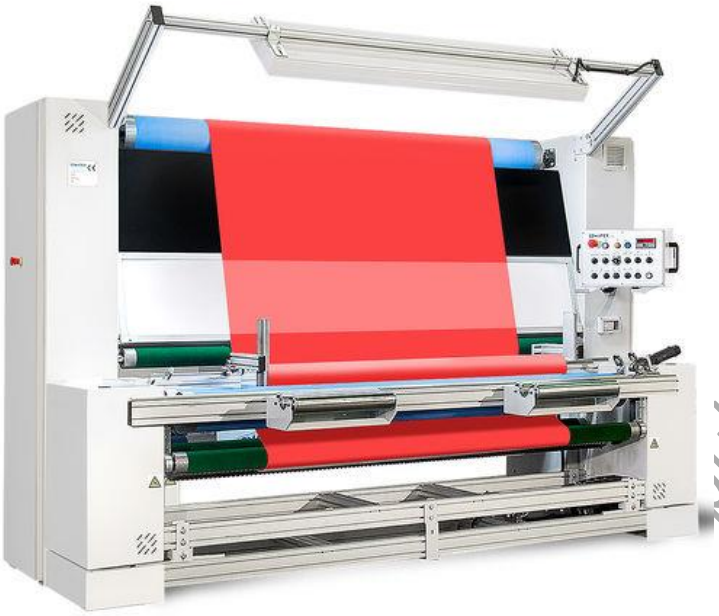
DRAFT STUDY MATERIAL



FABRIC CHEKCER

(Qualification Pack: Ref. Id. AMH/Q0101)
Sector: Apparel, Made-ups & Home Furnishing

(Grade XII)

PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION
(A constituent unit of NCERT, under MOE, Government of India)
Shyamla Hills, Bhopal- 462 002, M.P., India
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Preface

Vocational Education is a dynamic and evolving field, and ensuring that every student has access to quality learning materials is of paramount importance. The journey of the PSS Central Institute of Vocational Education (PSSCIVE) toward producing comprehensive and inclusive study material is rigorous and time-consuming, requiring thorough research, expert consultation, and publication by the National Council of Educational Research and Training (NCERT). However, the absence of finalized study material should not impede the educational progress of our students. In response to this necessity, we present the draft study material, a provisional yet comprehensive guide, designed to bridge the gap between teaching and learning, until the official version of the study material is made available by the NCERT. The draft study material provides a structured and accessible set of materials for teachers and students to utilize in the interim period. The content is aligned with the prescribed curriculum to ensure that students remain on track with their learning objectives.

The contents of the modules are curated to provide continuity in education and maintain the momentum of teaching-learning in vocational education. It encompasses essential concepts and skills aligned with the curriculum and educational standards. We extend our gratitude to the academicians, vocational educators, subject matter experts, industry experts, academic consultants, and all other people who contributed their expertise and insights to the creation of the draft study material.

Teachers are encouraged to use the draft modules of the study material as a guide and supplement their teaching with additional resources and activities that cater to their students' unique learning styles and needs. Collaboration and feedback are vital; therefore, we welcome suggestions for improvement, especially by the teachers, in improving upon the content of the study material.

Deepak Paliwal
(Joint Director)
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20 June 2024

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Table of Contents

Module 1	Introduction to Fabric & Its Construction Techniques

Module Overview

Fabric contributes for approximately 50-60% of the total garment cost, making it crucial to the entire garment production process. The fabric checking operation is a critical step in ensuring better quality. However, without a basic understanding of the fabric creation process and varieties, fabric checking operation cannot be done. The fabric checker's job is to find and fix fabric flaws before moving on to the next step in the process. The fabric inspection area should be well-kept, with all instruments and apparatus in good operating order. If a problem exists, it should be reported as soon as possible to avoid significant consequences. As a result, it's critical to understand the numerous fabric flaws and write an inspection report that can be reviewed by the appropriate authorities. Fabric quality control is an important step for ensuring that the fabric manufacturing process adheres to industry standards and expertise.

Learning Outcomes
After completing this module, you will be able to: • Explain and list Fabric Construction techniques • Describe Technical textiles & its uses • List and explain Types of fabric finishes • Analyze and identify Factors responsible for the quality of fabrics
Module Structure
Session:1 Fabric Construction techniques
Session:2 Technical textiles & its uses
Session:3 Types of fabric finishes
Session:4 Factors responsible for the quality of fabrics

Session 1: Fabric Construction Techniques

Every textile sector requires quality control and assurance; therefore the fabric checker's job is to ensure quality standards to the best of his or her technical knowledge and experience. Fabric checking requires a thorough understanding of fabric manufacturing and varieties of textile finishes, as well as the ability to recognise the type and severity of defects. Textile

industries use a variety of fabric manufacturing techniques in addition to weaving and knitting to suit consumer expectations.

Weaving is currently the major method of fabric production which includes the basic weaves and the fancy weaves. Knitted fabrics are rapidly increasing in importance and include weft types and the warp types. Other interlaced fabrics include net, lace, and braid. Nonwoven fabrics, which comprise fabrics made by felting and other processes, are also gaining popularity.

1.1 TYPES OF FABRICS

There is a difference between the fabric we wear and the fabric used in home furnishings and other applications. Some fabrics are thick and rigid, while others are thin. Some fabrics are plain, while others have self-design. Fabrics differ in appearance due to their construction. The characteristics, look, and wear ability of a fabric are all influenced by the fibres and yarns, as you learned in 11th grade. Fabric construction procedures also have an impact on the fabric's appearance, qualities, and performance. Fabrics are mainly divided into following categories:

1. Woven
2. Knits
3. Non-woven
4. Braided
5. Nets
6. Laces

Now, let's enumerate some of the important features of these techniques:

i) **Woven fabrics:** Woven fabrics are manufactured by the most commonly used method of fabric construction i.e. weaving. Weaving is where two sets of yarns (Warp and weft) are interlaced with one another at right angles. Woven fabrics are majorly used for clothing and home furnishing.

(a)

(b)

Fig.: 1.1 (a & b): Woven Fabric

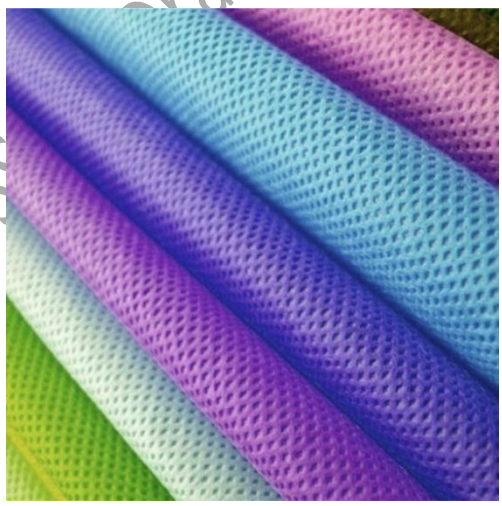
ii) **Knit Fabrics:** Knits are manufactured by the inter looping of yarns. It gives a lot of stretch and easy-care properties to the fabric. Knits are mainly used for hosiery. Knit fabrics are especially suited to clothing such as sportswear, T-shirts, and socks.

(a)

(b)

Fig.: 1.2 (a & b): Knit Fabric

iii) **Non-Woven fabric:** These fabrics are created directly from fibres without weaving or knitting. A web is made up of fibres that are held together in the presence of pressure, moisture and heat. Mechanical and chemical bondings are two options for bonding the fibres together to form a fabric. Nonwovens are used in a variety of industries, including agro and geo-textiles. Nonwoven sheets are utilised as interlinings in overcoats, collars, surgical masks, crop covers, greenhouse shade, and other applications.



(a)

(b)

Fig.: 1.3 (a & b): Non-Woven Fabric

iv) **Braided Fabrics:** Braided fabrics are created in a fashion similar to braiding of hair. In textiles, braiding is a machine or manual process of interlacing three or more yarns or bias-cut cloth strips in a diagonal pattern to make a narrow strip of flat or tubular fabric. These fabrics are mainly used to make trimmings and shoe laces.

(a) (b)

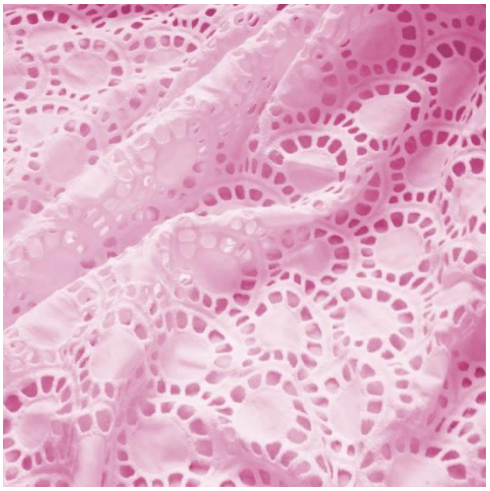
Fig.: 1.4 (a & b): Braided Fabric

v) **Nets:** Net or netting is any textile in which the yarns are fused, looped or knotted at their intersections, resulting in a fabric with open spaces between the yarns. Net has many uses, and comes in different varieties.

(a) (b)

Fig.: 1.5 (a & b): Net Fabric

v) **Laces:** Yarns are criss-crossed to create intricate designs. Yarns may be interlooped, interlaced or knotted to give open-mesh structure. Beautiful decorative designs can be created through lace making. Laces are very important trimmings that are used to decorate a garment.



(a)

(b)

Fig.: 1.6 (a & b): Lace Fabric

1.2 Fabric construction techniques:

i. Weaving

Woven fabrics are constructed by interlacing of two set of yarns perpendicular to one another. Weave constructions are classified in relation to the manner in which the warp and weft yarns intertwine. There are three basic components of weaving. They are:

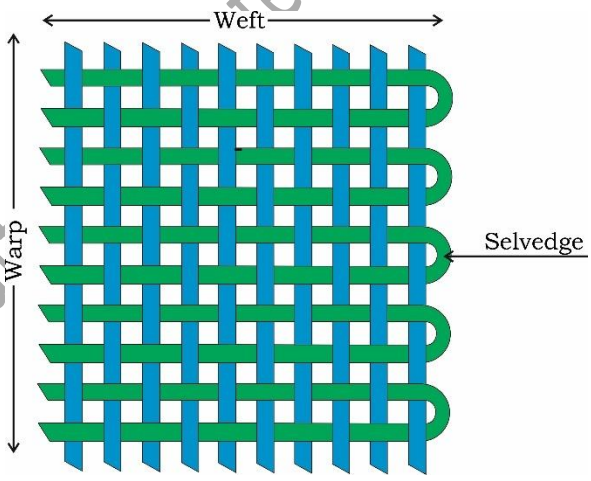


Fig.: 1.7: Components of Weaving

i. **Warp**: Yarns along the length of the fabrics or parallel to the selvedge. These are also called ends.

ii. **Weft:** Another set of yarns moves perpendicular to warps, are called wefts. They are interlaced with warps in a crosswise direction to make a fabric. They are also called picks or fillings.

iii. Selvedge: The edge along the two sides of the woven fabric is called selvedge. A selvedge is a "self-finished" edge of the fabric that prevents it from unraveling and fraying which means it does not require additional finishing work, such as a hem or bias tape.

Fig.: 1.8: Selvedge

Basic principle of weaving

Weaving process comprises of three basic functions shedding, picking and battening on loom. These three operations are responsible for the quality of the end product. Brief ideas about all these steps are given in the Fig -2 process of weaving.

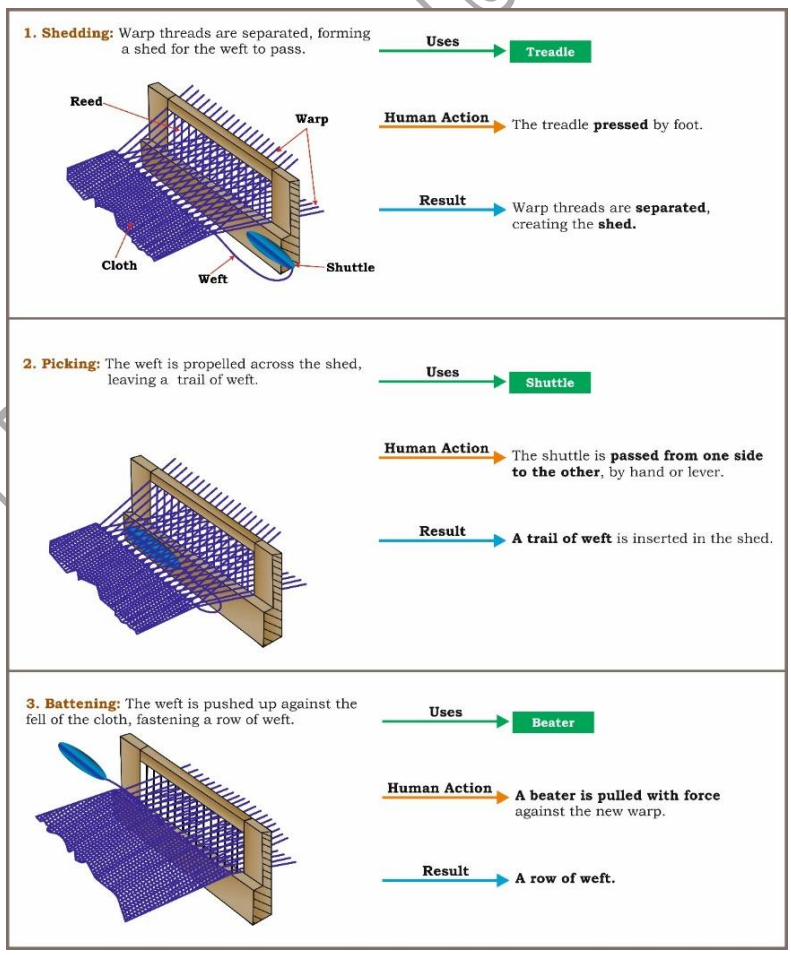


Fig.: 1.9: Process of Weaving

1.3 Types of weaves

The way warp yarns and weft yarns are interlaced is referred to as a fabric weave. There are three fundamental weaves from which we can create a variety of additional patterns. Plain, Twill, and Satin are the three fundamental weaves. Fabric weaves are crucial to understand since the smoothness, comfort, thickness, durability, tear strength, and even drape of the fabric are all determined by the weave type.

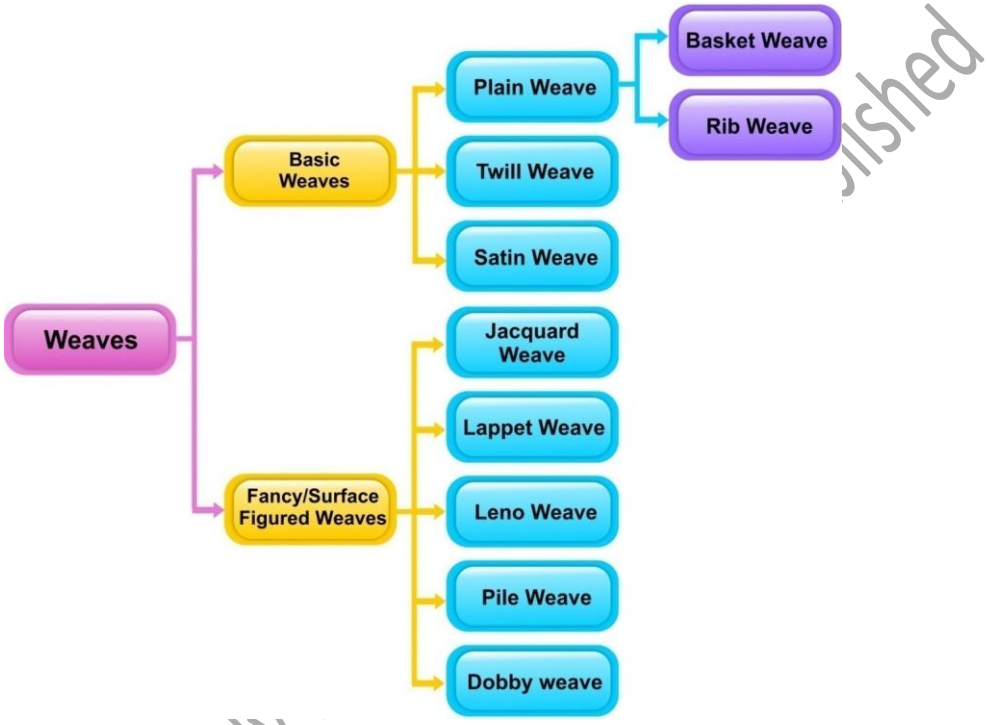
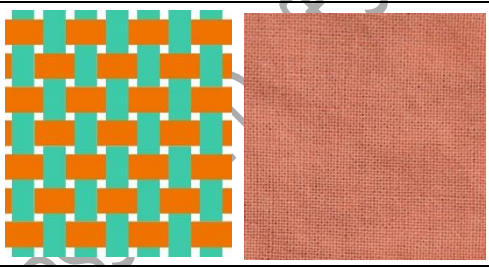
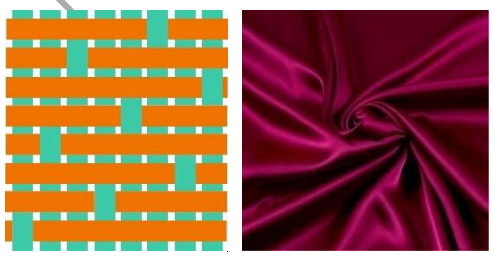
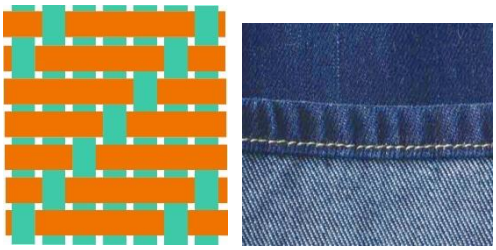
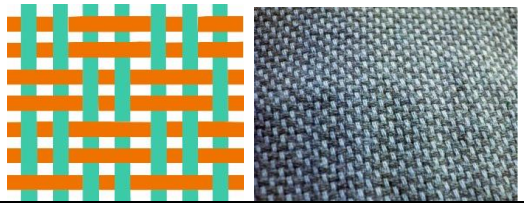
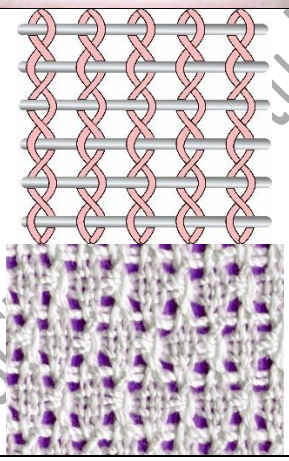
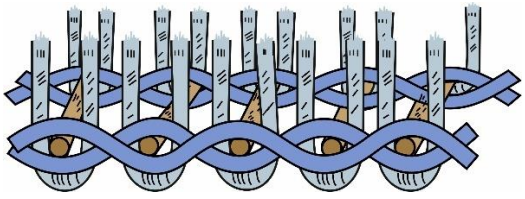


Fig.: 1.10: Types of Weaves

	**Plain weave** It is a fundamental weave for the fabric construction and used majorly for the construction of any type of garment. In this weave structure every filling (or warp) yarn passes alternately over and under consecutive warp (or filling) yarns.
	**Satin Weave** Second most basic or primary weave famous for its shine and structure in fabric construction. In this yarns pass over (or under) warp yarns after passing under (or over) a warp yarn so as to give the fabric a smooth glass-like surface when the float process is staggered. Satin weave fabrics have good drape peroperties.

	**Twill weave** Twill weave is also very common and comes under the category of the primary weaves after plain and satin weaves. In twill every weft yarn passes over (or under) two or more warp yarns, after passing under (or over) one or more warp yarns in staggered fashion, so as to produce a diagonal line on one or both sides of the fabric.
	**Basket Weave** Basket weave is a variation of the plain weave but with a multiple yarn grouping. Two or more yarns travel as a set. This gives a stronger and better properties to the fabric than the plain weave.
	**Jacquard Weave** Any combination of plain, twill, satin and basket weave counts used to give a complex configuration with a bias-relief effect. This weaves gives intricate designs on the fabrics suitable for home furnishings majorly.
	**Lappet Weave** A weave that has two superimposed warp layers in sections of the fabric. Generally done on small looms to create small designs or spots.
	**Leno Weave** A weave with an open-space effect. Each filling yarn passes through the ellipse formed when two adjacent warp yarns cross over each other in reciprocal fashion from filling to filling. These warp yarn amplitudes pass over or under each other before and after encompassing the filling yarn. This weave gives a open weave appearance.
	**Pile Weave** A weave that has the end of looped or cut yarns protruding out of one fabric surface. A double pile weave has yarn stubs protruding out of both surfaces. Velvet and corduroy are the common examples of pile weaving

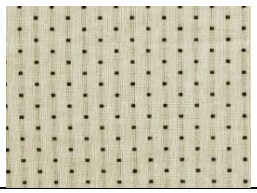
	
	**Dobby Weave** Dobby weaves, like bird's-eye piqué, have small, geometric, textured, frequently repeated woven-in designs that require a particular loom attachment.

Table 1.1: Types of weave

ii. Knitting

Knitting is the process of constructing fabric with one or more group of yarns by interloping the yarns.

There are two basic types of knitting: weft and warp.

Weft knit fabric is manufactured by building the loops of yarn in horizontal position through the fabric width. In Warp knitting, fabric is manufactured by making yarn loops parallel to the fabric length.

Weft knit fabrics are produced in tubular- or flat-form circular knitting, whereas warp knit fabrics are made only in flat form.

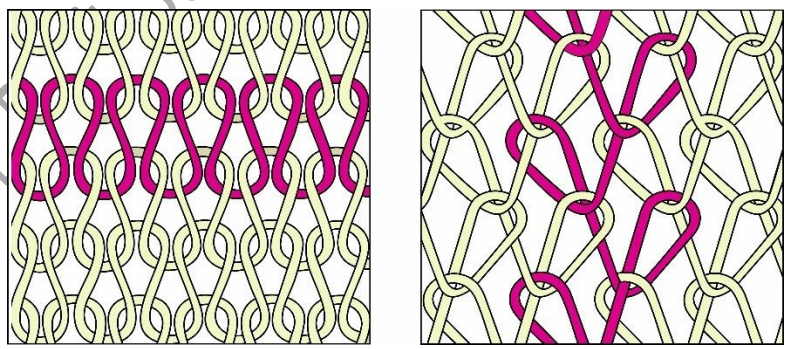


Fig.: 1.11: Weft Knit

In a knitted fabric you will see the following:

Courses (below right): These are the series of successive loops lying in crosswise direction.

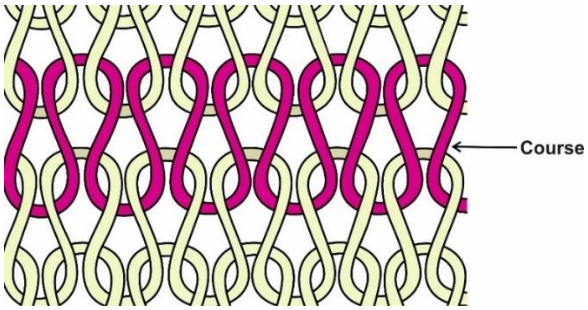


Fig.: 1.12: Courses Knit

Wales (below left): These are the lengthwise or vertical columns of loops.

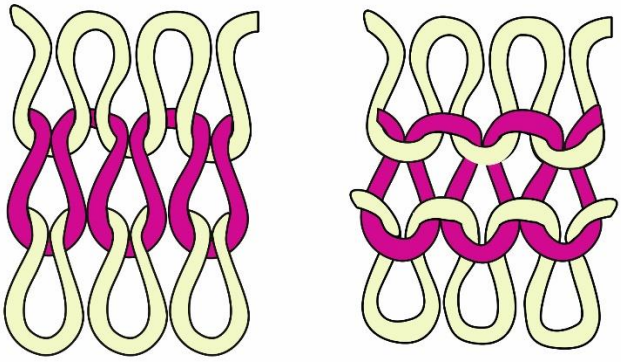


Fig.: 1.13: Wales Knit

PROCESS OF KNITTING

Whatever their structure, all knit fabrics are composed of three basic stitches: Knit & Purl, Tuck and Miss (float or non knit) which are foundation of all weft knitted structures.

a) **Plain or Purl Knit Stitch** can be produced in flat knit, tubular, or circular forms. Basic knit stitch is a plain stitch while Purl is basically reverse of a basic plain knit stitch. This plain flat knit is also called jersey stitch. Knit stitch (technical face) is a V-shaped appearance where the shanks are above and the feet are below the head of preceding stitch.

