Analysis The Defects Of Sewing Operations And Their Remedies

Session 2009-2013

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Dedication

"I humbly thank **Allah** Almighty, the Merciful and the Beneficent, who gave me health, thoughts and co-operative people to enable me achieve this goal."

I would like to dedicate this thesis to my loving family & beloved friend, who have supported me all the way since the beginning my studies. There is no doubt in my mind that without their continued support and counsel. I could not have completed this process.

May Allah bless them with good health, success & happiness of life.

(Ameen)

Final Term Research Project

Analysis the defects of sewing operations and their remedies

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Statement of Submission

This is to certify that **Tayyab Mahmood 091420-110** and **Zunaira Najeeb 091420-059** have successfully completed the final project named as: Analysis the defects of sewing operations and their remedies, at Master Textile Mills Ltd, 3-Km Off Raiwind Manga Mandi Road , Raiwind, Lahore, Pakistan with the support of School of Textile and Design, University of Management and Technology Lahore, Pakistan.

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Abstract

In this project, we are going to analysis the defects of sewing operations and their remedies by using TQM (Total Quality Management) tools and techniques. We present the basic structure of a TQM-based compensation system that can provide incentives based on a variety of defects of sewing operations. As a result, this approach encourages the continuous improvement central to the TQM philosophy, to give remedies for all the defects of sewing operations. We have selected the article for the analysis and improvement of the study is **five pocket basic jeans** and style as **Men Semi Fashion Jeans**. This garment is consist of stretched fabric and based on **42 operations** with different kinds of stitches. The content of the project would facilitate the association (Master Textile Mills ltd.) where it will apply in near future; the benefits to the organization can be listed as remedies of maximum faults which leads to profit earning of the organization and pay incentives getting higher.

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Chapter 1

Introduction of the title of Project

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1.1 Importance of Textile:

Textile is an important part of our live. The clothes we wear are the textiles which form an essential part of our daily routine. A textile is any kind of woven, knitted, knotted or tufted clothes, or a non-woven fabric (a cloth made of fibers that have been bonded into a fabric, e.g. felt). Textile has traditionally meant a woven fabric. The term comes from a Latin word taxere, meaning to weave. (1)

A textile is made from fiber and then fabric or other extended linear materials such as thread or yarn. The various categories of textiles include woven, crochet, knitted, knotted or tufted cloth, and non-woven fabrics such as felt. There are two types of fabric i.e. natural fiber and man-made fiber. (2)

1.2 Denim Fabric:

Denim is a strong, durable and long lasting fabric constructed in a twill weave with indigo and white yarns. The blue/indigo yarns are the lengthwise or "warp" threads (parallel to the selvage). The white yarns run across the fabric width (the weft threads). Denim is traditionally woven with 100%-cotton yarn; however, today it's blended with polyester, to control shrinkage and wrinkles, and Lycra to add stretch. Today, denim has many faces. It can be printed, striped, brushed, napped and stonewashed, and the indigo. (3)

1.3 History of denim:

Denim is a huge component in the wonderful world of fashion. It is a staple garment that everyone owns. Denim has been used in America since the late 18th century. The word comes from the name of a sturdy fabric called serge, originally made in Nimes, France and called Serge De Nimes. (4)

Blue Jeans trousers originally designed in the United States by Levi Strauss in the mid-19th century as durable work clothes. It is particularly identified as a standard item of Western apparel

worn by the American cowboy and later adopted by workingmen throughout the United States and then worldwide. After the mid-20th century, various adaptations became internationally a characteristic part of clothing for both men and women. They wore denim clothes because of its durability and its tough texture. As denim did not wear out easily so it is durable for the long run and there any kind of daily jobs. (5)

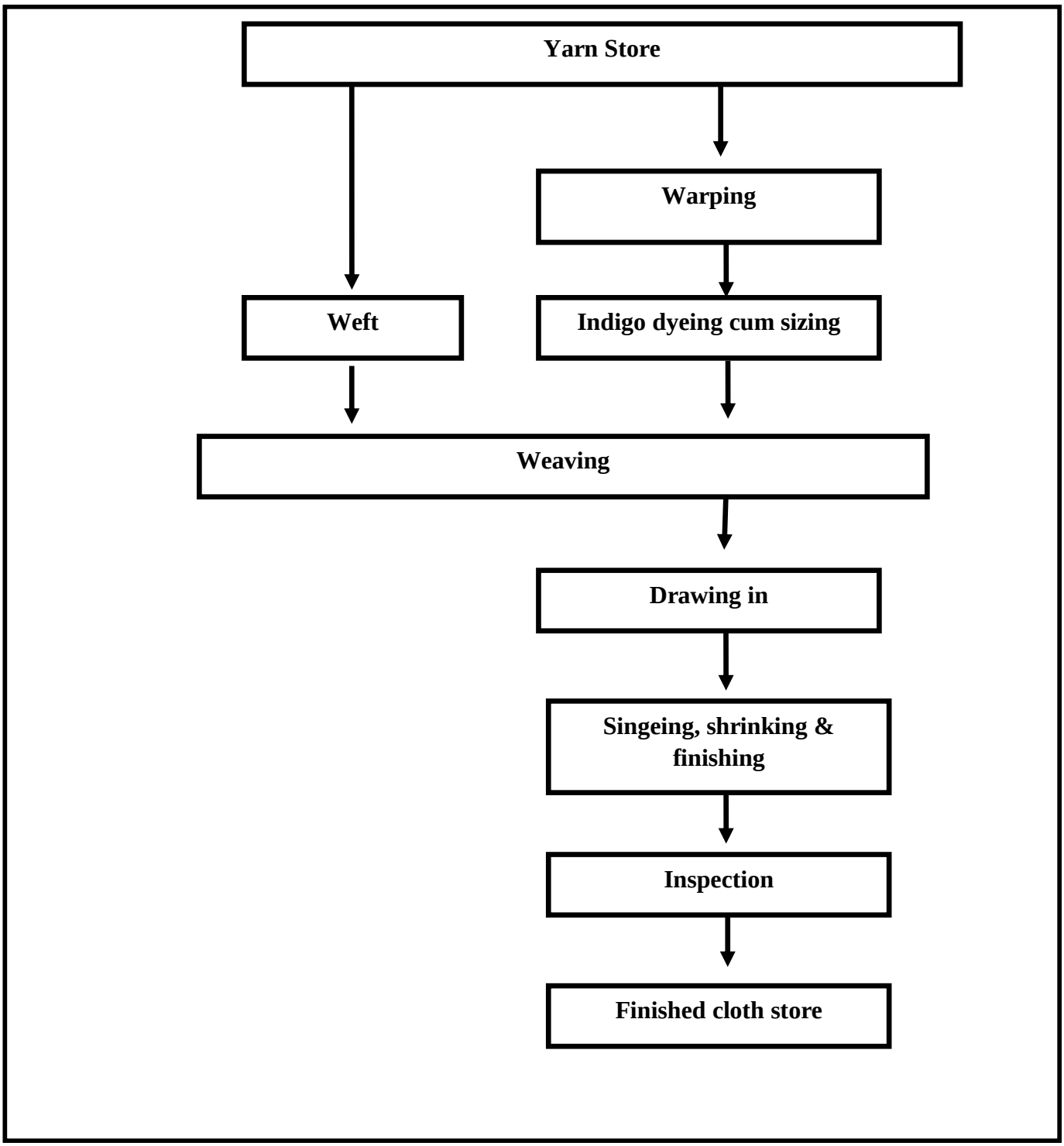
1.4 Denim Fabric Construction:

Denim is made from uneven tightly woven twill in which the weft passes under two or more warp threads. Lengthwise, yard is dyed with indigo or blue dye; horizontal yarns remain white. The yarns have a very strong twist to make them more durable, but this also affects the denim's color. (6) The yarns are twisted so tightly that indigo dye usually colors only the surface. The blue strands become the threads that shown on the outside of your denim and the white are the ones that make the inside of your denim look white. This produces the familiar diagonal ribbing identifiable on the reverse of the fabric. (7)

1.5 Manufacturing of Denim:

For manufacturing Denim and Grey Fabric, the process is same up to the level of weaving, but in case of Denim Fabric, dyeing is done at the stage of sizing whereas for Grey Fabric it depends upon the finished product. The details of each process are given below: (8)

Figure 1 Manufacturing process (denim plant)



1.5.1 Fabric Weaving:

a) Grey Yarn on Cones:

Normally yarns received for weaving in cone forms are either from ring spinning or from open end spinning in single or double fold as required.

For weaving, yarn used is categorized into:

- Warp yarn
- Weft yarn

Normally for Weaving, yarn used as warp should be sufficiently strong to withstand stress and strains exerted during weaving operations. (9)

b) Warping on Sectional/ Direct Warping:

At warping, the individual cones are put into the creel (the number of cones depends upon fabric construction) and yarn from individual cones is pulled together in sheet form, wound on a barrel called warping beams (for Direct warping) or on weaving beams (for Sectional Warping). (8)

c) Sizing of yarn in Set/ Beam to Beam Position:

On sizing, normally; 8-12 % size material on warp thread is applied. This improvement in strength and frictional resistance characteristic of warp yarn is essential. The yarn has to undergo severe strain & stress as well as frictional operations. (7)

d) Drawing–in:

Weaving is basically interlacement of two sets i.e. warps and weft threads in desired sequence and pattern. To perform shedding the warp yarn needs to be passed through healed eyes of the healed shafts, this operation is called as drawing-in. (8)

e) Beam Gaiting or Knotting on Loom:

Beam Gaiting in which the drawn weavers beams are fixed on weaving machines, threads are tied and healed shafts are coupled. If undrawn warp threads are directly knotted to the threads of finished beams, it is called Knotting.

f) Weaving:

As stated earlier, weaving is interlacing two sets of yarn and making fabric. One set is called warp thread which is in sheet form, the other one is called weft thread which is inserted between two layers of warp sheet by means of a suitable carrier i.e. Shuttle, Projectile, Rapier, Air current, Water current, etc. (8)

1.6 Types of Denim Fabric:

While the original denim was a 100% cotton serge material. Now you can get it in a variety of materials, including blends that give you the same wonderful look of 100% cotton denim with some great additional features. Denim's unique look comes from the rich indigo blue in one shade or another yarn woven together. Some denims no longer have indigo, but other colors with the white opposing threads, producing denims in a rainbow of shades.

- **Dry denim:**

Dry or raw denim, as opposed to washed denim, is a denim fabric that is not washed after being dyed during its production. In addition to being washed, non-dry denim is sometimes artificially distressed to achieve a worn-in look. (10)

- **Stretch denim:**

Stretch denim jeans are one of the fastest growing segments of the women's market for jeans manufacturers. Usually about 98% cotton and 2% Spandex gives stretched denim. (11)

- **Poly denim:**

Blends appeal to those who like the look of denim but prefer polyester blends that wash and dry quickly and are lighter weight and a bit dressier. These usually appeal to a slightly older market, but are also finding favor for pantsuits, etc. when the look is meant to be dressy but casual. (11)

- **Ramie cotton denim:**

Ramie is a plant fiber usually added because it reduces wrinkling and adds a silky luster to the fabric. It has to be blended with this stronger material in order to stand up as a denim material though it is not a necessity for fading. (11)

- **Poly-core Denim:**

Often found in replica jeans, offers the best mix of strength of polyester core and vintage aesthetic of cotton top thread layer. (11)

- **Ring-spun Denim:**

This is spinning process in which the individual fibers are fed onto the end of the yarn while it is in the twisting stage. The process consists of a ring, a ring traveler and a bobbin that rotates at high speed. The ring-spun yarn produced by this method crates unique surface characteristics in the fabric, including unevenness, which gives jeans an irregular authentic vintage look. (10)

- **Dual Ring Spun:**

Signifies a denim weave in which both the warp and weft threads are made of ring-spun yarn. It creates a much softer and textured hand than both open-end and regular (single) ring-spun denim. (10)

- **Black-Black denim:**

The construction of denim where the warp yarn is black instead of blue and which is also dyed black after weaving. This makes the jeans truly black rather than gray. (8)

- **Open End Denim:**

Open End or OE Spinning was introduced in the 1970s.Open End denim is bulkier, coarser and darker, because it absorbs more dye, and wears less well than Ring Spun denim. (10)

- **Over Twisted Denim:**

It is made from yarn that is over twisted, giving the fabric a particular crinkled surface. (11)

- **Printed Denim:**

The construction of denim has been printed with a pattern-a batik, stripe or floral, for example-often in contrasting colors and aimed at very young market. (10)

- **Reverse Denim:**

A novelty use of denim-turned inside out to give jeans a really different look. (11)

- **Pinto Wash Denim:**

Millions of yards of denim were soaked with water and had to be dried immediately to avoid mildewing. Designers, manufacturers and young consumers all jumped on the new product, making Pinto Wash Denim an instant success. (11)

- **Cotton Serge:**

The traditional denim is 100 percent cotton serge. Additionally, denim is often blended with other fabrics. (11)

- **Raw Denim:**

Raw denim is dark, unwashed fabric that is stiff and very durable. It fades with wear in certain areas, creating a natural distressed look. It also fades with washing. (8)

- **Ring Denim:**

A traditional type of denim fabric, revived in the late '80s and early '90-s, using ring-spun yarn for the warp. It is characterized by a softer hand and an uneven surface appearance. (8)

- **Bull Denim:**

A heavyweight denim weave (14oz. plus) with a typical 3x1 twill construction. An ecru fabric, bull denim is later printed or garment dyed. (11)

1.7 Denim Scope:

Today, denim has many faces it can be printed, striped, brushed, napped and stonewashed. The new generation still wore denim, but it had to be in different finishes, new cuts, styles, or in the form of aged, authentic, vintage jeans, discovered in markets. (12)Even formal wear designers turn to denim for inspiration occasionally. Today's consumers are much more conscious of the impact their choices have on the environment. During the last decade, the usage of denim garments, especially denim jeans, has been on a rise in the international as well as the local markets. That has provided the opportunity to the downstream industry to get strengthened. (5)

