. Serviceability is a combination of suitability of fabric and the quality of garments construction. Differences in weight automatically limit some fabrics to particular seasons and uses. In summer thin fabrics, such as voile, eyelet, batiste, sheer, creeps and chiffons, in winter, for heavier materials such as wool tweeds, homes puns, velvet, corduroy, and fur like fabric. Some stiff fabrics look better when a crisp appearance is required; soft and clinging fabrics are appropriate when slinky, draped effect is desired; rich and luxurious fabrics look best in the evening; washable fabrics appear to advantage when worn in the house, in garden, and for sports.

2.5.1.1 Women's skirts

Women's skirts are cut on straight, the bias, or circularly from the same fabrics that are used for dresses and suits. The fit or, more particularly the hang of skirt is important. A skirt should not wrinkle below the waistband and should be even at hem. The principles for selection of appropriate outer garments for adults are essentially the same for girls. Coats and dresses must be style - right for occasion. All girls, especially up to 10 years, need a roomy garment with large armholes and curved underarms, to permit raising the hands above the head without pulling out the seams or distorting the fabric. Tucks, pleats and shirring are important because they allow for chest expansion.

2.5.2 Women's sweaters

The sweater, a knitted of garment for the upper part of the body, has long been a staple for both casual and dressy wear. There are two main or classic types: the pullover or slip - on and the cardigan. Either type may have long or short sleeves, or either type may be in a classic or contemporary style. The classic sweater, not usually bulky, has a round neck without a collar. Contemporary styles are usually bulky and may have cable stitch and cowl necks.

Until the development of the non - cellulosic man - made fibres, wool was the major fibre used for sweaters, with cotton an important fibre for children's wear. But today the acrylics, particularly Orlon and Acrylan, are in the first place, with blends second and wool third. The reason for the great popularity of the synthetic is that they can be cleaned in the home laundry machine at the setting for fine fabrics, and they need no reshaping. Wool sweaters, unless labelled "machine washable," have to be hand washed, reshaped, and dried most carefully. Also man - made fibres are usually less expensive than comparable wool products, and are better than wool in resistance to abrasion.

The degree of softness of sweaters made from man-made fibres depends on the fibre denier (weight and fineness) the finer the denier the softer the fabric. The acrylics provide wool – like bulkiness by crimping short filaments so that they resemble wool fibres. Thus they provide more warmth than nylon. Nylon, which is crimped also but is less bulky, has smooth texture and a slightly shiny surface. It is more readily distinguishable from wool than is acrylic fibre. Acrylic fibre pills more than nylon in laundering and more particularly in rubbing against other garments or furniture. On other hand, nylon is more easily snagged by sharp objects and fingernails. Sweaters are also made of 100% polyester.

2.5.3 Blouses

Wash - and - wear blouses are important in any women's wardrobe. Fabrics that resist wrinkling are those made of the acrylic, polyesters, and cross linked or specially resin - treated cottons, blends of polyester and cotton (65/35 %), polyester and rayon (55% or more polyester with rayon),

50% or more polyester with acrylic, 80% or more acrylic with cotton, or 55% or more acrylic with wool are likely to give good wash - and - wear performance. 100% triacetate, 100% rayon or acetate, and 100% silk are also appropriate fabrics for blouses.

2.5.4 Coats and suits

When women buy coats they look for style, colour, fabric, fit, comfort and price. To one woman, colour and style may be most important; to another, comfort and price are paramount. And to still another, fabric, colour, and fit may be the major considerations. The weight of outer garments is governed by the season. Spring coats are lighter in weight than fall coats, and winter coats, of course are of the heaviest fabrics. Coats of cashmere or cashmere and wool and wool blends, camel's hair, single and bonded cloths, poplin, faille, worsted sharkskin, wool Shetland (single or bonded) are used in spring and fall.

Suits and pantsuits of gabardine, whipcord, tweed faille, covert, serge, corduroy, knitted fabrics are also used in spring and fall seasons. Coats made of fur like fabrics, wool tweed (single and bonded), cashmere ottoman (wool/nylon bonded to cotton and other blends), covert (wool/nylon bonded to acetate tricot), cashmere, Melton, wool broadcloth are used in winter season. Suits and pant suits of knitted fabric (wool and blends), flannel, tweed boucle.

2.5.5 Under garments

Women's undergarments consist of soft, lightweight attractive, minimum - care articles that are not bulky and that conform to the lines of the outer garment. Undergarments should not stick or cling to the outer garments, nor creep up or twist. A garment should easy to slip on, should stay in place, should not restrain any movements, should fit smoothly and should not be irritating.

Fabrics commonly used for underwear generally fall into two main classifications:

1. Rayon, acetate, nylon, other synthetics elastic fibres (rubber and spandex) in mixtures or blends, and

2. Any kind of lightweight cotton or blend in plain weaves or knitted.

Common fabrics used for nylon lingerie include nylon tricot (sometimes called jersey) mesh, crepe and satin. The materials for babies are, generally speaking standard; cotton is used more than that any other material, because it washes readily and does not irritate the skin.

2.5.6 Sleepwear

Gowns, pyjamas, and coat - and - gown or coat - and - pyjama sets can be tailored or lace trimmed. Some common fabrics used for gowns and pyjamas are rayon, acetate, silk or nylon crepe, silk pongee, cotton, batiste, some chiffons and georgettes, cotton knits, and nylon and rayon tricot.

2.5.7 Hosiery

While cotton hosiery and wool hosiery are important for sports, children's, and men's wear, the great majority of women today wear nylon most of the time. Cotton, Orlon acrylic and stretch nylon, cotton and spandex and 100% stretch nylon are used for women's and girl's socks, and for boy's and men's socks as well. There are two types of hosiery: full - fashion knit and circular knit.

Full fashioned are knitted flat stitches are taken off (two stitches are knit as one to decrease the number) so that the fabric is narrowed at the ankle. Circular - knit hosiery is commonly called seamless, because no back seam is present. Full - fashioned hosiery, a better fitting fabric than circular knit, retains its shape better during wear and after washing. For men in particular, the circular - knit hosiery is preferable, because there is no seam over the ball of the foot to irritate tender skin areas. Women's seamless stocking have gained in popularity because they eliminate the problem of crooked seams and because they fit smoothly on the foot. Tights are also fashionable and practical. They are generally made of a sweater like knit of 100% stretch nylon for women and children (cotton may be used for girls).

2.6 Fabrics for men's and boy's wear

Men's wear may be classified as Men's clothing and Men's accessories. A similar division may be made for boy's wear too. Work clothing is often treated as separate classification. Men's and boy's wear are composed of similar articles, the chief of which are shirts, sleepwear, underwear, hosiery, robes, ties, hand kerchiefs, belts, suspenders, garters, muffles and scarf, sweaters and bathing suits. Men's jewellery (non - textile) such as cuff links, studs, tie clips and stickpins, are also commonly included in the classification. Men's clothing includes garments such as suits, topcoats, cover coats, jackets and slacks. Boy's clothing includes suits, topcoats, overcoats, jackets, and raincoats. With the emergence of fashion as selling force, there are more divisions of men's and boy's section in department and specialty stores.

2.6.1 Shirts

Shirt may be classified according to the occasion for which they are worn:

- Sports and Casual
- Formal.

Dress shirts are usually all white, solid coloured or stripped. For work shirts khaki, dark blue or blacked are common colours. Sports shirts may be white, solid coloured, plaids, stripes or checks. Men's dress shirts sizes run 14 to 17 (neckband measurements). Men who cannot wear standard sizes should buy custom made shirts. Sleeve lengths come in sizes 32 to 36. Boy's sizes run 3,4,5,6, and 8,10,12,14,16,18,20. Sleeve lengths are usually identified as long or short.

All cotton or polyester and cotton blends are commonly used for shirting. Best quality fabric for shirt is produced from combed cotton of fine count, mercerized, and shrinkage controlled. Work shirts for utility wear are made of sturdy fabrics, such as mercerized cotton twill, polished cotton, a blend of 65% polyester and 35% cotton poplin, blends of 17% nylon and 83% cotton twill, all cotton chinos, 65% polyester and 35% combed cotton gabardine, all - cotton denim, and all - cotton drill. The emphasis in selecting work shirts should be suitability rather than style. For comfort shirts usually have long tails that stay trucked in sleeves may be long or short, and sizes are based on the neckband.

Although sport shirts vary in style, a common feature is that they are made to be worn without a tie. They may or may not have a collar and may have either short or long sleeves. Since sport shirts are intended for active sports and for casual wear, a comfortable easy - to - care - for fabric is suitable. In general, sport shirt fabrics are classified as knitted or woven. Shirts for formal wear are usually pleated or plain, with a starched or soft bosom depending on the current mode. Fabrics include pique, broad cloth, silk or synthetic fibered crepe, and blends. The durability of a shirt is determined by the grade of fabric (judged according to the quality of the fibres, yarns, weaves, and finishing processes). Ease in laundering is also a factor in durability. Single cuffed shirts are easier to iron than those with double cuffed, but the latter are usually more durable. Price is often a major consideration in selecting a shirt. Men's consider the factors of colour and collar style first. For the women, however, collar style and price were first consideration in buying a man's shirt.

2.6.2 Sweaters

Many customers are interested in style when they buy a sweater. The two classic styles for men as well as women are the pullover, which pulls over the head generally has no buttons but may have a short zippers, and the cardigan, which fastens down the front, generally which buttons or a zipper. The pullover with sleeves is more popular than the sleeveless variety, although the latter is often preferred under jackets or coats. Necklines of the pullover may be v-shaped, round, boat turtle or crew. Sizes are 36 to 46. The cardigan may be made with or without a shawl collar and two lower pockets. Sweaters are made in smooth and in bulky, shaggy hairy, and nubbed textures. The former are more comfortable under a jacket, whereas the latter are particularly suited to sportswear. Sweaters are made of all wool or all cashmere, all cotton, 100% acrylic texture nylon, and blends of 75% wool and 25% mohair.

2.6.3 Underwear

Garments sold in men's and boy's under wear departments include T - shirt, under shirts, drawers, shorts, briefs, and union suits (knitted one -

piece garments with sleeves and legs in varied lengths). The most popular style in underwear for man and boys are undershirts or T - shirts and shorts or briefs. Although union suits, shirts, and drawers are staple items in the underwear department, they are usually purchased by the older man who lives in a climate of cold winters.

For underwear the factor of comfort is very important. Probably the most comfortable underwear is made of a knitted fabric because it gives knit underwear with movements of the body. It is especially suitable for athletics. Since cotton absorbs perspiration better than silk, rayon or nylon, many men prefer cotton for underwear in all climates. Both woollen and worsted yarns can be used in knit underwear. The woollen fabric is soft and pliable and makes a good napped or fleecy surface. Worsted yarn is smooth and lustrous and makes a fine, even, smooth knitted structure. Wool knitted underwear is very warm ventilates the skin. It keeps the body warmth in winter and cools in summer; fits the body smoothly without binding and is easily washed and needs no ironing. Rayon and nylon yarns, which are often used in combination with another textile to give it lustre, may be used alone in lightweight underwear. These yarns, incidentally, are most attractive in white and pastel shades. 100% nylon knitted underwear, although it is very strong and quick drying, does not absorb perspiration. Rayon underwear is inexpensive, is very cool in summer and in good grades, washes and wears well. Laundry is an important factor in underwear. Both wash-and wear cotton and the non cellulose synthetics are easy to care for and require little or no pressing. The synthetics have the added advantages of drying quickly, but some men say that their fibres feel clammy because they do not have the absorptive quality of cotton.

2.6.4 Hosiery

Men want socks to fit well and above all to wear well. A comfortable sock is soft, fits smoothly over the instep, ankle, and heel, does not pinch the toes, does not slip or roll down, and is smooth on the sole of the foot. There are two main styles in men’s socks:

- Socks for formal wear
- Socks for sport wear.

Each style comes in lengths that vary from just below the knee to just above the ankle. The sock for street wear, which is more conservative than the sports type, usually comes in solid colours in stockinet or rib knit. Sports socks may be described as:

- Crew (bulky rib-knit white fabric with elastic top, or white socks with or without blazer stripes at the top);
- Argyle, with the familiar Jacquard plaid pattern;
- Novelty, with varied designs and colours, and
- Thermal, for winter made of stretch nylon outside (lined with 50% Herculon Olefin/ 50% cotton), or 80% worsted wool/20% stretch nylon.

A blend of heavily weight cotton 90% and 10% nylon, 70% nylon 30% cotton inside for comfort or 100% stretch nylon wears well. Bulky Orlon acrylic blends that feel woolly and are shrink-resistant are suitable for sport wear. Also, a 50% wool and 50% nylon blend and 80% wool and 20% stretch nylon are appropriate. Tops of socks are frequently made of spandex yarn in rib knit.

2.6.5 Sleep wear

Just as men seek comfort in underwear they also want comfort in sleeping garment. If a garment feels smooth and soft, it is easy to put on and take off, and if it has a full cut and smooth seems, it will generally prove comfortable. Probably the next most important consideration in sleepwear is durability which includes launder ability. Shrinkage of less than 5% considered satisfactory. Durable press is a valued selling point. For some men the appearance of the garment is more important than comfort or durability. In such cases, decoration, trimming, or quality of workmanship is noticed. Pyjamas generally include a coat - style or pullover (middy) top and trousers. Small children often wear the same style as grown - ups or they may wear one piece; sometimes with feet attached. The separate coat is buttoned down the front, whereas the pullover needs no front closing.

2.7 Common fabrics used in garment manufacturing.

1. Calico

Calico is balanced plain weave, made of cotton and blends usually polyester. It is top weight fabric. It is used for shirts, dresses, curtains small scale prints etc. Calico fabric has good strength, absorbency, low resiliency and drape. It is highly flammable.

2. Cotton lawn

Cotton lawn is made of combed or mercerised cotton. It is balanced plain weave. It is soft and top weight fabric. Used for blouses, shirts, dresses, underwear, sleepwear and handkerchiefs. It has good strength, absorbency and drape. It's resiliency is low and it is highly flammable. Stiff finish may be applied on cotton lawn fabric.

3. Cotton muslin

It is top weight fabric, with open or loose weave, sheet, sleepwear, shirt, dresses, etc. It has low strength, resiliency and good drape. It is characterised by high absorption and flammability.

4. Sheeting/ Percale

Sheeting or percale fabric is made of cotton and blends of carded yarn. It is balanced plain weave and used for house hold sheeting. Its total thread per inch are 118 (fairly sleazy and open), 128 (medium), and 140 (sturdy fabric).

5. Poplin

Poplin is made of cotton or blend with polyester. It has more warp than weft and weft is generally coarser. It close plain weave with cross ribs fine but easily visible when weft is thick. Poplin may be top or bottom weight or sturdy fabric. Poplin is used for shirts, dressed, pyjamas, rain coats, sport wears, and etc.

6. Taffeta

Taffeta is produced only from filament yarn. Its weave is close, and wrap and weft are almost same size. There are more warp yarns than weft yarns. It is fine smooth fabric with a very fine crosswise rib. Taffeta is top weight fabric, used for dressed, ribbon, trim lining, curtain, lampshades, umbrellas, luggage lining.

7. Drill

Drill is made of cotton or blend with polyester. It is produced from carded yarn with 3/1 warp face twill. It is tough fabric and bottom weight to heavy. It is used for work wear, sportswear bags etc. It is usually piece dyed.

8. Denim

Denim is produced from cotton or blend with polyester. Carded yarns only or rotor yarn is used for denim manufacturing. In denim warp yarns dyed (Indigo blue) and weft yarns undyed. It is warp face twill weave. Finished to give 'worn' look; this includes stone, acid, mud washed, even shot (to leave bullet holes). Weighs bottom to heavy.

9. Gabardine

Gabardine is usually wool or blend with man - made fibres. It is usually fine, combed, and worsted. Gabardine is warp face twill weave usually 2/1 and steep. It is Bottom weight fabric, used for slacks, Skirts, suits, coats, rain wear.

10 Tweed

Tweed may be wool, fairly coarse or cotton, man - made fibre and blends fabric. Fibres usually stock dyed. Tweed undergoes fulling in finishing closing up the yarns and making fabric warmer.

11. Sateen/Satin

Sateen is weft float fabric, mostly produced from cotton. It is top weight smoothest, fullest and mostly lustrous and very flexible fabric. Used for

lining, lingerie, blouses, bridal suits dresses and etc. Satin made of silk and man - made fibres is warp faced fabric.

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3. Preliminary Manufacturing Process

Abstract: The chapter 3 discusses the pre-assembly processes in garment manufacture starting from pattern making both manual and computerized methods and material utilization. It also deals exhaustively with spreading and cutting processes. The chapter also dwells into factors affecting material utilization.

Key words: pre-assembly, material utilization, pattern making, marker planning. spread, cutting, band knife, servo cutter

3.1 Garment manufacturing

Compared to many other product lines, apparel manufacturing remains labour intensive. Because of the variety of product categories, the endless change in materials and styling, and the difficulty in handling of soft goods manual operations are usually needed. The scope clothing industry has been defined as the manufacture of garments worn on the body, and this excludes the extremities, for example, hats, gloves, socks, shoes. Garment - a shaped article of textile fabrics or other flexible sheet material, intended to cover portions of human body. Garment may be grouped as active wear, pyjama, shirts, sleep wear, underwear, dress shirts, hosiery, outer wear, uniform, children wear, and work cloths.

Garment industry is one of the developing industry which gives employment to the population. It includes a diversity of company types and sizes of product types and volumes of production and manufacturing environments that is difficult to find in any other industry. Garment companies vary from the small number who employee several hundred or even several thousands of workers to the typical traditional company and prefer women workers. Garment industry is no more a tailoring unit with a haberdashers, it is an industry which translates the fashion in to action.

Garment is what we wear and fashion is how. The internal chain usually starts with the marketing department doing some formal or informal research to evaluate what the market sector served by the company could be looking for and at what prices. As a result, the clothing producer has to reconcile the conflicting requirements of the market and of these manufacturing facilities in order to stay in business.

The basic needs of the market are shown in the figure 3.1

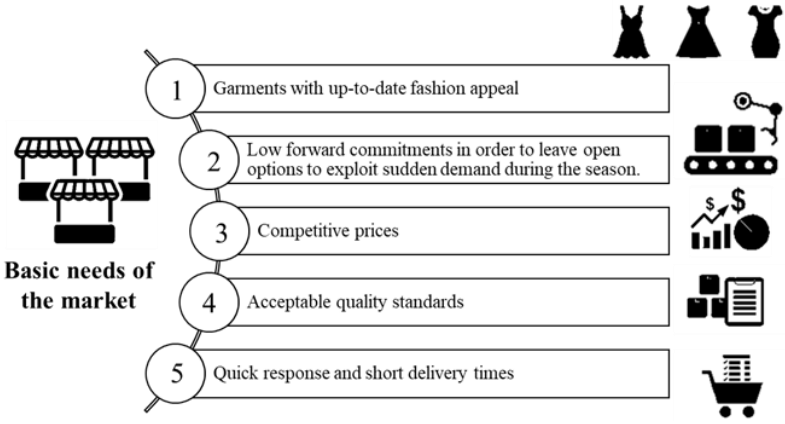

Figure.3.1. Basic need of markets

But to produce goods efficiently and profitably, the producer requires minimum of style and cloth variety, large orders, well in advance of delivery dates, adequate time for planning, time to develop garment and method engineering for 'price sensitive' and other critical types of merchandise, reasonable level of work in progress and parallel to this, the designer has probably visited overseas couture houses to obtain indications of the possible trends for the next season.