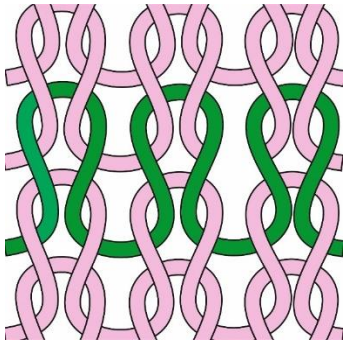


Fig.: 1.14: Plain Knit

b) **Purl stitch** (the technical back) is of the semi circle appearance where the legs are below, and the feet are above the head of preceding stitch. The loops form vertical rows, also called Wales, on the fabric face, giving it a sheen, and crosswise rows, also called courses on the back.

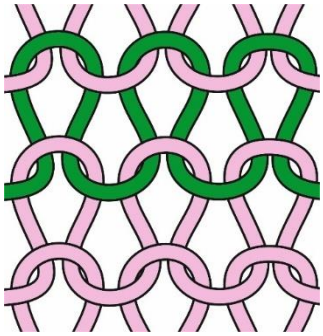


Fig.: 1.15: Purl Knit

c) **Tuck stitch** is a knit stitch which creates an open space in the fabric. It is made when a needle rises to take a new loop without casting the old. It consists of a held loop and a tuck loop both of which are intermeshed in the same course. A tuck loop always faces the technical back of the knitted structure.

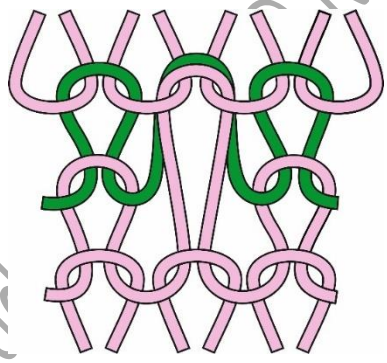


Fig.: 1.16: Tuck Knit

d) **Missed- stitch or Float stitch** is so called as it produces a float of yarn on the fabric's wrong side. Also termed as a miss stitch as it is a length of yarn not received by a needle and connecting two loops of the same course that are not adjacent wales.

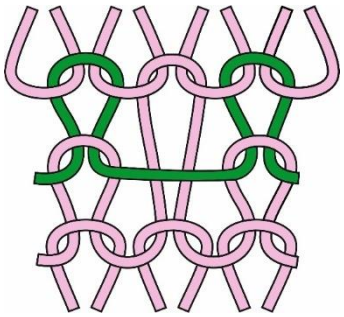
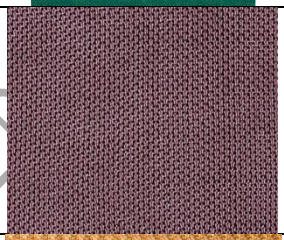


Fig.: 1.17: Missed- stitch or Float stitch

1.6 Knit structure

Flat or Jersey Knit		Flat vertical lines on the face of the fabric are the identification of Jersey fabrics, and dominant horizontal ribs on the back of the fabric.
Purl Knit		Purl knit gives the same appearance on both sides of the fabric. Many attractive patterns and designs can be created with the purl stitch.
Rib Stitch Knit		Front and back is same in Rib fabrics. Columns of wales are visible on both sides i.e. front and back of the fabric. Rib fabrics are characterized by their excellent elasticity.
Interlock Stitch Knit		They are variations of rib stitch knits. The front and back of interlocks are the same. These fabrics are usually heavier and thicker than regular rib knit fabrics unless used with finer yarns.
Double Knit		Made from the interlock stitches and its variations. This knit structure is produced with two pairs of needles.
Warp Knit		Made in a special knitting machine with yarns from warp beam. Unlike weft knits, they are knitted from multiple yarns, with yarns forming loops in adjacent wales.
Tricot Knit		Made almost exclusively from filament yarns because of uniform diameter and high quality. Fabrics constructed by the tricot knitting machine are usually plain or have a simple geometric design.
Raschel Knit		Can be identified by their intricate designs, the open-space look of crochet or lace, and an almost three-dimensional surface effect design.

Cable Knit		This is a double knit fabric made by the special loop transfer technique. The wales in the fabric have a rope-like an appearance, where plaits are based on the transfer of loops with adjacent wales.
Bird's Eye Knit		It is a variation of double knit fabric with a combination of tuck stitches along with knitting stitches. The tuck stitch creates interesting eyelet or hole effect on the fabric surface resembling a bird's eye.
Pointelle Knit		It is also a different type of double knit fabric. The fabric has patterned miss stitches. The fabric has looked like lace, with holes made by these transferred stitches.
Intarsia Knit		It is a single knit fabric. The patterns look identical on both the face and backside of the fabric. There are no floats found on the backside of the fabric.
Jacquard Knit		These have different colored loops made of different threads in the same course. Floats are an inherent feature of single jersey jacquards.
Knitted Terry		It is pile jersey fabric made with a special attachment in regular circular knitting machines similar to woven fabrics. The fabric has loops on the fabric surface. The fabric is made of two sets of yarns, in which one set of yarn makes the pile, while the other set of yarn makes the base fabric.
Knitted Velour		They are Pile jersey fabrics having soft protruding fibers on the fabric surface. Like knit terry, they are also made of an additional set of yarns making pile loops on the fabric surface.

Sliver Knit		It is made of special circular knitting machines in which the surface fibers imitating fur are attached to the fabric, by means of knitting sliver along with base yarn making the fabric.
Fleece Knit		It is a type of weft insertion jersey. Weft insertion fabrics are weft knitted fabrics in which an additional yarn is inserted for each course. These additional yarns are not knit, rather they are held by the loops in each course of the fabric.

Table 1.2: Types of knit

Activities

Activity

1. Collect fabric samples including woven and knitted and prepare a detailed analysis report.

Materials Required

1. Fabric Swatches
2. Scissors
3. Diary
4. Pick Glass
5. Needle
6. Pen

Procedure

1. Collect random sample swatches from any fabric vendor or industry.
2. Cut the swatch into square of minimum 4x4 inches size.
3. Use pick glass to observe the structure of the fabric swatch.
4. Identify and categorize it into woven and knitted.

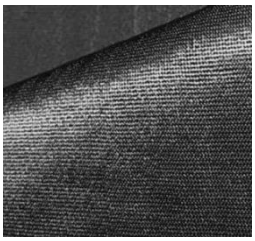
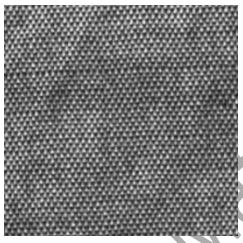
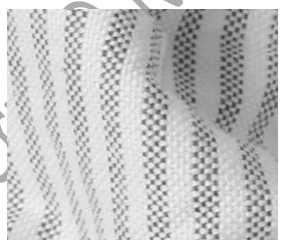
5. Try to identify the basic weave or type of knit in the fabric swatch by pulling warp and weft yarn by needle and studying the interlacement.
6. Pin the fabric in diary and note the observations with technical details.

Check Your Progress

A. Fill in the blanks:

1. _____ is the construction of fabric by interlacing two groups of yarns perpendicular to one another.
2. The knitted fabrics are classified into _____ and _____ fabrics.
3. _____ is basically reverse of a basic plain knit stitch.

B. Identify the weave type of the given fabrics:


Session: 2 Technical Textiles & Its Uses

Food, clothing and shelter are the most basic needs of a human being. Right from the stone-age man had been using textile fibers and these fibers have increased with every passing year. The latest developments in the textile industry and use of fibers in various different industries have led to the birth, growth and development of technical textiles.

The term “technical textile” refers to the textile products and materials which are manufactured primarily for their functional properties and performance. In these types of technical fabrics, the aesthetic and decorative properties are not of much importance as they are specially fabricated to incorporate and enhance the functional aspects for example improved thermal resistance, high tenacity, insulation etc. as per the end use in its various segments.

These products are then used in multiple non-conventional textile industries like construction, agriculture, healthcare, automobile, aerospace and much more. India has always been defined globally in the traditional textiles category and natural fibers as it is their strength, but now it is emerging as a key player in the technical textile industry as well. With respect to the technological advancements, several steps have been taken by the various countries to accommodate technical textiles in their industries.

This shift is also clear in India's textile sector. The invention of specialty fibers and their incorporation in many different areas suggests the importance of technical textiles. With growing awareness about the functional uses of the industry, it has led to higher consumption of these products across the globe. This brings to notice that technical textile is important for the fabric checker to understand the differences between these and regular fabrics, to assist in the process of inspection and approval.

The technical textile is all those materials and products designed for uses other than non-protective clothing, home furnishings, and floor covering, in which the fabric or fibre component is chosen primarily, but not exclusively, for its performance and properties rather than its aesthetic or decorative qualities.

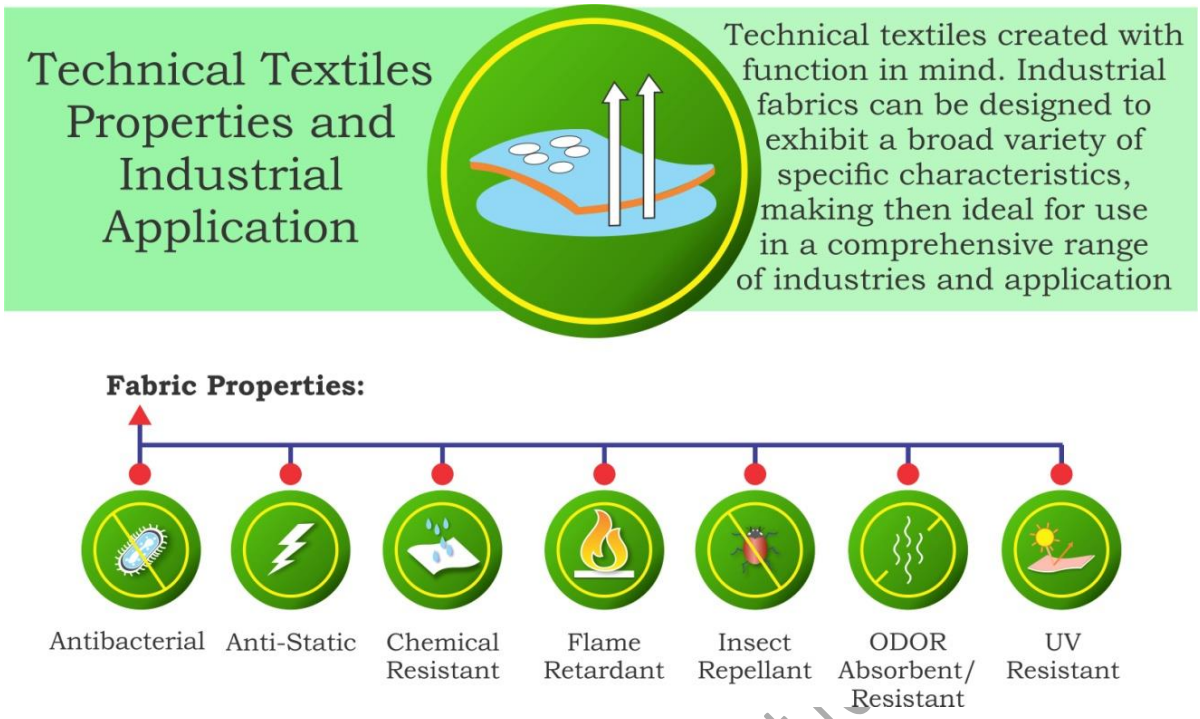


Fig.: 1.18: Technical Textiles Properties and Industrial Application

Technical textiles exhibit various engineered products which are manufactured using natural and manmade fibers both with a definite functionality and these functional fabrics have its application across various industries.

The technical textiles have been classified based on the usage as follows:

1. Agrotech: agriculture, aquaculture, horticulture and forestry
2. Meditech: Medical bandages, hygiene products
3. Buildtech: Building and constructional material
4. Mobiltech: automobiles, aerospace, shipping and railways
5. Clothtech: technical components of clothing and footwear
6. Oekotech: Environmental protection
7. Geotech: Civil engineering and geo textiles
8. Packtech: packaging material
9. Hometech: technical components of household textiles, floor-coverings and furniture,
10. Protech: personal and property protection
11. Indutech: filtration, conveying, cleaning and other industrial uses
12. Sporttech: sport and leisure

Fig.: 1.19: Classification of different technical textiles

Technical textile industry comprises of very diverse segments including various characteristics, functionality and end use applications. Under the Scheme for Growth and Development of Technical Textiles (SGDTT), launched during 2007-08, the government had set up bodies in the form of four Centers of Excellence (COE) to provide support to the manufacturers in its various segments. The four identified Centers of Excellence are:

S.no	Name	Area of Centre of Excellence
1.	Northern India Textile Research Association (NITRA)	Protech
2.	South India Textile Research Association (SITRA)	Meditech
3.	The Bombay Textile Research Association (BTRA)	Geotech
4.	Ahmedabad Textile Industry's Research Association (ATIRA)	Composites

NITRA: Northern India Textile Research Association (NITRA) is jointly established by Ministry of Textiles and Textile industry in 1974. It is also

one of the prime research institutes providing scientific research and support services to the textile industry. It is Centre of Excellence for Protective Textiles catering to quality evaluation of materials, R&D, manpower training and publishing books and papers.

SITRA: The South India Textile Research Association was established in 1956 in Coimbatore and is one of the best equipped research organization in the world. It is the Centre of Excellence for Medical Textiles

BTRA: Bombay Textile Research Association was established in 1954 with a perspective to meet the technological needs of the Indian textile market. It includes mill sectors as well as decentralized sector catering to manmade fibers, machineries, dyes, chemical auxiliaries and much more. BTRA- the Centre of Excellence for Geotech aims at creating awareness and development in the use of geo synthetics products which will help the growth of Geo textile sector in India.

ATIRA: Ahmedabad Textile Industry's Research Association was established in 1947 by the textile mills of Ahmedabad. It aims at creating a competitive and sustainable textile industry by providing innovative and sustainable solutions which can lead to a better industry, economy and society. It is the Centre of excellence for composites and also caters to environment engineering, Nano web technology and geotech.

Application of Technical Textiles

It is important to understand the specialized applications of the technical textiles. The fabrics, yarns and fibers used here should be capable of reducing risk like they should be insect proof, flame retardant, antibacterial, soil resistant, moth proof etc. and which can function actively as well. Some of the application functions that it needs to possess are as follow:

1. Mechanical functions: elasticity, tenacity, mechanical resistance
2. Functionalities for living beings: antibacterial, biodegradable, biocompatible
3. Exchange functions: filtration, insulation, air permeability
4. Protective functions: fire, antistatic, electrical insulation, UV Rays, electromagnetic field, NBC (Nuclear, biological, chemical)

Types of Technical Textiles:

Agrotech (Agro-textiles):

Agriculture is one of the largest industry in the world, hence it is very important to understand the needs of tomorrow with the growing

population, urbanization and industrialization. Agro textiles are the textile products used in agriculture with properties like stiffness, resistance to sunlight, resistance to toxic environment, bio degradation which help in better harvesting of crops. Adopting hi-tech farming techniques can lead to a higher overall yield with better quality and tasty agro products. These techniques include textile structures in various forms like shade house/poly house, green house that can enhance the yield of the agro-products. They also help in controlling environmental factors like humidity, temperature and water. Crop protection, weed control wind, rain and birds are some of the major concerns as a lot of damage occurs due to it. Agro textiles caters to a wide variety of products like bird net, windshield, mulch mat, hail protection net etc. which can be used to overcome these challenges faced by the farmers. The second largest industry next to agriculture is textile industry. The application of Agro textiles can help the agriculture and horticulture industry to grow at a massive level with higher yields with bearable losses and damages. Some of the examples of Agrotech products are:

- **Bird protection nets:** These nets are very effective in protecting the seeds, fruits and crops from the attack of pests. These are made up from open mesh net fabrics with an open structure that provides excellent air circulation, minimal shade and repels birds.

Fig.: 1.20: Bird protection nets

- **Monofil nets:** These nets work against prevailing winds. They act as windbreak fences which helps in protection against the damage caused by heavy winds like breakage of young branches, tearing of leaves, damaging of flowers etc. It can also withstand heavy hailstorms when installed as a roof profile above the crops.

Fig.: 1.21: Monofil nets

- **Insect Protection Net:** These are knitted and woven polyethylene monofilament meshes that protects the plants from insect attack

without any use of insecticide. It keeps away the harmful insects from tunnels or greenhouses and also keeps away the pollinating insects like bumblebees from escaping.

Fig.: 1.22: Insect Protection Net

- **Plant Nets**: These nets are used for plants like tomatoes and fruits that grow close to the ground. These nets are made from polyolefin fiber which protects the fruits and vegetables from excessive moisture by keeping it away from the damp soil thus reducing decaying of it.

Fig.: 1.23: Plant Net

- **Fruit Cover Nets:** These nets are made up from nonwoven fabric which protects the fruits and vegetables from damage against snow, frost, heat rain, creeps, insects and birds. It helps in better harvesting.

Fig.: 1.24: Fruit Net

- **Root ball Nets:** These nets are used when the plants are transported or replanted or when they are dug up. During these processes it is

important to keep in mind the safety and growth of the plant without damaging the root system. With the help of these nets the process of transplantation becomes easy as the roots can protrude through these nets.

Fig.: 1.25: Root Ball Net

- **Weed control fabric:** These fabrics prevent the attack of unwanted weeds in an ecofriendly manner and allow water, air, fertilizers to pass through from the fabric to plants and helping in better yield.

Fig.: 1.26: Weed Control Fabric

Meditech (Medical Textiles):

These are medical textiles fabrics used for health and hygiene purposes in the medical field. Medical textile industry caters to a wide range of bandages with various applications, diapers, surgical clothing, scaffolds, prostheses, tissues, gloves, antibacterial and antimicrobial finished products and much more. Fibers like silk cotton, polyamide are used with nanoparticles which helps in the transdermal drug delivery action of the medicines in the body curing the injuries faster. It aims at providing effective medical treatment to the patient with comfort and functionality so that it can enhance the quality life of the people who are injured or ill. Some of the examples of Meditech products are:

- **Baby Diapers:** Baby diapers are made up from non-woven hydrophilic fabrics & polymers. They are characterized by their super absorbent property which provides complete dryness and prevents growth of bacteria.

Fig.: 1.27: Baby Diapers

- **Incontinence diapers:** These diapers are for adults and also known as adult diapers. They are mainly for the elderly people who have no control over their bladder. They are designed in such a manner that they can absorb and retain fluid for long.

Fig.: 1.28: Incontinence diapers

- **Sanitary Napkin:** The technical component of the sanitary napkin is similar to that of diapers as the purpose is to absorb fluid and ensuring complete dryness. They are made from hydrophilic non-woven fabric.

- **Surgical Disposables:** The surgical disposables include drapes, gowns, masks, caps, covers and shoe covers. They are made up from polypropylene spun bond non-woven fabric with or without a polyethylene film. Initially cotton reusable surgical wear was used, which is required to be sterilized after every use. Surgical disposables are used to maintain hygiene and possesses functional characteristic like they have high barrier to blood or body fluids with proven sterilization performance, good bacteria efficacy. With the growth of

multi-specialty hospitals, medical tourism and hygiene the disposable medical items are replacing the reusable cotton ones

Fig.: 1.29: Surgical Disposables

- **Surgical Dressing Material:** They are used for healing purpose on wounds and are made up of woven and non-woven both. Wound care products mainly consists of absorbent pads, non-adhering dressing or adhesive plaster for example: crepe bandages, plaster of Paris bandages, rolled bandage, gauze bandage, light support bandage, surgical pads and much more.

Fig.: 1.30: Surgical Dressing Material

- **Implantable materials:** These are textile structures used in the form of repair, replacement, tissue growth, vascular grafts, artificial ligaments, artificial joints, scaffolds and so on inside human body for various different purposes.

Buildtech (Building Textiles):

They are also known as construction textiles, which are used in architectural and construction of buildings, hotels etc. These textiles cater to functions like protection against sunlight, insulation, concrete reinforcement, interior construction, noise prevention etc. There have been massive developments in the textile membranes which can be used for roof construction with high tenacity PVC coated fabrics, Teflon coated glass fibers, silicone etc. Some of the examples of Buildtech products are:

- **Scaffolding Nets**: They work as a multipurpose protecting tool against many severe conditions like bad weather, falling debris, shade against solar radiation which prevents floor heating tubes during construction while using wet cement and much more.

Fig.: 1.31: Scaffolding Nets

- **Hoardings / Signage's**: They are made up of translucent flexible material called flexible-face-sign fabric which is commonly known as flex. It is mainly used in hoardings, exhibition banners, trade shows display, advertising et. It is made up from warp knitted fabric and PVC coated polyester which comes in different varieties as per its application.

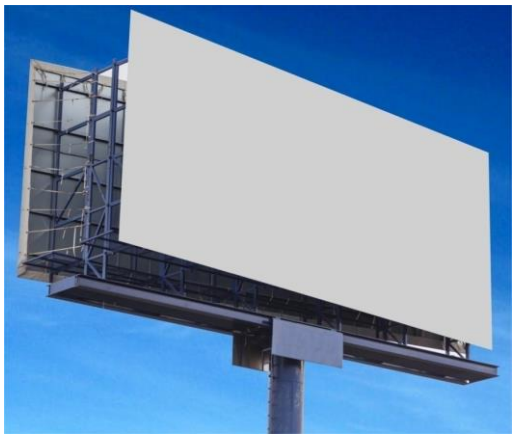


Fig.: 1.32: Hoardings

- **Tarpaulins – HDPE, Jute Tarpaulins and Cotton canvas**: It is a large flexible sheet containing water resistant property. It is widely used as shed to protect from rain, transportation in trucks and automobiles, used in warehouses for storage, boats, temporary storage, tents, etc. It is made up of cotton canvas, polyethylene and jute.

Fig.: 1.33: HDPE, Jute Tarpaulins and Cotton canvas

- **Architectural Membranes:** They are one of the new constructional materials being used in India which includes permanent and semi-permanent structures such as outdoor entertainment areas, car park covers, cafes , airports, stadiums, sports hall or any venue which requires protection from heat, wind, rain, glare, UV protection etc. it is a strong and aesthetically superior product that caters a lot of flexibility to the interior designers and architects which allows them to work on high levels of creativity.

Fig.: 1.34: Architectural Membranes

Mobiltech (Automotive textiles):

These textiles are used in the transport industry mainly in construction of automobiles. These textiles include its application in automotive components which includes the railways and aircrafts. They range from

simple to complex and highly engineered textile products like ropes, webbing tie downs, curtains, seat belts, parachutes, air balloons etc. which focusses not only on safety and isolation concept but also comfort and style aspect. Some of the examples of Mobiletech products are:

- **Nylon tyre cord:** The tyre industry is one of largest industry consuming around 98% of the total nylon tyre cord consumption. It provides strength to the tyre and has gradually replaced the usage of polyester and rayon. the nylon cord has high strength, high adhesion, impact resistance breaking strength and elongation.

Fig.: 1.35: Nylon tyre cord

- **Seat belt webbing:** They function as a safety harness and secures the passengers in a vehicle against collision or any harmful incident. They are made from woven narrow fabric made from high tensile strength polyester filament yarn or nylon filament yarn.

Fig.: 1.36: Seat belt webbing

- **Car upholstery/ Seat cover fabrics:** Woven seat covers are one of the important contributors of technical textiles in the automobile industry, providing emphasis on luxury and comfort. The seat cover

market has seen an immense uptrend in the market. They are made up from cotton, vinyl, velvet and leather.

Fig.: 1.37: Car upholstery/ Seat cover fabrics

- **Automotive Airbags**: These are protective equipment which reduce the injuries during an accident. Primarily nylon 66 or polyamide 66 are used with a silicone coating on it.