1.8 Denim production:

The export of denim garments from Pakistan has also been increasing in the past. Germany and USA are the major countries importing Pakistani denim products. Other major export markets are France, UK, Netherlands, Canada, Italy, Belgium and Irish Republic etc. (13)Major concentration of the denim garment manufacturing industry is in Karachi and Lahore. Other important cities which focus are Sialkot, Faisalabad and Gujranwala. The average production capacity of majority of small and medium sized jeans manufacturing units is about 1,000 jeans per day. However, large size manufacturers are producing as much as 30,000 jean trousers per day. (14)

1.9 Sewing:

Sewing is the art of binding or attaching objects using stitches made with a needle and thread. Where stitching of two pieces of fabric together using a straight stitch creates the simplest of seams. (15)The basic components of sewing are the same i.e. stitches and seams. Sewing a textile fabric is a very pointed operation which is governed by a broad spectrum of parameters like the type of sewing machine, the stitch type, the structure of sewing seam. Sewing process is the result of combination of all these factors. It requires thorough knowledge of all components within sewing process. (16)

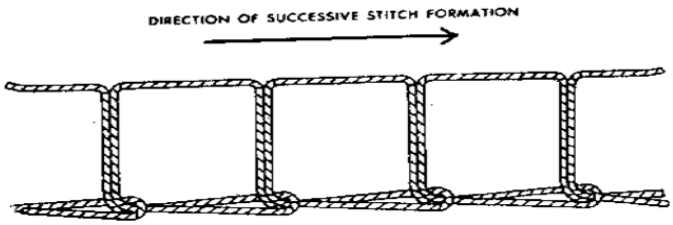
1.10 Stitch classes:

A variety of stitches are used for specific purposes, named according to the position of the needle and direction of sewing, the shape of the stitch or the purpose of the stitch . (17)The configuration of stitches classified them in to into six classes. Each type of stitch provides decoration to garments, covers the demands of joining fabrics together, and neatening raw edges. One may use more than one stitch at a time to enhance features. The six classes of stitch included as follows: (18)

- **Chain stitch (Class 100):**

One of the simplest stitch types, the chain stitch has one or more needle threads and is formed by Inter looping.

Figure 2 Stitch Class 100



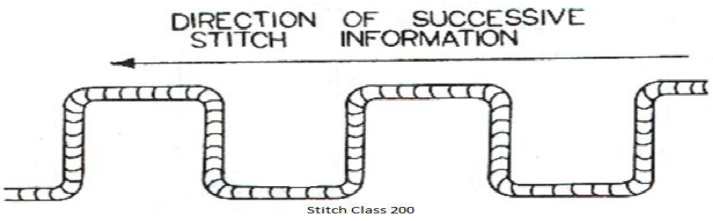
Stitch Class 100

This stitch is used for sewing buttons and buttonholes, hemming, basting and pad stitching. (18)

- **Rand Stitch (Class 200)**

Generally formed by hand, the hand stitch is made with a needle that is passed from one side of the material to the other as a single line of thread. (18)

Figure 3 Stitch Class 200

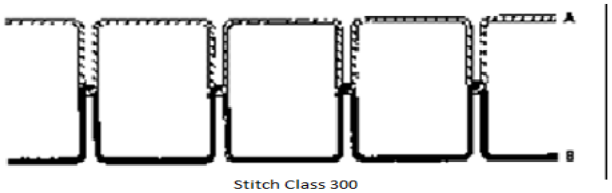


Stitch Class 200

- **Lockstitch (Class 300):**

Lockstitch has two set of threads that interlace to form the stitch. One set is called the needle threads and the other the bobbin threads. It requires bobbin thread and does not unrevealed easily.

Figure 4 Stitch Class 300



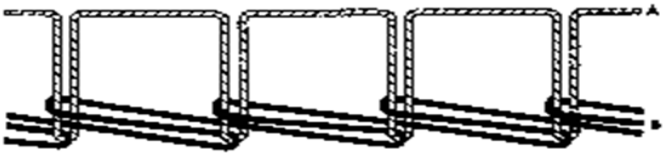
Stitch Class 300

It is used common usually used as seaming, hemming, pockets, and setting zippers. (18)

- **Multi Thread Chain stitch (Class 400):**

Two groups; one is called the needle threads and the other the lopper threads forms multithread chain stitch. Loops of one group of threads are passed through the material and are secured by interlacing and interloping with loops of another group.

Figure 5 Stitch Class 400



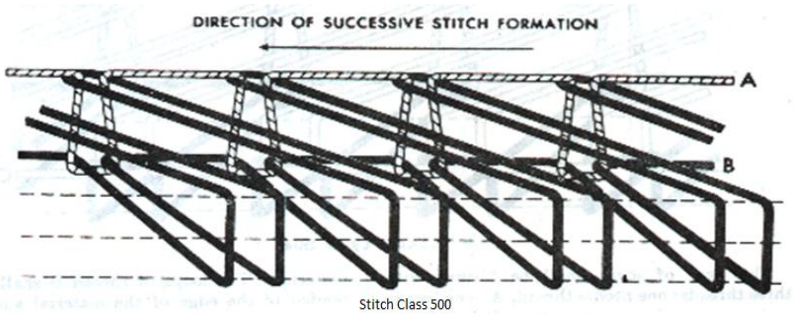
Stitch Class 400

It is used for seaming and in combination with the over edge stitch on over lock machines. (18)

- **Over edge Stitch (Class 500):**

The over edge stitch is formed with one or more groups of threads that interloped to form a thread sheath around the fabric edge. The most common stitches have one or two needle threads and one or two lopper threads. They are for neatening edges trimming woven and low stretch knitted fabrics and decorative edgings. (18)

Figure 6 Stitch Class 500

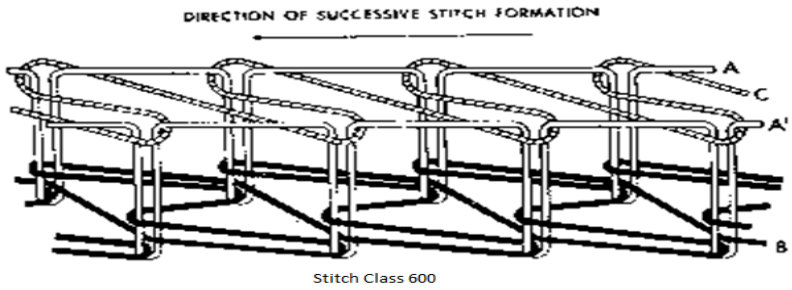


Stitch Class 500

- **Cover stitch (Class 600):**

The cover stitch is generally formed with three or more groups of threads that cover the raw edges of both surfaces. Stitches types in this class are formed with three groups of threads, two of the groups cover both surfaces of the material. It is very elastic most complex stitch class. It is used to create decorative seams on underwear and knitted casual garments. (18)