3.1.1 Material Utilization

Changing market demands and varied production strategies are creating diverse needs for preproduction processes. Small orders, increased flexibility, and Quick Response expectations are creating the need for fast turns on markers, low-volume spreads, and high-speed low-ply cutters. Another significant change in preproduction has evolved from team-based production units. Some manufacturers have expanded the

team approach to include spreading and cutting operations. One preproduction team spreads and cuts for two or three team-based sewing modules. It creates a pull system where cutters must have the work ready for the module on time and presented in the manner needed. If cutting is not accurate the sewing team knows with whom they need to work to improve the process. If a part is damaged and it holds up sewing production, the sewing team can immediately go to the preproduction team and have another piece cut. If the sewing team makes its production goal, this means the cutting team does also. This system can work effectively if teamwork is a priority with management. Because of proportionately high fabric costs and the increasing costs of managing waste, firms have increased their focus on ways to increase the utilization of material. Material utilizationis the process of optimizing the use of materials during product development and production. All preproduction operations-cut order planning, marker making, spreading, and cutting- impact material utilization. Preproduction operations are dependent on perfected patterns. Technical designers and production pattern makers develop the patterns for styles accepted into the line, perfect them, and grade them into appropriate sizes. All the patterns in each size of a style are verified, that is, checked very carefully before sending them to cut order planning.

Pattern verification includes checking the following:

- Correctness of grade increments
- Compatibility of grading with style specifications
- Length and alignment of adjoining seam allowances
- Notch placement and alignment with adjoining pattern pieces.
- Placement of internal markings
- Placement of grain markings

3.1.2 Pattern Making

It is a highly skilled technique which calls for technical ability, sensitivity for design interpretation and a practical understanding of the

process technology used by the factory. Industrial pattern making has two basic types

3.1.3 Block Pattern

This is a basic pattern with out any style features and incorporates the measurements, proportions and posture of the body for which garments, developed from this pattern, are intended. Block pattern can be developed by either of the following methods.

3.1.4 Flat Method

The components of the pattern, usually the body and sleeve, are constructed by a draft (technical drawing) which incorporates the measurements and proportions of the particular system used by the pattern maker. Itcad be produced by a computer.

3.1.5 Modeling

It entails the fitting of the block garment usually in toile, on a workroom stand of the appropriate size, when the fit balance are satisfactory, motile is removed from the stand and each component is copied on to pattern paper and the necessary making up allowances added.

3.1.6 Garment Pattern

The styled patterns used for cutting the original sample garments can be developed by a variety of means, including the flat method, modelling or a combination of both. When using the flat method, the pattern maker introduces style lines of the garment on to a copy of the block pattern, performs the necessary manipulation and then adds the requisite sewing and other allowances to each component. Notches are made in related components in the seam lines as guides for alignment and matching during sewing and make-up.

3.1.7 Computerized Pattern Making

At most large manufacturers, patterns are made on a computer with computer aided design (CAD) systems, the pattern maker manipulating small graphic patterns on the computer screen with a hand-held control

device. Geometry drives can make an infinite number of changes to the shapes and sizes the pattern including creating new design lines or adding pleats, fullness, and seam allowances.

To allow pattern makers to make patterns manually on a computer, another system has been developed allowing the pattern maker to work life size on a sensitized table with traditional tools and stylis that is attached to the table and the computer. The stylis picks up the lines drawn on the table and shows them on the screen. Changes can also be made directly on the screen. In both cases, patterns are immediately available for other operations such as grading and marker making. The essential features of this technology are pattern design and pattern generation systems.

Pattern design system- the pattern maker inputs to the system all the block patterns in current use and with the aid of the computer can construct garment patterns from them.

Pattern generation system- when the pattern components for the top cloth have been developed on the computer via pattern design system. The pattern generation programmer automatically generates the pattern for auxiliary components such as linings and foibles.

3.1.8 Pattern Grading

It is the process where by patterns of different sizes are produced from the original master pattern. This process can be performed manually or automatically by a computerized system. Patterns are graded according to size charts which present the sizes and the average measurements of the population group for which the garments are intended. Grading is the method used to increase or decrease the sample size production pattern to make up a complete size range. For example, the sample size 10 patterns must be made larger to accommodate sizes 12, 14 and 16 and smaller for sizes 8 and 6. Each company sets predetermined grade specifications, or rules. For example, a missy manufacturer’s grade rules might call for increments of one and a half inches in width and a quarter inch in length for each size.

Today most manufacturers grade pattern on CAD systems. The pattern maker guides a cursor around the edges of the sample pattern on a digitized table. At each of the key points, he or she pushes a button to record a grade point. Each point is cross referenced by a grade-rule table stored in the computer, which enlarges or reduces the pattern automatically according to the predetermined direction. If the pattern was originally made by computer, data are already in the computer and can be enlarged or reduced automatically. Pre-programmed grade rules for increase or decrease are automatically applied to the pieces of each grading location. Then the computer can print out the pattern in each new size. Manufacturers often use an out side service to make patterns, grade patterns, and make the marker.

3.1.9 Making The Marker

Marker making is the creation of cutting temples for the various parts of a garment. This may be done on the card board or paper, the former being more durable. In some cases markers are made on continuous rolls of paper for efficiency. Form all the pattern pieces of varying size, a master marker is made. The marker is the cutting guide or pattern. Lay out made on a sheet or light weight paper the same width as the fabric. The purpose of the marker is three fold:

1. To make a lay out for the cutter
2. To place pattern pieces close together to avoid fabric waste
3. To accommodate the cutting order / ratio (ensuring that the correct quantities of each size are cut)

The desire economical use of space is called a tight marker, which utilizes the highest percentage of fabric possible to avoid waste. Patterns are laid out so that each size and colour is cut as needed (popular sizes are repeated on the marker). Grain direction, one-way prints, plaids, strips, and naps are considered in making the marker.

Markers are made to fit specific widthsof fabric and quantities of sizes. If a marker is narrower than the fabric, the unused fabric is wasted. If a marker is wider than the specified fabric, garment parts located on the edge

of the marker will not be complete. Fabric is purchased by width but often it runs wider than the required width. When fabric width is grossly inconsistent, fabrics in a lot may be grouped by width and different markers produced for each width. Using the extra width in planning markers can save significant yardage.

Markers may be produced in sections or blocks or be continuous. Blocked or Sectioned Markers contain all of the pattern pieces for one style in one or two sizes. Sections may be used separately or joined together to form an extended multi-size marker. Blocked or sectioned markers are easier to visualize and handle, but they may not produce the best utilization of fabric. Sectioned markers may be used to adjust the volume requirements for various sizes or as a remnant marker. High-volume blocks can be placed on one end of the marker and low-volume blocks placed at the other end so the fabric can be spread to correspond with the volume needed for each block. Blocking keeps garment parts for one size in close proximity, which facilitates bundling and handling. Sectioned markers are advantageous if there is an en-to-end shade variation of the fabric. The following picture shows a spread that could be used with a sectioned marker and an unequal distribution of sizes.

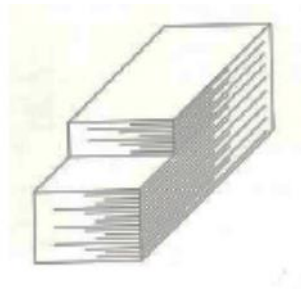

Figure.3.2 Stepped Spread

A stepped spreadfor a sectioned marker may consist of plies of varied length, spread at different heights. The most frequently used configuration for a stepped spread consists of a group of plies that are spread the full length of the marker and another group of plies beginning at the section

line. Stepped spreads are used to adjust the quantity of piece goods to the number of garments to be cut from each section of the marker

Continuous markerscontain all the pattern pieces for the all sizes included in a single cutting. They may be lengthy and often require more juggling of pattern pieces. Pattern pieces are grouped by size and shape of the pieces rather than by garment size. Continuous markers often have better utilization because there is more flexibility in grouping and manoeuvring large pieces and small pieces. Splice marks are planned into continuous markers to avoid excessive fabric waste and incomplete pieces.

Splice marksare points in a marker where fabrics can be cut and the next piece overlapped to maintain a continuous spread. Splice marks may be one inch or several inches depending on the overlap needed to accommodate the pattern pieces in the area of the splice. The rectangular box indicates the amount of overlap needed. The lower ply should be cut at the end of the box and the new ply of fabric should be aligned with the beginning of the box. If fabric needs to be cut before there is a splice mark, the cut should be made at the last splice mark and the extra fabric used for recuts or smaller markers. Splice marks are inherent when markers are planned in blocks. Piece goods may be spliced at any point where the sections of a marker are joined together. Splices are needed when flaws are removed, a roll change is made, or a short length of fabric is used.

The form of the fabric and whether it is symmetrical and/or directional determine the appropriate type of marker for a style. Markers may be open or closed depending on the form that the fabric is presented for cutting. Rolled fabrics are open and flat when spread. Markers for this type of

spread require pattern pieces for each part to be cut. Markers made with full-pattern pieces for each part to be cut. Markers made with full-pattern pieces are called open markers. Tubular knit fabrics are closed on both edges and therefore require pattern pieces that utilize the folds. Markers with half-pattern pieces for laying along the folds of the tube are called closed markers. Garment parts must be symmetrical if half-pattern pieces are used.

Marker makers must also consider the symmetry (side-to-side) and directionality (end-to-end) differences in fabrics. Symmetric fabrics are the same side-to-side. Asymmetric fabrics such as border prints are different side-to-side. Non-directional fabrics are the same end-to-end. Directional fabrics are different end-to-end. Examples of directional fabrics include knits, n fabrics, and prints with flowers all growing in one direction.

The marker mode is determined by the symmetry and directionality of fabric. There are three types of marker modes: nap-either-way (N/E/W), nap-one-way (N/O/W), and nap-up-and-down (N/U/D). In this case, the term nap is " to indicate the fabric is directional - it is different end-to-end. The nap of a fabric is created by its structure (corduroy or an unbalanced plaid), a finish, or a directional print. With symmetric, non-directional fabrics, pattern pieces can be placed on a marker with only consideration for grain line. This marker mode is called nap-either-way (N/E/W). Pieces are placed for best fabric utilization.

On some directional fabrics, such as corduroy, it may be possible for all the pattern pieces of one size to be placed in one direction and another size

placed ill the opposite direction. This is called nap-up-and-down (N/U/D). With this type of marker, the nap of corduroy jeans may run down for a size 7 and up for a size 9. The critical factor is that the nap must run the same direction in all the pieces of one garment. Napped fabric such as corduroy will appear shaded if the pieces in one garment have the nap running in different directions. Generally N/U/D will yield a better utilization of fabric than N/O/W.

A marker is made for a specific style, fabric, and number of sizes. The length of the marker determines the length of the lay that will be spread. Completed markers are sent to the cutting room electronically or in hard copy for the spreading and cutting processes.

3.1.10 Computerized Marker Making

Most manufacturers now make their marker on a CAD system or have it made by an out side service. Miniatures of the graded pattern pieces are displayed graphically on the computer screen. The operator can electronically position the pattern pieces in to the most efficient arrangement. Once the marker is completed, a full-scale marker is printed by the plotter on a long sheet of paper.

3.1.11 Marker Efficiency

Marker efficiency is determined by fabric utilization, the percentage of the total fabric that is actually used in garment parts. The area not used in

garment parts is waste. Marker efficiency depends on how tightly the pattern pieces fit together within the marker. The total surface area of the pattern pieces is compared to the total area of the marker to calculate the percentage of fabric that is used. This is determined automatically by marker-planning software. If marker-making technology is not available, the area of each pattern piece may be determined by a planimeter – a mechanical device that calculates the surface area as the outline of the pattern is traced. Factors that affect marker efficiency are fabric characteristics, shape of the pattern pieces, and grain requirements. Fabric Utilization is affected by the following factors:

(i) Fabric Characteristics

Fabric characteristics that affect utilization include differences in face and back, lengthwise directionality, crosswise symmetry, need for matching the fabric design, length of design repeat, and fabric width. These fabric characteristics frequently limit the arrangement of pattern pieces. Matching fabric designs requires special marker preparation and extra piece goods. Stripe or plaid lines must be indicated on pattern pieces and markers for accurate alignment and matching to corresponding pieces. The greater the length between repeats increases the potential for fabric waste.

(ii) Characteristics of Pattern Pieces

Characteristics of pattern pieces may limit fabric utilization. Generally the fabric utilization percentage increases when a variety of garment sizes are used in the same marker and when the marker contains both large and small pieces. Smaller pieces can often be nested with larger pieces. The shape of the pattern pieces determine hoe close they can be fit together (interlock). Irregular shaped pieces are difficult to fit together with other

pieces. Large pattern pieces are less flexible and often dictate the placement of other pieces.

Patterns are sometimes modified to increase fabric utilization although modification may not always be feasible. Some pattern adjustments that may be used to improve fabric utilization are: Splitting pattern pieces and creating a seam

- Rounding or slanting corners
- Reducing seam allowances and/or hem width
- Adjusting pattern dimensions without noticeable change to fir and style.
- Adjusting grain lines for hidden garment parts

Modifying grain lines specified by the designer. Both marker and cutting efficiency may be improved by using a common line between pattern pieces. For example, several waistbands in juxtaposition could share a common cutting line and be cut with one pass with a cutting knife. A common line needs to be a smooth, clean cutting line for both pieces so inaccuracies do not occur.

(iii) Grain Orientation

Grain line markings determine the placement of the pattern relative to the warp yarns in woven fabrics or wales in knit fabrics. Pattern pieces with a similar grain orientation, if grouped together on the marker, generally produce better utilization. Combining several bias pieces and straight grain pieces may not fit together as well and create more fabric waste. Markers usually have good utilization when all pattern pieces are on the bias or all

pieces are cut on straight grain. The firm's standards for grain tolerance may also affect marker efficiency. Tilting specific pattern pieces 1 or 2 percent may not be noticeable, and it may increase fabric utilization noticeably. This practice can impact the fit and drape of he finished garment but it may not be noticeable to the untrained eye. Computer marker-making programs will lock in the grain orientation of each piece unless an override function is used to adjust them. This can be done on a piece-by-piece basis.

(iv) Fabric Utilization Standards

Firms often establish fabric utilization standards. Firms producing basics may strive for 90 to 97 percent utilization, while fashion-firms may be able to achieve only 80 to 85 percent. It is important for firms to document material utilization and variances from the standards to monitor improvements or factors that impact the utilization. Better utilization is normally developed for basic styles because optimum fabric widths are used consistently and more time invested in cut planning and manipulating pattern pieces in the markers to reduce waste of materials. Markers for basic styles are used to cut large volumes of piece goods and may be kept on file and used repeatedly; thus, the time invested in improving utilization results in greater savings. Markers for fashion styles and Quick Response strategies may be used only once or for a limited number of spreads and few ply. Fashion garments are subject to constant changes in styling and materials and tight deadlines that limit the time available to develop efficient markers.

3.2 Cutting process

Production Process in the Cutting Room

Irrespective of size; all cutting rooms use the same basic system to produce cut work, with the row material going through the same operations in the same sequence. Cutting production starts with the receipt of inspected raw materials, production orders and graded patterns and finishes when bundles of cut work are issued for sewing. The total cutting process has four stages which is shown in the figure.3.3.

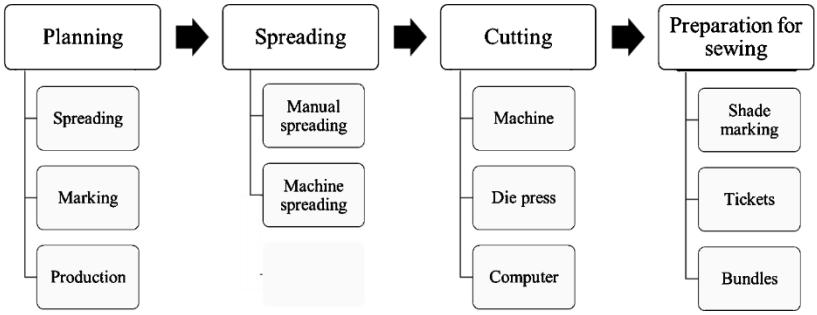

Figure.3.3. Stages of fabric cutting process

3.2.1 Planning

Lying out of the pattern so as to ensure the most economical use of materials can be performed by one of the three methods. The marker planner uses full size pattern and arrange them in the most economical fashion on marker paper. This is a specially printed paper having symbols on it which enable the marker planner to visually control the positioning of components according to their specified grain lines. Full size pattern are reduced generally to 1:5 scale and also the width of cloth represented at the same scale. Computerized systems are used to plan the markers, which can then be used for manual or computer control cutting. Markers can be produced on paper, which is fixed to the spread with pin or staples. For computerized cutting, the marker is held in position by the vacuum used to impress the spread and keep it stable.

3.2.2 Spreading / Laying

A spread / lay is a stack of fabric plies that have been prepared for cutting. Lay Planning is the basis of managing cutting room labor and table space. Spreading and cutting schedules are affected by table length, type of equipment, spread length, spreading time, and cutting time. The cutting room manager must minimize throughput time by efficient use of equipment, table space, and personnel. A spread on lay up is the total amount of fabric prepared for a single marker. A spread may consist of a single ply or multiple plies. The highest of the lay up or spread is limited by the vertical capacity of the spreader, cutting method, fabric characteristics, and size of the order to be cut.

The spreading table may be covered with a layer of paper before fabric is spread. This protects the fabric from any rough spots on the table surface, enables the lay up to be moved if needed, and prevents the base plate on the cutting knife from distorting lower piles of fabric. Piece goods may come from rolls, flat folds, pre-sectioned pieces, or irregular segments such as hides. Rolled piece goods are mounted on spreading machines and unrolled and piles are aligned as the spreader travels up and down the table. Fabric pieces may be cut to predetermine lengths for matching patterns or for additional processing such as screen printing, spreads of plaid fabric may be pre sectioned in to blocks so the design of the fabric can be perfectly matched before cutting to the shape of the pattern piece. The length of the spread is determined by marker length. A stepped spread for a sectional marker may consist of piles of varies length spread of different height. A stepped spreads are used to adjust the quantity of piece goods to the number of garments to be cut from each section of the marker. Stepped spreads are susceptible to excessive end loss as each ply is cut.

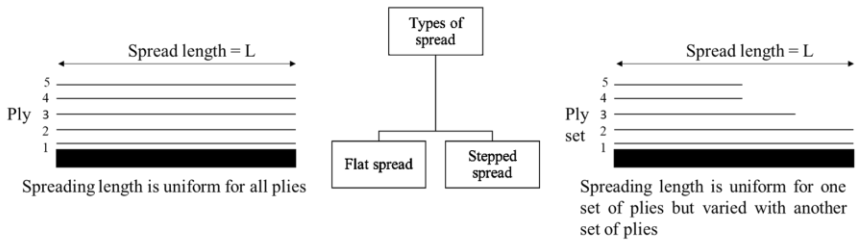

Figure.3.4 Types of spread based on length

The spread can be of two basic types based on its length which is shown in the figure 3.4.

Flat spread:All the plies are of the same length

Stepped spreads:These as the name suggests, is built up in steps, with all the plys in one step having the same length.