Fig.: 1.38: Automotive Airbags

- **Helmets:** Used as protective headgear for people driving two wheelers. The inner layer is made up from polypropylene or polystyrene and outer layer is made up from plastic or glass or other synthetic fibers.

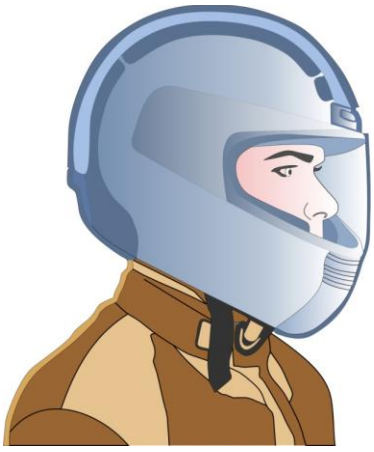


Fig.: 1.39: Helmet

- **Railways seat cover fabric:** The material used in the railway berths is polyurethane foam and Rexene cloth. Rexene is constructed from single or multiple poly vinyl film and also coated with fire resistant finish. Synthetic fibers like polyester and rayon are also used.

Fig.: 1.40: Railways seat cover fabric

- **Airline Disposables:** Major Air crafts uses disposables Tea pot covers, head phone bags, head rest covers.

Fig.: 1.41: Airline Disposables

Clothtech (Clothing Functional Textiles):

These are the clothing textiles which play a major role in the garment but are technically the hidden components in the clothing and footwear products. These textile materials include interlinings, sewing threads, insulating fiber fills, draw strings, Velcro, shoe laces, zippers etc. These are all an extremely important part of clothing as they provide a better fit and comfort to the wearer. It includes properties such as durability, stretch ability, abrasion resistance, and much more. Some of the examples of Clothtech products are:

- **Sewing threads:** They are used in stitching of apparels, embroidery, footwear, mattresses, saddlery, industrial gloves, seat belts,

upholstery, parachutes, tents etc. these threads ply or cabled yarns that are made from natural fibers like cotton, silk, blended fibers etc.

Fig.: 1.42: Sewing Threads

- **Shoe laces:** They are also known as shoe strings or boot laces and are primarily made up of cotton, polyester and nylon. A shoe lace consists of 2 main components- A hardened tape end which passes through the eyelets on a shoe or boot and a tape that pulls the shoe tightly. Laces are also seen in kids wear clothing, home décor, stationery, shopping bags etc.

Fig.: 1.43: Shoe Lace

- **Interlinings:** These are the fabrics which are used in between the inner layer and outer layer of the garment to provide strength, bulk or to improvise the shape of the garment. These are normally seen on the cuffs, collars, jackets, blazers etc. Interlinings are made up of cotton, polyester, poly cotton, viscose blend in both fusible and non-fusible varieties.

Fig.: 1.44: Interlinings

- **Zip Fasteners:** These are normally used for binding the edges for an opening of the fabric or garment or bag. They are normally seen in jackets, trousers, handbags, sports goods etc.

Fig.: 1.45: Zip Fasteners

- **Textile Labels:** Woven fabric labels are used for providing information, identification and promotion of the products and textile clothing. It is extremely important to use the correct clothing label in terms of the fabric. There are 3 types of fabric labels mainly:

✓ Damask: Made with finer yarns and high weave density where finer images and texts can be used.

✓ Satin: They are less expensive than damask, smooth, lustrous, shiny and soft in feel.

✓ Taffeta: They have a tight weave structure which makes it very stable and durable, it gives a brocade weave effect and are normally used as care instruction label as they are very cost effective.

Fig.: 1.46: Textile Labels

Oekotech (Ecotex):

They are the Eco-friendly Textiles, called as Ecotex or Oekotex. They are used in the environmental protection applications such as air cleaning, waste treatment/recycling, water cleaning etc. Ecotex has gained unimaginable popularity as compared to the other sectors of the textile

industry as it aims at protecting the environment and making ecofriendly products for the nature and humans both. Some of the examples of Oekotech products are:

- ✓ Organic Cotton
- ✓ Lyocell
- ✓ Tensil
- ✓ Hemp

Geotech

Geotextiles are woven, knitted and non-woven fabrics used for various functions to support drainage and separation at the ground level or below the ground level. Geo textiles are majorly used in coastal and civil engineering, road construction, drainage system, soil sealing. Synthetic fibers are used to prevent cracking of building material and concrete. It possesses good strength, low moisture absorption, low thickness and extremely good durability which helps to make the construction process better and simpler. Some of the examples of Geotech products are:

Fig.: 1.47: Geotextile

- **Construction of roads:** An effective geotextile provides separation to preserves the base and maintain the designed structure & the capacity of the road in terms of load bearing. It helps in preventing the failure of the base, which allows the passage of water therefore it prevents the soil from mixing with the base material and provides a better drainage system.

- **Railway:** The geotextile acts as a separator between the ballast (crushed stones on railway tracks.) and subgrade (coarse soil like sands, gravel etc.). Geotextiles help in maintaining the track alignment.

- **River Canal and Coastal Work**: Geotextiles is required for erosion protection and resembles a well graded aggregate filter. The filter structure is very effective as it provides high permeability and retains soil particles adjacent to it, which in turn minimizes the piping of subgrade soil and thus reduces the particles from entering the watercourse.

- **Drainage:** Geotextiles are used for drainage in earth and construction work very widely. In simple words it is the ability of the geotextile to drain fluids on its own which means it's not a part of drainage system but it is drainage system in itself.

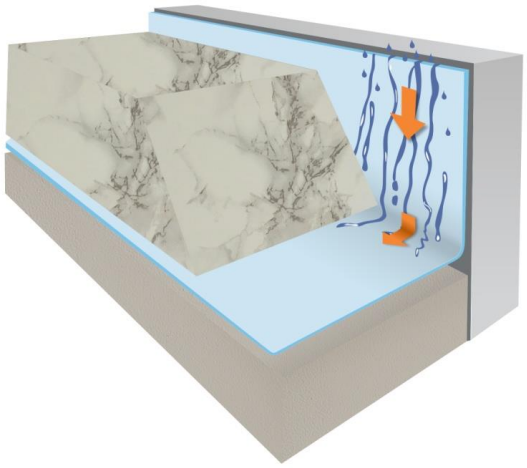


Fig.: 1.48: Drainage

- **Sports field construction:** The natural turf applications are implemented below the sand profile as synthetic drainage. A filter fabric creates a better perched water table for optimal growth for the turf.

Fig.: 1.49: Sports field construction

Packtech (Packaging Textiles):

The packaging textiles have been used since ages for packaging. It consists of woven light weight, medium weight and heavy weight fabrics that can be used in packaging like sacks, bags, wrapping material for textile bales, Flexible Intermediate Bulk Carriers (FIBCs) etc. The growing demand for reusable packaging, has created new opportunities in this segment. Traditionally natural fibers like jute, cotton were used in creating storage bags but with growth and development there is also a shift in usage of synthetic fibers as well. Some of the examples of Packtech products are:

- **Polyolefin Woven Sacks:** They are manufactured from PP/HDPE materials and are laminated or unlaminated, anti-slip coated or ultra violet stabilized TiO_2, $CaCO_2$ or as per specifications. They possess high strength, minimal seepage, moisture proof, durability, light weight and are also cheaper. The woven sacks are used extensively in packaging of fertilizers, cement, food grains, thermos plastic raw materials etc.

Fig.: 1.50: Polyolefin Woven Sacks

- Flexible Intermediate Bulk Containers (FIBC): They are similar but larger in size to the HDPE/PP bags. FIBC's are very cost effective and very appropriate for packaging during shipping and storing of dry bulk products. There are 3 types of FIBC's: circular woven, panel types, baffle types (square bags). They are used in bulk packaging of polymers like PET PVC Petrochemicals, minerals, agro products fertilizers detergents pharmaceuticals etc.

Fig.: 1.51: Flexible Intermediate Bulk Containers

- **Leno Bags:** They are used for preserving and as packing materials for fruits & vegetables like ginger, onion, garlic, cabbage, citrus fruits, pineapples. The length varies as per the requirement of the customer as it has superior aesthetics, chemically inert, excellent mechanical properties, ease to handle and store, cost effective and recyclable.

Fig.: 1.52: Leno Bag

- **Wrapping Fabric:** It is made from cotton, canvas, HDPE/PP which is mainly used for wrapping paper bundles, paper rolls steel coils, tyres, clothes etc.

Fig.: 1.53: Wrapping Fabric

- **Soft Luggage:** They are made out of woven fabrics like polyester and nylon which comprises of totes, sky bags and duffle. These bags can be with or without handles and wheels. It is very cost effective and light in weight for example: military bag packs, handbags etc.

Fig.: 1.54: Soft Luggage

- **Jute Hessian**: They are also termed as burlap which are a finer quality of jute fabric which is mostly preferred as a packaging material for all kinds of goods. They are used in upholstery, wall coverings, shopping bags etc.

Fig.: 1.55: Jute Hessian

- **Tea Bags:** Tea bags are made up of a filter paper pouch containing a thread that hold the tea powder and a tag. The filter paper pouch is constructed with a blend of wool and vegetable fibers which have a heat sealable thermoplastic such as PVC as a component fiber. There are 2 major marketers of tea bag in India, one is Tata Tea Limited and Hindustan Unilever Limited (HUL).

Fig.: 1.56: Tea Bags

Hometech (Household Textile):

These are domestic textiles used in home furnishing fabrics like curtains, wall coverings, carpets, sofa covers etc. In Hometech mainly fire-retardant fabrics are used by either adding fire resistant additives such as bromide of phosphorus compounds or by using fibers possessing good fire-resistant properties like mod acrylic. Interior decoration plays a very important role in the form of carpets, curtains, drapes etc. in every house. It is not only the decoration but also comfort in terms of seat covers, mattresses, bed sheets and safety which are few most important factors while selecting fabrics in Hometech. Initially textiles were predominantly confined only to the interiors but lately it has gained popularity in the part of construction as well. Materials like steel, plastic, wood and metals are replacing the traditional methods of interior decoration. Some of the examples of Hometech products are:

- **Carpet Backing Cloth:** It is a glass floor covering made-up on a loom. There is a huge range of carpets that are available like hand wove carpets, needle felt carpets, tufted carpets, hand knotted carpets, flat weave carpets etc. the primary backing is done with synthetic fabrics whereas the secondary backing is done with jute & woven polypropylene made of a leno weave.

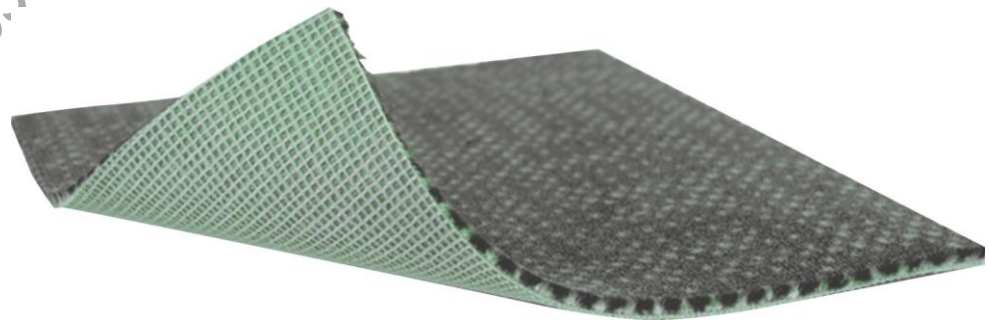


Fig.: 1.57: Carpet Backing Cloth

- **Stuffed toys:** They are also referred as plush toys or soft toys which are made up of knitted fabrics stuffed with some filling material. Stuffed toys are used for a variety of purposes for kids, for gifting, valentine's day, birthday or any special days. The outer layer of the toy is normally fleece, fur, acrylic plush, polyester felt etc. The stuffing material is cloth scrap, foam, paper foam, polyester staple fiber fill.

Fig.: 1.58: Stuffed toys

- **Blinds:** The window blinds are used with a purpose to perform certain function which includes glare and light control, outside view, ease in maintenance and handling etc. The window covering is composed of long strip of fabric with a rigid material which depends on the aesthetic and functionality that is required.

Fig.: 1.59: Blinds

- **HVAC Filters:** Heating, ventilating, and air conditioning (HVAC) are the systems that are used in commercial, residential and industrial buildings where humidity and temperature needs to be closely regulated and monitored. Filter media used in filters are made up from non-woven fabrics which are laid perpendicular to the air flow to arrest the solid particles.

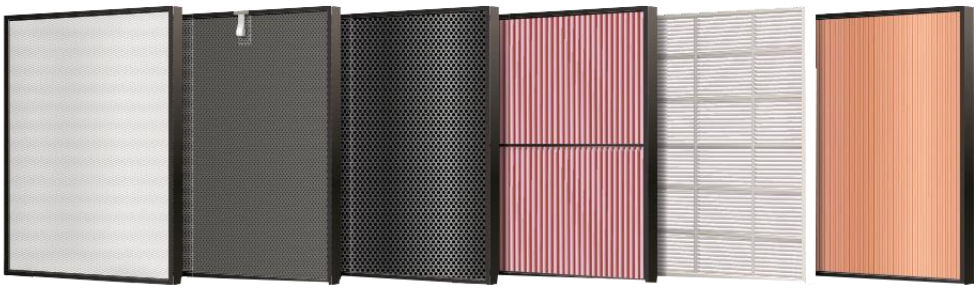


Fig.: 1.60: HVAC Filters

- **Mattresses and pillows:** Mattresses are broadly classified as coir, foam and spring mattresses. These are the elements that provide body to the mattress. The traditional Indian mattress is made up from cotton stuffing. The pillows and mattresses can be broken down into 3 main segments: hotels, hospitals, households.

Fig.: 1.61: Mattresses and pillows

- **Nonwoven wipes:** These are small piece of cloth used for cleaning and disinfecting. They are categorized into woven, non-woven and knitted. Nonwoven wipes have gained immense popularity due to its softness and excellent absorption. The wipes need to have various properties like soft and smooth texture, good moisture retention, good absorbance. Due to busy lifestyle and high disposable incomes the demand for the wet and dry wipes has increased tremendously.

Fig.: 1.62: Nonwoven wipes

- **Furniture fabrics:** Fabrics in furniture are mainly used for seating purpose in which hair fibers, foam, flock, velvet, kapok is used for padding whereas woven fabrics, leather, plastics and synthetic leather are used for coverings. Furniture can be segmented into office home and contract(hospital) furniture

Fig.: 1.63: Furniture fabrics

Protech (Protective Textiles):

These are Protective Textiles that are used in manufacturing protective clothing. A protective fabric can ensure and promote safety to the individual in their work place. Different types of protective clothing are manufactured as per the requirement for example bullet proof jackets, heat and radiation resistant clothing for protection against fire and much more. The aim of these fabric is to ensure protection against hazards. The main segments of protective clothing include fire resistant, chemical resistant, outdoor protection and high visibility. Some of the examples of Protech products are:

- **Industrial Gloves:** Industrial hand gloves are used as protective apparel for workers in factories. These gloves give protection to hands while performing heavy duty work and activities associated to it like handling objects producing sparks, heat and cushioning. Various types of hand gloves are used like leather, nitrile, knitted, latex, rubber latex which are produced in various different sizes. These gloves possess characteristics like mild heat resistance, high abrasion protection, anti-slip coating, durable, chemical splash protection and much more. Thus they are widely used in various industrial segments

Fig.: 1.64: Industrial Gloves

- **High Altitude Clothing**: They protect against extreme weather conditions like high velocity winds, low temperature, snow fall etc. Clothing needs to have functional and comfort properties at high altitudes and is also known as Extreme cold climate clothing(ECC). High altitude clothing includes jackets, trousers, coats, glacier cap, glacier gloves, rappelling gloves etc. They possess characteristics like abrasion resistant, resistance to quick wear and tear, high integrity, waterproof, moisture resistance and much more. Hydrophilic polyurethane coating is used in these clothing.

Fig.: 1.65: High Altitude Clothing

- **Chemical Protective Clothing (CPC):** They are used for protection from physical and chemical hazards. The chemicals are absorbed into the human body by two ways: physical contact where the chemicals are absorbed through skin and the second through inhalation, where the gaseous state gets absorbed through breathing. Non-permeable fabrics (PVC/Rubber coated fabrics) are used to create CPC.

Fig.: 1.66: Chemical Protective Clothing (CPC)

- **High Visibility Clothes:** They are also known as reflective wear and used for protection by people working in poor environments like highways, mines, airport runways etc. The high visibility clothing makes it easier to see working and guiding employees in the dark. They are highly used by the Armed Forces, Central Paramilitary Units, National Disaster Management Authority and Defense Services. There are 3 types of high visibility clothing:

✓ Photo Luminescent Material: provides yellow light in dark

✓ Reflection Materials: Shine is stuck by light

✓ Fluorescent Material: Absorbs artificial light and emits green yellow light in darkness

✓ Visible during the day also

Fig.: 1.67: High Visibility Clothes

- **Nuclear Biological and Chemical (NBC) suits/Hazmat suits:** Hazardous material (Hazmat) suits are designed to protect the people handling hazardous materials like radioactive, chemicals etc. They are developed to protect the soldiers who work under hostile environment with various chemical / biological agents and radioactive. They consist of a jacket and a trouser that can be worn directly on the undergarments. It comprises of 3 layers:

  Inner Layer: Cotton

  Middle Layer: Non-Woven Treated with Active Charcoal

  Outer Layer: Fabric with Fire Retardant Chemicals and Fibers.

Fig.: 1.68: Biological and Chemical (NBC) suits

- **Fire /Flame retardant apparel& Furnishings:** Flame retardant apparel and furnishings both are used widely in the industry. The clothing is widely used in engineering working conditions, iron & steel plants, welding industry. Whereas in furnishings it is used in blinds, curtains, upholstery wall coverings, especially in airlines, ships, offices etc. The fire retardant apparels and furnishings are manufactured from cotton with flame retardant coating or they are made from flame retardant fibers itself.

(a) (b)

Fig.: 1.69 (a & b): Fire /Flame retardant apparel& Furnishings

Indutech: These are the Industrial Textiles which are used in different ways by various industries for activities like purifying and separating industrial products, transporting matters between processes, cleaning gases and effluents and other coated products. It includes Knitted nets, non-woven filters, heavy weight coated conveyer belts. Some of the examples of Indutech products are:

- **Decatising Cloth:** It is an industrial fabric also known as decatising wrapper that is used in decatising machines. It is used for mechanical finishing in woven fabrics. The decatising cloth is made up of polyamide and cotton or poly cotton blended fabric.

Fig.: 1.70: Decatising Cloth

- **Bolting Cloth:** It is a mesh type fabric used for screen printing in the textile industry which is primarily a woven fabric manufactured from polyester and nylon yarns.

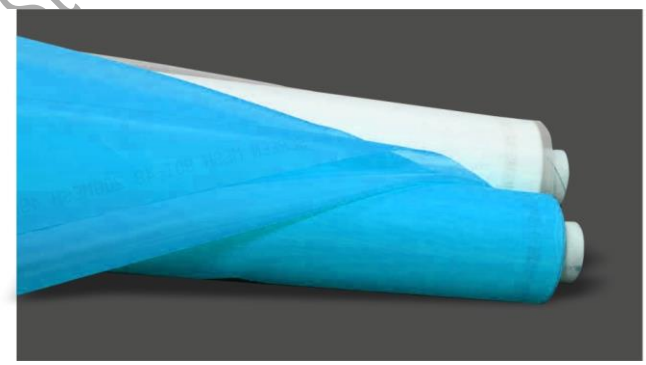


Fig.: 1.71: Bolting Cloth

- **Coated Abrasives:** Abrasives are primarily used in industrial applications to finish a work piece through rubbing the surface like grinding, buffing, polishing smoothening etc. There are 2 types of abrasives: woven and non-woven which are made up from cotton, cotton and polyester blends.

Fig.: 1.72: Abrasives

- **Conveyor belts:** Conveyer belts are the most economical and environment friendly mode of transporting bulk products. Conveyor belts are majorly used in the cement, mining thermal power plants and other industries where there is continuous movement of heavy load from one place to another.

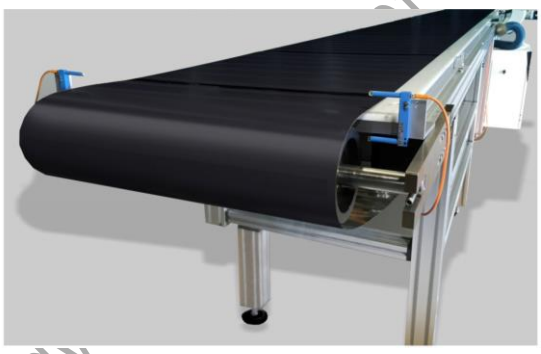


Fig.: 1.73: Conveyor belt

- **Computer Printer Ribbon:** Nylon 6 yarn is mainly woven into a fabric and then cut to the required size for making the computer ribbons. Properties like good absorption capacity, smudge resistance, good heat resistance enables the ribbon to withstand and undergo stress during printing.

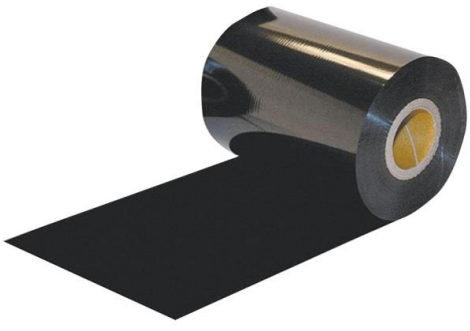


Fig.: 1.74: Computer Printer Ribbon

- **Printed Circuit Board:** Printed circuit boards are mechanical devices which are used to electronically connect and hold electronic components. Woven glass fiber is used as a reinforcement material with the resin to bind with the copper foils.

Fig.: 1.75: Printed Circuit Board

- **Ropes and Cordages:** Ropes are normally available in 3, 4, 8 strands with a standard length 110, 220, 330, 440 meter and other customer specifications. It has excellent strength, abrasion resistance, heat resistance, non-corrosive, light weight and highly flexible.

Fig.: 1.76: Ropes and Cordages

- **Industrial Brushes:** They are used for surface cleaning function for household and industrial both. Painting is the main application which demands the most. Other than painting industrial uses of it are cleaning of machines, textile polishing, textile finishing, bottle cleaning and much more.

Fig.: 1.77: Industrial Brushes

- **Composites:** Composites are produced by reinforcing thermoplastic or resin with fibers like glass fibers, carbon fiber aramid etc., they are very versatile and can be used to meet the needs of any complex design or requirements. They are widely used in the infrastructure projects like highways, airports, bridges, buildings etc.

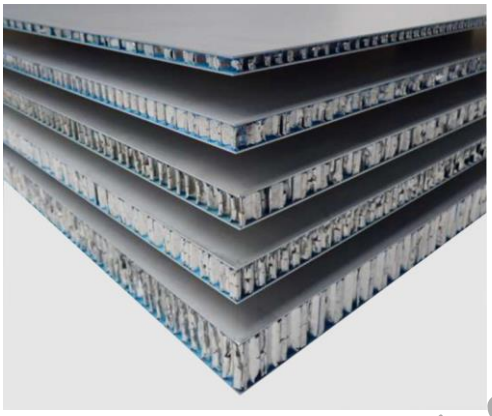


Fig.: 1.78: Composites

Sporttech (Sports Textiles):

Sports Textiles are mainly used for making sportswear which also includes sports accessories and shoes. With increasing interest and awareness in sports and leisure activities such as swimming, flying, cycling, trekking etc. has led to an immense growth in the sports textile apparels and accessories. Traditional cotton fabric has been replaced with synthetic fibers and coatings in the construction of Sporttech products. Some of the examples of Sporttech products are:

- **Sports Net:** Sports net are made up of HDPE, cotton, PP and Nylon. They are extensively used in tennis, football, volley ball, badminton, basketball etc.

Fig.: 1.79: Sports Net

- **Sleeping Bags:** Defense and paramilitary personnel make extensive use of sleeping bags.

Fig.: 1.80: Sleeping Bags

- **Sports Composites Market:** Sports composites are widely used in India which includes mainly:

✓ Protective equipment in Cricket: Leg guard, batting gloves, thigh pads, helmets, caps, cricket kit etc.