Figure 7 Stitch Class 600



Stitch Class 600

1.11 Seams:

In sewing; a stitch is a single loop of thread brought in and out of the fabric in a particular way, whereas row of stitches binding two objects together is called a seam. It is the main process by which we can converts 2D fabric in to 3 D forms. It is only possible by properly seaming and securing with stitch requires. (18)

Seams are classified by their position in the finished object and by their construction .The choice of seam type are determined by aesthetic standards, durability, strength of material, and comfort in wear. (15)Eight different classes of seam are used according to the minimum number of parts that make up the seam: the main fabrics of the garment or some additional such as a lace, piping, braid or elastic. The security of sewn seam depends basically on type of machine, properly machine setting, the aiding tools, and the stitch type. (18)

1.12 Properties of seams:

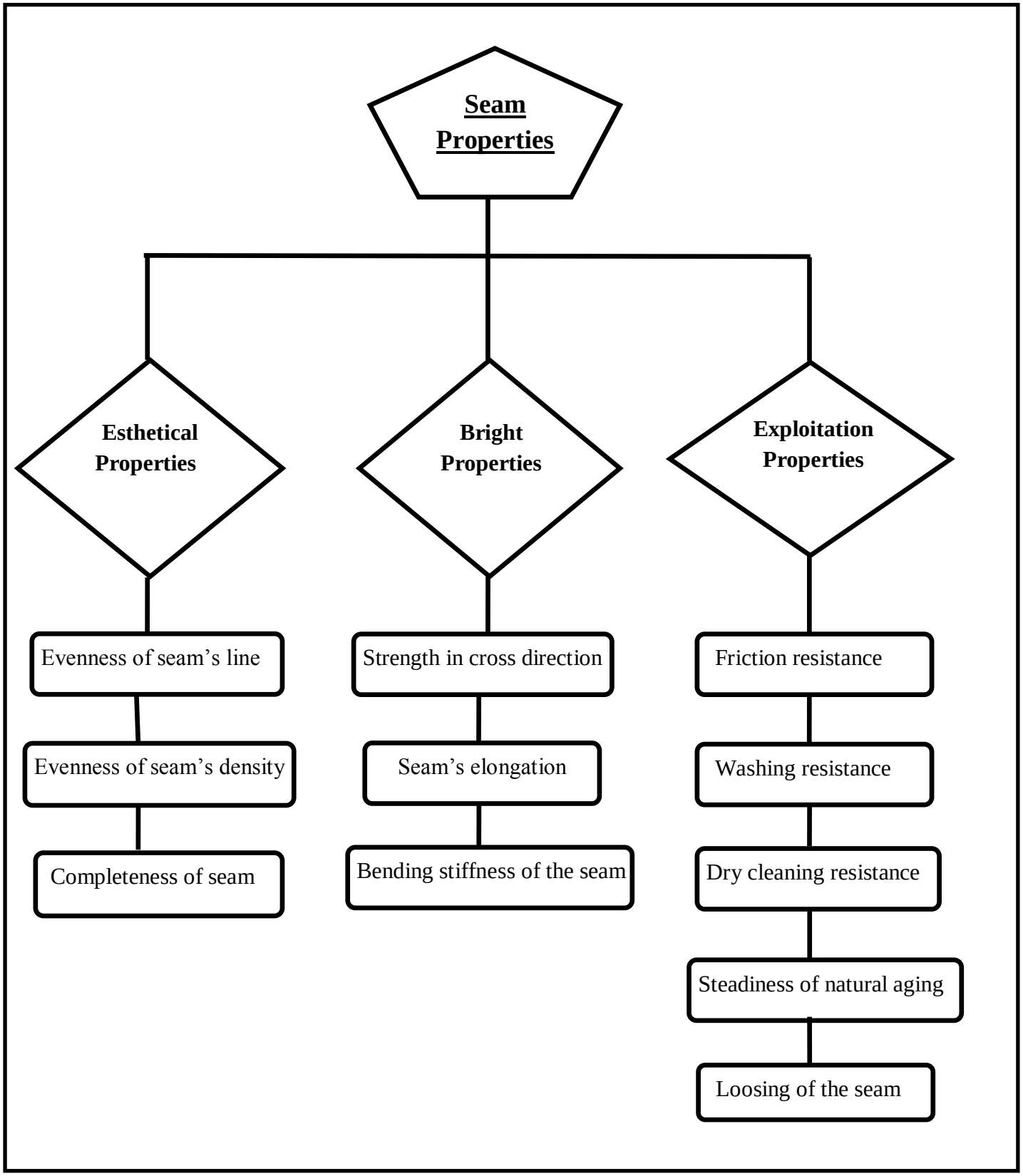
The objective of sewing is the construction of seams that combine the required standards of appearance and performance with an appropriate level of economy in production.

Good appearance in a seam normally means smooth fabric joins with no missed or uneven stitches and no damage to the material being sewn. Alternatively it may mean regular gathering

to create a style feature or a varying but controlled amount of ease to ensure a good fi t to the body. In other cases, fabric may be stretched deliberately to achieve an effect but the amount should still be predetermined and controlled. With the wide variety of fiber types and fabric constructions available, good seam appearance during manufacturing demands varying techniques. Once it has been achieved, it must be maintained throughout the designed lifetime of the garment, despite the additional problems that arise during wearing, washing and dry cleaning processes. (19) Performance of seams means the achievement of strength, elasticity, durability, security and comfort, and the maintenance of any specialized fabric properties such as waterproofing or flame proofing. (19)

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. Stretch fabrics are increasingly being used in garments, both low level 'comfort' stretch as used in stretch corduroy or denim where the amount of stretch may be up to about 30 per cent, and high level 'action' stretch for swimwear and dancewear where 100 per cent or more is normal. Such levels of stretch place very heavy demands on seaming. (19) A seam in a close-fitting or underwear garment must not present an uncomfortable ridge or roughness to the skin. If a fabric is coated in PVC, neoprene or polyurethane to make it totally waterproof, a simple form of sewn seam joining two sections will leave gaps between those sections, (19)as well as needle holes along the join, and the seam will not be waterproof. According to the nature of the coating, the seam must be welded, taped or 'doped' to seal over the join and block up the needle holes. A fabric used for a child's nightdress, which must by law conform to specified flammability requirements, must be constructed with sewing threads that will not propagate a flame along the seam. Finally, seam performance as well as seam appearance can be spoilt by the fact that damage may occur to the fabric along the stitch line. (19)

Figure 8 Seam Properties



1.13 Classes of seam:

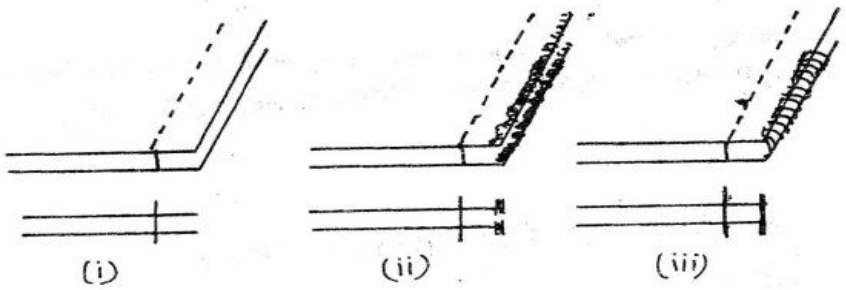
- **Superimposed seam Class 1:**

This class is the commonest construction of seam and it has the following types.