A stepped spread is generally used when for some reason the imbalance between the quantities to be so spreading is the process of super imposing lengths of fabric on a spreading table, cutting table or specially designed surface in preparation for the cutting process. Spreading may be done manually or by computer-controlled machines. Two aspects of spreading that affect spreading efficiency are the setup and actual lay out of fabric through the spreader and positioning the machine and related to equipment. The actual process of spreading involves laying out fabric in the desired number of layers.

One person or two, depending on the width and type of fabric, equipment and size of the spread, may lay up a spread. One person may work each side of the table in order to keep the fabric flat, smooth, and the tension free. With automatic spreading, the equipment controls the tension, fabric placement, and rate of travel.

3.2.3 Types of lay plan

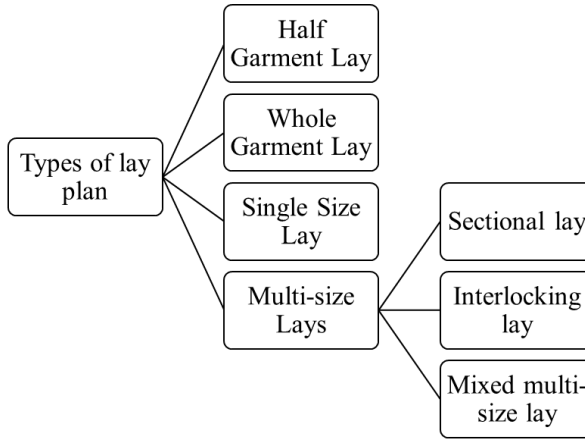

Figure.3.5 Types of layplan

Half Garment Lay: This includes only half of the garment pieces (for example the right side). They are used for folded or tubular fabrics and for fabrics, which are spread face to face.

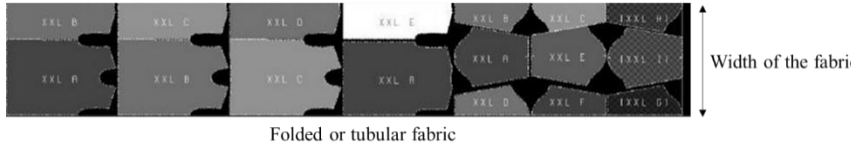

Figure.3.6 Half garment lay

Whole Garment Lay: All of the garment pieces, left and right sides are included in the lay. This type of lay is used for open width fabrics.

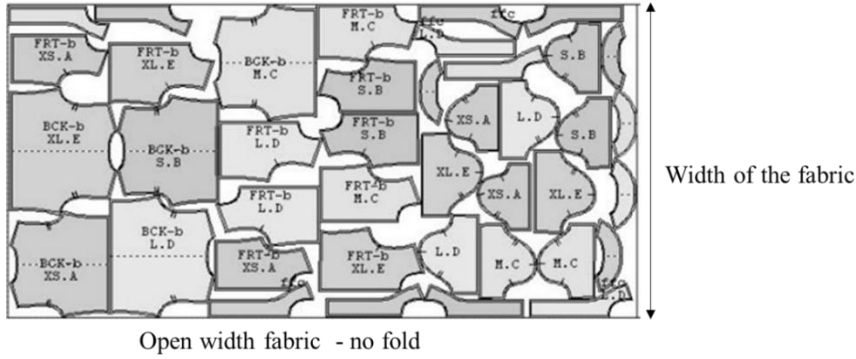

Figure.3.7 Whole garment lay

Single Size Lay: The lay includes all of the pieces for a single size. Restricting the lay to a single size makes order planning and laying up the fabric easier, but the disadvantage is a somewhat higher material consumption, compared to multi-size' pays.

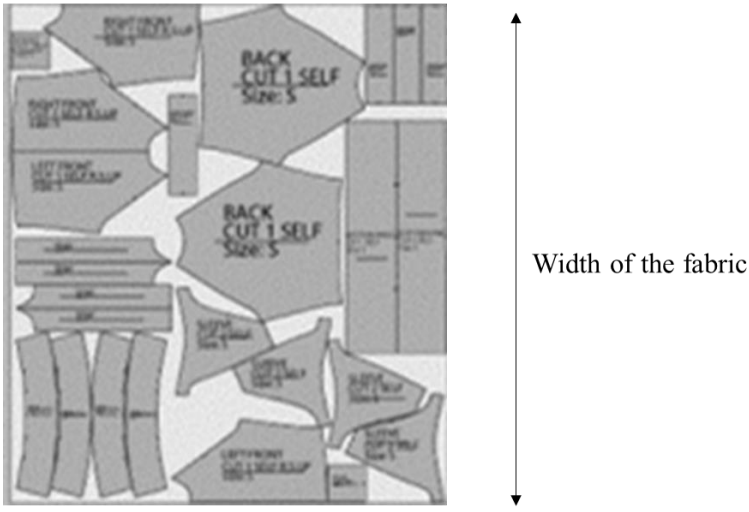

Figure.3.8. Single size lay

Multi-size Lays:

• Sectional lay:

The lay is made in at least two distinct rectangular sections. Each section contains all of the parts for a single size. Adjacent sections may be the same or a different size.

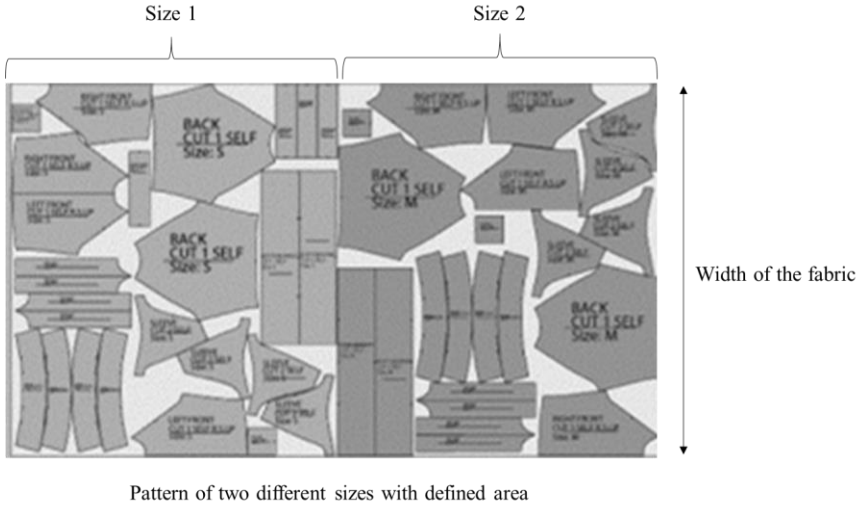

Figure.3.9. Multi size lay

• Interlocking lay:

Two or more sections, one after the other, usually different sizes, but the sections are not confined to strict rectangular areas; the pieces for the different sections may merge at the borders.

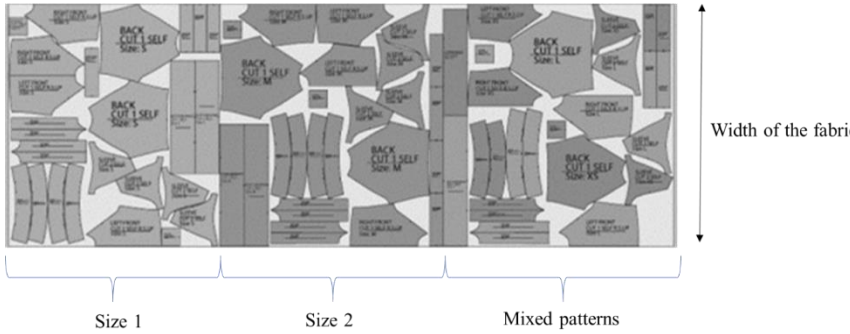

Figure.3.10. Interlocking lay

• Mixed multi-size lay:

In this case there are no distinct sections: the pieces for the two or more different garment sizes are intermingled. This is the arrangement, which normally gives the best material utilization.

Spreadingis the process of superimposing lengths of fabric on a spreading table, cutting table, or specially designed surface in preparation for the cutting process. A spread or lay-up is the total amount of fabric prepared for a single marker. A spread may consist of a single or multiple plies. The height of a lay-up or spread is limited by fabric characteristics size of the order to be cut, cutting method, and the vertical capacity of the spreader. The number off plies in a spread may range from 1 to 300.

Spreading may be done manually or by computer-controlled machines. One person or two, depending on the width and type of fabric, type of equipment, and size of spread, may be involved with the spreading process. Two people may be used for manual spreading unless the spread is very short. One person may work each side of the table in order to keep the fabric flat, smooth, and tension-free. With automatic spreading, the equipment controls the tension, fabric placement, and rate of travel. The spreading operator monitors the process and removes fabric flaws as needed.

3.2.4 Spreading Process

Two aspects of spreading that affect spreading efficiency are the setup and actual layout of fabric. Setup involves loading and threading fabric through the spreader and positioning the machine and related equipment. The actual process of spreading involves laying out fabric in the desired number of layers. Fabric may be spread face up, face down, or face-to-face.

3.2.5 Spreading Modes

A spreading mode is the manner in which fabric plies are laid out for cutting. The spreading mode is determined by the fabric characteristics, quality standards of the firm, and available equipment. Two fabric characteristics that determine the spreading mode are the direction of fabric and the direction of the fabric nap.

Direction of Fabric Face

The fabric face may be positioned in two ways: face-to-face (F/F) or with all plies facing-one-way (F/O/W), face up or face down. Face-to-face (F/F) spreading may be continuous as the spreader moves up and down the table. This is the fastest method of spreading, the least costly, and generally results in the lowest quality. With this method of spreading the face is up on one ply and down on the next ply as the spreader goes back and forth. Often symmetrical, non-directional fabrics are spread continuously, which places alternate plies face-to-face or back-to-back. Quality is affected because the operator is only able to monitor the face of fabric half the time.

F/O/W spreads, face up or down, are more time-consuming and expensive because fabric must be cut at each end of the spread and the new end repositioned. If a rotating turntable is used to turn the fabric roll 180 degrees at the end of each ply, the fabric can be spread from both ends of the table without a wasted trip. F/O/W spreading may be done with the fabric face up or face down. When the fabric faces up, the operator is able to monitor the face for flaws and imperfections as the fabric is being unrolled. This is particularly helpful when spreading prints. Pile fabrics, corduroy and velvet, are often spread face down, other high-quality fabrics are spread face up.

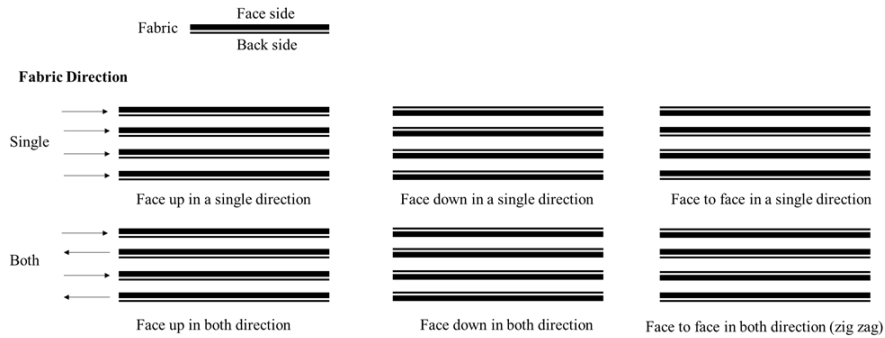

Figure.3.11. Spreading modes

Direction of Fabric Nap

A second consideration in selecting the spreading mode relates to the direction of the fabric nap. Placement of the nap may be nap-one-way (N/OW) or nap-up-and-down (N/U/D). Asymmetric and directional fabrics must have the nap running the same direction, nap-one-way (N/O/W). This spreading mode is the most time-consuming to lay-up but it generally produces the best quality. N/O/W fabrics may be spread F/F and F/O/W. if napped fabrics are to be positioned F/F the fabric needs to be cut and the roll turned at the end of each ply so the nap will lay in the same direction on facing plies. This is suitable for directional fabrics and to pair garment parts for the sewing operation. This is sometimes referred to as pair spreading.

Symmetric, non-directional fabrics allow flexibility for spreading. These fabrics can be spread with the nap running both up and down the spread. This spreading mode is called nap-up-and-down (N/U/D). This type of fabric may be spread face-to-face or face-one-way with the nap running up and down.

3.3 Spreading equipment

Basic spreading equipment consists of spreading surfaces, spreading machine, fabric control devices, and fabric cutting devices. Many firms operate productively with manually operated equipment, while other firms find the automated, high-tech equipment to be cost-effective for their operations. Cut precludes the use of a flat spread. The cut order plan details, the colours and ply lengths for a stepped spread if it is needed. Spreading it self can be a completely manual operation or can be performed by powered machines of various levels of technology. This is a preparatory operation for cutting and consists of laying piles of cloth one on top of the other in a predetermined direction and relation ship between the right and wrong side of the cloth. The composition of each spread, i.e. the number of piles of each colour is obtained from the cut order plan.

Basic spreading equipmentconsists of:

(i) Spreading surfaces,

(ii) Spreading machines,

(iii) Fabric control devices, and

(iv) Fabric cutting devices.

Many firms operate productively with manually operated equipment, while other firms find the automated, high-tech equipment to be cost-effective for their operations. Under-standing the parts and complexities of spreading equipment provides insight for troubleshooting problems and better preparation for the process.

3.3.1 Spreading Surfaces

The fabric type, spreading equipment, cutting method, cutting equipment and the company's quality standards determine the appropriate type of spreading surface. Spreading requires a flat, smooth surface. If the spreading surface doubles as a cutting surface, it also must be level. Spreading and cutting may be done on the same surface, but automated cutting often requires spreading and cutting to be done in adjacent but separate locations.

Spreading and cutting surfaces are available in standard widths that correspond to fabric width. Narrow fabric can be spread on a wider table. A spreading surface needs to be about 10 inches wider than the fabric. Spreading tables may have tracks or rails placed along one or both sides of a tabletop or just a few inches off the floor. This track helps guide and control the spreader as it moves up and down the length of the table. With some types of equipment, the table tracks are geared to synchronize the movement of the spreading machine with fabric unrolling, in order to regulate tension.

Spreading tables may also be very specialized for certain types of fabric and cutting equipment. Pin-tables have rows of pins located below the surface that can be extended through slats to hold fabric in a precise

location for accurate matching of pattern repeats. Vacuum tables are used to compress lay-up and prevent shifting or movement during cutting. A spread is covered with a plastic film that forms a seal over the lay-up when a vacuum is applied. A lay-up of quilted fabric can be compressed as much as 75 percent when the vacuum is used. This allows more plies in the lay-up and restricts the movement of slippery fabrics for more accurate cutting.

Cutting equipment may be moved to a lay-up as another lay-up is prepared further down the table, or fabric can be spread on one surface and then transferred to the cutting surface. Air flotation tables, when activated; allow easy movement of a lay-up onto an adjacent cutting area. A layer of air between the table surface and the bottom layer of paper reduces friction and allows a lay-up to be moved easily without putting stress on the fabric or the operators. Spreading tables with conveyorized surfaces carry the fabric to the cutting machine so that no time is wasted. Ideally one lay-up can be cut while is being spread. Conveyors may be used with computerized cutting systems, large die presses, and laser cutters.

3.3.2 Spreading Machines

The fundamental purpose of spreading machines is to superimpose layers of fabric in a smooth, tension-free manner for accurate and efficient cutting. Manually operated spreading machines can be as simple a roll bar mounted on four wheels that is pushed up and down a spreading table by an operator. Manual spreaders travel only as fast as an operator moves them, while some of the faster automated machines can spread 100-150 yards per minute. Spreading speed can only be utilized on long spreads with few defects. Spreading speed may affect productivity, quality, and cost of the operation, but it should not be the primary focus for purchase of new equipment. Manual spreading machines may be used by small firms as the primary spreading device and by large firms for short spreads. As spreading machines become more sophisticated, they are motor driven and have fabric control devices included increasing productivity, decreasing variability, and making spreading more cost-efficient.

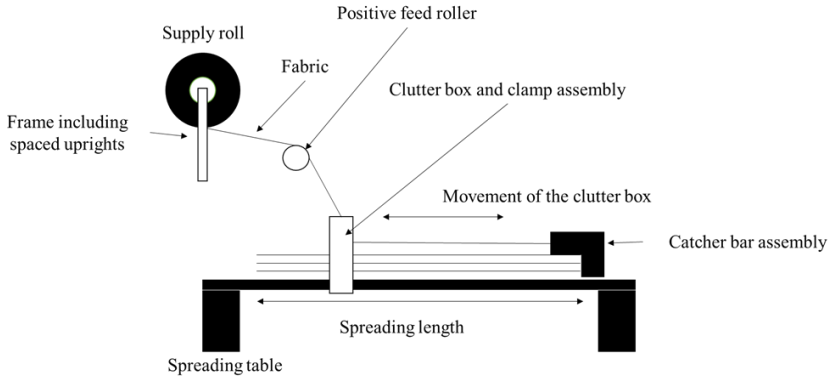

Figure.3.12.Automatic Spreading Machine with fabric control device

3.3.3 Fabric Control Devices

Fabric control devices are mechanisms that control fabric as it is carried up and down the table and unrolled by the spreading machine.These devices include:

(i) Tensioning mechanisms,

(ii) Positioning devices, and

(iii) End treatment systems.

(i) Tensioning involves synchronizing the rate of spreading with the rate fabric is unrolled. A positive feed system utilizes a covered roller that is driven and timed to the movement of the machine. It prevents the momentum of a large roll from continuing to unwind when the machine slows down or stops. Roller covers of different materials may be used to give better gripping power for different types and weights of fabric.

(ii) Positioning devices and sensors monitor position and control fabric placement during spreading. These devices improve the quality of a spread. Electronic edge sensors monitor selvages as fabric is spread. A deviation from the proposed alignment triggers a motor that shifts the roll

to the correct position. Alignment can be held to one-eighth inch tolerance with these devices.

(iii) Width indicators may sound an alarm to alert the operator whenever fabric becomes narrower than the established width. Width variations are analyzed to determine where in the marker they fall, whether the fabric will still fit the marker, or whether the variation should be treated as a defect and removed.

(iv) End treatment devices are used with spreaders but are separate and placed at the end of the spread. The specific end treatment equipment needed depends on whether the spreading mode is face-to-face or face-one-way. A face-to-face spread utilizes an end catcher and folding blade that work together. These are mechanical parts, mounted at opposite ends of the marker to catch and hold the fabric as the blade shapes and creases the fold. An overfeed device may be built into the spreading unit, which automatically feeds extra material when a fold is to be made. End treatments have a major impact on fabric waste. There must be enough fabric at the end of a lay to retain it in place, but any fabric beyond the end of the marker is wasted.

For F/O/W spreads, a knife box is needed along with an end catcher. A knife box contains a cutting unit (usually a small rotary knife) that operates in a track and cuts across the fabric width when engaged. With face-one-way spreads, each ply must be cut from the roll at the end of the marker. The catcher simply holds the fabric end in place for cutting. As multiple plies are spread, the fold blade and/or knife box must be elevated to the height of the top ply in order to fold or cut the fabric.

3.4 Cutting

The first stage in the manufacturing of garments is the cutting and for that pattern making is the base. Cutting is separating of the garment in to its components and in a general form it is the production process of separating (sectioning, curving, severing) a spread in to garment parts that are the precise size and shape of the pattern pieces on a marker. The cutting process may also involve transferring marks and notches from the garment

parts to assist operators in sewing, chopping or sectioning a spread in to blocks of pieces goods many precede precision cutting of individual pattern shapes. This is done to allow for accurate matching of fabric design or easier manufacturing of a cutting knife.