✓ Inflatable balls: Football, basketball, volley ball, baseball hand ball etc

✓ Boxing equipment: Boxing gloves, boxing head guards, punching gloves, speed ball, punching bag etc.

Fig.: 1.81: Sports composite

- **Artificial turf:** It is made up of synthetic materials with appearance similar to grass. It is used for making playing surfaces for hockey and other sports which are played on grass. Various layers of pile fiber backing cloth and absorbing layers are used. It is also used for

decoration purpose to create a better indoor look of balconies, lawns, hotels etc.

Fig.: 1.82: Artificial turf

Activities

Activity

1. Collect 10 items of day to day needs such as helmets, diapers, nets, etc. and prepare a detailed analysis report.

Materials Required

1. 10 Daily need items
2. Diary
3. Pen
4. PC with Internet

Procedure

1. Collect 40 items of daily needs
2. Classify the items based on understanding of the technical textiles into technical and non-technical ones
3. Make a list of the 10 items which fall under technical textiles

4. Identify and categorize them into various types of technical textiles
5. Try and search more about the items of daily needs and its classification under a particular type of technical textile
6. Note the observations with technical details of all the items of daily needs
7. Prepare a report based on findings

Check Your Progress

A. Fill in the blanks:

1. Sports net are made up of _____, _____, _____ and _____.

2. _____ are used as protective apparel for workers in factories.

3. _____ are majorly used in coastal and civil engineering, road construction, drainage system, soil sealing.

4. _____was established in _____ by the textile mills of Ahmedabad.

5. _____are made out of woven fabrics like polyester and nylon which comprises of totes, sky bags and duffle.

B. Answer the following:

1. Write a short note on Technical Textiles.
2. Explain the meditech in detail along with examples.
3. What are the applications of technical textiles?
4. Name and specify the importance of the various bodies of excellence in technical textiles.

Session: 3 Types of Fabric Finishes

The process by which the appearance and quality of the fabrics is improved is called fabric finishing. It also increases fabric's resistance to laundering and wear. The operations involved in fabric finishing vary depending on the texture and the purpose of the fabrics. Finishing is the process done after production in the textiles .i.e. yarns, fabrics, garments to make it attractive, presentable as well as impart certain desirable.

FINISHES ARE DIVIDED INTO TWO TYPES:

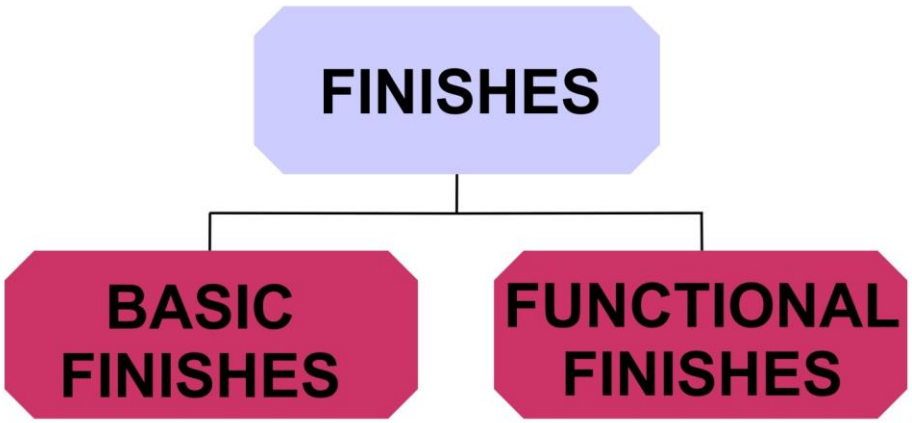


Fig.: 1.83: Types of Finishes

1. Basic finishes: Those finishes which can be applied during the fabric manufacturing process or on the finished fabrics. These finishes are important for the final appearance and performance of the fabric.

i. **Shearing:** Pile-weave fabrics and fabrics that have been napped are usually sheared to give an attractive smooth surface to the cloth. Shearing levels all surface irregularities caused by the plucking action in the napping process.

ii. **Singeing:** Singeing is one of the first essential preparatory processes that impart smoothness to the fabric. Singeing burns off lint, threads, fuzz and fiber ends and leave an even surface before the fabric passes through other finishing processes or a printing operation.

iii. **Bleaching:** In bleaching cloth is finished as white by removing all natural colours. This is also necessary if discoloration or stains have occurred during the previous manufacturing process. Bleaching is

done for the cotton, woolen and silk. Man-made fabrics do not need bleaching, as they are naturally white. The kind of chemical to be used depends upon the kind of textile fiber of which the fabrics is composed.

iv. **Mercerizing:** Mercerizing is an important preparatory process for cotton fabric. It is also used in the finishing of linen. Mercerised fabrics have more lustre and strength as compared to non-mercerised. This process also improves the dye pick up of the fabric.

v. **Calendering:** Calendering is essentially an ironing process that adds sheen to the fabric. The method varies according to the type of finish desired. Calenders are heavy machines made up of at least two rolls.

vi. **Pressing:** Mostly pressing method is used for wool fabrics to remove short hair fibers present on the surface of the fabric. This pressing method is similar to calendering.

vii. **Embossing:** The process of producing raised Fig.:s or designs in relief on the surface of the fabrics by passing the cloth between heated engraved rollers is known as embossing. The process can be applied to the fabrics made of all types of fibers except the wool. To preserve the embossed finish of such fabrics, they should be washed in lukewarm water with a mild soap, never bleached, and ironed on the wrong side while damp.

viii. **Crepe and Crinkled effect:** Permanent crepe effects are obtained by using hard twisted yarns in the weaving process. Another method imprints a crinkled effect by means of engraved rollers, but the finish disappears in repeated washing. In another finishing method, caustic soda is impressed on the cotton fabric in the form of Fig.:s or stripes and the fabric is then washed. The part imprinted with the caustic soda shrinks, and the other part puckers.

A permanent crinkle may be obtained on a fabric that can melt, such as nylon. The fabric is put through a hot roller on which there are raised figurations. The contact of the fabric against the raised hot surface helps it to melt and pucker at these points.

2. Functional finishes

Special finishes imparted to fabrics, keeping the functional use of the fabric is known as special or functional finishes.

i. **Absorbency finish:** Although the cellulose fibers like cotton, linen and rayon have good absorbency, sometimes it is desired that they should be more absorbent. Appropriate application of ammonium compounds modifies the cellulose to become more absorbent, providing greater comfort and usefulness for such uses as undergarments and towels.

ii. **Wrinkle resistant finish :** These finishes are also sometimes referred to as 'crease-resistant' or 'Wash and wear' finishes. DMDHEU namely Dimethyl Dihydroxy Ethylene Urea is used to impart wrinkle resistant finish on the textiles. The purpose of this finish is to prevent deformation of the fabric by undesirable and unintentionally introduced folds and rumples. Some finishes are more wrinkle-resistant than others, but fabrics treated with any of these finishes tend to smooth out when properly hung after wearing.

iii. **Flame retardant finish:** A wide variety of flame retardant chemical finishes have been developed for application to fibers and fabrics. Carbonate and ammonium salts are used for flame retardant finish.

iv. **Antibacterial finish:** Chemical antiseptic finishes using Chitosan, impart a self-sterilizing quality to a fabric. The appearance and the feel of the fabric does not change and no chemical odour remains. Dry cleaning does not impair the finish.

v. **Prevention of mildew:** Cellulose fibers are particularly susceptible to mildew. Silk and wool are also susceptible, but to a lesser extent. Such untreated fabrics will become stained, malodorous and eventually deteriorate by the fungus if allowed to remain in a moist condition for a period of time. Shower curtains or other fabrics may be mildew proofed at home by soaking the material in soapy water, then, without rinsing, dipping it into a solution of boric acid and carbolic acid, which prevents rapid growth of the mildew fungus. The most effective mildew proofing agent is 0.05 per cent solution of phenyl mercuric acetate in water.

vi. **Water repellent finish:** The fibres in the fabrics become covered with a film of synthetic resin. This repels and delays adsorption and penetration of water through the fabric. This finish allows air to permeate the fabric, and its comfort is largely retained in contrast with the water proof finishes. Most of the original water proof finishes, produced by the application of rubber, waxes and oxidised oils, have been replaced by applying impervious films of polyvinyl chloride - PVC plastic. The low cost of this type of application, associated with the very light weight of the water proof fabric produced, compensates for the lack of comfort in the garment produced.

vii. **Waterproof finish:** For a fabric to be truly waterproof, it must be completely sealed with a substance that is insoluble in water. Modern waterproofing materials include the vinyl resins, which do not oxidize and crack as readily as rubber.

CONCLUSION

Textile Finishes that enhance the feel and drape of fabrics involve the addition of sizing, weighting, fulling, and softening agents, which may be either temporary or permanent. Thus finishing is used to improve the serviceability and durability. All of the finishes given above can somewhat change the appearance of a fabric so it is important for a fabric checker to have a knowledge about all these finishes to act accordingly.

Fig.: 1.84: Finishes for appearance

Fig.: 1.85: Finishes for Functionality

Activities

Activity

Prepare an infographic depicting different types of fabric finishes.

Materials Required

1. Fabric Swatches treated with different types of finishes
2. Colored A4 sheets
3. Glue
4. Colors
5. Pen/Pencil

Procedure

1. Collect different types of fabric swatches treated with different finishes or you can take pictures from internet.
2. Cut the swatch into square of fabric/pictures of minimum 4x4 inches size.
3. Observe the finishes of the various samples.
4. Identify and categorize it into various finishes based on observation.
5. Note down the finishes observed and their benefits.
6. Make a detailed infographic of the finishes and present it in the class to share the learnings.

Check Your Progress

A. Fill in the blanks:

1. _____ is the process done after production in the textiles .i.e. yarns, fabrics, garments to make it attractive.

2. _____ levels all surface irregularities caused by the plucking action in the napping process.

3. _____ fabrics have more lustre and strength as compared to _____.
4. _____ is essentially an ironing process that adds sheen to the fabric.
5. Chemical antiseptic finishes using _____, impart a self-sterilizing quality to a fabric.

B. Answer the following:

1. Write a short note on fabric finishing mentioning the names of various finishes.
2. Explain the various types of finishes in detail with relevant examples.
3. Write a short note on functional finishes.
4. List out the various appearance finishes.

Session: 4 Factors Responsible for the Quality of Fabrics

Fabric checking is the visual examination or evaluation of a fabric against certain standards, specifications, or requirements to see if the required standards are satisfied or Fabric checking can be defined as a process of systematically observing fabrics to see if they fulfil the customer's specifications for count/construction, colour, pattern, measurement details, hand/feel, and other quality factors. This will reduce the number of panels or textiles that are rejected due to fabric faults, ensuring that the finished products are of high quality. Fabric inspection is also referred to as a pre-production inspection when it comes to garments or other textile products. In this session the factors which affect the quality of woven and knitted fabrics are discussed. A fabric checker should have Knowledge of various factors affecting fabric which will help him identifying, rectifying and eliminating fabric errors.

i. Factors Affecting Quality of Woven Fabrics

The basic parameters that are essential for woven fabrics are as follows:

a. Ends per Inch (EPI) and Picks per inch (PPI)
b. Yarn Count
c. Yarn type
d. Balanced Construction
e. Crimp
f. Weave or Fabric Structure or Design
g. Finishing

a. Ends per Inch or Picks per Inch: It is a measure of thread density. EPI and PPI affect the compactness of the fabric.

b. Yarn count: It is also known as thread count or cloth count

Thread count ranges from as low as 20 threads per inch as to as high as 350 threads per inch. Normally EPI and PPI of a fabric are described as EPI×PPI. Thus a fabric of 74×66 means 74 EPI×66 PPI.

c. Yarn types: Yarn types decide the appearance of the woven fabric. Yarns are classified into natural and synthetic. A fabric could be weaved by single types of yarn or the combination of natural yarn and

synthetic yarn based on the requirements of customers. The appearance of same structured cloths could vary on the yarn types.

d. Balanced construction: A fabric is said to be well balanced if the number of warp yarns and weft yarns per inch are almost equal.

e. Crimp: Crimp refers to the amount of bending that is done by thread as it interlaces with the threads that are lying in the opposite direction of the fabric. Crimp is defined as the ratio of difference of length of yarn (Ly) taken from length of fabric (Lf) to the length of fabric (Lf).

Crimp = (Lf-Ly)/Lf

a. Often it is more convenient and preferable to use percentage values. Thus we can define crimp percentage as:

b. Crimp% = (Lf-Lf)/Lf

c. A crimp will normally give values ranging from 0.01 to 0.14 ie. (1% to 14%).
Crimp is related to many aspects of the fabric. It affects the cover, thickness, softness and hand of the fabric. When it is not balanced it also affects the wear behaviour and balance of the fabric, as the exposed portions tend to wear at a more rapid rate than the fabric. The crimp balance is affected by the tensions in the fabric during and after weaving. If the weft is kept at low tension while the tension in warp directions is high, then there will be considerable crimp in the weft and very little in the warp.

f. Weave: It refers to the arrangement of warp and weft in the fabric. Woven cloth structure also varies on the order of interlacement of warp and weft. Plain, twill or satin are different from each other. Interlacement depends on the design of the fabric.

g. Finishing: Finishing operation has impact on the appearance of the woven fabric. By finishing modifications, fabrics become smooth, hard, water proof or fire proof.

ii. Factors Affecting the Quality Of Knitted Fabrics

a. **Stitch length** (or loop length) is the key factor to determine & maintain quality of the knitted fabrics. The stitch length, usually measured in millimeters (mm) or inches, is the length of the yarn in the knitted loop. Generally the longer the stitch length, the more open and lighter the fabric.

b. **Stitch density:** Stitch density is the next important parameter to be set in knitting and represents the total number of needle loops in a given area. Stitch density is the product of courses per inch (or per cm) and wales per inch (or per cm) and is measured in units of loops per square inch or cm.

c. **Yarn irregularities** or yarn faults can produce intermittent thick/thin horizontal stripes across the fabric.

d. **Fabric spirality** is a deformation (skewing) of the knit structure which arises when singles yarns or unbalanced two-fold yarns are knitted into single bed structures. The fabric twists on steaming or wetting, leading to garment seams that are no longer vertical.

e. **Barré** can be caused by incorrectly set knitting equipment, or variations in lustre, yarn spacing or loop length.

Other Fabric Properties

Fabric weight (W): It is the weight of the yarn per square meter in the woven fabric, which is the sum of the weight of the warp (W1) and weight of the weft (W2).

Weight of the warp is calculated as (per square m):

W1= [n1 x 100 (1+c1%)/100] x [N1/1000] g

Where
n1 = Ends per cm
N1 = Warp count in Tex
C1% = Warp crimp percentage.

Similarly weight of the weft is calculated as (per square m)

W2= [n2 x 100 (1+c2%)/100] x [N2/1000] g

Total weight per square meter = W1+W2

Weight/piece = (W1+W2) × piece length × piece width in gram.

Cover factor (K): it is defined as the area covered by the yarn when compared with the total area covered by the fabric. The warp cover factor can be found by using the formula.

K1= n1 x sqrt(N1)/10
Where
n1 = Ends/cm
N1 = Count of warp in text

Similarly the weft cover factor can be found by the formula

k2 = n2 x sqrt(N2) /10

So the total cover factor is
K = K1 + K2

Fabric Thickness: For a wide range of fabric, this parameter is not important, but it becomes critical for fabrics that are to be used as belts and felts.

The basic parameters that are essential for every knitted fabric are as follows:

1. **Fabric weight:** refers to the relative weight of fabric, not the absolute weight. The weight of a fabric can be expressed in two ways, either as the 'weight per unit area' or the 'weight per unit length'. The most widely used method of expressing knitting fabric weight is grams per square meter (GSM). The "weight" of a knitted fabric is primarily depended on two factors, namely the loop length and the yarn count. The effect of loop length is simple to express: If yarn count remains constant, then loop length will be more resulting in reducing the weight per unit area of the fabric. There are two method for calculating GSM of a knitted fabric:

$$\text{GSM} = \frac{\text{Course per inch x Stitch x 39.37 x 39.37 x Tex}}{(1000 \text{ x } 1000)}$$

$$\text{GSM} = \frac{\text{Course per inch xWales per inch x Stitch length (mm}}{(\text{English Count (Ne)})} \text{ x } 0.9155$$

Fabric Width: The fabric width makes high influence on the marker making efficiency. Just 1 cm variation to the expected width would be a big loss. So, it is very important to have a constant width of the fabric. Normally knitted fabrics are wider than woven fabrics. Rolls having a measurement greater than the specified purchased cuttable width are allowed maximum tolerance of +3 per cent for knits. Fabric width can be calculated by the following formula:

$$\text{Fabric Width} = \frac{\text{Course length x Stitch length}}{\text{Kw}}$$

$$\text{Fabric Width} = \frac{\text{p x d x G x Stitch length}}{\text{Kw}}$$

Where,

Stitch Length is in cm

D = Machine Diameter

G = Machine gauge

Kw = 38 (for dry relaxed state), 41 (for wet relaxed state) and 42.2 (for finished relaxed state)

Dimensional Stability: Dimensional stability is ability of a material to maintain its essential or original dimensions while being used for its intended purpose and shrinkage is the contraction in the dimension of the fabric due to usage.

Spirality: It can be defined as a fabric condition resulting when the knitted wales and courses are angularly displaced from that ideal perpendicular angle. This displacement of the courses and wales can be expressed as a percentage or as an angle measurement in degrees. Spirality depends on feed density, machine cut, and loop shape, but the magnitude of spirality can be offset by the selection of yarn twist direction. For knitted fabric the spirality should be max 3 degrees after washing.

Bow and skew: is created when the pattern is distorted across the width of the fabric. Bow or skew can be induced during knitting, dyeing, tentering, finishing, or other operations where a potential exists for uneven distribution of tensions across the fabric width.

Activities

Activity

Collect 8 fabric samples including woven and knitted and prepare a detailed analysis report.

Materials Required

1. Fabric Swatches
2. Diary
3. Pick Glass
4. Pen

Procedure

1. Collect random sample swatches from any fabric vendor or industry.
2. Cut the swatch into square of minimum 4x4 inches size.
3. Use pick glass to note down the EPI and PPI of the fabric swatch.

4. Make a detailed report on the basis of observations w.r.t structures of woven and knitted and present it in the class to share the learnings.

Check Your Progress

A. Fill in the blanks:

1. _____ is created when the pattern is distorted across the width of the fabric.
2. For knitted fabric the spirality should be max _____after washing.
3. _____ makes high influence on the marker making efficiency.
4. Fabric weight refers to the _____ of fabric, not the _____.
5. _____ and _____ affect the compactness of the fabric.

B. Answer the following:

1. What are factors affecting the quality of knitted fabrics.
2. What are factors affecting the quality of woven fabrics.
3. Explain the crimp and its relevance w.r.t woven fabrics.
4. Write a short note on cover factor and explain its calculation.

Module 2	Fabric Checking Machines and Analyzing Various Fabric Defects

Module Overview

Depending on the end-use, fabrics must have certain characteristics. Various flaws in the fabric detract from the overall appearance or unnecessarily disrupt some of these desirable characteristics.

As a result, before releasing fabric for transportation, it must be thoroughly inspected to ensure that a high-quality product reaches the customers.

In this session we will learn about the role of fabric checker in fabric checking operations. This will ensure the correct method of loading the fabric roll onto the fabric inspection machine, and avoiding the damage caused to fabric in movement and handling process.

There are various parameters involved in setting up a fabric checking machine; hence the fabric checker must have complete knowledge of the machine operation as well as maintaining the tools and machine quality with necessary reporting to the concerned authority.

Learning Outcomes
After completing this module, you will be able to: • To learn about Fabric Checking Operation • Describe and demonstrate operations of fabric checking machines • To analyze and evaluate various fabric defects
Module Structure
Session:1 Fabric Checking Operation
Session:2 Methods of fabric checking
Session:3 Analyzing and evaluating various fabric defects

Session: 1 Fabric Checking Operating

Various types of inspection in reference to the apparel industry can be defined as the visual examination or review of raw materials (like fabric, sewing threads, buttons, trims, etc.), partially finished components of the garments and completely finished garments in relation to some standards. But in case of fabric checking, the main objective of inspection is the detection of the defects at fabric stage as early as possible in the manufacturing process so that time and money are not wasted later on in either correcting the defect or writing off defective garments.

1.1 Importance of fabric Inspection

Fabric Inspection is an important aspect which is followed prior to the garment manufacturing, so that rejections can be avoided which are caused due to fabric quality issues resulting in unexpected losses in manufacturing. Therefore, we can say that following are the uses of fabric inspection/fabric checking operations:

a) As fabric is received, it should be inspected to determine acceptability from a quality viewpoint based on inspection standards.

b) Fabric inspection is done to check the fault/defect rate, fabric construction, color or shade of the roll from end to end or edge to edge, hand or feel length/width, print defects and appearance faults.

c) Fabric inspection ensures to minimize the rejection of cut panels or rejected garments due to fabric faults.

d) Approved fabric ensures not only finished garment quality but also reduces rejections, improves efficiency and timely deliveries.

e) The purpose of fabric inspection is to determine the quality and acceptability for garments.

Some garment manufacturers rely on their fabric suppliers to perform fabric inspection and fabric defects. Sometimes, in many small companies, Fabric checking is done while spreading and cutting by the same personnel who spreads the fabric on the table for cutting.

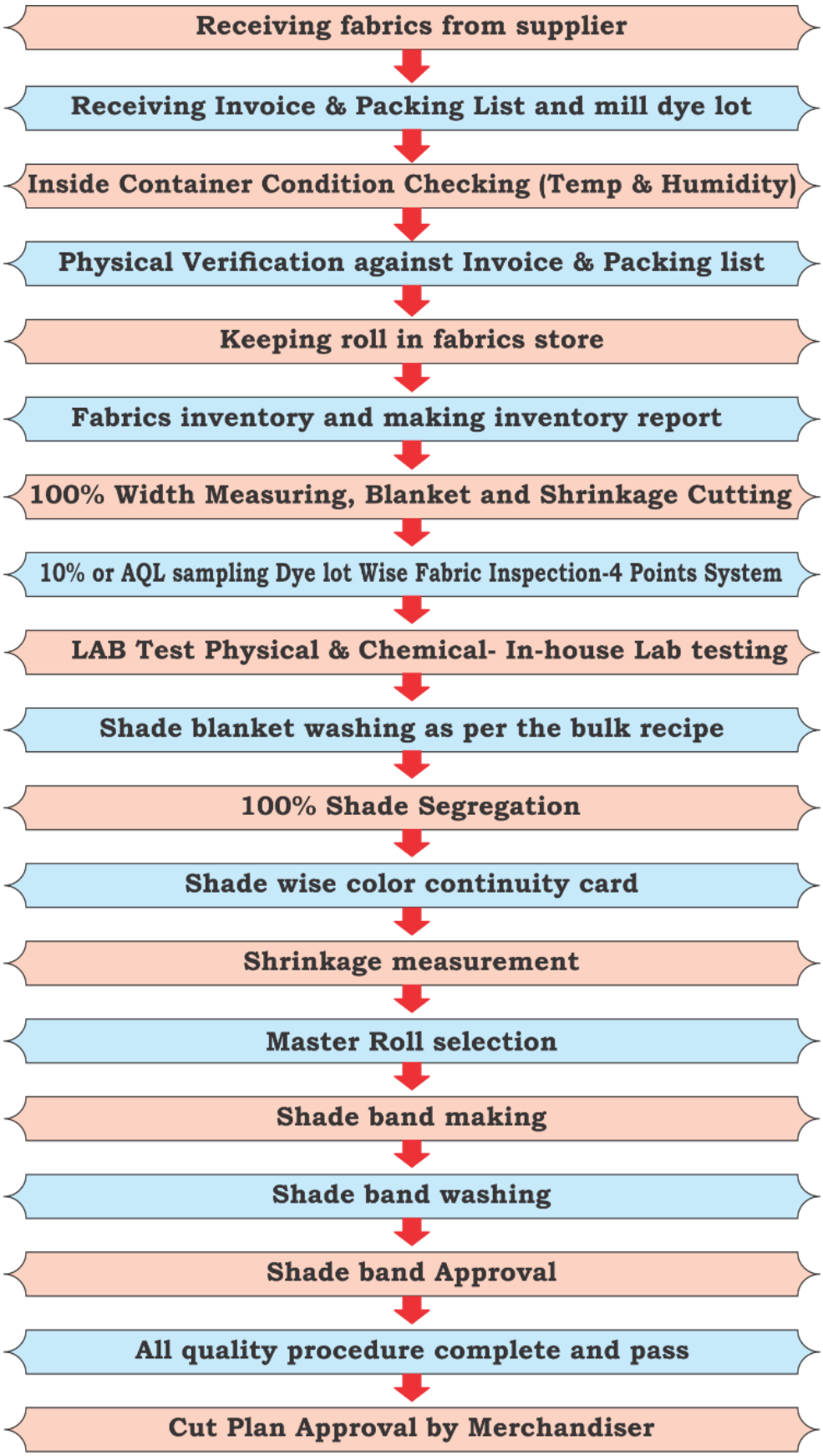


Fig.: 2.1: Fabrics processing Flow chart of Apparel Industry

- 10% Dye lot Wise Fabric Inspection. 4 Points System.
  - Visual defects.
  - Running shade & Centre/selvage shade.
  - Moisture checking for post-cure fabric

- In-house LAB Testing- Physical & Chemical.
  - Shrinkage
  - Fastness to Rubbing & Washing.
  - GSM/ Count/Con.
  - Tensile & Tear.
  - DP rating test for post-cure fabric

- 100% Shade Segregation.
  - Shade wise segregation & Qty Details.
  - Before/after wash Dye lot Swatch-7 Sets.
  - Distribution to concerned department after approval.
  - Shade/ width wise report

- Fabric Issue to Cutting.
  - Issuing fabric to cutting Pattern/Shade/width wise.
  - Verification of sticker details by using shade segregation report & Scan Barcode for the record.