- Superimposed seam
- French seam
- Piped seam

Superimposed seam is formed by superimposed the edge of one piece of material on another. French seam is done in two stages by superimposing two layered fabric. Piping is inserted as an additional component of a superimposed seam known as piped seam. (17)

Figure 9 Seam Class 1



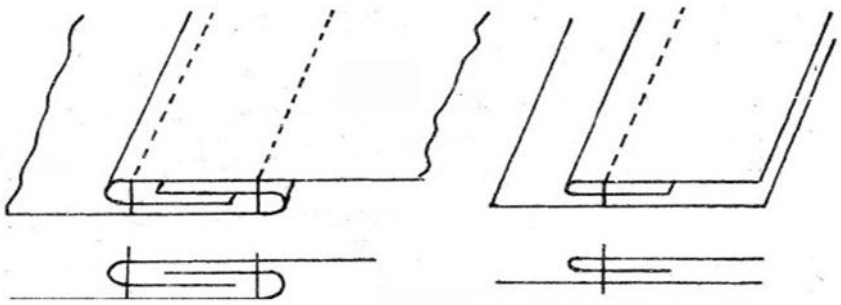
- **Lapped seam Class 2:**

This class is has the following types.

- Lapped seam
- Lap felled seam
- Welted seam

Lapped seam is simple is but not common in clothing. It is sewn with two rows of stitches on a twin needle machine. The machine is equipped with a folding device. When this seam is used with denim jeans consists of long seams becomes lap felled seam. The type of raised, topstitched seam often referred to as a welted or a raised and welted seam. (17)

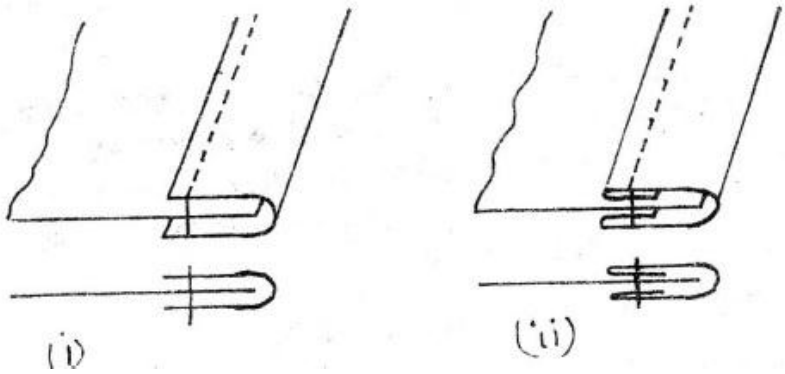
Figure 10 Seam Class 2



- **Bound seam Class 3:**

The bound seam consists of an edge of material which is bound by another edged of fabric. It is cannot be constructed without binding other. The problem with self-fabric is fray of the raw edges. Machine is equipped with aiding tool. A folding device turns the edges under and wraps the strip over the edge of the shell fabric. (17)

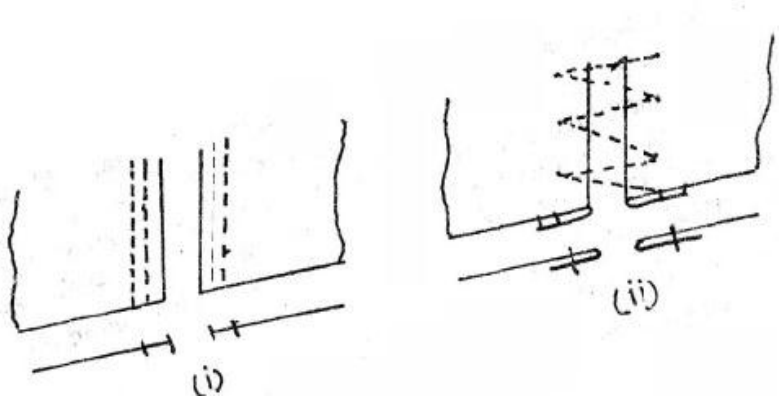
Figure 11 Seam Class 3



- **Flat seams Class 4:**

In this class, seams are referred to as flat seams. The fabric edges 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 side of the fabric. Knitted fabrics most used flat seams. (17)

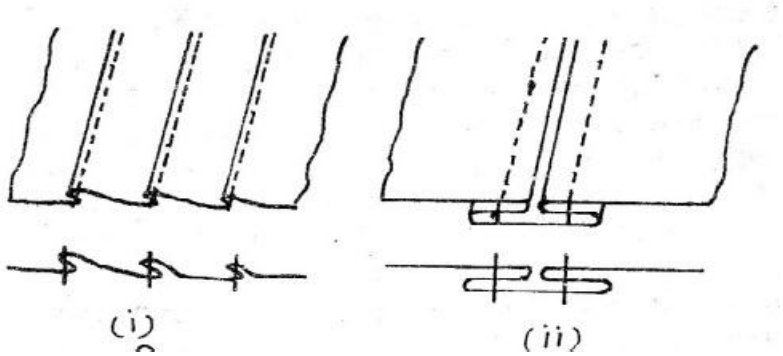
Figure 12 Seam Class 4



- **Decorative stitching class5:**

This seam is commonly used for decorative sewing on garments. Single or multiple rows of stitches are sewn through layers of fabric. The use of one needle row stitch would have little effect. (17)

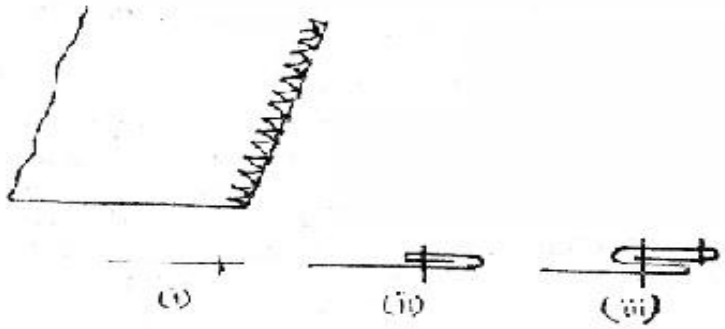
Figure 13 Seam Class 5



- **Edge neatening class 6:**

Seam stitching in this class is formed in contrasting to binding with another or the same fabric. As well as folded hems and edges which has been neatened with an over edge stitch. (17)

Figure 14 Seam Class 6

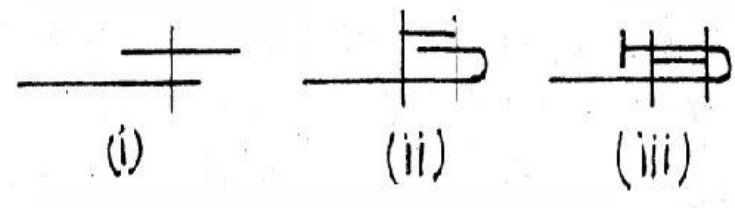


- **Class 7:**

In this class seams are formed by addition of separate items to the edge of a garment part.