Fabric pieces may be cut to predetermined lengths for matching patterns or for additional processing such as screen-printing. Spreads of plaid fabrics may be pre-sectioned into blocks so the design of the fabric can be perfectly matched before cutting to the shape of the pattern piece. Pre-sectioned pieces may also be garment parts knitted to specific finished lengths such as sweater bodies. Pre-sectioned pieces such as leather or other specialty fabrics may be and cut as a single ply or laid up and cut as a multiple-ply spread. Cutting often is carried out in two stages: rough cutting (separating the individual pieces) and the final cutting (accurate cutting of the individual shapes). Different types of cutting tools have different degrees of precision.

3.4.1 Factors involved in Cutting

- Nature of fabric (grain line shade, twill etc.)
- Thickness of fabric.
- Design characteristics of finished garment.
- Machines and tables used.

Using the markers made from graded patterns and in accordance with the issue plan, fabrics are cut to prepare garment assembly. This is the major operation of the cutting room, of all of the operations in the cutting room this is the most decisive, because once the fabric has been cut, very little can be done to rectify serious mistakes.

3.4.2 Cutting Techniques

The marker is put on the layers of fabric with the conventional method, a skilled cutter follows the pattern outlined on the marker, using a strait – knife machine with a long, thin blade that vibrates vertically as it is pushed

through many layers of fabric. A vertical knife can cut to a depth of 9 inches. For only a few layers, a cutting machine with a rotating circular knife may be used. The cutter must select the correct speed and blade for each type of fabric. For example, a coarse blade edge is used for tightly woven fabrics and a smooth edge for softer fabrics.

The cutting tools (cutters) can be classified in to:

1. Portable cutters
2. Stationary cutters

3.5 Portable cutters

Powered scissorsthese are used for cutting one or two piles and are often used in the sample room.

Round knife this is very fast machine, excellent for cutting straight lines or gradual curves. Blade sizes range from 4cm to 20cm in diameter and the effective cutting height is about 40 percent of the blade diameter.

Straight knifethe workhouse of most cutting rooms, the straight knifes, if correctly used, is versatile and accurate enough for most purposes.

3.5.1 Portable Cutting Knives

An operator can move portable knives through a spread. There are two main types of portable knives: (i) vertical reciprocating straight knives and (ii) round knives. Structurally and mechanically the two types of machines share many similarities. Structurally, both types of knives have a base plate, power system, handle, cutting blade, sharpening device, and blade guard. Round knives operate with a one-way thrust as the circular blade makes contact with the fabric, and vertical knives cut with an up-and-down action. Circular cutters and straight knives are pushed by hand through the stationary material.

3.5.2 Round Knife Cutter:

Circular cutting tools use a rotating circular blade. The smallest devices (power shears) is used for cutting single ply lays and for cutting fabric plies to length during manual spreading. Depending on the size of the device it is possible to cut to a depth of about 10mm. The larger circular cutter is used mainly for dividing a lay into sections. It is suitable only for cutting in straight lines or very gradual curves, in depths of about 150mm.

3.5.3 Straight Knives:

A straight knife cutter has a vertical blade, which reciprocates up and down. It is capable of both coarse and precise cutting to a depth of about 300mm. Corners and curves can be cut accurately. Since all of the layers are cut at the same place (unlike a circular cutter), and provided that the knife is held vertical, then all of the pieces cut from a lay are identical.

Vertical straight knives with reciprocating blades are the most versatile and commonly used cutting devices. Reciprocating blades have a vertical cutting action. Blades vary in length from 6 to 14 inches. Blade length and the adjustable height of the blade guard are factors in determining the spread depth that can be cut. The 90-degree angle of the narrow, thin blade to the cutting surface makes this knife a good choice for accurately cutting sharp corners, angles, and curves. Vertical straight knife machines make only lateral cuts into a spread therefore cannot be used to cut out areas from the center of garment parts.

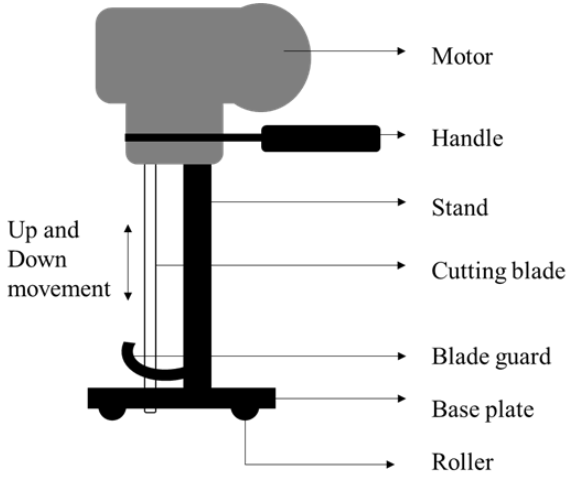

Figure.3.13. Straight knive cutting machine

3.5.4 Basic Components of Portable Knives

Blades are mounted in a vertical position at a 90-degree angle to the cutting surface. Blades vary in shape, size, cutting action, and fineness of the cutting edge. A straight blade contacts the spread at a 90-degree angle; assuming the blade and spread are kept vertical, all plies are cut at the same time. A rotary blade does not cut all plies evenly at the same time. A round blade contacts the spread at an angle; thus, the top ply is cut before the bottom ply.

(i) Knife bladescan have a major affect on the quality of the cut. Factors that affect the performance of a blade are the blade edge, surface texture of the blade, coarseness or fineness of the blade edge, and blade composition. Blade edges may be straight with a flat surface, saw-toothed, serrated, or wavy with a striated surface. Straightedge blades with a flat surface are general-purpose and the most widely used, while the other types are more specific to certain types of fabrics. Serrated blades are used to reduce heat buildup during cutting, wavy edges are used for plastics and vinyls, and saw-type blades are use for cutting canvas.

(ii) The Base Plateis the foundation that supports and helps balance the cutting mechanism. Bases vary in shape and size, depending on the size and weight of the knife it supports and the maneuverability needed. The base plate guides the knife in relation to the table surface and elevates the spread off the cutting table for contact with the blade. Bearing rollers to facilitate maneuverability and ease of movement supports base plates. Edges of the plate are sloped and the front curved to easily slide under the bottom ply and provide less fabric distortion and drag as it is maneuvered during cutting. The base plate helps maintain the position of the blade at a 90-degree pitch.

(iii) The Power Systemcontrols the motor and the potential cutting speed. The amount of power needed to cut a spread depends on the height of the spread and the density of the fabric to be cut. The horsepower of the motor determines the amount of thrust or cutting power of the blade. Higher speeds allow operators to move knives faster. Greater horsepower

increases machine power but it also may increase weight of the motor, which must be balanced by the blade housing and base plate. Larger, more powerful knives, which may weigh approximately 35 pounds, are often more cumbersome, heavier, and harder to manipulate and maneuver. Motors with variable speeds provide more versatility.

(iv) Sharpening Devicesappropriate for the specific blade type are found on almost all mechanized cutting equipment. Blades dull quickly when cutting deep spread or dense fabric. As a blade becomes dull, it creates friction and may cause rough, frayed, or fused edges. Sharpening devices may be stone or emery wheels or abrasive belt sharpeners. Cutting blades are sharpened frequently during the cutting operation simply by touching the control.

(v)Handle,all manually operated cutting devices have a handlefor the operator to grip, guide, and propel the knife through the spread. The operator's other hand is used to stabilize the plies ahead of the knife to prevent bunching of fabric.

(vi) A Blade Guard, when positioned at spread height, rests on the top ply to help stabilize the spread and to protect the operator's hand. Metal mesh gloves are available as a safety device for cutters using vertical knives.

3.6 Stationary Cutting Knives

Stationary cutters

Band knife – the narrow blade of this machine allows the finest of shapes to be cut very accurately.

Press cutting- this process involves the use of a hydraulic press which forces a shaped metal cutting die through a pile of material and is mostly used when large quantities of small components have to be cut very accurately. Press cutting is also often used for cutting many of the components for leather and suede garments.

Stationary cutters are those cutting machines that have blades or cutting devices that remain in a fixed position. The two basic types of stationary cutters are (i) Band knives and (ii) Die cutters. Operators must move the fabric or lay up to the machine and engage the cutting action.

3.6.1 Band Knives:

The band knife-cutting machine contains a narrow, sharpened, endless steel band moving vertically through the layers of fabric. The fabric layers are guided by hand against the blade. An air cushion will often be provided below the fabric layers to make it easier to guide the material. The plies may be stapled together to prevent slippage. Band knives are used for precision cutting to a depth of up to 300mm. Corners, tight curves and pointed incisions are cut precisely.

Band knives have fine blades that rotate through a slot in the cutting table while cutting. The operator positions, controls, and guides the fabric block around the knife. A band knife can be used to make only lateral cuts into a spread, as the operator must propel the fabric into the rotating blade. Band knives blades are finer and narrower than reciprocating blades, which make it easier to manipulate tight curves and intricate patterns. Band knives are more accurate than vertical knives when used to cut small blocks or shave small amounts off pre-cut blocks. Band knives are used to trim pre-cut blocks of small or midsize pieces. They would not be used for cutting a whole spread or large pieces because of having to manoeuvre the block around the blade.

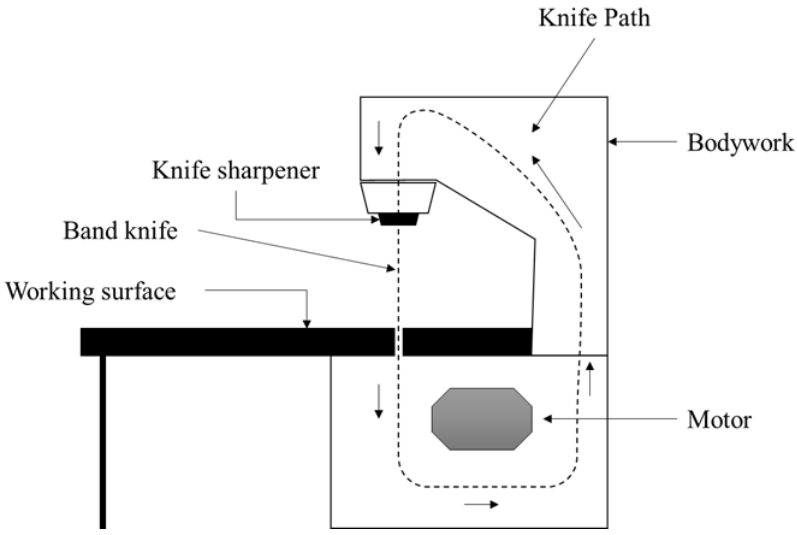

Figure. 3.14. Band knife cutting machine

3.6.2 Die Cutting:

Die cuttingmay be used for garments or parts of garments that do not change from season to season, such as a jeans pocket, pocket linings, interlinings and leather belts.

A die, a device that operates much like a cookie cutter, is made for each piece to be cut. The sharp edges of the die are pressed against the layers of fabric to cut them. A gang die can be made by connecting several dies together. Die cuttingis the most accurate means of cutting because each and every piece is cut to the exact same shape. Diesare pre-shaped metal outlines with one cutting edge. Die cutting involves use of a die to cut out a specific garment part or trim from a single piece or small block of fabric. The die-cutting operation involves placement of the fabric, positioning the die on the fabric, and engaging the machine to press the die into the fabric.

A die cutting machine is provided with prefabricated cutting tools, (cutting dies) having the exact shape of the garment pieces. Die cutters are used mainly for leather, coated and laminated materials and in areas where the same patterns are used over a long period e.g., production of working clothes. The dies are expensive to make. Dies are frequently used to cut

small pieces that require high accuracy, such as collars, pocket flaps, and appliqués. Leather goods are frequently die cut. Gloves with their fine detail are usually die cut as are shoes that require consistency of parts.

3.6.3 Servo Cutter:

The bridge between computer-controlled and manual cutting is the servo-cuttingsystem. This type of system has an overhead servo motor with adjustable speed and a suspension system that supports the knife perpendicular to the cutting table. This reduces problems with tilting the blade and in accurate cutting. The knife is mounted on a swivel arm, which is extended above the cutting table. It also has a small base plate and narrow blade guide for easier maneuvering by the operator. It can make tighter turns with less distortion in the lay. It combines vertical cutting and band knife cutting into one machine. This type of system enables the operator to cut deeper spreads with greater accuracy than with a freestanding straight knife and for a lesser investment than computerized cutting.

3.7 Automated, Numerically Controlled Cutting Systems

The four types of automated cutting systems are blade cutting ,water jet cutting, and plasma jet cutting .Electronic microchips control the cutting device , travel pattern, and speed. Computer-generated markers are stored and used to guide the operation of the cutting head. The input for this operation comes from the markers generated on computerized marker planning systems. The marker date is transferred to the cutting unit by means of tapes, floppy disks, or directly from the marker planning system itself. Computerized cutting is six to eight times faster than any manual method and products cut components with a consistent level of accuracy although a computerized cutting system requires a substantial initial investment, it is considered to be the most effective investment for large-scale cutting production.

3.7.1 Automatic blade cutting

Automatic blade cutting is the most highly developed and widely used computerized cutting system. Numerically controlled knives cut multiple plies with great accuracy and speed. Paper markers are not needed for numerically controlled cutters. Operators communicate directly with the main control unit through a command console micro processing unit with a keyboard. Easy data entry and instant communication with the main control unit allow technicians to pre-program multi-step commands, set parameters, and start the process with a single keystroke.

The central control unit operates the components of the system such as the cutting head, cutter carriage, knife sharpening, and conveyorized cutting table. A cutting head is a sophisticated mechanical component with the capacity to cut, mark, and drill as dictated by the computer. Automatic knife sharpening is done at preset intervals during the cutting operation. The cutter carriage moves the cutting head and provides lengthwise and crosswise motion during the cutting operation. The reciprocating blade can be adjusted to the height of the spread and density of the fabric. Knife speed automatically adjusts to the forward speed of the cutting head. As the cutting head slows for corners, curves, or notches, the reciprocating blade also slows to reduce heat and possible fusing. Most reciprocating knife systems use a vacuum to hold down the fabric. Placement of plastic film over a spread helps compress the fabric into a firm stationary lay-up when the vacuum is applies. The effect of the vacuum is to reduce the height of the spread and eliminate fabric movement during cutting. An intensified vacuum force is automatically applied to the area directly under the knife to further restrict material shifting

3.7.2 Laser cutting

Laser cutting focuses a powerful beam of light projected on to a minute area to cut fabric by vaporization. The fine, V-shaped beam is only 0.004 of an inch. The beam cuts without pressure on the fabric, which is a major advantage for some types of fabric. The fabric remains immobile during the cutting operation. Lasers cut with incredible speed (twice that of

automatic knife cutting), accuracy, and multi-directional ability, but with some heat emission. Laser-cut edges are sharp and clean. The heat produced tends to seal fabric edges, which can be an advantage for fabric that ravels and a disadvantage for cutting multiple plies as edges may fuse together. Laser-cut garment parts are easier to assemble, as they are consistent in size with smooth sharp edges to align. Laser- beam cutting is sometimes used for men's suits, which are cut a single layer at a time. The laser, a concentrated light beam is also directed by a computer.

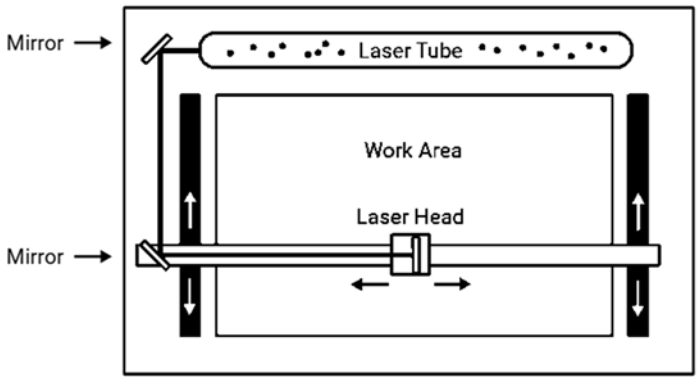

Figure.3.15. Laser cutting machine

3.7.3 Water jet cutting

Water jet cutting is another computer operated, multi directional method that has limited usage at this time. Water jet cutting is performed by propelling a tiny jet of water (0.001-0.0015 inch) through the fabric at very high pressure (70,000 psi). The forward edge of the jet stream shears the fabric as it moves along the cutting line but does not wet the fabric, generate airborne contaminant, or exert an appreciable force on the material. The water jet will cut multiple plies without fusing, but it may fray and tangle the yarns of some fabrics, which make it difficult to separate the plies. It is used when heat build up must be avoided and water absorption is not important. Water-jet cutting is being used for some fabrics and leathers, especially in the shoe industry.

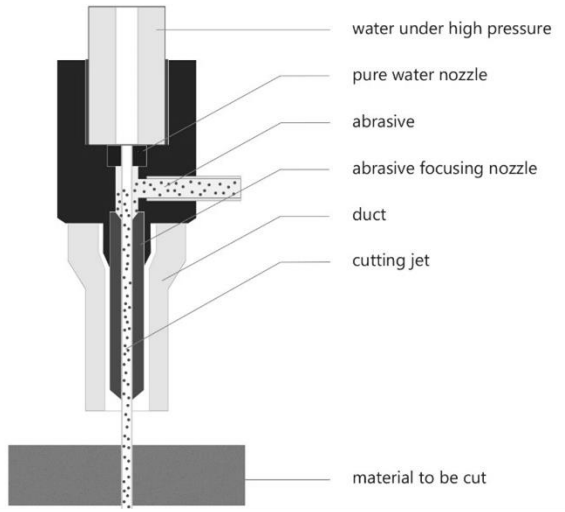

Figure.3.16. Waterjet cutting machine

3.7.4 Plasma Jet Cutting

Plasma Jet Cuttingis a computer-operated, high-speed, single-ply cutting device that offers many of the same features of a laser cutter but at a lower price. Along with the plasma jet cutting system, Investronica has developed a Matching System for automatic matching and cutting of striped, checked, or printed fabric. A television camera reads the fabric on the conveyor, and a digital image processor decides the best way to match and layout the pattern pieces based on determined matching rules. Matches can be made among different prints, selvages, and fabric characteristics. This system eliminates re-cutting parts for more precise matching.

3.8 Transferring Marks and notches

Marks and notches are transferred from markers to the perimeter or internal surfaces of garment parts to facilitate the sewing operation. Operators depend on marks for alignment, placement of parts, special treatment during the assembly process. When using operator-controlled cutting equipment, it is the cutter's responsibility to transfer the marks

accurately to the cut garment parts. Computer-controlled cutters mark garment parts during the cutting process. Marks should not damage or discolor the visible parts of a garment. This is especially true with internal marks, but edge marks if incorrectly done can also cause seam damage. Marks must be accurately placed and readily visible for sewing operators until the specific sewing operation requiring the mark is completed.

(i) Edge marks are made in a variety of ways, but a vertical straight knife or a hot notcher is commonly used. A small lateral cut into the lay with a straight knife is best suited to firm, smooth materials that do not ravel easily. This method of marking requires a perfectly vertical lay with no sloping, otherwise some pieces will be marked too deep, while others will not be marked at all.

(ii) A hot notcheris a hand-held device with a vertical electrical element that scorches fabric at the point of contact. Temperature and notch depth are adjustable for the fabric. A hot notcher is a good choice for edge marks on natural fiber and knit fabrics as it makes clearly visible marks that do not disappear. When used properly, it does not cut, pucker, or ravel the fabric. It is not a good choice for thermoplastic fibers.