FABRIC INSPECTION METHODS

The objective of fabric inspection is delivering quality fabric to the garment makers so that good quality garments can be curated. A defective fabric will only produce a defective garment. In case a faulty fabric is used in garment making, it will increase the cost of manufacturing as it will result in repair work, part change, and even garment rejection. To avoid processing defective fabric in production, as a preventive action, fabric rolls are inspected.

Fabric is checked / inspected to determine its acceptability from a quality view point. There are various fabric inspection systems such as-

FOUR POINT SYSTEM

Fabric inspection is performed according to ASTM D5430-93, which is the most widely used procedure in the garment industry (Standard Test Methods for Visually Inspecting and Grading Fabrics). Defects are spotted and marked with points from a distance of three feet. In this approach, every possible defect is assigned a demerit point based on its severity.

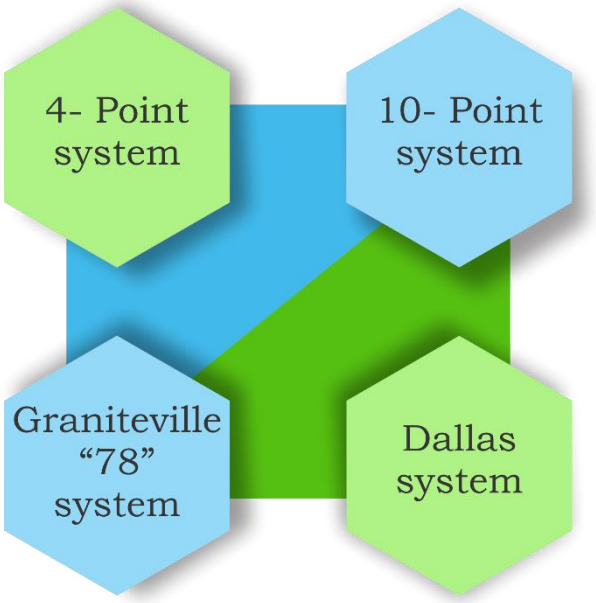


Fig.: 2.2: Four point system

TO USE THIS SYSTEM ONE MUST KNOW FOLLOWING THINGS:

1. Fabric inspection method or preparation
2. Vast idea on nature of fabric defects (how an error looks and its appearance)
3. Criteria of giving penalty points based on defects and defect length
4. Calculation method of total penalty points for total defects found in a fabric roll or than
5. A Check sheet or format for recording data

The 4-Point System assigns 1, 2, 3 and 4 penalty points according to the size and significance of the defect. Each fabric roll in the sample should be inspected with points assigned according to the following criteria:

4 POINT DEFECT EVALUATION		
Point assigned	Size of defect	
	Inches	Cms

1	≤3″	<8cm
2	>3″ ≤6″	>8cm<15cm
3	>6″≤9″	>15cm<23cm
4	>9″	>23cm

CRITERIA FOR GIVING PENALTY POINTS

In the following table the penalty evaluation points have been given for different length of fabric defect and dimension of holes. These are used as base guidelines to evaluate the fabric.

Size of defect	Penalty points
Length of defects in fabric (either length or width)	
Defects upto 3 inches	1 points
Defects >3 inches ≤6	2 points
Defects >6 inches ≤9	3 points
Defects >9 inches	4 points
Holes and openings (largest dimension)	
1 inch or less	2 points
Over 1 inch	4 points

Rules to use the four point system for fabric inspection:

1. No more than 4 penalty points can be assigned for any single defect
2. No linear yard or meter can contain more than 4 points, regardless of the number of defects within that yard or meter.
3. Assign a maximum of 4 points to each:
    - Consecutive linear yard or meter in which a continuous running defect exceeds 9 inches (23 cm)
    - Full width defect
    - Yard or meter within a shipment which has any continuous defect (i.e., roll to roll shading, narrow or irregular width, creasing, uneven finish, barre', skew, etc.)

4. Defects must be documented by type and point count on the inspection report
5. All defects must be marked with sticker at the location of defect or with a marker (sticker, swift tack, etc.) at selvedge edge
6. Fabric width must be checked a minimum of 3 times during inspection and documented on the inspection report
7. Actual roll length should be checked and documented on the inspection report.

POINT CALCULATION

Once the rolls are inspected, the Points per 100 Square Yards or Meter must be calculated to determine acceptability of the roll and / or shipment. The formulas for the calculations are shown below:

FOR INDIVIDUAL ROLL:

$$\text{Points per 100 Square Yards} = \frac{\text{Total Points for the roll} \times 3600}{\text{Inspected Yards} \times \text{Cuttable Fabric Width (inch)}}$$

$$\text{Points per 100 Square Meters} = \frac{\text{Total Points for the roll} \times 100{,}000}{\text{Inspected Meters} \times \text{Cuttable Fabric Width (MM)}}$$

FOR SHIPMENT:

$$\text{Total Shipment Points per 100 Sq. Yards} = \frac{\text{Total Average Points per Linear Yard} \times 3600}{\text{Shipment Inspected Yards} \times \text{Cuttable Fabric Width (inch)}}$$

$$\text{Total Shipment Points per 100 Sq. Meters} = \frac{\text{Total Average Points per Linear Meter} \times 10{,}000}{\text{Shipment Inspected Meters} \times \text{Cuttable Fabric Width (MM)}}$$

ACCEPTABLE LEVEL OF DEFECTS IN A FABRIC ROLL:

Most industries consider that up to 40 points per 100 square yards is acceptable. Although, in the apparel and textile industry, textile mills, apparel brands and buyers set their own standards for acceptable points. A standards level is set by American Society for Testing and Materials (ASTM).

Many mills rank fabrics as first quality and second quality as an alternative to just Pass/Fail the fabric roll or fabric lot. Again grading is done based on number of penalty points per 100 square yards.

One most important thing one must remember that its acceptable points can be defined as points per 100 linear yards as well as points per 100 square yards. Secondly, acceptable points for individual roll and acceptable average points of all roll are set at different level.

- Maximum Acceptable Points = 20 points per 100 sq. yards or 22 points per 100 sq. meters.
- Fabric width up to 64-66 inches shall be classified as first quality if number of penalty points there in does not exceed 50 points per 100 linear yards.
- For fabric width wider than 64-66 inches' acceptable penalty points should be proportion of 50 points per 100 linear yards. (Use 64 inch for such calculation)

In general, acceptable level of 'points per 100 linear yards' or 'points per 100 square yards' are different for different fabric types. For example:

For **Cotton Twill/Denim** 28 points per 100 square yards (23 points per 100 square meters) for individual fabric roll

For **All synthetic fabrics** 20 point per 100 square yards (16 points per 100 square meters) for individual fabric roll

Example 1: A fabric roll of 100 square yard inspection

Effects Length	No. of Faults	No. of points
Up to 3 inches	10	10x1=10
3 inches to 6 inches	5	5x2=10
6 inches to 9 inches	2	2x3=6
Above 9 inches	0	0x4=0
Total		Total= 26

$$\text{Points per 100 Square Yards} = \frac{\text{Total Points for the roll x 3600}}{\text{Inspected Yards x Cuttable Fabric Width (inch)}}$$

Using the above formula;

Points per sq. yards=

$$\frac{\text{Total defects}}{\text{Total fabric length in yards}} \times \frac{100}{1} \times \frac{36 \text{ inches}}{\text{inspected fabric width}}$$

= 26 x 100 x 36”
120 1 48”

= 16.25, So, defect is acceptable.

Example2: A fabric roll 120 yards long and 46 inch wide contains following defects.

Defects	Defects point	
4 defects up to 3 inch length	4x1	4 points
3 defects from 3to 6 inch length	3x2	6 points
2 defects from 6 to 9 inch length	2x3	6 points
1 defect over 9 inch length	1x4	4 points
1 hole over 1 inch	1x4	4 points
Total points		**24 points**

=15.652. So, defect is acceptable.

Advantages of 4 point system:
Four-point system has no width limitation since it is used globally. This system is easy to understand and any one on the role can learn it and perform fabric checking accurately.

10 POINT SYSTEM

This system assigns penalty points to each defect, depending on the length of the defect. Penalty points are assigned as follows:

WARP DEFECTS	PENALTY POINTS
10 – 36 inches	10
5-10 inches	5
1-5 inches	3

Upto 1 inches	1
FILLING DEFECTS	**PENALTY POINTS**
Full Width	10
5 inches to half width of fabric	5
1 – 5 inches	3
Up to 1 inch	1

Ten-Point Inspection System is used to grade the fabric as per their penalty points, i.e. first and second. If the total penalty points do not exceed the total yardage of the piece, that piece will be graded as "first", and if the total penalty points exceed the total yardage of the piece, it will be graded as "second"

Advantages of 10 point system:

The ten point system is one of the oldest and most used system to inspect the woven finished fabrics. In this system length of fabric is used and along the length of warp and weft, defects are identified.

Disadvantages of 10 point system:

This system has width limitation therefore cannot be used widely or consistently for inspecting various fabrics. With the changing width one will have to change the fabric inspection method too and it will make more tedious and confusing for the worker to maintain different reports on point system. Hence it makes this system difficult to use practically.

GRANITEVILLE "78" SYSTEM

This type of fabric inspection system categorises the defects into major and minor categories. The defects which fall in major category are those that are evident and cause the goods to be of second-quality. The minor defect is the one which may or may not cause the garment to be of second quality based on its location in the end-use product. Penalty Points are assigned as per the following:

Defect length	Penalty points
9”	1
9”-18”	2
18”-27”	3
27”-36”	4

The maximum penalty points per linear yard that can be assigned are determined by dividing the fabric width in inches by 9.

Therefore, Maximum penalty points for 48 inches wider fabric = 48/9 = 5.33 or 6.

Maximum penalty points for 60 inches wider fabric = 60/9 = 6.33 or 7.

The maximum penalty point per square yard is 4.

DALLAS SYSTEM FABRIC INSPECTION:

This system was created with knitwear in mind. The Dallas Manufacturers Association approved it. If a defect is discovered in a finished garment, it is classified as a "second" under this system. According to this system, a "second" is defined as "more than one defect per ten linear yards, calculated to the nearest 10 yards”. A 60-yard piece, for example, would be allowed to have six defects.

Disadvantage of Dallas system:

It increases the cost of production as defect is located after the garment is finished.

Minimum acceptable width

This measurement does not include the selvedge. During the inspection of a piece, the width of the fabric will be verified at least three times (beginning, middle and end of a piece). Second quality pieces are those that have a measurement width that is smaller than the specified purchased width.

STANDARDS FOR ACCEPTANCE OF FABRIC

Average index for inspected rolls should not exceed » 28 points / 100yd² and maximum index for any roll not to exceed » 40 points / 100yd². These values are not specified in the garment and textile sector, and buyers set their own requirements for acceptable points. Instead of just passing or failing a fabric roll or fabric lot, several mills grade fabrics as first quality and second quality.

In general, different fabric types have varied acceptable levels of 'points per 100 linear yards' or 'points per 100 square yards.” For example:

For **Cotton Twill/Denim** 28 points per 100 square yards (23 points per 100 square meters) for individual fabric roll

For **All synthetic fabrics** 20 point per 100 square yards (16 points per 100 square meters) for individual fabric roll

A simple check sheet must be used to record or gather problems during inspection. A check sheet contains general information, fabric lot information, fabric defects by size, a summary of fabric flaws, the number of items inspected and the total penalty points, as well as the fabric lot's final inspection result. To keep track of the amount of flaws, use tally markings. A sample 4 point system fabric inspection format has been given below:

Sample 4 Point System Inspection Format

Fabric Description				Supplier Name		Fabric Received Date		Checker	
Colour				Process Type		Total Fabric Rcvd.		Date:	

S.No.	Lot No.	Length (yds)		Width (in inches)		Defect Categories																Total Points Found	Points per hundred sq. yards	Status & Remarks
						Defect-1				Defect-2				Defect-2				Hole		Others						
		On Tag	Actual	On Tag	Actual	0-3"	3"-6"	6"-9"	> 9	0-3"	3"-6"	6"-9"	> 9	0-3"	3"-6"	6"-9"	> 9	0-1"	Above 1"	0-3"	3"-6"	6"-9"	> 9			
						1	2	3	4	1	2	3	4	1	2	3	4	2	4	1	2	3	3			
Total																								

Signature of the Quality Manager

Signature of the Checker

Fig.: 2.3: Sample- 4 Point system inspection format

General Inspection Procedures

- Fabric inspection is done in suitable and safe environment with enough ventilation and proper lighting.
- Fabric moving through the frame must be at 45-60 degrees to the fabric checker, and it must be done in a cool white light environment with 2 F96 fluorescent bulbs above the viewing area. Backlighting can be turned on and off as needed.
- Fabric speed on fabric checking machine must not be more than 15 yards per minute.
- Approved standard of bulk dye lot must be available before starting inspection for assessing color, construction, finish and visual appearance.

- Shade continuity within a roll by checking shade variation between centre and selvage and the beginning, middle and end of each roll must be evaluated and documented.
- The width of the fabric must be measured from selvage to selvage and matched to the standard.
- All defects must be flagged during fabric checking.
- To avoid a shortage, the length of each inspected roll must be compared to the length specified on the supplier ticketed tag, and any difference must be documented and reported to the mill for extra replacement.
- When inspecting yarn dyed or printed fabrics, the repeat measurement must be determined from the beginning, middle, and end of selected rolls.
- No penalty points are recorded or assigned for minor defects. Only major defects are considered.

Activities

Activity

Create a Power Point Presentation in detail on the inspection methods and Four Point System.

Materials Required

1. Pen
2. Register
3. Writing Material
4. Laptop/Computer

Procedure

1. Collect information from various Online and industrial sources.
2. Arrange the information in a PPT format
3. Present the same in your classroom

Check Your Progress

A. Fill in the blanks:

1. As fabric is received, it should be _____to determine acceptability from a quality viewpoint based on standards.

2. _____increases the cost of production as defect is located after the garment is finished.

3. _____is the most used method in garment industry for fabric inspection which is performed following ASTM D5430-93

4. The purpose of fabric inspection is to determine the _____and for garments.

5. _____has width limitation therefore cannot be used widely or consistently for inspecting various fabrics.

B. Short Questions

1. Explain the processing of the apparel industry with the help of a flow chart.

2. Explain briefly the commonly followed inspection procedures in the industry.

3. Write short notes on Graniteville "78" System & Dallas system

Session 2: Understanding Operations of Fabric Checking Machines

Fabric inspection is usually done on machines which are specially made for the purpose of fabric inspection where the defects can be identified with the help of these machines, as the inspector has a very good view of the fabric and the fabric need not be reversed to detect defects. These machines are power driven, semi-automatic or manual in which the inspector pulls the fabric over the inspection table-under adequate light.

The defects are located, marked and recorded on an inspection form. These machines are also equipped to accurately measure the length of each roll of fabric as well as monitor the width of the fabric. The variation in width of fabric can result in a higher cost of manufacturing for basic garments since profit margin for these garment manufacturers is usually lower than that for fashion garment manufacturers and therefore, maximum fabric utilization is vital.

2.1 FABRIC CHECKING MACHINE

Fabric Checking Machines are designed to check fabric weaving defects, shade variations and dimensional accuracy in width and length. The fabric inspection method allows inspecting and making necessary markings for quality control in manufacturing process. There are different fabric inspection machines available to detect faults in fabrics which are not easily noticeable to the human eye. These are:

i. Basic level: Manual Fabric Inspection Machine

ii. Intermediate level: Mechanical/Semi-automatic fabric Inspection Machine

iii. Advanced level: Automated Inspection Machine

The fabric inspection machines facilitate in fabric inspection process, by unrolling and rerolling of fabric. The fabric inspection machines also come with fabric length counter (length measurement), which measures fabric length while fabric checking is done.

These inspections machines are equipped with all essential features like tensionless handling, accurate length measurement, proper illumination, Straight roll selvedge, auto cutting of fabrics in case big rolls are changed in batch rolls. Machines are operated with AC motor thus ensuring saving of power.

These machines are also available with 4-point system software (an attached device for data entry). Fabric checker can feed fabric faults in the system and enter penalty points for the specific fabric faults while checking fabric by using this software. The data analysis of fabric quality becomes easier

with this added feature. In the market, one can find many brands and manufacturers of the fabric inspection machines.

i. Basic level: Manual Fabric Inspection

Fabric can be visually inspected at this level on Horizontal or Slanting Inspection tables illuminated from the top and bottom. A fabric inspector pulls the fabric over the illuminated inspection table and the defects are located, marked and recorded on an inspection form manually. A top fabric guide roll is provided for an easy flow of fabric, with an option of adding edge guide and a metre counter. The fabric rolls are mounted behind the inspection table in adequate light and re-rolled as they leave the table. The length of fabric is inspected through mechanical length counter. Generally, a tray is provided to keep the loose fabric for inspection. the fabric movement is generally from the bottom to the top in the mechanically driven version, but it is reverse in the case of manually driven ones where standard width of the fabric to be inspected varying between 60 to 75 inches. The Checkmate table is an example of the basic level fabric inspection.

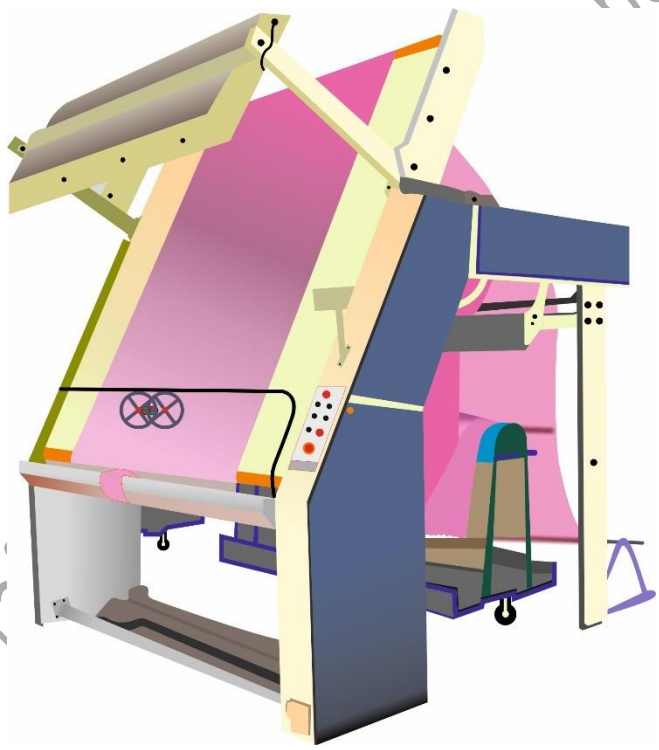


Fig.: 2.4: Manual Fabric Inspection

ii. Intermediate level: Mechanical/Semi-automatic fabric Inspection machine

These fabric inspection machines are power driven with variable frequency drive inverter to control precise speed and proximity sensors to control the evenness of edges, with an automatic stopping option. The speed of the machine can vary between 12 meters / minute to 60 meters / minute and some models have the option of testing delicate fabrics for sudden tightening to avoid damage to the fabric structure.

Another advantage of semi-automatic inspection machines is the electronic wheel type encoder provided to measure length of the inspected fabric as well as monitor the width of the fabric. While the length measurement is helpful in defining the number and length of lays, even width of the fabric maximizes fabric utilization. The mechanism is such that the fabric runs smoothly through the roller systems (with tensioning adjustments) and then under a metre counter, on to a holding pipe. Fabric speed on inspection machine must not be more than 15 yards per minute, that being the ideal speed at which an operator can comfortably detect faults.

An electronic wheel type encoder is provided with this machine to measure the length and width of the tested fabric. The machine is made in a way to move the fabric smoothly through the roller (with adjustment of stiffness) and then under the meter calculator, to the catch pipe. In this type of inspection machine, the speed of the fabric should not be more than 15 yards per minute. This is the accurate speed at which the operator can detect errors correctly.

In semi-automatic inspection machine, two-way lighting system, at the top and bottom, safety sensors and emergency stop function support better control over the fabric inspection. The machine is fitted with a metre counter to check the quantity of fabric as well as a fabric holding tray to manage the fabric handling.

This is the most commonly used technology for fabric inspection and helps in better and faster inspection, the results are still dependent more on the inspector's skill and expertise.

Fig.: 2.5: Semi-automatic fabric Inspection machine

iii. Advanced level: Automated Visual Inspection

The textile sector has experienced some spectacular technological changes during the last decade. Automated visual inspection is an example of such advancement in fabric inspection. The most important change is switch over from the inspection by human eye to scan the fabric by camera. The process is designed in such a way that the location, size and image of the defect are recorded in the inspection system. After the inspection, the product is

graded in terms of severity of defects and the detailed report is obtained. The aim is to save the manpower and time, as well as improved accuracy in the inspection process.

At the first level of inspection process, the image of the fabric is changed into a digital image in grey shades, this helps the software to read and differentiate between the image of the defect and the fabric. After that the software marks the areas with defects in the form of a window and the location of each defect is stored into the system. At the second level of image processing the defect window is further examined based on five aspects, namely height and width, the ratio of total defect area to the overall window area; total number of defects in the overall defects window and finally the ratio of the smallest defect area over the largest defect area. Based on these mentioned aspects, data regarding each defect is obtained, which helps in the recognition and classification of defects based on standard inspection system such as 4-point system. The system uses high resolution colour line scan technology and enhanced Defect Sorting Algorithms (DSA) to achieve defect detection and analysis.

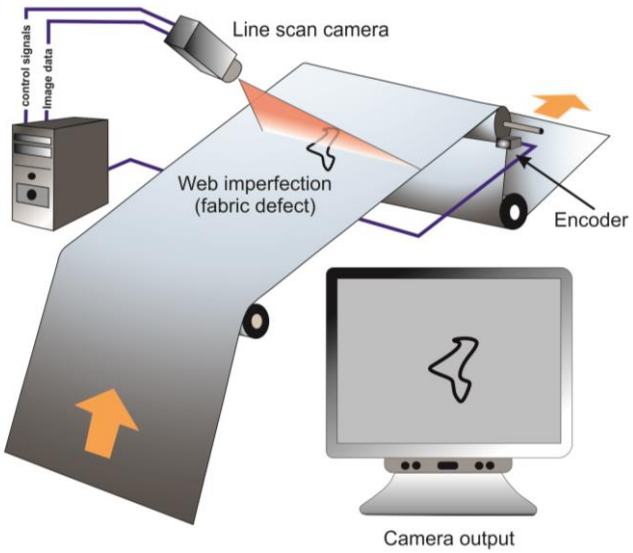


Fig.: 2.6: Automated Visual Inspection

On-loom Fabric Inspection using Cyclops

Some textile mills use the on-loom Fabric Inspection System to check fabric directly at the weaving stage, which works with the microprocessor of the weaving machine and in case a running fault is detected, the On-loom Fabric Inspection System stops and holds the loom, preventing continuation of manufacture of defective fabric. The weaver has to make a declaration, verifying that the defect cause has been eliminated before the loom can be put back in production. The weaver's declaration also allows further specifies the nature of the defect for which the loom has been stopped.