They are similar to the lapped seam except that the added component has a definite edge on both sides. An example where the additional item is interlining is another version of the buttonhole band on a shirt. (17)

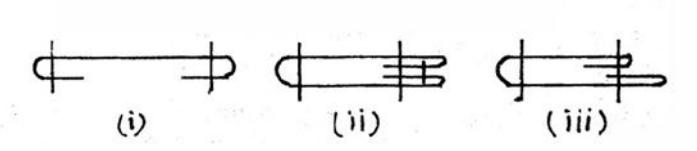
Figure 15 Seam Class 7



- **Class 8:**

The commonest seam type in this class is the belt loop as used on jeans, raincoats. Cover stitch type mentioned above which has two needles and a bottom covering thread. It shows two rows of plain stitching on the top and ensures that the raw edges are covered on the underside. (17)

Figure 16 Seam Class 8



1.14 Denim sewing:

The production of good quality for denim fabric does not guarantee good quality garment. The most important is the fabric selected for garment should have good sew ability. In the apparel industry, sewing is one of the main processes, in which there has been a constant increase of the degree of automation. (13) It requires much expertise model and techniques but unfortunately precise models are normally unavailable and quantitative information about the operating parameters of the machines is in general unknown or not used. (12)The process is based on apparel, sewing machine trial and error method, the aiding tools, manufacturers experience and also machine settings rely on general guidelines.

Common stitch type and seams used with denim: (20)

- Hem ticket pocket
- Sew eyelet buttonhole
- Topstitch waist band corner
- Sew waist band
- Serge side pocket facing
- Topstitch left front fly
- Sew inseam
- Hem bottom
- Sew side
- Bar tack front fly
- Sew belt loop
- Make belt loop
- Sew leather label to waist band
- Decorative stitch to hip pocket
- Sew hip pocket to back

1.15 Quality Standards:

The increasing multiplicity of denim garment operations, combined with the significant manufacturing process boosts the need to reduce quality problems, which normally introduce

serious production delays. (21) In this framework, the only thing which can benefit the apparel manufacturer is use of equipment that involves automation in it. (6) The improper selection of any one component can result in failure of the product manufactured. The characteristics of a properly constructed sewn seam are strength, elasticity, durability, security, and appearance of fabric. All these characteristics must be balanced with the properties of the material to form the optimum sewing and to avoid defects in sewing. In addition to this the technique and skill of the sewing machine operators also govern the secure swing. (17)

1.15.1 Quality aspects:

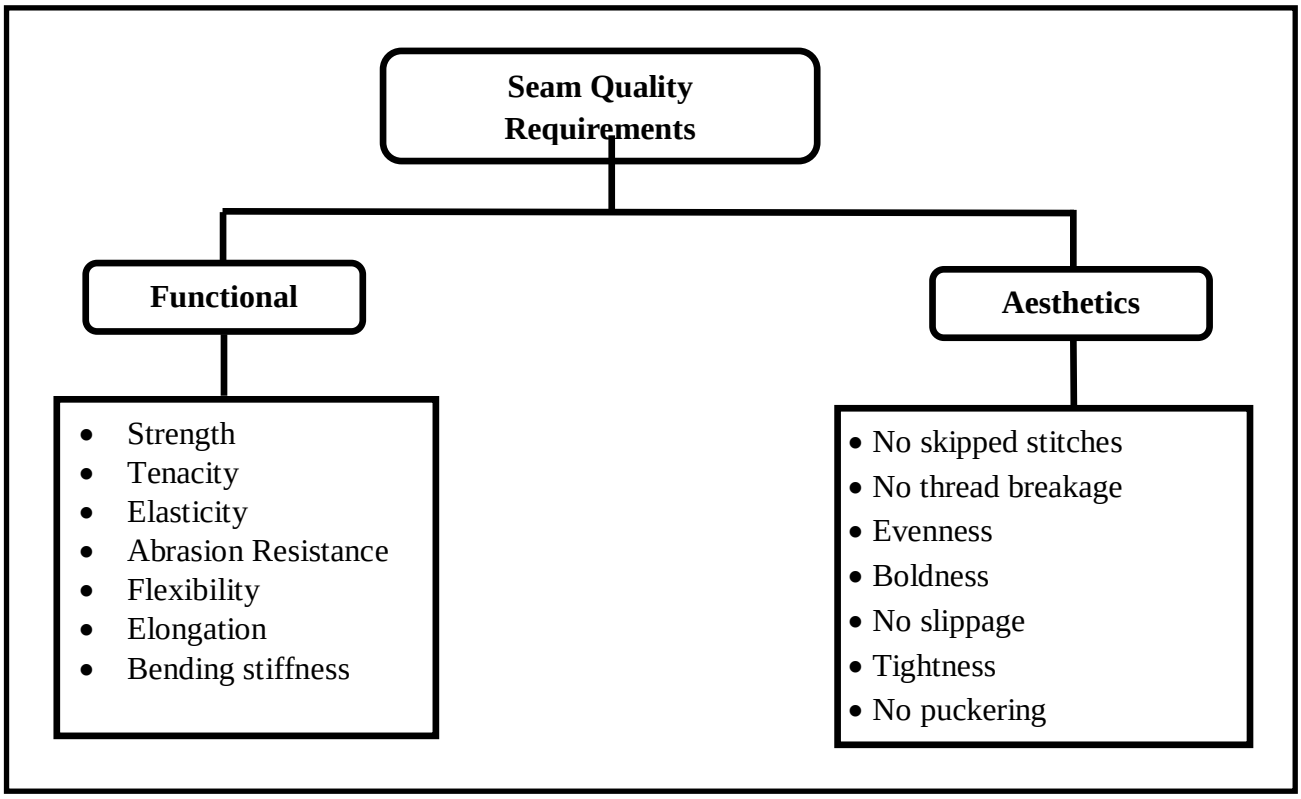
According to the standard ISO 9004-2, quality is the essential nature of something, which distinguishes the characteristic or property of any product. Different persons have their own quality parameters, some persons find good durability and performance as good quality, for others, attractive design and brand status is good quality. (22)

The broad concept of quality can be divided into three subcategories:

- Intrinsic
- Extrinsic
- Perceived

Intrinsic quality is created during product development and production and is depending on materials, methods and processes. Extrinsic quality is not a part of the specific product; it is everything around the product like brand, shop, price, merchandising, marketing and reply of retailers. Perceived quality is the intrinsic and extrinsic quality together. (21)\

Figure 17 Seam Quality Requirements



1.16 Seam quality requirements:

i. Functional properties of seam:

The objective of sewing is the construction of seams that combine the required standards of appearance and performance with an appropriate level of economy in production. Good appearance in a seam normally means smooth fabric joins with no missed or uneven stitches and no damage to the material being sewn. Seam must be able to ensure a good fit to the body. The basic function of a seam is to hold pieces of fabric together. A seam is a joint between two pieces of fabric. To perform its function correctly the seam should have properties closely allied to those of the fabric being sewn.