(iii) Internal marksare needed for alignment and positioning pieces such as pockets, overlays, and appliqués. Drills are used to mark an entire lay-up at one time. A drill is positioned on top of a lay-up. A motor rotates the needle, which penetrates the top ply and drills its way through to the bottom ply. Penetration is made by needles of varied diameter (3/64 to 3/8 inch) and point types. Some points actually cut a hole in the fabric which is easy for operator to locate but can cause problems in finished garments. Other types of drills carry a marking fluid or wax substance that will disappear in pressing. In some cases hot needles are used for marking.

Firms that choose not to use drills for fear of damaging fabric may use mechanical thread-marking machines. These are slower but not as hard on the fabric or as messy. Another alternative is marking individual pieces or garments with a template and wax pen. This is the most time-consuming approach but it may be the most accurate.

Offloading – Bundling and Ticketing:

After cutting, garment parts must be prepared for the sewing operation. Offloading is the process of removing cut parts from the cutting table, counting, ticketing and grouping them. The method and sequence this follows depends on the production system, how the materials are to be transported to the sewing facility, and any additional operations that may be completed in the cutting room

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4. Garment Assembly Process

Abstract: The Chapter 4 discusses the assembly and joining technology of fabrics adopted in garment industry. It eloboartley disucusses the fusing materials and its requirements. It also gives an idea about sewing techniques in garment making in terms of stitches and seams, sewing equipments.

Key words: Fusing, stitch, seam, sewing

4.1 Fusing technology

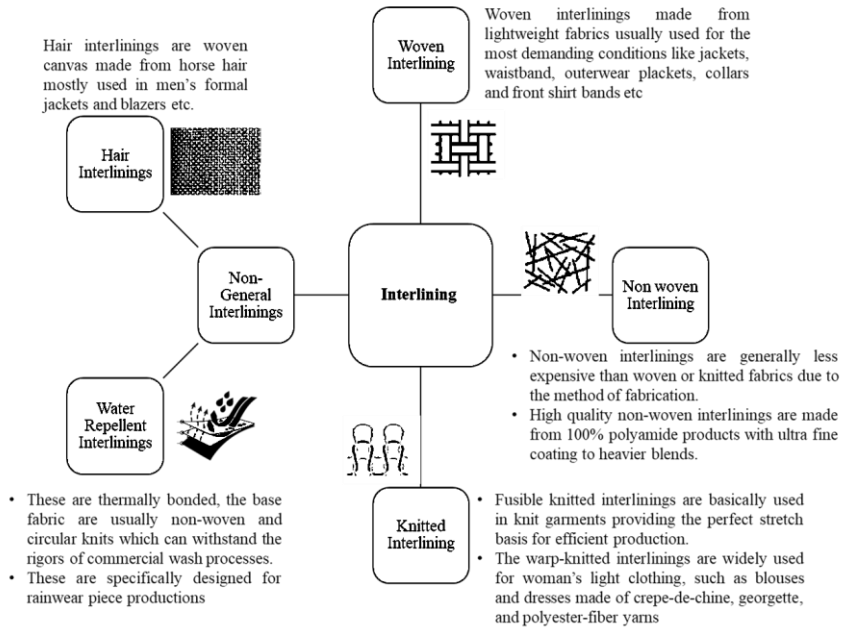


Figure.4.1. Types of interlinings based on material

The most important area of garment construction where an alternative process has significantly taken over from sewing is in the attachment of interlinings. When interlinings are sewn in, it can be difficult on parts such as collars to avoid a wrinkling of the interlining inside the collar and pucker around the edge. On large parts such as jacket fronts, the attachment of interlinings by sewing is expensive and requires a skill if a high standard is to be achieved. The alternative process, which has been developed is that of fusing, where by the interlining is bonded to the outer fabric by means of a thermoplastic resin. The interlinings are can be classified into four types on the basis of material which is shown in the figure 4.1.

The term fusible interlining is used to describe a base fabric coated on one side with a thermoplastic adhesive resin, which can be bonded to another fabric by the controlled application of heat and pressure. These materials, generally called fusible, provide the designer with a number of properties which can enhance the appearance of finished garments by the followings:

- Control and stabilization of critical areas.
- Reinforcement of specific design features.
- Minimum of modification to the “handle “of the top cloth.
- Preservation of a crisp and fresh look.

Advantages of using fusible interlinings:

In most cases the use of fusible interlinings shortens manufacturing time with a consequent reduction in direct labour cost.

There is a reduction in the skill required in many operators involving fusing compared with the sewing in of interlinings and this leads to a reduction in training time.

It is easier to achieve consistent quality in the lamination process than it is with many of operations of sewing in of interlinings.

Fusible interlinings provide opportunities for alternative methods of garment construction.

4.1.1 Requirements of fusing

The laminate produced by fusing should show the aesthetic qualities required by the designer in the finished garment.

The strength of bond of the laminate must be sufficient to withstand handling during subsequent operations in the garment manufacturing process as well as the flexing which takes place in wear.

Fusing must takes place without either strike-through or strike back occurring. When the softened adhesive resin is pressed into the garment fabric, it is important that it does not go right through to the face side of that fabric, and that it does not go back to the outside of the interlining base cloth.

The fusing process must not cause thermal shrinkage in the outer fabric. Fusing commonly takes place at around 150 oc and at this temperature many fabrics may subject to thermal shrinkage.

A further possible effect of the heat of the fusing process is that of dye sublimation. Fabrics may change colour to a level, which is unacceptable and in a way which causes a miss-match between the fused and unfused parts of the garment. Since the fusing process involves pressure, there is a risk that pile fabrics may be subject to crushing during fusing. Where shower proof fabrics are fused, there is a possibility that the presence of a fused interlining in the garment may wick water through the fabric in the fused areas while the unfused areas remain satisfactorily shower proofed. Water resistant interlinings have been developed for these situations.

4.1.2 Fusing process

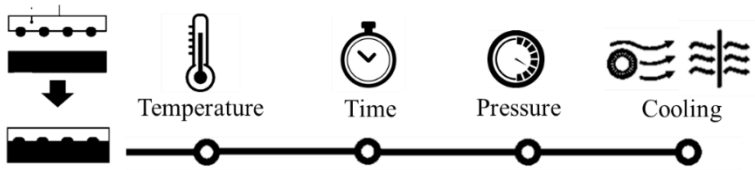


Figure. 4.2. Factors affecting fusing process

Regardless of which fusible and machine are used, fusing is controlled by four processing components (figure.4.2):

1. Temperature
2. Time
3. Pressure and
4. Cooling

Temperature: There is a limited range of temperatures that are effective for each type of resin. Too high a temperature causes the resin to become too viscous, which could result in the resin being forced through to the right side of the cloth

Time: the only time element of any value during the fusing process is when the top cloth and fusible are under pressure in the heating zone of the machine. This time cycle for a particular fusible is determined by:

Whether the fusible has a high –or low melt resin

If a high or heavy substrate is being used.

The nature of the top cloth being used, thick or thin, dense or open.

Pressure: when the resin is viscous, pressure is applied to the top cloth and fusible assembly to ensure that:

Full contact is made between the top cloth and fusible

Heat transfer is at the optimum level.

There is an even penetration of the viscous resin into the fibres of the top cloth.

Cooling: Enforced cooling is used so that the fused assemblies can be handled immediately after fusing. Cooling can be induced by various systems. Including water-cooled plates, compressed air circulation and vacuum.

4.1.3 Properties of fused laminate

In addition to the outer fabric of the garment, three factors determine the properties of the fused laminate:

1. The base fabric of the interlining: Base fabrics are available in the woven fabric and non-woven constructions described for sew-in interlinings and also as warp knits. The warp knits are either a lock knit or weft insert construction.

2. The type of fusible resin: the choice of resin is restricted by limits imposed by the outer fabric, the fusing equipment to be fused, the end use requirements, and the precise behaviour of the resins in response to heat. The resins used are mostly chemicals whose names will be familiar from other uses. The following are resins:

- Polyethylene
- Polypropylene
- Polyamide
- Polyesters
- Polyvinyl chloride (PVC)

3. Method of applying resins to base cloths: There is further scope for varying the properties of an interlining and its effect on the outer fabric of a garment by varying the applications of the resin to the base cloth.

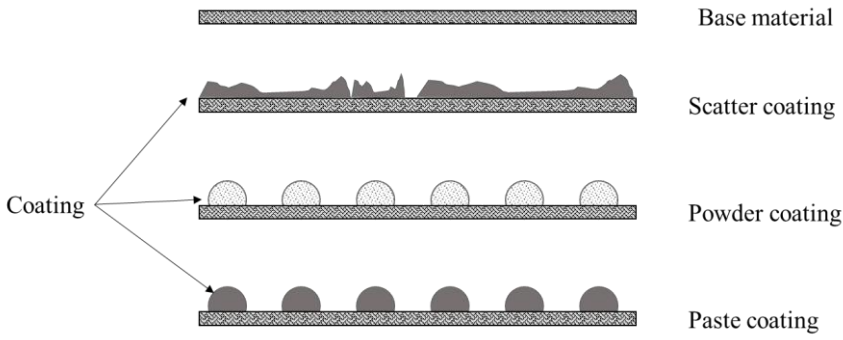


Figure.4.3. Coating method

The most popular methods (Figure.4.3) used are:

Scatter coating: specially designed scattering heads are used to provide an even scatter under automatic control. The resin is then softened in an oven, pressed onto the base cloth and cooled.

Dry dot printing: The powdered resin fills engraved holes on a roller. The base cloth passes over a heated roller and then against the engraved roller. The powdered resin adheres to the cloth in the form of dots. Oven heating follows the printing operation to ensure permanent adhesion. The temperature and pressure on the two rollers is varied for different resin types. Patterns of dots can vary from 3 to 12 dots per cm according to the garment manufacturer's requirements.

Paste coating: Fine resin powders are blended with water and other agents to form a smooth paste and are printed onto the base cloth. Heat removes the water and the dots coalesce into solid resin. This type of coating gives precisely shaped dots and is used to produce the finer dots used in shirt collar fusible.

4.1.4 Fusing equipment

The equipment used for fusing can be divided into:

Specialized fusing presses: A number of different types of fusing press have been developed over the years, providing control of the heat and pressure applied to the garment part and providing for fusing to takes place on flat sections of garments that have not yet been sewn. In many companies, such fusing presses are sited in the cutting room and the fusing operation takes place before transferring the garments to the sewing room. Fusing presses vary in the way they operate and these differences affect both the quality of the fusing and productivity of the operation.

i) Flat bed-fusing press:Figure 4.4 shows the principle of operation of this type of fusing press. It consists of two horizontal metal platens between which the fabric and interlining laminate are sandwiched. In the simplest mode of operation, the operator places the garment part face down on the lower platen places, the interlining resin side down on the top of it in the correct position, and closes the press.

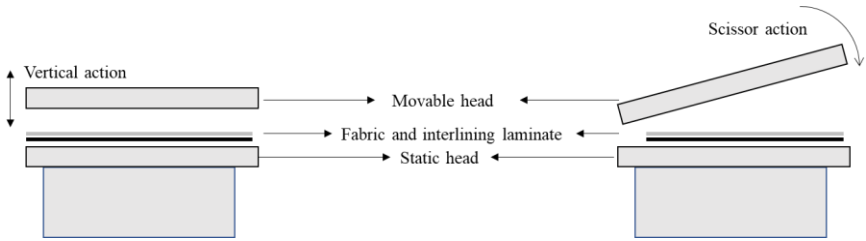


Figure.4.4 Flatbed fusing machine

ii) Continuous fusing systems:

The figure 4.5 shows the systems operate by passing the garment or fabric part, with its interlining placed on it, past a heat source and, either simultaneously or subsequently, applying pressure. Heat is provided in one of three ways:

With direct heating, the conveyor belt carries the components to be fused into direct contact with a heated surface, either a drum or curved plates.

With indirect heating, the components are carried through a heated chamber.

With low temperature, gradient heating, the components are carried through a pre-heating zone. Heating is either direct or indirect. With this approach the temperature reached at the glue line is only just above that required to make the resin a viscous fluid and in some cases fusing takes place satisfactorily with a glue line temperature of only 120 oC. This reduces the possibility of heat shrinkage in the outer fabric and is a feature of some of the most recent fusing presses.

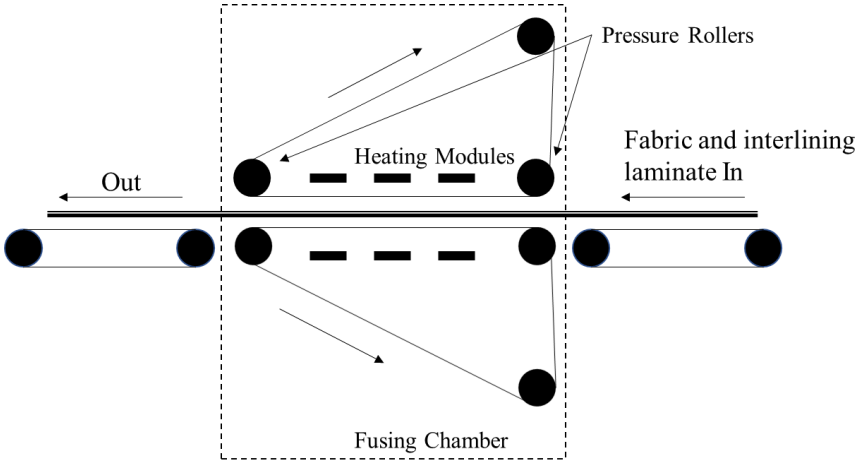


Figure. 4.5 Continuous fusing press

iii) High frequency fusing: In the fusing press described so far, heat has been provided by electric heating elements. This limits the number of thickness of fabric, which can be fused at once because of the time taken for the heat to transfer through the fabric to the resin. If multiple layers of fabric and interlining could be stacked up and fused simultaneously, productivity might be increased. Over a number of years, attempts have been made to do this by generating heat by means of high frequency energy, in the same way as in a microwave cooker.

Hand iron: Only those interlinings which can be fused at relatively low temperatures, low pressures and in relatively short times are at all suitable for fusing by hand iron. There are a number of difficulties. The operator cannot know the temperature at the glue line and cannot apply pressure uniformly. The operator estimates the time subsequently. Only small parts can be fused with any degree of success ,and then only by pressing the iron for a fixed time onto the fusible ,covering the area step by step and using steam to help the heat transfer.

Steam press: In this case fusing takes place on presses of the type used for intermediate and final pressing of made up garments. Temperature at the glue line is achieved by steam from the head of the press .The temperature reached depends on the steam pressure at the press head, the efficiency of the press and its cladding. Pressure is provided mechanically or pneumatically by closing the press head on the buck. Vacuum in the lower part of the press, or buck, assists rapid cooling.

4.1.5 Methods of fusing

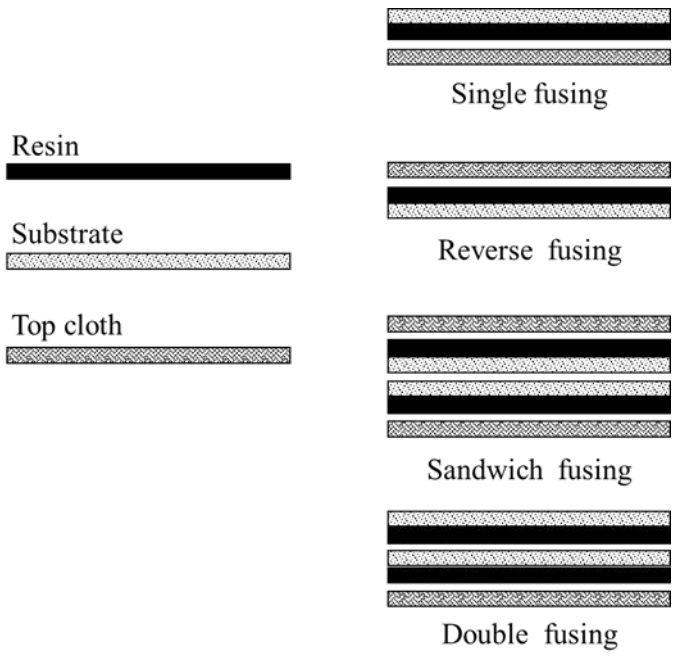


Figure. 4.6. Method of fusing

All the descriptions of the fusing processes that have been included so far ,have represented it as a single piece of interlining, laid resin side down ,on a single piece of garment fabric, laid right side down. This is referred to as single fusing and it is the safest in the sense that it is easiest to set the press conditions to achieve the correct temperature at the glue line. Some of the variations will now be described and illustrating them will demonstrate some of the method of garment construction that involves fusible interlinings. The main variations are:

- Reserve fusing
- Sandwich fusing
- Double fusing

Reserve fusing:

In this method the outer fabric lies on top of the fusible. It is sometimes used in fusing shirt and blouse collars. On flat bed presses with elements only in the top platen, it is necessary to adjust temperature settings.

Sandwich fusing:

This is effectively carried out only on a horizontal continuous press where heat is applied both from above and below. Two pairs of components, forming two laminates, are fused together, with the two outer fabrics on the outside of the sandwich (of four layers) and the two interlinings on the inside. With correct temperature settings, the glue line temperature may be achieved in both laminates but the potential for strike-back occurring and causing all the layers to adhere together is considerable.

Double Fusing:

This is the fusing of two sorts of interlining to the outer fabric in one operation. It is most commonly used in shirt collars and men's jacket fronts.

4.2 Sewing technology

The dominant process in garment assembly is sewing, still the best way of achieving both strength and flexibility in the seam itself as well as of manufacturing method. In every sector of the clothing industry, sewing operations are performed by a great variety of machines, each of which has the capability for specific operations on a particular category of garments and / or fabric. This wide choice of sewing machinery is also matched by those for sewing threads, needles, and other auxiliary components.

4.2.1 Stitches and seams

Stitches and seams are the basic elements of sewing, and national and international standard have been developed for accurately classifying them as follows.

Stitches:

There is a need for stitches, which join and stitches which neaten, for machines with more than one needle and for stitches which form a covering layer over the fabric. The basic classes of stitch in British 3870 are :

Class 100 (Chain stitches): These are chain stitches formed a needle thread only and they are typically used for basting, felling and blind stitching.

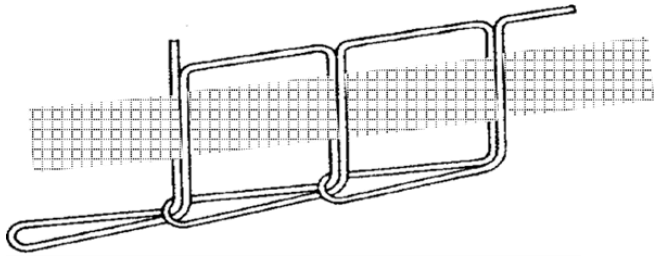


Figure. 4.7. Class 100 chain stiches

Class 200 (Stitches originating from hand stitching): Originally hand stitches; these are mostly formed by single threads passed from one side of the material to the other with each successive penetration of the needle. Various classes of these stitches are used for saddle stitching and the prick stitching of edges.

Class 300:These are also referred to as lock stitches because the top and under groups of threads are interlaced to form the stitch. The most widely used stitch formation in this class is Type 301- figure below, which is produced by a regular sewing machine.