Manual vs automatic inspection

The price of the textile fabric is reduced by 45% to 65% due to defects. waste reduction through accurate and early detection of defects is an important aspect of quality inspection. A trained inspector inspects all types of fabric, correctly identify all defects and divide them into the corresponding classes by visual fabric inspection. The highest level of attentiveness is maintained only for a period of 15 to 20 minutes. After that, a person will tire continuously. The reproducibility of a visual inspection will rarely be over 50% even in a well-run operation but in case of automated inspection, the results are consistent and reproducible.

2.2 PARAMETERS FOR SETTING A FABRIC CHECKING MACHINE

There are various parameters which should be kept in mind before beginning the inspection of fabric. Fabric checking machines are of various types; hence the fabric checker must know all the components and features of the machine. Firstly, it reduces the risk of fabric damage. Secondly, it lessens the risk for personal injuries. Finally, it is essential to understand the machine in order to get optimum results in fabric checking.

The following are the parameters for setting up for fabric checking machine:

a) Fabric checking machine needs to be handled with proper care and instructions provided by the manufacturer of the fabric inspection machine.

b) The fabric checker must read the instruction manual carefully before operating the machine. This is the most important step in fabric checking.

c) Ensure that the table is completely lighted from below and top. The casing should be sloped so that the fabric gets ahead at an angle of 45–60 degrees to the horizontal.

d) The counter length meter should be working accurately. Overhead CWF lighting is advised at least > CWF 1000 LUX so that it should provide a luminous level of a minimum of 100-foot candles on the surface of the fabric.

e) The fabric should be aligned properly on the inspection table; otherwise the re-rolling will not be accurate.

f) The inspection roll should have the required tension according to its construction and structure.

g) The fabric should be placed flat without creases and folds.

h) The rollers and guiding rollers should be working properly.

Once the inspection machine is set, the fabric checker must stand at least 2-3 feet to view the full length of fabric.

- Additional features for helping fabric checker for achieving accurate results while working on fabric checking machines

a) Adjustable speed meter

b) Full forward and reverse run function

c) Foot switch control

d) Auto-stop function

e) 4-point system software

f) Camera detection for defects

g) Electronic counter meter

h) Scroll control for crease

2.3 FABRIC ROLL LOADING PROCESS ON THE MACHINE

It is important to know the correct loading process of a fabric roll in a basic fabric inspection machine. Process flow need to be followed while working on mechanical or semi – automatic fabric inspection machines.

Fig.: 2.7: Fabric Roll Loading Process

The guiding rollers are necessary to have a good fabric tension while inspection. Also some inspection tables come with counter meter for keeping a note of the total length and width of fabric inspected. The inspection tables are illuminated from bottom and above for the fabric checker to easily visualize the defects. The fabric checker can tie the next fabric from both ends to the previous inspected fabric roll to avoid the beginning steps and keeping the fabric tension similar without time wastage.

Fabric loading process may vary from machine to machine due to different manufacturing industries. In some automatic inspection machines the process is fully automated.

2.4 GUIDELINES FOR FABRIC CHECKING OPERATIONS

Machine and Tools should be in proper working mode. The fabric checker will not be able to achieve proper results if the machine or tools are defective. Working with a defective machine can lead to more dangerous results. It can be risky for the operator as well as for the company as a whole. Hence some common problems can be diagnosed as early as possible using visual inspection, sound, temperature, etc. of the machine.

Maintenance is the chronological activities or as the process of systematic activities which is done to keep the factory plan equipment machine tools etc. in an optimum working condition, minimize the breakdown of machine's to improve Productivity of existing machine tools and avoid sinking of additional capacity and to prolong the useful life of the factory plant & machinery. Tools should be cleaned and a thorough maintenance is needed periodically to avoid any kind of defects. If the problem remains unresolved, the fabric checker should inform the concerned personnel or his superior authority. Finally, it should be the role of the concerned authority to call for a technical agent from the manufacturing company to check and fix defects existing in the machine.

Important points should be taken into account when inspecting fabrics.

i. Make sure the work area is free from hazards.

ii. Obtain and check the data on the work ticket or job card and carry out functions in line with the responsibilities of job role.

iii. Ask questions to obtain more information on tasks when the instructions are unclear.

iv. Accept and review the work target agreed to with your supervisor and check for special instructions if applicable.

v. Select and sort the correct tools, equipment's and materials for the work.

vi. Check that equipment is safe and set up in readiness for use.

vii. Setup the equipment & machineries (e.g.: Fabric Checking Machine) for Fabric Checking as per the job requirement.

viii. Make sure that tools (e.g.: Marker, measuring tape, ruler, etc.) are safe and clean to use on the material.

ix. Update and develop knowledge of the products.

x. Minimize wastage.

xi. Carry out operations at a rate which maintains work flow and meets production targets.

xii. Dispose of waste materials safely and return re-useable materials.

xiii. Carry out visual inspection to ensure the products are free from handling defects.

xiv. Conform to company quality standards.

xv. Follow company reporting procedures about defective tools and machines which affect work and report risks/ problems likely to affect services to the relevant person promptly and accurately.

xvi. Leave work area safe and secure when work is complete.

xvii. Complete forms, records and other documentation.

Therefore, we can say that fabric checking operation is not a simple task. The objective of fabric inspection is delivering quality fabric to the garment makers and making quality garments. A defective fabric will only produce a defective garment. In case a faulty fabric is used in garment making, it will increase the cost of manufacturing due to repair work, part change, and even garment rejection. To avoid processing defective fabric in production, as a preventive action, fabric rolls are checked. In this way defective and damaged fabric can be separated and sent back to the fabric suppliers. Also the maintenance and reporting should be done by the fabric checker in regular time intervals to avoid risk of health and physical damage and achieve best results in fabric checking operation.

2.5 PREPARATION OF THE FABRIC

Setting the standard for the amount of fabric to be inspected; the quantity can range from 10% to 100%.

a) Segregating fabric rolls lot wise i.e. (dyeing, printing, knitted or woven).

b) Selecting fabric rolls randomly.

c) Measuring fabric width and length.

d) Checking fabric on the inspection table or on a flat table.

e) Marking visible defects on the fabrics

Precautions while handling fabric rolls

While handling and moving fabric rolls from one place to another some precautionary steps must be followed to avoid the damage and defects.

a) Regular cleaning of factory floors.

b) The place of inspection should be-kept clean.

c) The fabric rolls inspected should be wrapped in proper plastic or paper covers to avoid dust and dirt.

d) Fabric checker and the workers responsible for the movement of fabric must wear gloves and ensure cleanliness.

e) The machines should be maintained on a regular basis so the fabric are not stained with oil or grease marks.

f) In smaller industries, the dyeing area should be away from the work area of inspection to avoid unforeseen damage to the fabric rolls.

g) Using material handling equipment's can reduce the physical damages due to movement.

Material Handling Equipments

These are some of the Material Handling equipment's which can be used in an industry for easy movement and handling of fabric:

Fig.: 2.8: Material Handling Equipments

Activities

Activity

Demonstrate fabric loading process on a fabric checking machine with the help of flow chart.

Materials Required

1. Register
2. Pen

Procedure

1. Visiting the fabric inspection department in the industry.
2. Observing the fabric roll being mounted on the fabric roller.
3. Note the points to avoid damage.
4. Note down the process in from beginning to the end.
5. Prepare a flow chart of the process.

Check Your Progress

A. Fill in the blanks:

1. The main objective of inspection is the detection of the defects by _____.
2. The purpose of fabric inspection is to determine the _____ and _____.
3. The _____are necessary to have a good fabric tension while inspection.
4. _____is an analysis of defects in fabric.
5. _____is to keep the factory plan equipment machine tools etc. in an optimum working condition.

B. Short Questions:

1. Define Fabric Inspection. Name the systems of inspection used in the industry.
2. What is a fabric inspection machine?
3. List some material handling equipments used in the industry.
4. What are the various damages caused due to fabric movement and handling?
5. List the basic guidelines to be followed by a fabric checker for fabric checking operations.

Session: 3 Analyzing and Evaluating Various Fabric Defects

In this session we will learn about how to begin the process of fabric checking on an inspection machine. Fabrics are prone to various types of defects, hence it is the role of the fabric checker to identify and analyse the defects, further providing acceptance or rejection of the fabric roll. The defects should be marked and filled in inspection record to produce a fabric report to the concerned supervisor. Once the fabrics are inspected properly, they will be transferred to the next process depending on the end product.

3.1 INSPECTING FABRIC FOR DEFECTS

a) The fabric defect should be identified and given penalty points.

b) The fabric checker should have adequate knowledge and able to identify of fabric defects.

c) The fabric checker can mark any defects to the side with colored tape or thread so that they can be easily found and noted.

d) Some garment makers will require faults to be marked with a sticker on the fault. This should be communicated in pre-production meetings.

e) Defects must be recorded for every roll and clearly identified on the roll ticket. Records must be kept.

f) If the defect is minor the fabric checker can mend the defect on the fabric checking machine itself.

h) Length of the faults is to be measured in the warp or weft direction and the direction in which the fault is longest is the fault direction. However, when the warp and weft length are same and when the penalty of the shorter direction is heavier, take the fault of the direction in which the penalty is heavier.

i) When the fault in the warp direction is over 1 yard, the part which is over 1 yard is deemed as fault of the same kind of others.

j) When two or more than two faults observed, record only with a higher point.

k) When there are two or more faults within the length of 1yd and the penalty points come over 4 points, the points over 4 points are not added.

l) The inspector needs to be at a distance of 3 feet away from the inspection table and the linear speed of inspection not to be less than 0.1 meters per second when inspection is done on fabric inspection machine.

3.2 MARKING DEFECTS ON FABRIC

Defects can be seen readily with the fabric inspection machines, as the fabric checker has a very good view of the fabric and the fabric need not be reversed to detect defects. These machines are power driven or the inspector pulls the fabric over the inspection table. The defects are located, marked and recorded on an inspection form. These machines are also equipped to accurately measure the length of each roll of fabric as well as monitor the width of the fabric. The variation in width of fabric can result in a higher cost of manufacturing for basic garments since profit margin for these garment manufacturers is usually lower than that for fashion garment manufacturers and therefore, maximum fabric utilization is vital.

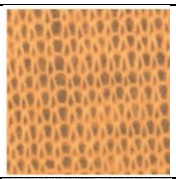
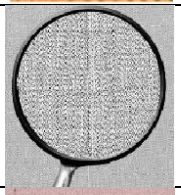
The main aim of fabric inspection department is identification and analysis of fabric defects using various standard methods. The selection of fabric should be done according to AQL (Accepted Quality Level) 1.5. A fabric defect is an imperfection existing on the surface of the fabric. A fabric defect can be classified into three categories:

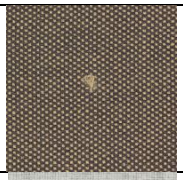
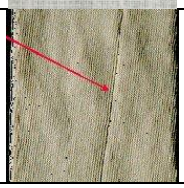
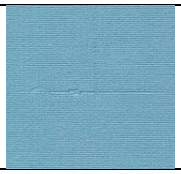
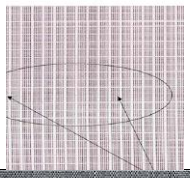
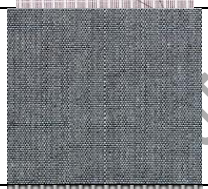
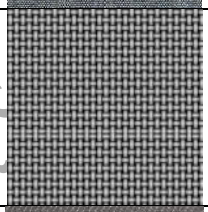
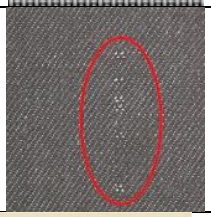
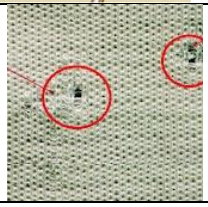
a) **Minor Defects** – These include small faults which have no influence on the purchase of the product.

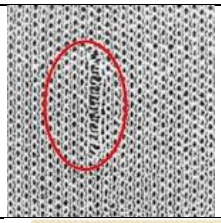
b) **Major Defects** – They are those which when exposed, are likely to affect the purchase of the product.

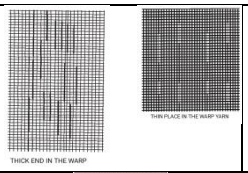
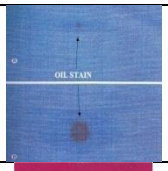
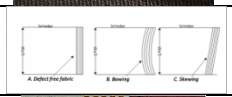
c) **Critical Defects** – They result in causing an entire roll to be rated as a second or worse.

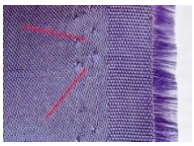
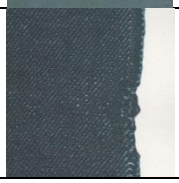
Fabric defects were already discussed in class 11th. Further is an elaborated table providing the category and explanation of the various fabric defects:

YARN DEFECTS		
BARRE		These are horizontal stripes or streaks of uniform or uneven width caused mainly due to high yarn tension.
BROKEN FILAMENT		This defect occurs when individual filaments constituting the main yarn are broken.
COLOURED FLECKS		It occurs due to the presence of coloured foreign matter in the yarn.

KNOTS		This results when broken threads are pieced together by improper knotting.
SLUB		A Slub is a bunch of fibres having less twist or no twist and has a wider diameter compared to normal spun yarn.
SPIRALITY		It is the twisting of yarn due to residual torque in it.
WEAVING DEFECTS		
BROKEN END		This result due to breakage of warp yarns during weaving.
BROKEN PICK		This results due to breakage of filling yarns during weaving.
DOUBLE END		When two or more ends by fault get woven as one generating a thick bar running parallel to the warp.
DOUBLE PICK		Instead of single, double weft yarns are woven in the fabric
FLOAT		Float is the improper interlacement of warp and weft yarns in the fabric over a certain area.
GOUT		It results due to an accumulation of short fibres in the yarn and gives a lumpy appearance on the fabric.
HOLES, CUTS OR TEARS		These defects may be generated due to poor handling.

LADDER		This defect is found in knitted fabrics. It indicates a row of dropped stitches in the wale direction.
LASHING IN		This defect occurs when an extra piece of yarn is woven in the fabric near the selvedge.
LOCAL DISTORTION		Displacement of warp and/or weft yarns from their normal position.
MISSING END		Omission of an entire end along the length of the cloth
MISSING PICK		Omission of an entire pick across the width of the cloth.
REED MARKS		These appear as a pronounced warp way crack and are caused by a damaged or defective reed.
SLACK ENDS		Slack ends are due to the broken ends that are being woven without tension. The yarn puckers as it is woven.
SLOUGH OFF/ SNARLING		Bunch of weft yarns is woven into the fabric together due to yarn slippage.
SMASH		It refers to the ruptured cloth structure created as a result of many broken warp ends and floating picks.
TAILS OUT		These are untrimmed loose threads on the selvedge due to improper cutting.

THICK AND THIN PLACE		Bunching up of yarns in the fabric causes thick and thin places in the fabric.
TIGHT ENDS		This defect in the fabric is due to warp yarns which are under much higher tension than the normal amount.
ISOLATED DEFECTS		
FUZZ BALLS		Fuzz balls are created when the fibres are broken loose and pushed back on the yarn.
NEPPY SURFACE		This condition is characterized by an excessive amount of small tangles and/or knots of fibres (neps) appearing on the fabric surface.
OIL STAINS		Oils from machinery stain the fabric.
UNEVENNESS		Fabric surface unevenness and defects are usually created by yarn irregularity and defects in the weaving process.
WET PROCESSING DEFECTS		
COLOUR BLEEDING AND STAINING		Colour bleeding from dyed yarn in fabric tints and stains the adjacent fabric when the fabric undergoes subsequent processes.
CREASE MARKS		Crease marks are created due to creased fabric passing through squeeze rolls in the dyeing or finishing process.
DYE MARKS		Dye spots or dye marks are caused due to dye deposits on the machine or improper mixing of dye stuff in the solution.
FABRIC WIDTH VARIATION		Fabric shrinks width-wise due to wet processing.
MISS-PRINTING		Misprint is when the print is not as per the design required.

PIN MARKS		These are pin holes created when a fabric is put over a pin tenter and the holes are created far in from the selvedge, distorting or tearing the fabric.
TORN SELVEDGE		A torn selvedge is caused due to the fabric rupturing under excessive tension when it is being processed through the tenter frame.
WAVY SELVEDGE		Wavy selvedge is a result of the edge of the fabric being longer than the centre.
SELVEDGE TURNDOWN		Selvedge turndown is the mark of selvedge created on the fabric due to the selvedge being folded and passing through squeeze rollers.

3.3 Damages / Defects caused due to fabric movement and handling

Fabric inspection is an analysis of defects in fabric. Fabric does not only consist of defects due to weaving, printing or dying or other fabric manufacturing techniques, but can also be caused due to mishandling of fabric from one work area to another. They are as follows:

a) On the factory floor

b) Machine oils

c) Handling of fabrics with dirty hands

d) Avoiding the use of tools and equipments for movement of fabric

e) Crease marks when fabric roll is not mounted properly and passes through rollers in the inspection process

f) Abrasion mark (discolored area) caused by friction or rubbing during inspection or handling.

g) Holes from rough mechanical parts during mounting or handling of fabric.

3.4 OTHER IMPORTANT PARAMETERS CHECKED SPERATELY FOR ANY DEFCETS

i. COLOR / SHADE INSPECTION

In addition to the inspection for fabric defects, each fabric order must be checked for shade issues. If multiple lots are involved, it is critical to ensure that all rolls within a lot match for shade following the process outlined below.

1. Cut a swatch from every roll in the order
2. In a light-box, compare each piece to the others within the lot
   - Create a shade blanket where applicable
   - Note: Ensure the light box is placed in a dark place and shielded from ambient light
3. Confirm or adjust lot breakdown and separate rolls by shade group
   - Ensure each roll is marked with the proper shade group identification.

ii. FABRIC SHRINKAGE

This test is done to define right percent dimensional change (shrinkage) in all types of fabrics. Fine pre-set shrinkage template with 25cm x 25cm" & 50cm" x 50cm" benchmarks length-wise & width-wise is used as standard. The standard is set to the scale to evaluate shrinkage and stretch directly Up to 15%. Two fine tipped black and yellow fabric markers are used for accurate marking on light and dark colour fabrics.

- The marking template should be placed on the specimen to be tested, making sure that the fabric is in flat position before marking.
- Hold the template firm, and carefully mark the fabric through the eight slots of the template, to ensure that it does not move.
- Now put the fabric in the washing machine or Dry Cleaning.
- Dry the sample as per specified method. It can either be Line Dry or Flat Dry or Tumble Dry.
- To find the dimensional change read the Shrinkage/Stretch on 3 points on the Wrap side and 3 points on Weft Side.
- Get the mean value of wrap-wise and weft wise readings to get the Accurate Shrinkage or Stretch.

iii. DEFECTS RELATED TO MACHINE

- Holes in the fabric caused due to any sharp part of machine.
- Stains caused due to machine oils or any other dirt on machine.
- Yarn puckering
- Colour fading due to machine lights.
- Abrasion caused while movement of fabric on machine.

Activities

Activity

Collect few samples of fabrics to identify defects in them.

Materials Required

1. Register
2. Pen
3. Fabric Samples

Procedure

1. Visit any nearby factory or fabric shop to collect samples.
2. Cut the samples in 2 inches X 2 inches square and mention the defects on them.
3. Discuss queries with faculty

Check Your Progress

A. Fill in the blanks:

1. _____ results in causing an entire roll to be rated as a second or worse.
2. _____ are created when the fibres are broken loose and pushed back on the yarn
3. The role of the fabric checker to _____and _____the defects,
4. _____ are those which when exposed, are likely to affect the purchase of the product.

B. Short Questions:

1. Explain briefly about the process of inspecting fabric for defects

Module 3	Quality Control Procedures and Reporting Systems

Module Overview

One of the first things to realise when it comes to determining fabric quality is knowing that different types of fabrics present different characteristics and therefore the standards are different for each type of fabric. For instance, one cannot expect similar smoothness between a 100% cotton fabric and a fabric made of blended materials. This difference does not mean that one fabric is of better quality than other. The fibres of high-quality fabrics are woven together closely and tightly. There should be no visible gaps between fibres, as this is generally a sign of poor fibre quality. These fabrics are prone to tearing. The combination of vertical and horizontal weaves in high-quality fabrics is more well-balanced, resulting in a stronger fabric surface. In this session we will learn about different quality control procedures and reporting system.

Learning Outcomes
After completing this module, you will be able to: • Describe the importance of Understanding quality process • Describe how to Maintain and preserve the quality of fabrics • Analyze Reporting systems and types of reports
Module Structure
Session:1 Understanding quality process
Session:2 Maintaining and preserving the quality of fabrics
Session:3 Reporting systems and types of reports

SESSION 1: UNDERSTANDING QUALITY PROCESS

Quality is the most important criterion in today's world, and the textile sector is no exception. Every industry nowadays aspires to create the finest quality products in the shortest period of time, necessitating the implementation of a more sophisticated quality control system. We will learn about quality control in this session, which is an important part of fabric inspection. Quality standards can become an industry's significant

advantage and contribute to increased profits. Because the fabric checker is the initial point of contact in the inspection process, the job responsibilities should also focus on quality.

1.1 QUALITY AND QUALITY CONTROL

Quality may be defined by the sum of all those attributes which can lead to the production of products acceptable to the consumer. When these desired attributes are achieved without any defect or fault is known has quality product. Thus keeping fabric defects to a minimum is of prime importance from a quality perspective. Customers demand and expect value for money. As producers of apparel there must be a constant endeavour to produce work of good quality.

Quality control or QC is usually understood as assessing for quality after products have already been manufactured and sorted into acceptable and unacceptable categories. It is costly for companies that do not take a quality assurance method, but only look at quality in terms of quality control.

Several organizations have created standards and specifications to help in assessing consistent quality. Major organizations include the American Association of Textile Chemists and Colorists (AATCC) and the American Society for Testing and Materials (ASTM). These written standards assess fabrics and apparel products usually in terms of characteristics such as pilling, frosting, or color transfer. Now a days individual companies sometimes write their own specifications or a precise statement of a set of requirements to be satisfied by a material, product, system, or service that indicates the procedures for determining whether each of the requirements are satisfied based on their target market's expectations.

Fabric quality is of utmost importance to the overall quality of apparel and textile products. Regardless of how well a product is designed or constructed, if the fabric is of poor quality, the product will most likely to fail with the consumer.

So, quality of raw material plays a very important role to achieve the quality product like most fabrics are comprised of fibres that are spun into yarns and then woven or knitted into fabric. Support materials like linings and interlinings usually go from the fiber to the fabric stage. Since fibers are the building blocks of all apparel and textile products, it is important to start with quality fibers regardless if they are natural, manufactured, regenerated, or synthetic.

1.2 FABRIC QUALITY CONTROL APPROACH

Quality control of fabric requires considerable hands-on expertise and a keen focus on detail. Fabric inspectors use the industry standard four-point grading method, along with input on the main concerns and specific

requirements for each product, to build a comprehensive fabric inspection checklist. Fabric inspectors conduct a series of measurements and on-site checks to verify the quality of mass production based on the Acceptable Quality Limit (AQL), international regulations, and safety standards.

Some tests on fabrics require a controlled environment to analyze their compliance with the standards. Fabric inspectors select products from each batch and forward them to an accredited laboratory for processing.