The characteristic of a properly constructed seam are: (7)

- **Strength:**

A seam must be strength, the standard being maximum thickness and economy of sewing thread strength is usually measured in two directions. (5)

- **Extensibility:**

This is required in all seams although the degree varies according to the fabric being sewn. The characteristic of the seam must confirm to those of the fabric as closely as possible. For example the seam must be capable of stretching at least as much as to the fabric to be used. (23)

- **Durability:**

A seam must be durable, long lasting and not abrade (scrape) or wear easily during everyday use of the garment including all necessary laundering. By proper selection of fabric, thread, and the type of seams used, the seam should make the strengthen the garment itself (21)

- **Secure:**

Security is closely connected with durability. A seam need to be secure and not to unravel or broke during everyday use of the garment. (17)

- **Appearance:**

The ideal seam should join pieces of fabric in an unobtrusive and efficient manner with no discontinuity in physical properties or appearance as the grains in the garment are traversed. This is of course an ideal but it does provide a target at which to aim. (11)

- **Elasticity:**

Seam elasticity can be accomplished by a combination of having the correct number of stitches per inch and having the proper stitch balance. The more stretch the fabric has, the more stitches per inch that is required. (7)

ii. Aesthetical Properties of Seams:

- **Improper Stitch Balance:**

Loops are seen either on the bottom side or topside of the seam. (18)

- **Needle Cutting :**

Needle holes appear along the stitch line that will eventually turn into a run. It is caused by the needle damaging of the fabric as it is penetrating the seam. (21)

- **Open Seam - Seam Failure:**

The threads in the seam have ruptured leaving a hole in the stitch line. It is caused by improper stitch for application. (24)

- **Ragged/Inconsistent Edge:**

Where the edge of the seam is either extremely ragged or rolls inside the stitch. (18)

- **Broken Stitches:**

A splice occurs on the stitch line. If this occurs on Topstitching, then the seam does not appear to be 1st quality merchandise. It is caused by Thread breaks or thread run out during sewing. (18)

- **Uneven stitch:**

Stitching is not performed straight and a part of stitches is sewn in disorder. (21)

- **Irregular stitch:**

Irregular knotting points of thread occur on upper and lower faces of cloths under certain tightness. (19)

- **Balloon stitch:**

Large or small thread loop suddenly occurs on upper or lower cloth from knotting point of sewing thread. (15)

- **Stitch skipping:**

Stitches of sewing thread partially skip and stitching is not performed completely. (21)

- **Missing stitch:**

Stitches are out of the sewing line. (15)

- **Slipping seam:**

The force is applied to stitch, the constituent thread of the part moves and stitch opens or slips. (9)

- **Thread breakage:**

When the force is applied to stitch, sewing thread is cut. (21)

- **Broken material:**

Constituent threads of cloth are cut by sewing machine needle at the time of sewing. (25)

- **Thread return(Reverse):**

The line that occurs when constituent thread of cloth turns and thread on the wrong side faces the right side by the shock force at the time of penetration of sewing machine needle.

- **Weaving thread lift:**

Defective pattern occurs when a part of weaving threads is shifted by stitch, sewing machine needle, awl, etc.

- **Seam puckering:**

It occurs near stitches by shrinking by sewing, sewing slippage, etc. (26)

- **Sewing slippage (Uneven material feed):**

Upper and lower cloths slip each other in the feeding direction.

- **Left-to-right inclined stitch of bobbin thread:**

Left-to-right inclined stitches are formed.

- **Towel face:**

Knotting positions of sewing thread continuously occur on the lower side of cloth in the state of large thread rings. (22)

- **Clogged stitch:**

A certain resistance force is applied to the sewing product and stitch pitch becomes irregular.

- **Pitch error:**

Stitch length is changed by change of feed force, cloth slippage, etc. This phenomenon is fit to occur between high and low speed sewing's. (21)

- **Seam brays (Thread looseness):**

Sewing thread gets loose and the state of stitch skipping occurs.

- **Hangnail:**

The state that several pieces of yarn of sewing thread are cut during sewing.

- **Idle stitching (Drop stitching):**

Knotting point of thread is formed without sewing product. (27)

- **Feed dog defect (Rasp-cut defect):**

Scratch (trace of teeth) made by feed dog when feeding cloth.

- **Needle breakage Defect:**

Scratch on sewing product made by needle tip when several stitches are performed in the state that needle is broken during sewing. (18)

- **Needle mark (Trace of needle):**

Trace of hole of sewing machine needle due to re-sewing, basting, etc.

- **Excessive Seam Grin:**

Seam Grinning on Woven Fabric.

- **Unraveling Buttons:**

A tail of thread is visible on the topside of the button and when pulled, the button falls off. (12)

1.17 Denim quality:

Two main groups affect the intrinsic qualities of jeans i.e. material and production. It is easier to analyze possible improvements by the help of these groups during researching on quality.
The material type holds fiber, yarn and fabric structure. Whereas production consists of the production phase with pre-treatment, cutting, sewing, trimming and finishing. (15)

Material			Production		
Fiber	**Yarn**	**Fabric structure**	**Pretreatments**	**Making**	**Finishing**

Table 1 Denim quality

To ensure both high durability and quality, fiber fabric and garment properties are tested. Durability properties can be tested in laboratories but depends on consumer usage. (15)

- **International Standards:**

The International Organization of Standardization (ISO) is an international institution with purpose to simplify and improve the quality management of companies and organizations. Most of the standards of today are international. Using these international standards the common base of information will make things easier by trading and production across the world. These standards makes easy to access capacity, quantity, value and quality of the product. (22)

- **Quality Audits:**

A quality standard is a common tool which contains the intrinsic quality level that the company requires. It requires in the product development, planning and production processes of a company to maintain uniformity among products and between orders of the same product, to

avoid large variations. (22) The first step is to test the product. The testing of materials may be done several times during the production processes. Base tests are made on the same fabric as the first prototype but at last test is made on final bulk material fabric. (6)

- **Size and fit standards:**

Measurement standards are set up by companies to avoid and to prevent large measurement variations among different garment styles. The sizing system and measurement tolerances are normally based on the sizing standard of the company. The standard provides accepted variations and tolerances for the measurements of every size. The measures that are commonly checked during quality audits of denim jeans are: waist, thigh, knee, bottom hem, inseam, back rise and front rise. (6)