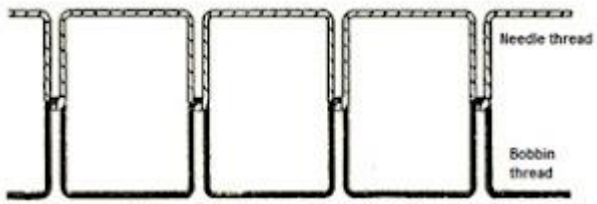


Figure. 4.8. Class 300 Lock stitch

The lockstitch uses two threads, an upper and a lower. The upper thread runs from a spool kept on a spindle on top of or next to the machine, through a tension mechanism and a retracting arm, and finally through the hole in the needle. The lower thread is wound onto a bobbin, which is inserted into a case in the lower section of the machine. To make one stitch, the machine lowers the needle through the cloth into the lower section, where a hook catches the upper thread at the point just before it goes through the needle. The hook mechanism loops the upper thread entirely around the bobbin case, so that it has made one wrap of the bobbin thread.

Then the retracting arm pulls the excess upper thread back to the top of the machine, the needle is pulled out of the cloth, and the feed dogs pull the cloth back one stitch length.

Lockstitch is so named because the two threads, upper and lower, "lock" together in the hole in the fabric through which they pass. The term single needle stitching, often found on dress shirt labels, refers to lockstitch, as opposed to chain stitch which unravels easily and is usually used on lower quality garments.

Class 400 (multi thread chain stitch): formed by two or more groups of threads, the loops of which are interlaced and interloped, stitch no 401 figure below is a chain stitch formed from two threads and is widely used for knitted materials because the stitch formation makes for good extensibility and lateral strength.

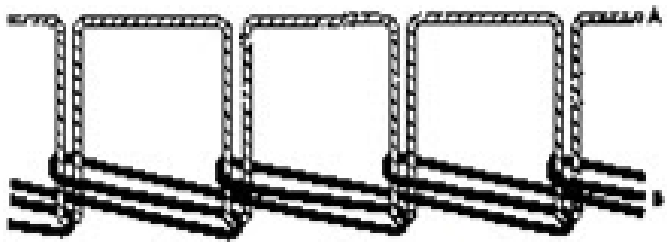


Figure. 4.9. Class 400 Multi thread Chain stitch

Class 500 (Over edge chain stitch): These are known as over edge stitches because at least one group of threads covers the edge of the material In this class, stitch Type 504 is a three-thread over locking stitch used for assembling lightweight knits and also for cleaning and finishing seam and hem edges of garments.

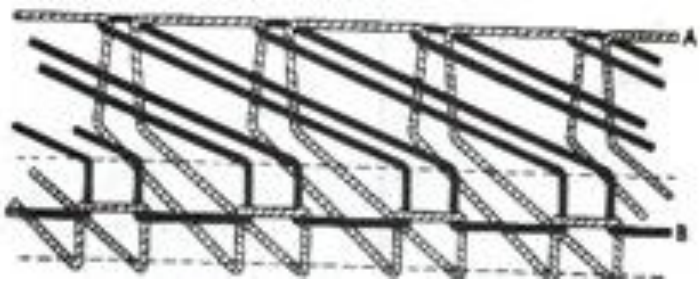


Figure. 4.10. Class 500 Over edge chain stitch

Formation of an Overlock Stitch

When the needle enters the fabric, a loop is formed in the thread at the back of the needle. As the needle continues its downward motion into the fabric, the lower looper begins its movement from left to right. The tip of the lower looper passes behind the needle and through the loop of thread that has formed behind the needle. The lower looper continues along its path moving toward the right of the serger. As it moves, the lower thread is carried through the needle thread. While the lower looper is moving from left to right, the upper looper advances from right to left. The tip of the upper looper passes behind the lower looper and picks up the lower looper thread and needle thread. The lower looper now begins its move back into the far left position. As the upper looper continues to the left, it holds the lower looper thread and needle thread in place. The needle again begins its downward path passing behind the upper looper and securing the upper looper thread. This completes the overlock stitch formation and begins the stitch cycle all over again.

Usages of Overlock Stitch

Overlock stitches are typically used for: 1-thread: End-to-end seaming of piece goods for textile finishing.

2-thread Overlock stitches: Finishing seam edges, stitching flatlock seams, stitching elastic and lace to lingerie, and hemming.

3-thread Overlock stitches: Sewing pintucks, creating narrow rolled hems, finishing fabric edges, Decorative edging, and seaming knit or woven fabrics.

4-thread Overlock stitches: Decorative edging and finishing, seaming high-stress areas.

5-thread Overlock stitches: Seam construction in apparel manufacturing.

Though overlock stitches are traditionally used for edging and light seaming, merrow has explored many unique and surprising applications for overlock stitches and has designed machines to fit these applications.

Some examples of applications are:

- Sewing Netting
- Butt-seaming
- Edging emblems
- Purl Stitching
- Decorative edging

Class 600 (Covering chain stitch): There are many complex stitch formations in this class because the stitches can be formed from three to nine threads and the use of up to four needles.

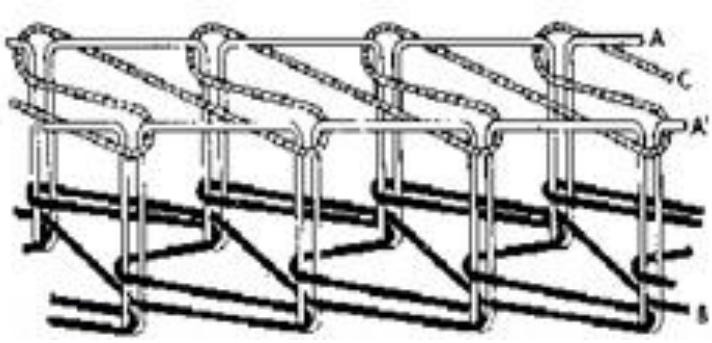


Figure. 4.11. Class 600 Covering chain stitch

Class 700: This is a single thread lock stitch like the 300 classes, which has very limited applications because of its inherent weakness.

4.2.2 Seams

It is necessary to define the term seam at early stage in any discussion because its applications are broader than is generally realized. A seam is a joint between two pieces of fabric. British standard 3870: 1991 classifies seam constructions under eight headings. Performance of seams means the achievement of strength, elasticity, durability, security and comfort, and maintenance of any specialized fabric properties such as waterproofing or flameproofing. Seams must be as strong as the fabric, in directions both parallel to and at right angles to the seam. They must also stretch and recover with the fabric.

Seam types:The choice of seam type is determined by aesthetic standards, strength, durability, comfort in wear, convenience in assembly in relation to the machinery available, and cost. Typical examples are given here with diagrams.

Class 1- Superimposed:

This seam is constructed with a minimum of two components and is the most widely used seam construction in this class. Among others, safety stitch and French seam are covered by this class.

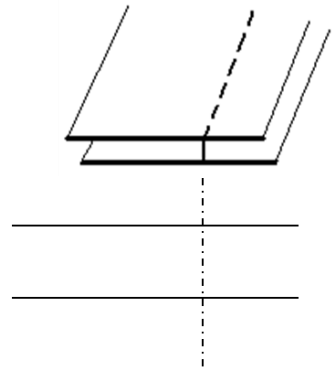


Figure. 4.12. Superimposed seam

Class 2- Lapped seam:

The simplest seam type in this class is formed by lapping two pieces of materials as shown in figure below. The best example of this class is

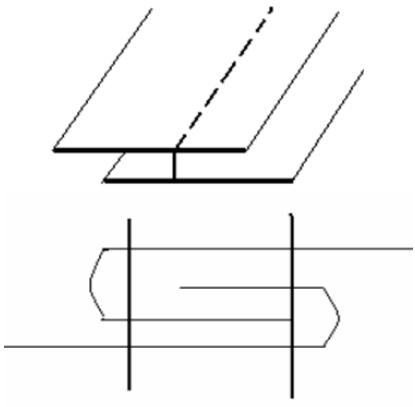


Figure. 4.13. Lapped seam

The lapped seam construction used for many denim articles and for certain types of blouses and shirts.

Class 3 - Bound seam:

In this class, the seam consists of an edge of material, which is bound by another, with the possibility of other components inserted into the binding. It is used for constructing a decorative edge binding from self or other material such as tape.

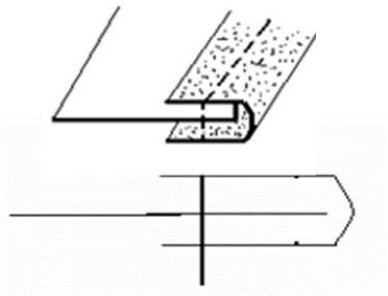


Figure. 4.14. Bound seam

Class 4- Flat seams :

In this class, seams are referred to as flat seams because the fabric edges do not over lap ,butt are 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 needles on both sides of the fabric. 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 under wear.

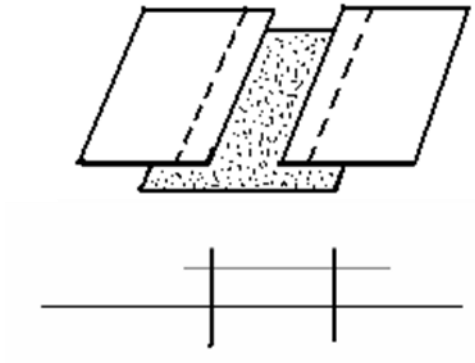


Figure. 4.15. Flat seam

Class 5 - Decorative:

The main use of this seam is for decorative sewing on garments where single or multiple rows of stitches are sewn through one or more layers of fabric. These several layers can be folds of the same fabric. This construction consists of a row or rows of stitches sewn through one or more plies of fabric. The channel seam shown in figure is representative of this class.

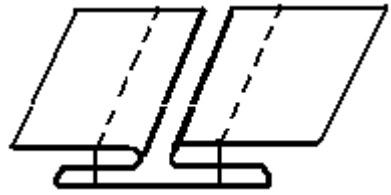


Figure. 4.16. Decorative seam

Class 6 - 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. This could refer to the over locked edge of a single ply or to the single turned over locked hem of a blouse.

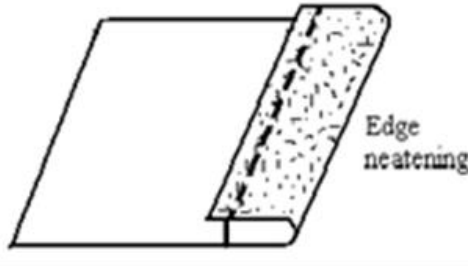


Figure. 4.17. Edge neatening seam

Class 7:

Seams in this class relate to the addition of separate items to the edge of a garment part. They are similar to the applied seam except that the added component has a definite edge on both sides. Examples would be a band of lace attached to the lower edge of a slip, elastic braid on the edge of a bra and inserted elastic on the leg of a swimsuit.

Class 8:

The final seam class is another where only one piece of material need be involved in constructing the seam .The commonest seam type in this class is the belt loop as used on jeans, raincoats, etc.

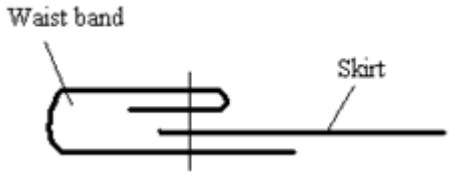


Figure. 4.18. Class 8 seam

4.3 Components of sewing

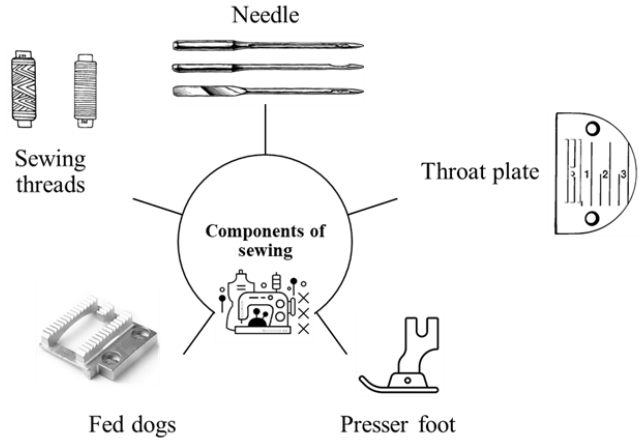


Figure. 4.19. Components of sewing

Irrespective of type of sewing machine, all sewing machines function in a similar way and the best example for illustrating these elements is the regular sewing machine. There are five basic components of sewing:

1. Needle
2. Throat plate
3. Presser foot
4. Fed dogs
5. Sewing threads

1. Needles:

Needles have been used for hand sewing since about 1800 BC and were originally made from ivory, bone, wood and horn. During 15th century iron needles were introduced for hand sewing, and in 1800 Balthasar Krems of Germany was the first to use a needle with the eye near the point

for a chain-stitch machine he had developed. The large scale production of sewing machines started about 1840 and this was paralleled by numerous developments in the manufacture and quality of machine needles. The correct selection of needle type and size to suit the sewing thread and the fabric that is being sewn, results in a more satisfactory stitch. The selection of needle is also done based on its tip or point profile – a sharp pointed needle is called as set point needle and blunt and rounded point needle is called ball point needle. Usually ballpoint needles are selected for knitted fabrics. Fine fabrics should be sewn with a fine needle size 11, medium fabrics size 14 and heavy fabrics size 16 or 18.

The functions of sewing machine needle are to form a passage in the material through which the needle thread can wholly or partially pass and form a loop which can be picked up by the looper or hook mechanisms. Needles are formed in straight or curved forms. The following are the parts of needle.

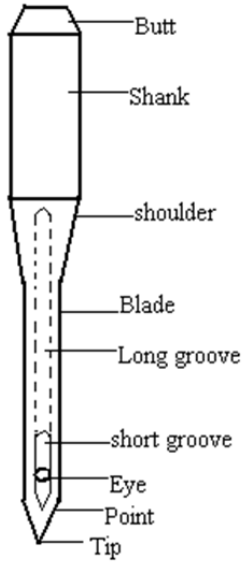


Figure. 4.20. Sewing machine needle

Butt:the truncated conical shape at the top of the needle which facilitates its insertion into the needle bar or clamp.

Shank: usually larger in diameter than the rest of the needle, the shank can be cylindrical in shape or flat on one side, depending on the method used to secure the needle in or on the needle bar.

Shoulder: the section joining the shank to the blade.

Blade: the longest section of the needle, this runs from the shoulder to the eye.

Grooves: on one side of the needle there is a long groove, which protects the needle thread as it enters and is with drawn from the fabric. There is a short groove on the opposite side, which extends a short distance above and below the eye and its purpose is to aid the passage of thread into the material and loop formation.

Eye: an elliptical hole between the two grooves, the shape and finish of the inside top of the eye are important factors in the prevention of thread damage during sewing.

Point: this is shaped to provide the best to provide the best penetration of the material being sewn.

Tip: the tip, when combined with the point determines the ease and extent of penetration into the fabric.

2. Throat plate:

The throat plate is a static component, which has slots for the fed dogs, and one or more holes for needles or a slot for sewing –needle machines such as a zigzag. The upper surface of the throat plate is highly polished so as to enable the material to slide over this area as smoothly as possible.

3. Presser foot:

The presser foot is attached to the pressure bar of the machine and its two prime purposes are to hold material security against the throat plate and prevent it shifting during the movement of the needle and also to maintain a slight pressure contact between the material and the fed dogs to ensure that material moves at the same rate and direction as the feed dogs themselves.

4. Feed dogs

The basic function of the feed dogs is to move the fabric forwarded by a distance equal to the stitch length, between successive penetrations of the needle. The feed dog itself can have one or more raised rows of serrated teeth, which rise through the slots in the throat plate and slightly enmesh with the underside of the fabric.

5. Sewing threads

Almost all garments produced have one component in common: The sewing thread. Whilst sewing threads are usually a relatively small percentage of the cost of garment, they have an extremely significant influence on the appearance and durability of the finished product. The production of sewing threads is an extensive and complex subject, and the reader is well referred to the technology of the read and seams.

4.4 Sewing machines and equipments

Since the mid-1980s many technological advances have been made to the sewing machinery, which is used for the production of clothing. New construction materials and improved electronic systems have played an important role in these advances. Sewing machine manufacturers are now seriously taking into account the operators who will use their machines and are incorporating many of the following items into their designs.

4.4.1 Basic machines

A comprehensive review of all the different machines on the market is beyond the scope of this topic, but the following are some of the machines most widely used for the production of clothing.

Regular Sewing Machine:

This machine is the basic workhorse of the clothing industry and has numerous applications due to great variety of work aids and feed systems available for it. Some of the main features of this class of machine are :

They are generally available in three versions for sewing light, medium/or heavy weight materials. With the additions of a programmable microprocessor control system, the machine can be programmed for repetitive operations such as sewing around labels or stitching simple decorative elements. Many versions of this machine have bobbins, which hold 50 % more thread than the conventional bobbin. Electronically controlled thread cutting, tacking, needle positioning and foot lifting systems have become standard equipment on these and many other machines.

Lock Stitch Bar Tacker:

This class of machine has a wide range of applications a part from regular bar tacking operations. It can easily be converted to sew an endless variety of stitch patterns in an area 6 cm X 6 cm where the pattern contains up to 72 stitches. Sewing speed is adjustable according to the thickness of the part being sewn, and the free cylinder arm maker handling easier where bar tacking on cylindrical sections of garments such as belt loop, pocket corners and trouser flies.

Lock Stitch Button Hole Machine:

The machine illustrated is for sewing button holes in light weigh materials, such as those used for blouses, dresses and shirts .In one continuous operation the machine sews a rectangular shaped buttonhole by means of purl -stitch, and both ends are secured by a bartack. The machine is operated by one pedal only and the head can be mounted in the length or across the width of the work top, depending on whether vertical or horizontal buttonholes are being sewn.

Three -Thread Over Lock with a Microprocessor:

Based on a regular over lock machine, this version is used for the assembly seaming of garments made up in light weight knitted materials. The microprocessor enables the accurate calibrations of stitch tension without manually adjusting the spring tensioners, and permits automatic.

Blind Stitch Machine:

These machines are available in different versions for blind stitching the hems and facing of garments made in materials ranging from sheer to heavy weight. The machine forms a single –thread stitch and can sew up to 3000 stitches per minute. Stitch penetration control is digitally displayed and most machines are fitted with thread trimmers and a stitch-condensing device, which prevents the end of the sewing from unravelling.

Button Sew Machine:

The variables in button sew machines are the size and shape of the button which determines the design of the button clamp, the number and disposition of the holes, the form of stitching where there are four holes and whether the button has a sewn shank or neck, the stitch type (Lock stitch or single thread chain stitch) and the number of stitches. Buttons may be flat with two or four holes or they may have a shank on the back. Where they are flat, a thread shank may be required so that there is space behind the button for the thickness of the garment when fastened.

Label Sewers:

A variety of label sewers is available from those sewing simple zigzag stitches to a predetermined length on one or two edges of a label to those which are programmable profile stitches able to be set to sew round a wide range of shapes and sizes of label. A specially shaped cylinder bed machine is available over which the inside pocket of a jacket can be passed, enabling jackets to be labelled with a retailer's label after manufacture.