Quality Parameters of Woven Fabrics:

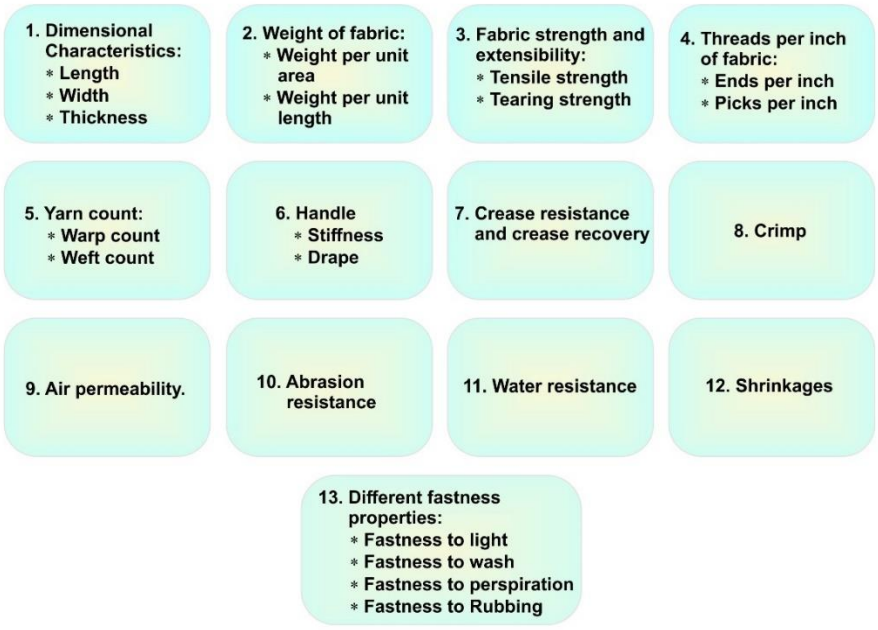


Fig.: 3.1: Quality Parameters of Woven Fabrics

Quality Parameters of Knitted Fabrics:

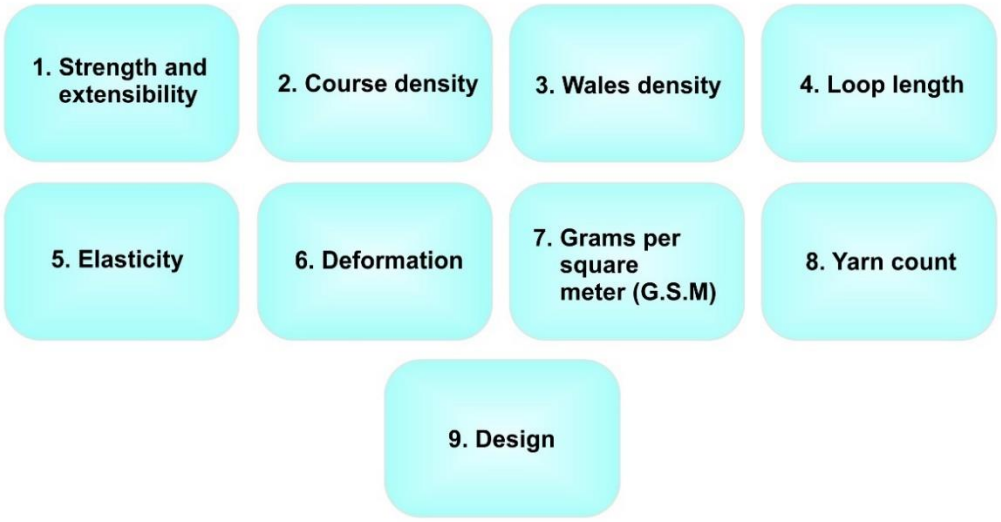


Fig.: 3.2: Quality Parameters of Knitted Fabrics

Quality Parameters of Non-woven Fabrics:

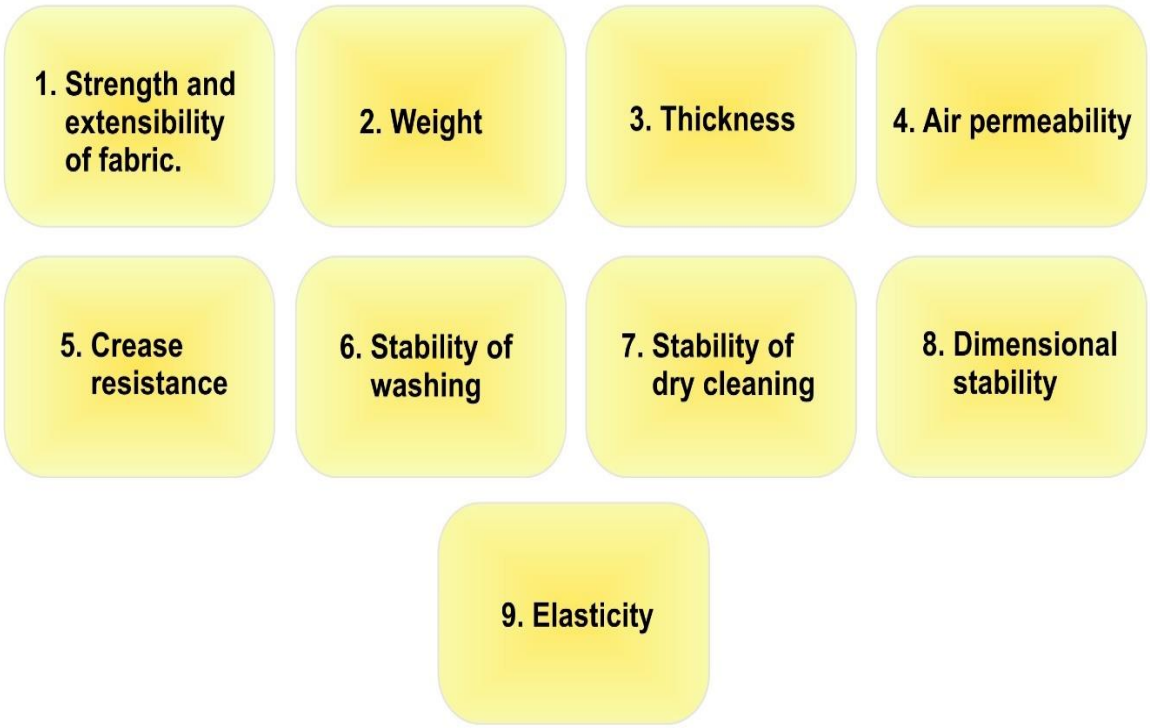


Fig.: 3.3: Quality Parameters of Non-woven Fabrics

1.3 QUALITY CONTROL AND MONITORING

For textile manufacturers, visual inspection is a vital but costly operation. It occurs at a number of points throughout the textile manufacturing process. The final inspection is for quality control, whereas inspection at other stages is typically used to identify defective material so that it can be repaired or eliminated from the manufacturing process before incurring excessive costs.

With regard to articles, colors, pattern and structure, manual cloth inspection remains the ideal method for judging fabric, as an inspector can utilize his or her own experience and expertise to subjectively judge the severity of a given fault. Manual visual inspection of textiles does have a number of widely acknowledged limitations, however. The subjective nature of the process gives rise to inconsistencies from one inspector to the next, while basic human error is, from time to time, inevitable, meaning that all faults may not be detected.

These limitations can be overcome by automatic fabric inspection systems, which provide consistently objective and reproducible assessment of the fabrics. The inspection data is provided directly in electronic form and can

therefore be processed quickly and the analysis can be immediately transmitted to the people concerned.

1.4 AUTOMATION TO IMPROVE QUALITY

Fabric checking, though, has proven to be one of the most difficult of all textile processes to automate. It has taken decades for computer and scanning technology to develop reasonably user-friendly systems to meet latest demand of the industry. Automatic inspection systems are designed to increase the accuracy, consistency and speed of the detection of defects in the manufacturing process of fabrics.

To ensure quality, fabric checking should ideally be both fast and exact. For this reason, high speed automatic inspection systems have increasingly become the focus in terms of development.

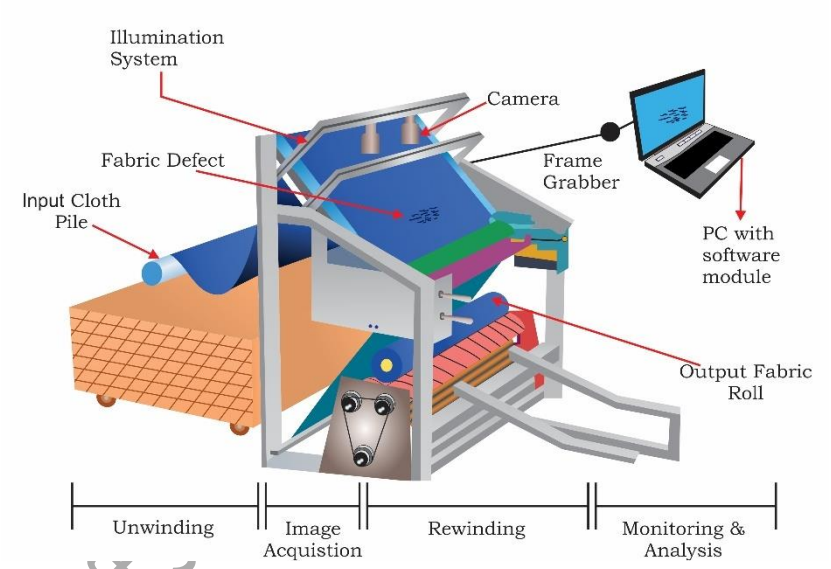


Fig.: 3.4: Process of an Automatic Fabric Inspection System

1.5 QUALITY CONTROL IN WOVEN FABRICS AND KNITTED FABRICS

WOVENS FABRICS

The defects and general properties of a fabric are commonly used to determine its quality. Fabric parameters such as width, ends and picks per unit length, weight per unit area, and the fabric's required functional qualities are among them. Yarn defects should be minimised during the preparation process, as they could otherwise result in an unsatisfactory fabric look or defects. Fabric faults must also be kept to a minimum during the weaving process, as the cost of fabric defects can be very high, with potentially significant losses in the product's value. In recent years, the tolerance level for non-repairable flaws per 100 m of fabric has been

significantly reduced (from 15 to 5) and is expected to reach as low as 3 in the future.

KNITTED FABRICS

The quality of the fabrics/garments produced in knitting largely depends on the following key points

- Quality of the yarn
- Knitting machine condition
- Process parameters of knitting
- Process control scheme of the industry.

So attempt should be made to identify the given key points in knitting and control those as per norms.

The most important parameters and settings for knitting machines with regard to quality control are:

a) **Yarn input tension** - Input tension can easily be adjusted with the help of the yarn tensioner and can be measured using a yarn tension-meter. A new concept in this field is the incorporation of a built-in tension-meter on every yarn feeder for continuous measurement and control.

b) **Stitch cam setting** - Circular weft knitting machines are provided with a large number of stitch cams; the cam setting must be uniform across the circumference otherwise an uneven loop length will occur and fabric will be defective. Positive yarn feeding is important to help achieve a uniform setting for all stitch cams. Arrangement of a centralized cam setting from a particular point can solve this problem.

c) **Rate of yarn feeding and Take-down load** – This parameter influence the yarn tension during the knitting process and the resultant loop length in the knitted fabric.

d) **Number of feeders** - In order to increase production more feeders can be added to a circular weft knitting machine. However, due to mechanical defects or shortage of material, one or more feeders are sometimes kept idle. In this situation knitting continues, but the fabrics in the non-feeding or idle stitch cam zones become prone to defect.

e) **Needle gating** - The order of needle gating depends on the design of the knitted fabrics. If the order changes anywhere in the needle bed the design will vary and the fabric will be defective. For this reason it is

essential to inspect the order of needle arrangement in the needle bed and rectify any changes that take place.

f) **Tucking and floating arrangements** - Sometimes tuck or fl oat loops are created in a regular pattern to make various derivatives of regular designs to enhance the aesthetic value of the knitted fabric. Therefore it is also essential to inspect the mechanism of tuck and fl oat loop formation at regular intervals, otherwise defects may occur.

1.6 IMPORTANCE OF QUALITY CONTROL

a) **Encourages quality consciousness:** Quality control develops and encourages quality consciousness among the workers in the factory which is greatly helpful in achieving desired level of quality in the product.

b) **Satisfaction of consumers:** Consumers are greatly benefited as they get better quality products on account of quality control which gives them satisfaction.

c) **Reduction in production cost:** By undertaking effective inspection and control over production processes and operations, production costs are considerably reduced.

d) **Most effective utilization of resources:** Quality control ensures maximum utilization of available resources thereby minimizing wastage and inefficiency of every kind.

e) **Reduction in inspection costs:** Quality control brings about economies in inspection and considerably reduces cost of inspection.

f) **Increased goodwill:** By producing better quality products and satisfying customer's needs, quality control raises the goodwill of the concern in the minds of people.

g) **Higher morale of employees:** An effective system of quality control is greatly helpful in increasing the morale of employees, and they feel that they are working in the concern producing better and higher quality products.

h) **Improved employer-employee relations:** Quality control develops to better industrial atmosphere by increasing morale of employees which ensures cordial employer-employee relations leading to better understanding and closeness between them.

i) **Improved techniques and methods of production:** By supplying technical and engineering data for the product and manufacturing processes, improved methods and designs of production are ensured by quality control.

j) **Facilitates price fixation:** By introducing quality control measures, uniform products of same quality are produced. This greatly facilitates the problem of price fixation**.**

k) **Increased sales:** Quality control ensures production of quality products which is immensely helpful in attracting more customers for the product thereby increasing sales.

Activities

Activity

Create an infographic explaining quality parameters of woven knitted and non woven fabric.

Materials Required

1. Writing Material
2. Laptop/Computer
3. Colours
4. Glue

Procedure

1. Collect information regarding quality parameters of woven knitted and non woven fabric from various Online and industrial sources.
2. Collect pictures related to all these parameters.
3. Prepare an infographic using any creative template with the help of information collected and paste pictures wherever necessary to give your infographic a more appealing look.

4. Submit the same in your classroom

Check Your Progress

A. Fill in the blanks:

1. Keeping _____to a minimum is of prime importance from a quality perspective.
2. _____is usually understood as assessing for quality after products have already been manufactured and sorted into acceptable and unacceptable categories.
3. ASTM stands for_____
4. AQL stands for_____

B. Short Questions

1. Explain quality control and monitoring. What is automation to improve quality of fabrics in textile industry?
2. Explain quality control in context of knitted fabric. What are the most important parameters and settings for knitting machines with regard to quality control?
3. Explain importance of quality control process.

Session: 2 Maintaining and Preserving the Quality of Fabrics

Fabric makers and garment manufacturers both conduct fabric inspections. Fabric inspection, as you now know, is the process of inspecting a fabric sheet for flaws and creating an inspection report. Following the fabric examination, the fabric is graded according to its quality level. A fabric roll inspection report is created for that fabric roll at the completion of the checking. Fabric rolls are graded and divided during fabric inspection by marking them with one of the following categories (in a garment manufacturing unit):

Passed - these fabric rolls are ready for use

Failed - Not ready for use in the cutting. Can be accepted after correction.

Rejected - Not acceptable. rejected fabrics are sent back to the supplier

Decision pending - Awaiting for approval from the authorized person whether to pass or fail or reject the fabric.

Fabric grading can be done in a variety of ways in the textile industry, such as Gold, Silver, or grade A, grade B. Fabric inspection reports used to be sent along with the fabric to customers in the textile industry.

Fabric is the most expensive component among the items necessary for garment manufacturing because it is a main raw material for constructing clothes (in most of the apparel product categories). Fabrics are checked prior to packing fabric in textile industries, and in garment manufacturing units, fabric is inspected prior to bulk cutting as standard operating practise. Garment units inspect fabric using various inspection procedures such as the 4-point system, 10-point system, or random fabric checking (5-10 percent of total fabric length).

Fabric checking has the purpose of providing high-quality fabric to garment producers and producing high-quality products. A defective fabric will only result in a faulty garment. If a defective fabric is utilised in the production of a garment, the cost of production will rise owing to repair work, part changes, and even garment rejection. Fabric rolls are inspected as a preventive measure to avoid processing substandard fabric in production. Defective and damaged fabrics can be separated and returned to fabric suppliers this way.

If the garment unit has faith in the fabric supplier's quality, they can inspect the materials by picking fabric rolls at random. Traditionally, some factories would test 10% of total fabric rolls. If the industry finds an unsatisfactory result in 10% of the fabric, they inspect all fabric rolls.

2.1 ROLE OF SUPERVISOR IN QUALITY CONTROL

The supervisor has a major role in ensuring that the required fabric quality is being achieved. Supervisor can achieve the required quality only if he is aware of the requirements and know to process of achieving the same. He or she should devote their greater time in monitoring and controlling the parameters to achieve the task. In short, a supervisor must be encouraged and permitted to supervise.

As a result of systematic development the supervisor should, amongst other facets of supervision, be:

- Thoroughly familiar with the specification of the product,
- Thoroughly familiar with, and skilled in, techniques of monitoring the consistency of the product,
- Understanding of the importance of achieving a certain level of quality.

Supervisor can communicate the importance of these factors to their subordinates for building the foundation for an overall improvement in workroom standards.

2.2 EFFECTS OF MAINTENANCE:

Regular and proper maintenance of fabric checking machine would eliminate any unnecessary wear and tear on various parts and equipment. It will also extend the life of machinery by reducing corrosion and increasing their working life. These are the results of ordinary maintenance such as cleaning, lubricating, repairing, replacing, fitting, and refitting, among other things.

It is necessary to maintain adequate lubrication, fitting, mending, and replacement as needed for the safe and comfortable operation of machinery. Because the machinery is regularly maintained and serviced as needed, it will run continuously, reducing downtime and resulting in better quality and less waste.

OPERATIONS INVOLVED IN MAINTENANCE:

1. **Setting**: Setting can also be called as adjustment. Setting is to set or install the machine parts or required ancillaries.

2. **Checking:** Checking means investigation of machine working condition. It is very important task of maintenance. It is done by very skilled technician. The time taken for checking the machines depends on how complex the machine is and what parts need frequent checking. The

task of the technician is to investigate if there is any fault or congestion that may hamper the smooth working of the machine. Sometime just oiling of the machine parts also helps the machine to run smoothly.

3. **Repairing**: Repairing or altering of spares parts (if necessary) is to be detected and necessary measures are to be taken (repairing\altering\setting\adjustment).

4. **Overhauling:** It is the work of maintenance, but not frequent or schedule work. It is done as per requirement.

2.3 SYSTEM OF MAINTENANCE

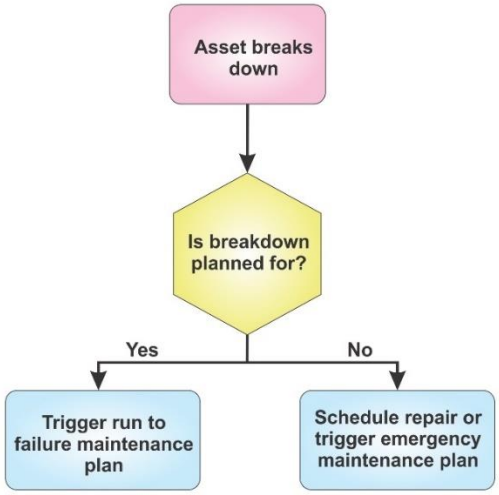
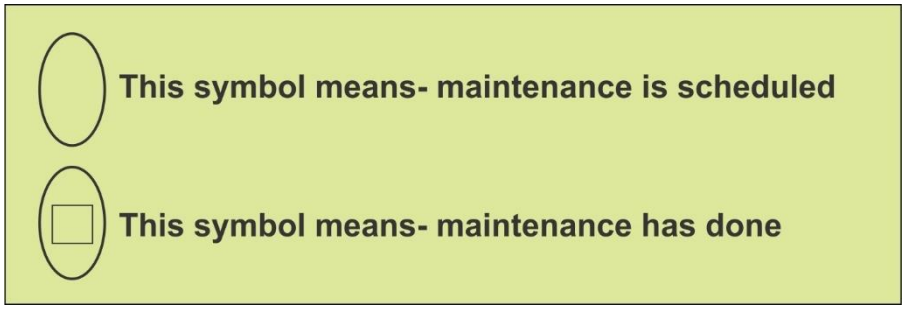


Fig.: 3.5: System of maintenance

BASICALLY THERE ARE TWO TYPES OF SYSTEMS

1. **Schedule Maintenance:** Schedule maintenance is planned Maintenance. Plan is based on time duration and working hour of machine. This Maintenance reduces the frequency of breakdown maintenance and this is excellent method to keep machines in healthy condition.



If machines would be in healthy condition automatically the productivity increases and this improves quality of products also. As for example if

machines are in good condition, there would be less frequency of breakdown, no time loss when new operator arrives/appointed, rpm of motor would be more in result increased speed of machine etc. Through all these productivity increases. If schedule maintenance is in perfect shape quality also increases. As for example no irregular stitches, Jump stitch, broken stitch, puckering, the maintenance described here should be performed every 3 months or 1000 hours of operation. Every maintenance should be in recorded and documented form. Since Auditor checks all the records and accordingly crosscheck - Record is must.

Machine Details								
Stitching Line - A 35 March								
Stitching Line - B 35 March								
Stitching Line - C 35 March								
Stitching Line - D 35 March								

2. **Breakdown Maintenance:** This is a daily machine breakdown service that occurs while on the job. This could be anything, major or minor. Only a skilled technician could handle this. Minor issues, such as skip stitches, loose stitches, thread breakage, and needle breakages, are common in this category. If routine maintenance is properly implemented, it may be able to drastically reduce the amount of maintenance required. Its fundamental motto is to retain records, because it is a requirement of the Auditor, and the last six months' record should always be available. Annual Service and Maintenance Contracts are offered by machine manufacturers and dealers. This may be done by a factory for specialised and complex machinery.

Date	Machine Number	Complain By	Complain Time	Attended Time	Parts Consumed	Sign Supervisor	Sign repairer	Remarks

Breakdown maintenance is unique in its applications because it cannot be used with certain industries or products, especially ones that involve health and safety. This means that breakdown maintenance is most frequently used when parts are inexpensive or nonessential.

Here are some examples in which breakdown maintenance is applicable:

- Equipment can't be repaired at all (inaccessible, designed to not be repaired)
- Asset consists of inexpensive or easy-to-replace parts
- Non-critical pieces of equipment (like hand tools)
- Objects/equipment those are disposable or meant to be replaced at the end of their lifespan
- Short-life assets (batteries, high flow pumps)

As one can see from these examples, breakdown maintenance becomes viable when there's no inherent safety risk to letting a part or piece of equipment break. As an example, consider a facility's light bulbs. If a light bulb is not linked to a safety feature, it doesn't make financial sense to replace it before it has burned out.

Fig.: 3.6: Pros and Cons of breakdown maintenance

However, breakdown maintenance is absolutely not viable when people's safety can be endangered by a part or product breaking. For example, the fabric checker cannot rely on fabric checking machine parts breaking down to fix them because doing so could lead to a severe injury to him. When it comes to people's lives, preventive and predictive maintenance are the right choice.

2.4 PRESERVING QUALITY THROUGH TEXTILE TESTING

Normally garment is produced from fabric, and the fabric can be woven or knitted, solid color dyed, printed, check, or stripe. While making garments with these fabrics especially for large quantities, maintaining quality is a challenging task. As sometimes buyer rejects the whole lot of garments due to some quality problem of the fabric. To avoid such kinds of problems, fabrics have to test to identify their actual quality before making the garments and it is called fabric testing.

Fabric testing is also done as per the standards approved by the buyer. The principal aim of this Quality Control is to ensure that organization is achieving the standards. Though Quality Control is strictly followed in every factory, it is not possible to achieve perfection. In Quality Control section, Fabric checker tries to make different swatches of same shade but little variation occurs among the swatches and the closest shade that matches with the sample is accepted by the buyers.

There are two types of tests are done in QC department. They are –

a) **Physical Tests** – These are done to check the physical attributes of the fabric. These include tests like:

- Yarn Grade
- GSM - Grams Per Square Meter
- Width

GSM in fabric, also known as grams per square metre is simply the metric measurement of the weight of a fabric. This measurement helps one decide on the best weight to buy, considering the usage of the material at hand. The higher the GSM number, the denser the fabric will be. For example, if the label on a linen fabric reads 180-200 GSM, the fabric would be thick. In addition to the above given tests, some other tests are also performed in some cases to ensure the quality.