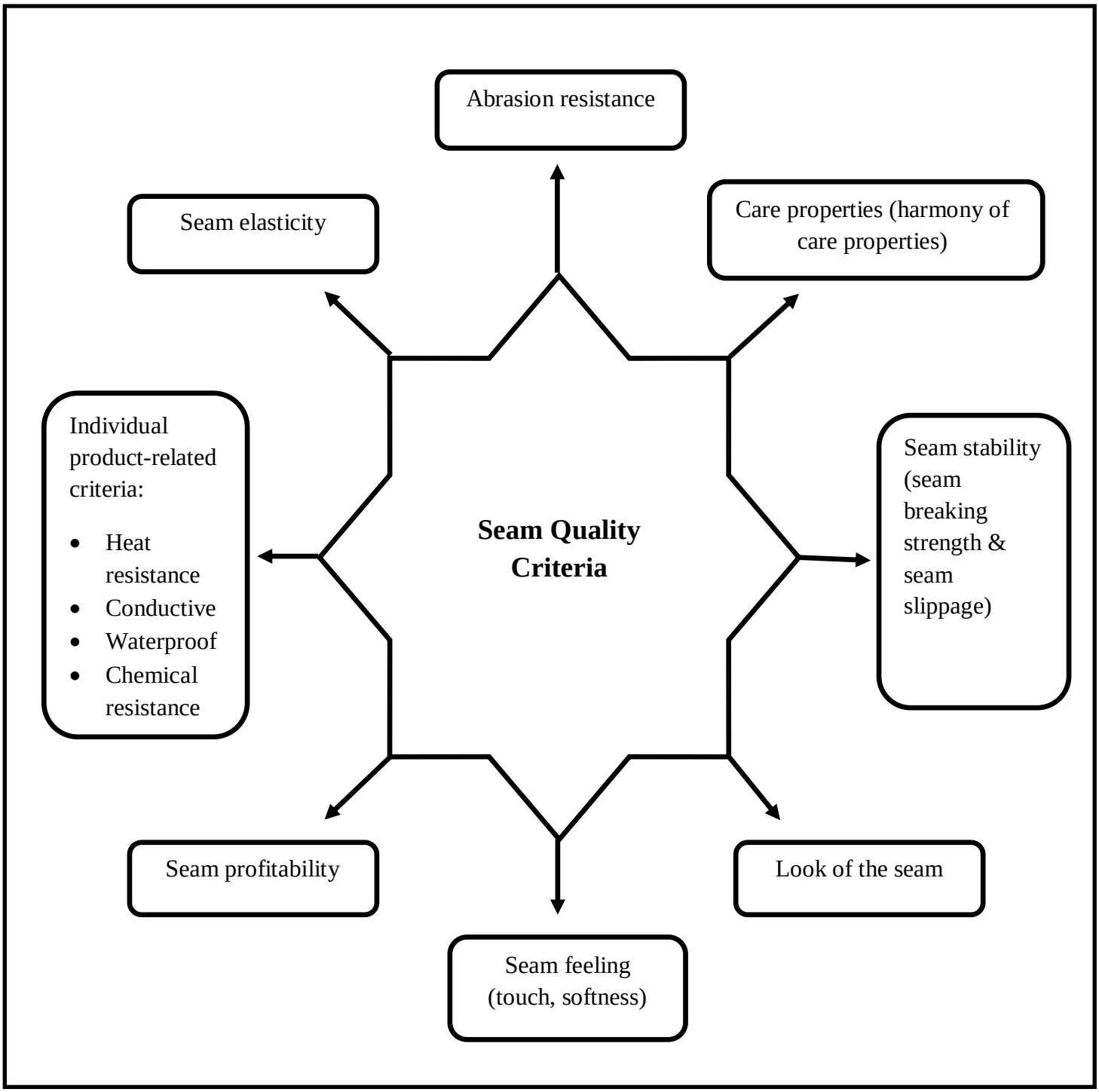
- **Accepted quality level:**

Accepted Quality Level (AQL) is a quality control tool for inspection of products. The AQL will tell the amount of products that should be inspected and how many defects that is accepted. Each company has its own AQL-level, the inspection level and the size chooses what levels they want to work with. (6)There are three inspection levels; I, II and III. It depends on how comprehensive test are made. Defects are classified by their severity; minor, major or critical. Three minor defects are equal to one major defect. If the amount of defected products in the inspected lot exceeds the AQL, the order should be rejected, otherwise it can be accepted. (20)

- **Customer claims:**

Reclaims are the results of the expectations of a costumer to the properties and performance of the product that are not fulfilled. Reclaims are also due to the promises that are given by advertisements, salesmen that are not fulfilled on using that product. (15)If we give complete information about the product then it will increase the awareness of costumer and it will more attract its users. Claims should be handled at once and without questioning the customer, if not necessary. This will benefit both the company and the customer. (14)

Figure 18 Seam Quality Criteria



1.18 Seam quality criteria:

i. Abrasion resistance:

The seam abrasion resistance characterizes the thread's resistance to abrasion stress in the seam. It is determined by the fabric, the seam construction, and the sewing thread. Fleecy and voluminous fabric protects the sewing thread from rubbing, hard and glossy fabric expose the seam more and thus increase the abrasion stress. (10)

The seam construction(stitch and seam type) also influence the abrasion stress, for example lap seams for joining two layers cause a more intense abrasion stress. (24)

ii. Care properties:

The greatest influence on a seam touch has the sewing thread, and this is also factor that can be changed easily. Strength, construction and the raw material of sewing thread.

For example fine polyester bulk yarns make different seam feeling than course polyamide multi-filament thread. Spun cotton threads create a different touch than braided polyester threads. (24)

iii. Seam stability:

For assessing the seam stability, it is important to check the cross resistance and the seam slippage. Seam breaking strength describes the resistance of seams to tensile stress on seam in the crosswise direction.

The used sewing thread is primary factor for possible breaking strength of seam-its raw material, strength, and construction. (10)

When choosing the sewing parameters, the stitch density, stitch type, and the thread balance in the seam have a great influence on the seams breaking strength. Increasing the stitch density by only 1 stitch/cm, leads 25-30%increase of seam breaking strength. (26)

iv. Look of the seam:

It is the visual perception can be impaired only if one dislikes something. And there are many causes for this. (10)

- Seam pucker.
- Seam mark.
- Unfortunate matching of sewing thread and fabric
- Unfavorable thread look
- Unfavorable stitch looping and incorrect thread balance.

v. Seam feeling:

Many garments are worn directly on the skin; many seams are touched by our hands every day; so a seam touch cannot be left out as a criterion for the seam quality.

In sportswear, flat seams and a favorable touch are of extreme importance. A seam touch depends on the fabric, the seam construction and the sewing thread. (24)

vi. Seam profitability:

It is an important criterion when designing and deciding on seam. For production, it is extremely important that quality seams can be realized economically. By choosing the right parameters and the right sewing thread, the seam profitability can be influenced.

Profitability in seam processing depends on the following calculating factors: (8)

- Individual sewing thread costs (cost and price).
- Labour costs + nonwage labour costs.
- Operating supplies, for example, sewing machine needles.
- Cost of work place.
- Energy costs per work place.

vii. Seam elasticity:

Seam elasticity means the elasticity and the behavior of a seam under tensile stress in lengthwise direction. It is primarily determined by the thread reserve in the seam and by the type of thread as well as the stitch type for example chain stitch and over lock seams are more elastic in nature compared to the lockstitch seams. Elastic seams are important for many applications which include undergarment, sportswear, swimwear, diving suits etc.

Parameter for determining elasticity is thread reserve, tread tension, stitch type, stitch density, and thread balance of needle and bobbin thread. (8)