A basic sewing machine or sewing head, as it is sometimes called, consists of the fundamental parts required to form a stitch, sew a seam, or perform a specific sewing operation. The major components of a basic sewing machine include a casting, a lubrication system, a stitch-forming system, and a feed system. The speed at which a machine can operate depends on the engineering of the machine's components. The machine casting is the metal form that provides the exterior shape of the machine. Shapes vary with the bed type, the sewing function that is to be performed, and how piece goods are to be presented to the needle. The casting houses the

internal workings, such as the gears, cams and shafts that operate the stitching and feeding mechanisms.

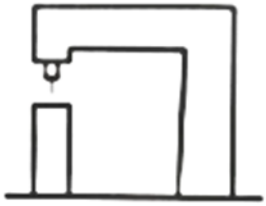
Bed Type

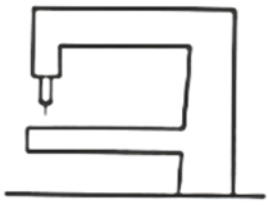
The bedis the lower portion of the machine under which the feed mechanisms and loopers are located. Sewing machines are frequently described by bed types.

The following table illustrates the various types of machine beds along with their uses:

Table.4.1 Types of sewing machine based on bed type.

Types of Sewing Machine	**Stitch Type**	**Features and Uses**
Flat bed machine (basis type) 	Lockstitch, Chain stitch	The large working area allows a wide range of application; the material can easily be guided around the needle and the presser foot. This basic type is used for all kinds of flat sewing work.

Types of Sewing Machine	**Stitch Type**	**Features and Uses**
Raised bed machine 	Lockstitch, Chain stitch	The bedplate 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 buttonholers.
Post bed machine 	Lockstitch, Chain stitch	This type has an increased working height Special applications are found in the working of three-dimensional products. e.g. shoes and bags.

Types of Sewing Machine	**Stitch Type**	**Features and Uses**
		The post makes it easier to work on tight curves and corners, to sew in sleeves and to complete large, half-assembled products.
Cylinder bed machine 	Lockstitch, Chain stitch	This type has an increased working height and a bed in the shape of a horizontal arm. It is especially suitable for working on tubular parts, such as cuffs, sleeves, and trouser legs, and also for button sewing and bar tacking. It is used extensively in the

Types of Sewing Machine	Stitch Type	Features and Uses
		making of clothing from knitted fabrics.
Side bed machine 	Chain stitch, Over-edge	Machines which are specialized for sewing at edges need only a small working area

Stitch Forming Mechanism

The stitch-forming systems are the mechanical parts that on correct synchronization, form stitches and sew seams. Many of the stitch forming devices are specific to the type of stitch or type of machine. The various stitch-forming mechanisms are (1) thread control devices, which include tensioners and take-up devices; (2) needles; (3) bobbins, bobbin cases, and hooks; (4) loopers; (5) spreaders; (6) throat plates, tongues, and chaining devices; and (7) threading fingers and auxiliary hooks. Correct stitch formation is dependent on the appropriate combination of these parts and their precise synchronization. Good maintenance is essential to maintaining the needed precision.

Thread control devices

Thread control devices include thread guides, tension devices, and take-ups, which are necessary to provide uniform thread flow.

Thread guides control the positioning and movement of thread. Damaged or faulty thread guides can damage sewing thread and cause thread breakage and weak seams. Tensioning devices control the flow and tautness of thread as it travels through the stitch-forming parts of a sewing machine. Tension determines the balance and tightness of a stitch. Tensioning devices consist of a pair of tension disks, a spring, and thumb nut that can be adjusted to control the ease with which thread passes between the disks.

Compare thread tension to hand-tying a knot. Until the strands forming the knot are pulled, it does not take shape and has no holding power. If pulled too tight, both appearance and performance are affected, and strands may break. In stitch formation too much tension may cause thread breakage or puckered seams; too little tension allows slack and excessive looping, and loose stitches that will not hold. Tension needs to be adjusted when thread, fabric, and/or needles are changed.

Thread take-up controls the supply of thread required to form each stitch. It gives extra thread to the needle to form the stitch but takes it away to set the stitch.

Needles:

Needles carry the thread through the fabric so a stitch can be formed. Proper stitch formation is dependent on the formation of a loop of thread below the fabric that can be picked up by a hook or looper.

Lower stitch-forming devices:

Lower stitch-forming devices include the hook found on bobbin cases of lock stitch machines and loopers. A hook is a rotating device encompassing the bobbin case that picks up the needle thread loop to form a lock stitch. If the hook misses the loop, no stitch is formed. Precision and timing are critical to stitch formation.

Loopers may carry lower threads to interlock with needle threads or other looper threads. Loopers have a set motion pattern that must be synchronized with the needle motion and feeding. Spreaders work in conjunction with a lopper to assist loop formation. They move the thread but do not carry the thread. Threading fingers move the cover threads back and forth in forming the cover stitches.

Stitch Tongues or Chaining Plates:

They are pointed metal extensions that may be part of or attached to throat plates. Stitch tongues are essential for the formation of the three-dimensional stitches. Tongues vary in length and shape depending on the requirements of the specific stitch type and operation. A long, thin pointed tongue is needed for tight, close stitching such as a rolled edge, while a flatter, wider tongue is used for flat seaming.

Feeding System:

The material-handling components of a machine are often referred to as the feeding system. For a precise line of stitches to be formed, fabric must be moved through the stitch-forming area of the machine with accuracy and precision. The feeding system controls fabric movement. It usually consists of three parts: the presser foot, the throat plate, and the feed mechanism. Each of the parts has many variations in shapes, sizes, and functions. They are specific to the machine type, number of needles used, types of attachments used, and types of operations. They are parts of a system and must be compatible. If one is changed, the other parts must be changed to make the system work effectively

Presser foot:

The presser footis the upper part of the feeding combination that holds the fabric in place for the feeding action and stitch formation. The presser foot, which is attached to the presser bar, controls the amount of pressure placed on the fabric as it is fed through the machine. The amount of pressure can be adjusted for the sewing speed and fabric type and weight. Higher speeds may require more pressure to control the movement of fabric.

Flaggingoccurs when the fabric rises and falls with the needle action. This interferes with stitch formation. Flagging can be prevented with more pressure and a smaller needle hole in the presser foot and throat plate.

A basic presser foot may be constructed as a single unit or hinged to facilitate movement over bulky seams. The most common type is the flat pressure foot, which consists of a shank that attaches to the presser bar and the shoe that rests on the surface of the fabric.

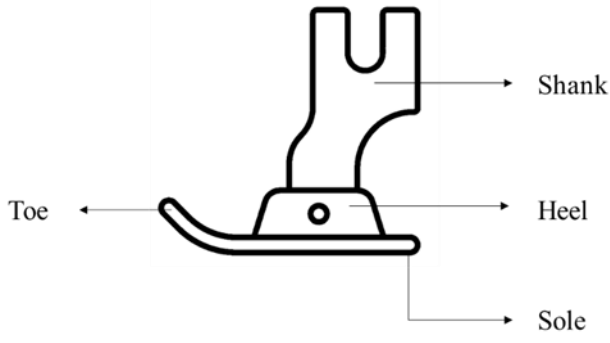


Figure. 4.21. Basic parts of a presser foot.

Variations in the basic presser foot occur in the shoe parts, which include the sole, heel, and toe. The sole is the surface that is in direct contact with the fabric, which may be smooth, toothed, channeled, and so on. The toe is the forward portion of the shoe that is responsible for holding, guiding, and positioning the unsewn fabric. The heel is the back portion of the shoe that is primarily responsible for holding fabric and retaining its established position for the feeding and stitching action to take place. Each of these areas of a presser foot has many variations that are adapted for specific operations.

There are well over 100 different types of presser feet and each is specific to function. Some of the possible modifications of presser feet are short toes for sewing curves, long toes for long straight seams, offset soles for stitching along raised edges of fabric (patch pockets and collar edges), channeled soles for fitting over bulky lapped seams, solid narrow feet for

sewing close to raised edges or zipper chain, and so on. Some of the more specialized feet contain other operational parts. Presser feet are uniquely designed for different sewing operation and can be changed readily, but they must be coordinated with other feeding and sewing parts.

Throat Plates:

Throat plates are removable metal plates attached to an adapter plate or throat plate support, directly under the needle. Throat plates support the fabric as the needle penetrates to form the stitch. Throat plates have openings for needles and lower feed devices. The appropriate size and shape of the throat plate varies with the machine type and its specific function in the stitch-forming process. The number and size of openings in a throat plate depend on the number, size, and action of needles and the number and location of feeds. Throat plates are interchangeable and must be compatible with other stitch forming and fabric-carrying parts in order for stitches to be formed properly.

Working of Feeding Mechanism:

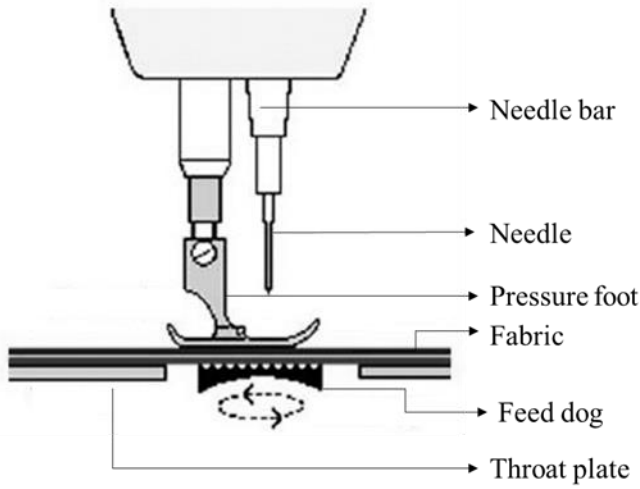


Figure. 4.22. Drop feed mechanism

Feed mechanisms control the direction of fabric movement and the amount of fabric movement for each stitch. There are continuous feeds,

intermittent feeds, top feeds, bottom feeds, and simultaneous feeds. Feed mechanisms affect stitch length and the rate of travel. Many feed mechanisms are specific to the type of machine, while others are specific to the operation.

Most machines have bottom-drop oscillation feeds called feed dogsthat rotate in an elliptical pattern below openings in the throat plate. Feed dogs (feed teeth) rise above the throat plate and carry the fabric toward and away from the needle and drop down and away from the fabric as the needle descends into the fabric to form a stitch. Feed mechanisms must be synchronized with needle motion so fabric is moved only when the needle is rising and completely out of the fabric.

Feed dogs can be changed to suit a specific operation, type of seam, and type of fabric. Fine feeds (20 or more teeth per inch) will cause less damage than larger teeth that are more widely spaced. Rubber feed dogs may minimize damage on delicate fabrics, while larger metal teeth are suitable for more rugged materials.

Performance of feed dogs is also dependent on the amount of pressure from the presser foot. Feed dogs and presser feet should be selected to complement each other. The wrong combination of feed dogs, presser foot, and amount of pressure can cause skipped stitches, uneven stitching, and damaged fabric.

4.5 Work aids

Work aidsare labour-saving devices used to simplify an operation, reduce handling, increase productivity, improve work quality, and reduce operator fatigue. Many work aids have been developed to facilitate the use of basic equipment and make it more adaptable to specific operations. Carefully selected work aids can often produce significant savings. Work aids can be purchased, created by research and development departments, or developed by engineers, mechanics, and technicians on the production floor. Work aids may be used in all types of operations including cutting, sewing, and finishing, but they are most widely used in the sewing room

because of the accuracy and labour intensity required. The possibilities are endless and here we can cover only a few of the more common aids in this text. Some work aids depend on manual involvement by an operator. Others may operate mechanically or by pneumatics or electronics. These include separate devices, attachments, and machine options.

Separate Devices

Separate devices positioned in the workstation are frequently used to facilitate operations and for materials handling. These may include bundle trucks or carts, stands for positioning bundles so they are easily accessible to the operator's grasp, bins or racks for easy disposal of parts when sewing is completed, or snips for cutting thread. Clamps are helpful in maintaining orderly stacks of parts.

Attachments

Attachments are primarily mechanical work aids that can easily be added or removed from the machine or work station according to the requirements of a particular sewing operation. Attachments may be stationary, swivel, slide, or pivotal in order to be engaged and disengaged from the area of operation. Attachments often assist an operator in guiding, positioning, folding, and regulating the materials during the sewing operation.

Guides

Guides are designed to facilitate alignment, accuracy, and consistency in positioning and stitching the fabric. They may provide both a tactile and visual focal point for an operator. The principle of tactile response can be compared to driving on a curbed road. The driver becomes sensitive to the position of the wheels relative to the curb. Contact with the curb is a sure indicator of being too close. For manual operations, using both tactile and visual senses is preferred. Use of tactile guides may increase the rate of production, but visual alignment is needed to develop accuracy.

Folding devices

Folding devices are used to position trim just in front of the needle. For example, bias strips can be applied by drawing the binding off a roll above or to the side of the machine and through a folder and tensioning device before reaching the needle. The folder, which is an open-ended funnel, causes the edges to turn to the underside as it passes through to the needle. The exact position of the attachment on the cloth plate may be a factor in how bias strips or other trims are applied. Attachments may also be used to fold various types of edge finishes and trims, including hems.

Reference

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5. Finishing Process

Abstract: The Chapter 5 discusses the finishing and packing of manufactured products so as to reach the point-of-sales. Different methods of pressing and various equipments used for pressing are discussed. The various parameters and their impact on quality of finishing process are also explained.

Key words: steam press, crease, mold, buck press, form finishing machines, tunnel finisher, High Tech Pressing Machine.

5.1 Principles of pressing

Pressing can be defined as a process, which changes the geometric fibre structure of the area being pressed by the controlled application of heat, steam and pressure. In this sense, removing a crease from a garment involves the same change of fibre lay as that required to open a seam or to press a hem. Pressing is the application of heat, moisture, and pressure to shape, mold, or crease fabrics, garments, or garment parts into the forms intended by their designers. Pressing may be done during assembly to facilitate other operations and improve quality or as a final finishing process. There are many types of pressing equipments, some versatile and others that are specific to the type of operation. Selecting the appropriate equipment for the fabric and operation is important to garment quality and appearance. Pressing equipment is used to prepare components for stitching and to set the shape in completed garments.

- In-process pressing or under pressing is used to crease, shape, and/or smooth components for more accurate seaming. Sharp edges on garment components increase accuracy in sewing.

- Finish pressing or off-pressing adds the final shape to seams and garments. Without finish pressing even the well-executed seams will not have a pleasing appearance.

With very few exceptions, every type of product manufactured by the clothing industry is pressed either during or at the end of its assembly or at the end only. The exceptions are items of corsetry and under wear which, due e to the materials and construction, do not require any form of pressing. Regardless of the extent of pressing which garment undergo, pressing is a crucial process, which imparts the final finish to a garment. A garment always has a greater hanger or package appeal if it is fresh looking and crisply pressed.

5.1.1 Classification of pressing

The total process of pressing can be divided in to two groups of operations: under pressing and top pressing.

Under pressing:

This term covers all of the operations performed on garments during their assembly. Seam opening, dart pressing and the pressing of flaps and patches are typical operations with in this group. Under pressing, when broken down in to a sequence of operations, not only makes successive operations a little easier, but also enhances garment quality. For example, it is far easier for an operator to press a panelled back well if the component is on its own rather than closed to the shoulders and side seams of the fronts. This example demonstrates good working principles for under pressing: when possible, the component should not be positioned naturally during pressing and should not be constricted by other parts.

Top pressing

Sometimes referred to as off-pressing, this group includes all the operations used to finish garments when they have been completely assembled. The operations involved can range from a simple smoothing out with a hand iron to about fifteen machine and hand operations which

are required to press lined coats. The extent of the operation is determined by the construction of the garment, the fabric and, in some cases, how well the garment has been under pressed during its production. There is no doubt that top pressing is the major process for finishing a garment and giving it its final appearance, but top pressing can only achieve the best results when performed on well made-up garments. Top pressing a defectively produced garment might help to ameliorate some of the faults, but it will never make a good garment out of what is basically a bad garment.

5.1.2 Components of pressing machine

Regardless of fabric, type of garment or the machinery and equipment employed, the majority of pressing operations have the same components.

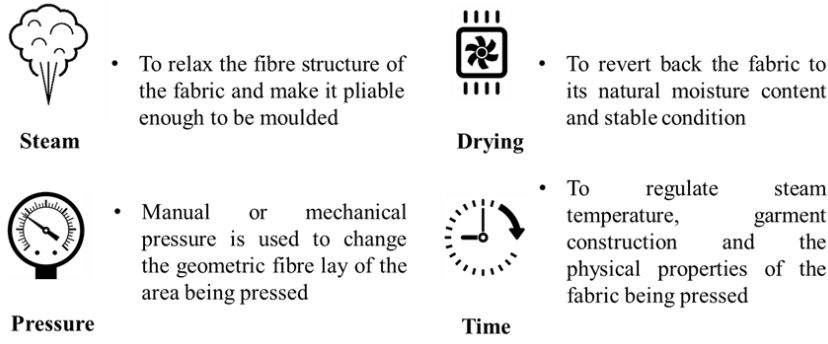

Figure.5.1. Components of steam press

Steam

The purpose of using pressurised steam is to relax the fibre structure of the fabric and make it pliable enough to be moulded by manipulation and pressure. Steam itself is an odourless, invisible gas consisting of vaporized water, and its white cloudy appearance is caused by minute water droplets interspersed in the vapour. In factories steam is generated by boilers fired by electricity or fossil fuels such as coal, gas or oil. Depending on the number of pressing work station in the factory, steam can be distributed from central boiler room by small boiler located close to the work station.

There are also independent pressing units, which have a built in boiler for generating their own steam.

- Steam is a flexible, adaptable and efficient component of pressing.
- Some of its outstanding features are:
- It has very high heat content.
- Its heat is generated at a constant temperature.
- It can be easily distribute and controlled.
- Water is relatively cheap and plentiful.

Steam has been used through out the centuries for pressing and it is still the best medium for this purpose.

Pressure:

After steaming, manual or mechanical pressure is used to change the geometric fibre lay of the area being pressed. A simple example of this change is the pressing open of a regular seam. This structural change is typical of the majority of pressing operations.

Drying:

Following the application of steam and pressure, the area, which has undergone these processes, has to be dried and cooled in order that the fabric can revert to its natural moisture content and stable condition. The drying process is usually performed by a central vacuum pump which is connected to pressing units, or by pumps built in to ma machine it self. The vacuum action removes the residual moisture from the material while it is lying on the pressing area.

Time:

The length of time to which a component or garment ifs subjected to steaming, pressure and drying is a combined function of steam temperature, garment construction and the physical properties of the fabric being pressed. Whilst there are no fixed rules for the duration of these

components, experience is a good teacher. Accurate control of the four components of pressing is essential to the maintenance of uniform quality. This is one of the main reasons why modern pressing machines can be programmed for the duration, operating conditions and sequence of all of the elements with in a specific pressing operation.

5.2 Types of finishing machinery and equipment

It is possible to press samples of light clothing, such as dresses, blouses and night dresses, on versatile unit equipped with a hand iron. However, if the samples are of constructed garments, while most of the simple under pressing operations can be performed with a hand iron, there are still several operations, which require the specialized machines in the factory. This is especially relevant to top pressing where to most of the operations are performed on special purpose machines. The usual procedure is for the sample room to do what can be done correctly and then uses the factory's machines for everything else.

There are hundreds of different types of pressing machines on the market because of the variety of garment types produced, each with its own specific pressing requirements. Here are the respective of there types.

5.2.1 Hand Irons

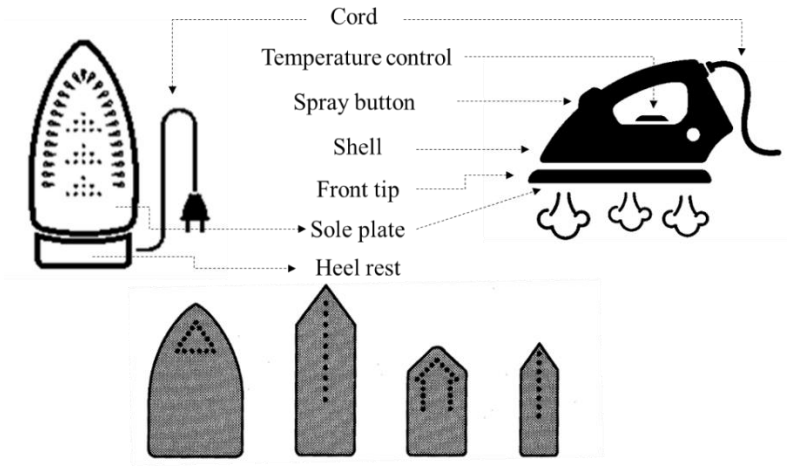

Figure.5.2. Hand irons and different shapes of sole plate

Hand irons are used for numerous operations in the production of clothing. One example of these is electric high-pressure steam iron. Hand irons are produced in a variety of shapes and weights to suit specific types of operations. The following are some examples of the sole plate shapes available.

5.2.2 Basic Pressing Equipment

Over the last hundred years, pressing equipment has undergone considerable change. In the 1890s men's suits were pressed with gas-fed irons weighing as much as 20 pounds. Gas was fed by a rubber hose to the center of the iron and then ignited to produce heat. With this system a presser could press 10 men's suits in a 10-hour day. The effectiveness of the pressing job then, as now, depended on regulating the time and temperature of the application of heat, moisture, and pressure. Control of these conditions depended on the skill of the presser.

The old adage "Necessity is the mother of invention" describes the evolution of pressing equipment as well as other segments of the industry. A tailor's apprentice that injured his arm is given credit for inventing a pressing machine that reduced the physical demands of pressing and incorporated the principles of pressing applied today.

5.2.3 Types of Pressing Equipment

Solid-surface pressing equipment uses a firm surface to apply pressure while steam and heat mold the fabric, garment, or garment parts. Pressure may be applied through rolling action, gliding action, or compression. Solid-surface pressing equipment consists of buck presses, irons, blocks, dies, rollers, collapsible forms, and creasing and folding blades.

(a) Buck presses

Buck pressesare commonly used by manufacturers of slacks, skirts, and jackets as well as by most dry-cleaning plants. Components of a buck press include a lower buck and a complementary moveable head with a linkage system, buck padding, steam and vacuum systems, frame and table, gauges, and manual or automatic controls for steam, vacuum, heat, and pressure. Buck presses may be used for in-process pressing and finish pressing depending on the requirements of the garment.

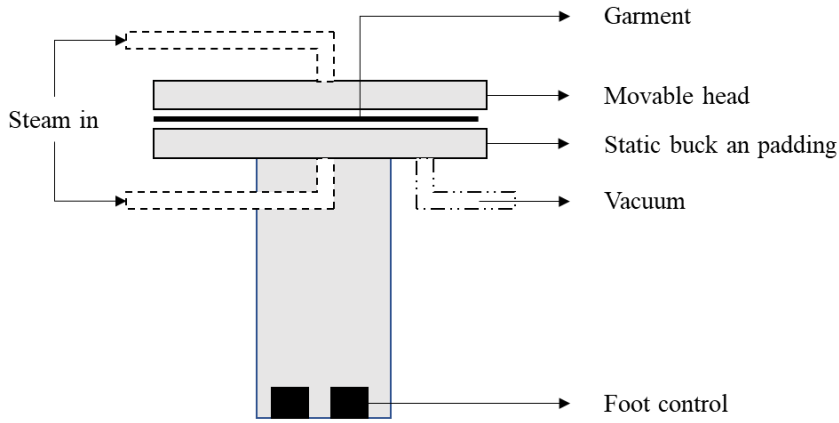

Figure.5.3. Buck press

The actual pressing devices are a lower buckand complementary head that move in a scissor like pattern. Bucks vary in length, width, and contour. The lower surface, or bed buck, is usually in a fixed, horizontal position and supports the garment during pressing. The head is attached to the lower buck but is mobile. The head moves down, when activated by the operator; to cover the material as it rests on the bed buck. Steam is released

and drawn through the garment by the vacuum system. When the head is released, it returns to an open position. Timing of steam and vacuum applications are critical to a quality operation. Buck paddingserves to distribute steam evenly, reduces the impact of steam on the fabric, and provides a soft resilient surface for the fabric. Padding protects the fabric from shine due to high pressure and the hard surfaces. It also acts as a buffer to prevent uneven steam pressure or high ejection velocities, which may cause steam spots on the fabric being pressed. Some fabrics are more prone to these problems than others. Adjusting the amount of padding to suit the fabric improves the quality of pressing.

(b) Block or die pressing

Block or die pressingis a molding process that establishes a product's conformance to a form. Block pressing may change the surface characteristics and dimensions of a product. The fabric or product is placed on a fixed form (die) or block before pressure, heat, and/or steam are applied.

Hat and glove manufacturers may use block pressing to shape and mold their products. Another form of automated die pressing is used to fold and crease patch pockets and pocket flaps. An operator positions the component over a die and engages the machine, and folding blades fold and hold the edges to the underside for creases to be set. This may be used in tandem with automated sewing to stitch the pocket in place. Die presses may also be used to shape and mold collars, collar stands, and cuffs.

Form Finishing Machine:

This is one of the types of machines used for finishing men’s and women’s jackets, blouses and skirts. During the pressing operations the body and sleeves are precisely tensioned by pneumatically operated clamps or pressure pads, which can be set for individual forms. A microprocessor monitors and regulators the programmed times, temperatures and the sequence or combination of team, hot air, cold air and vacuum.

Figure.5.4 Foam finishing machine

The small cabinet press:

Is designed to press the heat shirts before they are buttoned, thus preventing button marks on the finished article. During the pressing process the back and front are tensioned by air-filled bags, which ensure an even pressing surface when the shirt is between the two shaped pressing plates. This particular machine can be efficiently operated by one person only when there is a reasonable balance between the handling and pressing cycle times.

Tunnel Finisher:

This is used for knitwear, which can carry up to 30 articles at time through the finishing process. The tunnel has two sections, one for gentle seaming and the other for quick drying of the garment. Garment forms can be adjusted for different styling and sizes and the microprocessor controls the processing time, steaming time and the quantity and steam and air temperature. Up to 24 individual pressing programs can be stored in the microprocessor.

High Tech Pressing Machine:

High tech pressing machine for men's and women's clothing is a digital programmer and presses the shoulder, sleeve head and sleeve cuff in one set-up. To sum up it is no exaggeration to say that a part from cutting, the two corner stones of garment quality are fusing and pressing. The pressing processes give the final finish and appearance. The importance of pressing should never be under estimated, because of its decisive contribution to garment quality and appeal.

5.3 Technological advancements in pressing

Advancements in finishing technology focus on several areas:

(1) Greater versatility

Greater versatility is needed to service the wide variety of fashion garments a manufacturer produces over an extended period of time. This may be accomplished with a variety of interchangeable bucks that are designed for specific garment shapes and a greater range of settings suited to a wider variety of fabrics. Self-contained units are moveable workstations so components can be pressed while in a modular production line.

(2) More precision in determining exact pressing requirements of fabrics and finishes,

Microprocessorswith a wide variety of settings can control factors such as conveyor speed, steam and air volume, and temperatures. Computers determine settings and control the processing so that each garment can be treated in the exact same manner. Carousel pressing combines several pressing operations that one operator can complete at one workstation with minimal handling and control.

(3) Improved quality and energy saving

Energy costs are high, and many equipment manufacturers have concentrated efforts to improve the energy efficiency of the pressing systems. This includes things such as increasing the insulation to prevent heat loss, self-contained systems so the source of heat and steam is closer to the pressing unit, and the inclusion of vacuum systems to reduce the amount of heat and steam needed for effective pressing.

In some new pressing equipment, the steam generator and pressing devices are included in a self-contained unit that makes it portable in the plant. Advancements in buck pressing include more automation, with less operator handling and control. Automated buck presses control the amount of time, temperature, and pressure for the steam application and the vacuum cycle. The head releases automatically when the determined amount of time lapses. This guarantees equal exposure to steam and extraction for each garment. With manually operated presses, the operator controls the time of exposure. Steam tunnels may be automated, too. The steaming, drying, and degree of exposure may be controlled by microprocessors to provide consistency throughout the operation

5.4 Finishing

In total all the trimmings used for the garment cab be substantial cost item and so their selection and use require careful considerations. There is no point in improving materials utilisation if the savings made are thrown away by using expensive tapes as stay tapes. The professional approach is: sufficient for the intended purpose no more.

5.4.1 Linings

Garment linings have functional and customer appeal objectives and this selection will examine the principals involved, starting with the material itself.

5.4.1.1 Fibre types and properties

Today natural fibres are rarely used to construct linings due to the high cost and some difficulties with impairing a suitable finish to the fabrics synthetic fibres are now the most widely accepted for garment linings, and the following describes the main properties of those which have the most wide spread use in the clothing industry.

Viscose

Like most other synthetic fibres, it goes through a number of chemical and mechanical processes until the filaments are ready for spinning in to yarn. Linings made from viscose fibres have strength, lustre, softness and an affinity for dyes.

Rayon

Rayon linings have similar properties to those of viscose linings but are some what weaker.

Polyamide

Polyamide produces linings with excellent tensile strength and a relatively high degree of elasticity and it takes dye-stuffs very well. A draw back with polyamide linings is that some solvents used for dry cleaning can have a detrimental effect on the fabric.

Polyester

Polyester fibres are closely related to polyamides and linings made from polyester fibres have many similar properties. Generally, other than some polyamide linings, none of the linings made from these synthetic fibres are armed by dry cleaning and they can be safely pressed up to a temperature of 170. Although some warp knitted linings are available, weaving is the predominant method of construction.

5.4.1.2 Function and Appeal

Function

Garment linings have a number of functional purposes besides their main one which is to cover all or part of the interior surface of a garment. These other functions include:

- As linings have a sheer surface, putting on or taking off the garment is a smooth and simple action.

- Linings help to preserve the shape of skirts and trousers made from loosely constructed or stretchy materials.

- Garments such as dresses, skirts and trousers, made from diaphanous materials, sometimes need ‘cover up’ areas. Lining does this job well.

Some types of outerwear materials have a tendency to cling to the body of the wearer and this can spoil the silhouette of the garment. Some type of outerwear materials have a tendency to cling to the body of the wearer and this can spoil the silhouette of the garment. A layer of lining between the body of the wearer and the top cloth will usually eliminate this problem.Linings are often used to assist in the formation of design features on garment. For example, the difference in lengths between the body shell and the body lining creates the blouson effect. The same principle is also used to create an ‘over hang’ look on puffed sleeves.

Appeal

An important factor of customer is to present a garment whose inside has an attractive appearance. The surface and lustre properties of the lining have a considerable influence on this, and those properties for lining most widely used are:

Taffeta

This is a crisp fabric woven with a faint warp pattern which produces a shiny surface. These linings are generally piece dyed which helps to soften them and make them able to withstand normal washing and dry-cleaning processes.

Crepe

This is made from specially processes yarns, mostly viscose acetate, the finished surface of this lining has a minute and uniform crinkled appearance.

Satin (sateen)

This lining is characterized by a smooth and highly has a smooth and highly lustrous surface and a dull back. Satin is the name for a weave pattern.

Colour

Colour also plays an important role and linings with a woven, printed or embossed pattern can give an extra fillip to a garment. Some large companies incorporate their logo in the weave pattern of their linings.

5.4.1. Making-up and testing linings

Lining materials fray easily and should be assembled on a special stitch machine (four thread safety stitch machine). Although thread consumption is greater than on a regular machine, the seam produced is superior.

Irrespective of whether linings are pressed or not before setting, all vertical seams in lays should be pressed to one side. A part from making the presser's work a little easier when finishing the garment, this helps to prevent 'seam grain' which could happen if the seam has left to find its own lay direction, or even worse, if the seam is pressed open.

Where the body linings are pressed as one unit with the cloth, the shrinkage factors of the cloth and lining should be checked tom verify that the two materials have compatible shrinkage in the width and the length. If the

discrepancy is substantial, it would be worth substituting a different lining because working with linings which have excessive shrinkage could lead to complications during production and finishing.

Grain line makings are as necessary for linings as they are for top cloth and fusible. They should match the grain lines of the relative cloth components, although this can be ignored for components such as sleeve linings and linings for skirts and trousers, which are some times cut across the piece instead of in the length.

5.4.2 Secondary trimming

Closures

Most garments require some form of working parts to open and close them and those parts which are not attached to the garment during its production have to be added in the finishing process. Some of the typical closure systems used in apparels are discussed here.

Buttons

Buttons are the most widely used closure system for clothing of all types. They can be produced from plastic materials such as polyester acrylic and polyvinyl resins, and they can be designed according to a specific requirement.

Garment buttons can serve two purposes:

Utilitarian

This refers to buttons which are used to open and close garments and other design features where the wearer requires access combined with an element of security. For example, the hip pockets on trousers or the patch pocket on a safari-styled garment.

Decorative

These are buttons which have a purely decorative function and one of the most common forms is on double-breasted garments. Most of the buttons sewn on to the sleeve vents of tailored garments are of decorative value only, although at one time they had a functional purpose.

Attaching buttons

Attaching buttons have two stages, marking and sewing.

Marking

The hand marking of button positions requires accuracy in four respects:

For symmetrical garments the button positions have to ensure the over all symmetry of the garment. Some of the important points to observe are:

- Collar ends and lapel steps on both fronts must be the same distance down from the neck line.
- Pockets have to be at the same height.
- Lateral seams need to be matched across the fronts.
- Darts should start and finish at the same levels.
- The button spacing has to be exact in order to ensure flat laying fronts.
- The specified warp allowance must be observed.
- With striped or checked materials, pattern symmetry and alignment are essential.

Sewing

The buttons of classic shirt and blouse samples are generally sewn on during production by automatic button sewers. These machines can be set for specific spacing and the buttons are automatically fed to the button

clamp. As factories producing these types of garments mostly work to standard spacing, sewing the buttons on to the occasional sample does not interfere too much with production.

The buttoning of garments when they have been completed is usually performed in the sample room as this is more convenient than using the button sewing machines in the factory.

Buttons should not be sewn on to garments which will be subjected to pressure during their top pressing. Apart from leaving an impression of the button on the cloth, there is also every possibility that the button could be broken by the pressure of the pressing machine bucks. Knitted and other garments which are steam finished only can be safely buttoned before top pressing.

Hooks and eyes

This is a relatively simple closure system which is widely used for zip openings on dresses and blouses made from light-weight materials. Hooks and eyes can be sewn on by a simple button sewing machine fitted with special clamps for the two working parts.

Press studs

These can be made from plastic or metal and consists of two working parts, the male and the female, which are locked together when subjected to a slight pressure. It is advisable to set press studs through two piles of materials and with knitted fabrics a reinforcement strip between the two the two plies will prevent distortion.

Like buttons, plastic press studs can be colour matched to materials and often the visible face of metal or plastic studs carries the logo or decal of the producer.

Rivets

Whilst these are not closure parts, they are widely used for decorative and reinforcement purposes on denim garments. Rivets require an appropriate device to set them on garments.

Zips

Zips are one of the most extensively used closure methods utilised by the clothing industry. Apart from the functional purposes, zips are also used for decorative effects or as a design features. Zips are a continuous form of closure as against buttons which are intermittent.

Zipper types

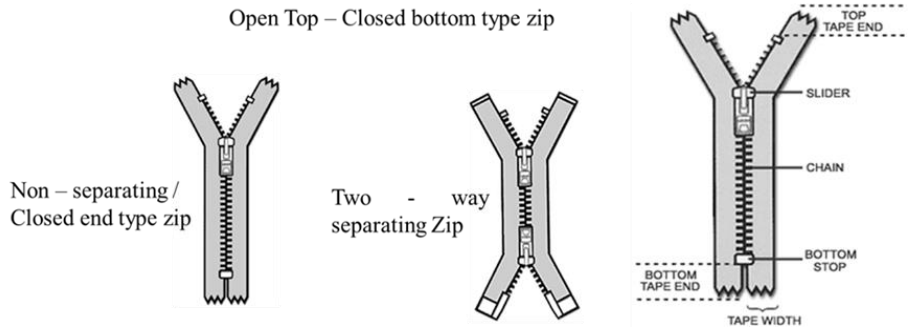

Figure.5.5. Types of zippers

There are several types of zips available, which enables the designer to select a zip that is the most suitable for a particular garment or end use. Some of the more commonly used zips are given here.

Regular type

Regular zips are used in different lengths for skirts, dresses and other articles of clothing. This zip is usually inserted in to a seam and whilst the zip is concealed, the setting stitching shows on the out side of the garment. To set this type of zip, a half presser foot is used which enables the operator to sew close to the chain.

Invisible zip

This is so called because the zip and its setting stitching can not be seen on the right side of the opening. The insertion of this zip requires a special type of presser foot and the setting operation itself is shorter and easier than for a regular zip.

Separated zips

This type of zip is utilised when the garment can be worn either closed or fully opened. Some typical applications of separated zips are for over coats, parka jackets and zip-out linings.

Continuous zip

Used for men's trousers and all categories of jeans, continuous zips with an average length of 50m are wound on to reels with the metal chain closed or separated in to left and right sides. This permits each side of the zip to be set on to the respective panels before the crotch seam is closed. The slide and bottom stop are fitted by means of small mechanical devices located in suitable positions along the production line.

Continuous metal zips are cheaper in use than those made to specific lengths as they can be cut to the exact lengths required and there is no need to maintain regular stocks of different lengths or the odds and ends which are bound to accumulate.

Cleaning

The last stage of the finishing process is to thoroughly clean the garment of all thread ends and stains. This means that the sample has to be gone over very carefully because nothing gives a worse impression to a buyer than trailing threads or un-removed stains on the inside or outside of the garment.

Types of zipper materials

1.Metal Chain

Zipper	Type of Material
Aluminum	Chain that is constructed principally from aluminum
Brass	Chain that is constructed of brass, typically a combination of copper and zinc.
Antique Brass	Chain made from brass that is chemically treated to give the appearance of worn or tarnished brass.

2. Molded Plastic Chain

Figure.5.6. Molded Plastic Chain zip

These plastic zippers have individually injected molded teeth, fused directly onto the tape of the zipper. The resins used to manufacture the molded plastic chain are incredibly strong. These zippers are ideal for many medium and heavy weight garments or any outdoor application.

3. Coil Nylon Chain

Figure.5.6. Coil nylon chain zip

Coil zippers are often referred to as nylon zippers. The teeth of these zippers are extruded plastic, sewn onto the zipper tape. These zippers are very flexible and are available in a variety of sizes (gauges). Coil zippers

have many applications from fashion-wear to all types of tents and canvas goods.

Reference

1. Qian Zhang and Chi-Wai Kan, A Review of Fusible Interlinings Usage in Garment Manufacture, Polymers 2018, 10(11), 1230; https://doi.org/10.3390/polym10111230