- **Shrinkage**: It is one of the most important testing that needs to be done to check if the fabric rolls received to have the shrinkage in accordance with that of approved FOB. If not, there is a certain control limit within which the shrinkage in the fabric can be tolerated. The shrinkage is then later added on to the marker patterns before cutting.

- **Tensile Strength:** When the stretching force (load) is applied to the fabric, it begins to elongate. The stretching force (load) increases gradually, elongation also increases, when the amount of stretching force reaches on a certain point, the fabric begins to break. Now we can say that the tensile strength of the fabric is the amount of stretching force (load) at which the fabric begins to break when it comes under stretching

conditions. It is measured in Newtons per square centimetre or pounds per square inch.

- **Abrasion Resistance:** Abrasion resistance is the ability of a fabric to resist surface wear caused by flat rubbing contact with another material. There are different test methods commonly used by the textile industry to assess abrasion resistance.

- **Pilling Resistance:** Pilling is a fabric surface characterized by little pills of entangled fiber clinging to the cloth surface and giving the garment unsightly appearance. The pills are formed during wear and washing by the entanglement of loose fibers which protrude from the fabric surface.

  Under the influence of the rubbing action these loose fibers develop into small spherical bundles anchored to the fabric by a few unbroken fibers.

- **Crease Resistance:** The resistance to creasing of textile material during use is known as crease resistance.

- **Continuity card and Shade band**

  The colour shade of most dyed or printed fabrics cannot be kept consistent throughout the order since they are created in batches with varying colour shades, making uniformity impossible to achieve. Because a garment cannot be created with shade variance in its components, it is standard procedure to inspect the entire consignment for all shades. Fabric swatches from all rolls of fabric are cut and checked against the approved FOB for this work. A specific shade number is assigned to all of the shades discovered throughout the shipment based on this. Because only a certain amount of shade variation can be accepted in a shipment, any shade variation beyond that must be confirmed with the buyer.

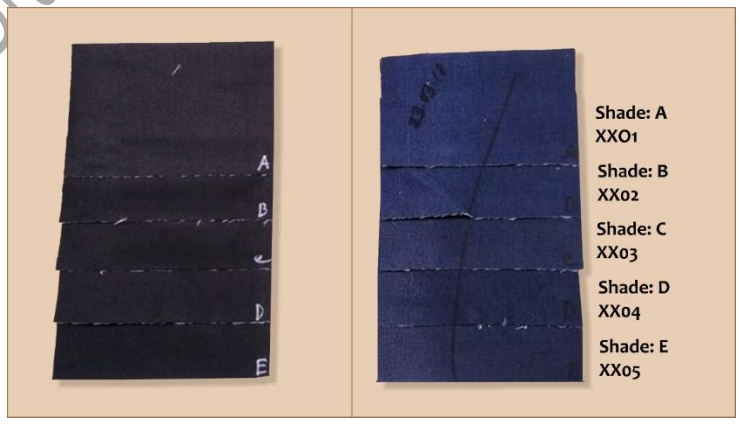


Fig.: 3.7: Shade Card

- **CSV (Centre Selvage Variation)**

It is one of the most crucial tests that must be completed correctly. Even if they are cut from the same ply, ignoring this shade fluctuation can result in a mismatch in the shade of the garment component. The fabric is divided into 5-6 parts after being cut parallel to the width with a length of approximately 15 cm. The components must be serially numbered, beginning at one selvedge and progressing to the next. After that, the components must be switched and stitched together. By discontinuing the shade at the cut, the variation in the shade across the width will be more noticeable.

Only a small percentage of rolls with this problem can be approved because it is such a noticeable defect in the fabric. Exceeding the restriction might result in the entire fabric order being rejected, making the fabric provider questionable. A marker can be altered to keep the components near to each other throughout the shade for a slight CSV.

- **End to end Shade Check:** It is checked to ensure if the colour shade throughout the fabric roll is uniform or not. For this, a strip of fabric is cut from both the ends of the fabric and sewn with each other. Then the cut parts are compared for change in any shade variation through a shade card. Companies have their own tolerable level for which this variation can be allowed for cutting. On exceeding that the fabric supplier becomes questionable for this kind of variation.

b) **Chemical Tests** – These are done to check the chemical attributes of the fabric. These include tests like:

- **Color Fastness to Perspiration:** The color fastness to perspiration (acid and alkaline) refers to the ability not to fade and not to stain when the dyed fabric is perspired, and it is one of the main color fastness testing items of textiles.

- **Color Fastness to Washing:** Color Fastness to washing is one of common test items of textile dyeing fastness, mainly testing the color dyeing fastness of textile fabrics for garment and home textile products after one or more simulations of household and commercial washing.

- **Color Fastness to light:** Light fastness, or color fastness to light, is the resistance of printed or pigmented materials to fading or color change due to exposure to sunlight or an artificial light source.

- **Color Fastness to heat:** Heat color fastness refers to the ability to keep original color of dyed fabrics under conditions of different heat. Heat

color fastness test can be done in dry, tide, wet environment, which depends on the use of textiles. The machine using in heat color fastness test is Ironing Sublimation Color Fastness Tester. When testing, dyed sample pasting with one or two prescribed adjacent fabric contact closely with heating device, heated in a certain time under specified temperature and pressure.

- **Color Fastness to Rubbing:** Colour fastness to rubbing test (also known as the Crock test) records the amount of colour that a fabric emits when rubbed. This is mainly for upholstery fabrics. A fabric sample is placed in the crock test machine. The fabric sample is rubbed with a wet and dry cotton cloth.

2.5 LATEST INSTRUMENTS USED IN FOR TESTING PURPOSE

Fabrics such as woven fabric, knit fabric, solid colour dyed fabric, and others are used to make garments and other end products in the apparel manufacturing sector. The specified fabric must be tested by the producers according to the buyer's approved requirements before proceeding into large-scale production of any outfits. The buyer may reject the entire order if the fabric quality is poor. Fabric testing is used to assess the true quality of fabrics before they are used to make clothes in order to minimise such problems.

A fabric testing machine is used to test the physical characteristics of the fabric, such as fabric fineness, tensile strength, density, length, etc. Fabric testing machine usually includes all the following machines.

Fig.: 3.8: Testing Instruments used in Quality Control

Activities

Activity

Make a chart depicting different types of machines used for fabric testing purpose.

Materials Required

1. Writing Material
2. Chart paper
3. Colours
4. Glue

Procedure

1. Collect information regarding different types of machines used for fabric testing process.
2. Collect pictures of all these machines.
3. Prepare a chart explaining about these testing machines and how they work. Paste pictures wherever necessary.
4. Submit the same in your classroom

Check Your Progress

A. Fill in the blanks:

i. A _____ is created for that fabric roll at the completion of the checking.

ii. The _____ has a major role in ensuring that the required fabric quality is being achieved.

iii. _____reduces the frequency of breakdown maintenance.

iv. CSV stands for_____

B. Questions

i. Explain the role of supervisor in quality control.

ii. Discuss effects and operations involved in maintenance of a fabric checking machine.

iii. Explain system of maintenance in detail.

iv. Explain physical and chemical tests of the fabric that help in preserving quality of fabric.

Session 3: Reporting Systems and Types of Reports

A simple check sheet is used to record or collect the total number of defects during inspection. The Check Sheet includes the general details of the fabric inspected, fabric defects according to defect sizes, summary of fabric defects, the fabric lot and the inspection result. The fabric checker can use tally marking to record the number of defects.

3.1 OBJECTIVES FOR MAINTAINING THE REPORTS

1. On procurement of order the factory may write many of the basic utmost required quality points for suppliers, which need to be followed compulsorily.
2. Suppliers who own inspection report must be available before dispatch of the fabric lot.
3. While inspection, approved fabric must be there for the comparison with bulk lot.
4. Following should be checked while doing the fabric inspection: Colour shade checking, Side to side selvedge colour, selvedge side to middle colour, beginning and end fabric colour etc. Inspect the fabric roll chosen on machine with appropriate light and speed to detect the defects. Weight, yarn count, Bowing, skewing, odour, softness of fabric, shrinkage of yarn and fabric are some of the defects to be inspected as discussed in earlier session.
5. Colour wise defect identification and major defect should be marked with red arrow head sticker and thread should be knotted on the selvedge for easily identification of defects when supervisor or representative comes for complete inspection report.
6. Yard quantity, face and reverse side must be identified on label sticker of roll. The details mentioned in this label need to be entered manually by the fabric checker in the inspection report, so that it becomes easy to crosscheck and correspond the report with each fabric roll or lot.
7. There are different coloured stickers used for reject and ok fabric roll. Roll sticker must have following information: Roll number, Roll length, roll weight (if knits), dye/ print/ colour shade lot, supplier name, fabric composition and description, cuttable width, defect points etc.
8. Writing record is required for quality inspection in simple and easy to understand format. Minimum 6 months past record is required in audit as according to international norms.

9. All the fabric should be on pallets or properly placed in racks with proper identification marks, numbers or system.
10. Classification of defect / sample identified on display board for better understanding. Such as satin should be specially inspected for yarn pull, crepe for density of crepe and required width, printed fabric for miss print etc. these standard charts come handy when a fabric checker is newly appointed or if the fabric checker need to confirm the encountered defect.

3.2 REPORTING SYSTEMS IN TEXTILE INDUSTRY

Fabric checking is a major part of fabric inspection and where inspection comes, comes evaluating and reporting for better improvement leading optimised quality output. It helps in maintaining the standard of the product being developed. Industries follow various methods of checking the fabric. Each industry develops their management reporting systems to suit the need of quality to be maintained. It is always better to maintain the quality during the early stages where various raw materials are used to construct a single product to avoid wastage and irreparable damage. In textile industries fabric can be the end product of the industry and in some fabric can be a raw material to further make various products out of it.

REPORTING SYSTEM

A reporting system is a part of a management control system. It provides crucial business information which can be in the form of reports and/or statements. The system is aimed to help members of the administration by providing well-timed and relevant information.

NEED OF EFFECTIVE REPORTING SYSTEMS

Reporting systems helps the management to improve the functioning and quality of work. Reporting system helps the management to collect critical data prepared by designated employees who observe and report each step of the manufacturing process in order to assist management to evaluate the effectiveness of various industrial operations. These reporting systems can be applied in various departments of the organisation like accounts department, employee headcount or HR department, for various client, products, investment performance, etc. The reporting system has a wide scope; however there are six major reasons that contribute to the need of a good management system.

1. Constant requirement of reports for decision making and analysis of trends.
2. Reports being inaccessible with the right stakeholders at the right time.

3. Lack of visibility and a single universal view of the industry's performance.
4. Data termination, replication of data leading to data management and quality issues leading to error prone reports.
5. High value resources.
6. Changing a worldwide report to fit native needs.

An active management reporting system (MRS) helps in:

1. Improved decision making: making performance crystal clear
2. Improves management effectiveness: the data analysis helps in understanding the loop wholes and gives scope of improvement
3. Improves receptiveness to issues: since the reports are used to note the actual scenario the issues or problems are more easily spotted and are quick in its approachability
4. It also improves efficiency of resources in the delivery of organizational services: since reporting also generates the data of the amount of resources required, wastage is minimised.

While reporting systems are beneficial to any organisations there are few essential points to be kept in mind while preparing a report system. These are discussed as following:

- The main idea of running a reporting system is to generate good reports: They should be generated in a well-timed manner and should have the suitable flow of information; it also should be prepared in the correct format.

- The system should be adequately flexible to modify to all the requirements that are made by the user. It should also offer insights if eccentricities from predefined standards or estimates occur. It should do all discussed while being economical to the organization. Localization of reports aids in keeping them simple. Industries should concentrate more on localizing their MRS-management reporting systems, as it makes reporting simple. In each area or domain this helps in taking better decisions for.

- Accuracy is the foremost expectation of a reporting system as they evaluate a company's result at any given point in time. There shouldn't be any differences in terms of reporting. The reports that are generated by the systems are used for critical analysis by senior management, more so Chief level executives therefore the need for accuracy is high.

- The effectiveness of a MRS is only when it promptly generates clear report. There is no point of having a management reporting system if, it doesn't produce reports when needed. Industries can obtain information faster and accurately with the technologies that are available.
- A fundamental aspect for any management reporting system is for it to be cost effective. Reports generated from this system should never be too difficult to assemble, as well as they should be able to justify their costs. Depending upon the cost of the MRS the companies can decide on what type of system do they want and will those systems be useful for them or not. As in the end the generated must help the management take mindful decisions.

To simplify the above, the reports should be detailed enough to let management know where the next change has to be implemented for better and improved results.

There will be a continuous necessity among executives to acquire the latest information in the maximum comprehensive and appropriate way imaginable. Therefore, grounded on the ever-evolving parameters, new reports should be proactively produced or the needed changes must be done to the existing reports itself.

There are two types of reports:

Fig.: 3.9: Types of reports

Also, a programmed delivery of reports (both static and dynamic) constructed on the managerial grading levels is a critical contributing element for the success of a MR system.

An effective management reporting system should preserve a standard set format in its consistency in terms of the reports' appearance and impression and the knowhow, tools and procedures used for all reports.

Each report collected from various departments is scrutinised by concerned team of executives. In the department of fabric checking it is the role of fabric checker to maintain and prepare reports and hands it over to the

supervisor. Any issues regarding fabric checking procedures or fabric checking machines must be resolved by the fabric checker. If he or she is unable to find appropriate solution to the problem the issue must be taken to the immediate senior i.e supervisor to avoid any misinformation. Below is a flow chart of Management Reporting System in Textile & Apparel Industry

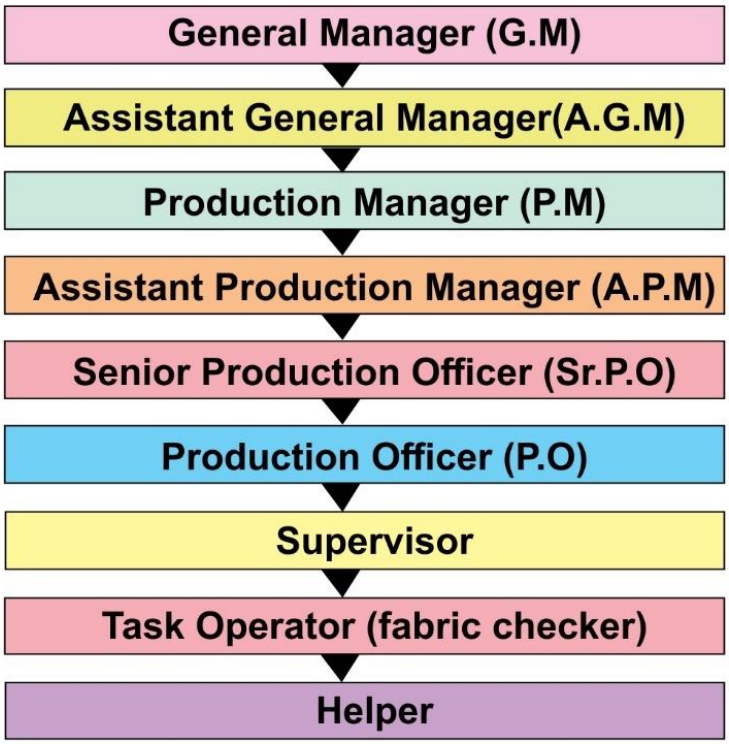


Fig.: 3.10: Management Reporting System in Textile & Apparel Industry

3.2 INSPECTION RELATED DOCUMENTATION

The Fabric Inspection Report is the primary document used to record the quality characteristics of the individual rolls inspected as well as identifying acceptance or rejection of the entire shipment. The information contained in the report may be used for communication with the mill or other production areas within the factory. As a result, it is important that the following information be complete and recorded accurately.

a) Factory Name
b) Mill Name
c) Fabric Name / Article Number
d) Fabric P.O. Number
e) Mill / Supplier roll number
f) Roll length

- Ticketed

- Actual

g) Cut table width

  - 1st Measurement – At the start of the roll at least 2 meters or yards into the roll
  - 2nd Measurement – At the middle of the roll
  - 3rd Measurement – At the end of the roll at least 2 meters or yards before the end

h) Number of defect points per roll by defect category

i) Defect result calculated by roll in points/ 100 Sq Yards/Meters

j) Inspector comments per roll, if applicable

k) Accept / Reject decision per roll and

3.3 REPORTING RELATED DOCUMENTATION

As discussed in earlier sessions, reports are integral part of management information system. These systems run on the data collected and analysed through reports. This ultimately helps in maintaining the quality of the fabric and minimise unwanted wastage.

These reports are collected from various departments across the manufacturing unit. In this session we will discuss the types of reports prepared in fabric inspection department. Apart from fabric checking machine there are various reports prepared in order to maintain the quality of the fabric in overall aspects like colour, stain, texture, weight etc.

In a fabric manufacturing industry, the fabric inspection officer's day starts with production reports. The fabric inspection officer enters to the factory floor with questions such as -

- How many fabric bundles are inspected in last production day by each machine? Compare actual inspection with inspection target given to the floor in-charge and fabric checkers.
- What were the issues for low number of inspected rolls? Why were there too many quality issues?
- What factors are responsible for not achieving yesterday's target?

Fabric inspection officers get answers to their questions in reports with data.

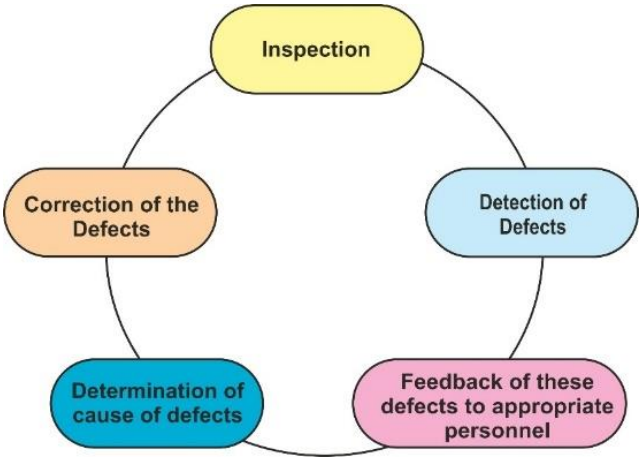


Fig.: 3.11: Fabric inspection process

In fabric manufacturing industry, the supervisors and fabric checkers can manipulate numbers to show good performance and hide their shortfall. So, instead of discussion and verbal reports, most of the managers believe in written and printed reports.

To know the factory's day to day achievement very well, some inspection are done and inspection-related reports must be made and reported to higher management. Each factory has its own set of guidelines and system to run their factory. Therefore, list of production reports may vary company to company.

3.4 TYPES OF REPORTS USED IN THE INDUSTRY

There are few common reports; those are widely used and are very important to know your trade well. In this session, are listed down these reports and explained the purpose of those reports. All reports are related to fabric inspection. These reports are the source of information-based, analysis and performance-based.

1. FABRIC CHECKERS ATTENDANCE REPORT:

This report explains how many fabric checkers and supervisors are present on a particular day. From this report managers quickly assess, what would be a day's target to complete the inspection of certain number of rolls. Which machines have a shortage of fabric checkers and where there is enough fabric checkers and from where some fabric checkers can be shifted to another line to fill all machines and run the inspection target to run smoothly. The fabric checkers attendance report is an important report to floor in-charge. A day before's attendance report as well as clock-in and clock-out report is also important to see whether all fabric checkers worked full time or not.

2. DAILY INSPECTION REPORT:

Daily Inspection Report contains a day before's inspection records machine wise and lot-wise. Inspection information in term of –

- How many rolls per lot have been loaded to each machine in a day before?
- How many pieces are cumulative in inspection till-date of the lot that is currently loaded?
- How many rolls have been dispatched to finishing or washing department?

3. HOURLY INSPECTION REPORT:

This report carries information about the current day's hourly fabric inspection output. In this report, fabric checking machine's output is being updated hourly or bi-hourly. This report helps supervisors to chase fabric checkers when the machine output goes down. Where inspection data is recorded manually, only output data is captured and displayed on the fabric checking digital board. But factories those use real-time inspection monitoring system, fabric checker wise and machine wise hourly inspection data can be viewed.

Line/Section No.	T-4	Checker Name	--------	Total Units Checked	247
Style No.	2541	Date	--------	Total Defects Found	31
				DHU	12.55

Hours	Total Pieces Checked	Number of Defective Pieces	Total Defects Found	Remarks
Hour - I	20	2	4	
Hour - II	25	1	5	
Hour - III	28	2	2	
Hour - IV	18	1	6	
Hour - V	26	4	4	
Hour - VI	40	2	5	
Hour - VII	20	1	2	
Hour - VIII	25	4	1	
OT Hour	45	1	2	
Total	**247**	**18**	**31**	

Fig.: 3.12: HOURLY INSPECTION REPORT

4. EFFICIENCY AND PRODUCTIVITY REPORT:

The daily inspection report provides actual output numbers of each machine and each roll. The machine output is directly proportional to the efficiency of the fabric checker and his/her speed. If you have two different types of fabrics being inspected in two different machines one can-not compare the results between two. For example, if one machine is inspecting a woven fabric and another is inspecting a knit, or if one is inspecting a solid coloured fabric and other is inspecting a printed fabric in dark colour. The time taken by the fabric checker working on these two machines will be as different as the inspection data recorded in the sheet.

The easy way to check the performance of fabric checker and the machine is to time and compare the same fabric type that may be from different lots. This will help to understand and generalise that how much time is taken to complete like kind of fabrics by different fabric checker. This will also help to find out the efficiency and productivity of the fabric checker working on the fabric checking machines.

5. MANPOWER AND MACHINE UTILIZATION REPORT:

Monthly Production and Efficiency Report Template								
Line:						Month	July	2020
Date	Style	Manpower (A)	Working Hours (B)	Line Output (Production) (C)	Garment SAM (D)	Total Minutes Attended (E=A*B*60)	Total Minutes Produced (F=C*D)	Line Efficiency (%) (Eff%=F/E*100)
1-Jul	BDA	40	8	450	26	19200	11700	60.94%
2-Jul	GGS	45	8	550	24	21600	13200	61.11%
3-Jul	GAC	50	8	650	20	24000	13000	54.17%
4-Jul	ZAD	50	8	480	25	24000	12000	50.00%
5-Jul	-	-	-	-	-	0	0	0
6-Jul	-	-	-	-	-	0	0	0
7-Jul	-	-	-	-	-	0	0	0
8-Jul	-	-	-	-	-	0	0	0
9-Jul	-	-	-	-	-	0	0	0
10-Jul	-	-	-	-	-	0	0	0
11-Jul	-	-	-	-	-	0	0	0
12-Jul	-	-	-	-	-	0	0	0
13-Jul	-	-	-	-	-	0	0	0
14-Jul	-	-	-	-	-	0	0	0
15-Jul	-	-	-	-	-	0	0	0
16-Jul	-	-	-	-	-	0	0	0
17-Jul	-	-	-	-	-	0	0	0
18-Jul	-	-	-	-	-	0	0	0
19-Jul	-	-	-	-	-	0	0	0
20-Jul	-	-	-	-	-	0	0	0
21-Jul	-	-	-	-	-	0	0	0
22-Jul	-	-	-	-	-	0	0	0
23-Jul	-	-	-	-	-	0	0	0
24-Jul	-	-	-	-	-	0	0	0
25-Jul	-	-	-	-	-	0	0	0
26-Jul	-	-	-	-	-	0	0	0
27-Jul	-	-	-	-	-	0	0	0
28-Jul	-	-	-	-	-	0	0	0
29-Jul	-	-	-	-	-	0	0	0
30-Jul	-	-	-	-	-	0	0	0
31-Jul	-	-	-	-	-	0	0	0
Monthly Average Effiecieny						88800	49900	56.19%

Fig.: 3.13: Monthly Production & Efficiency Report Template

Manpower and machines are the prime resources of any company. A Manager needs to look into resources to keep an eye on how company resources are get utilized. The factory must not have surplus manpower on the floor. On the other hand, the factory must have least required manpower for a factory to inspect a given fabric lot consignment according to the plan. Both the manpower and machines are the cost to the company. So it is important to check this report on daily basis.

This report may also include a number of employees who have done overtime work hours to achieve the target of the day or to complete the given consignment in time.

6. FABRIC INSPECTION REPORT:

As discussed in earlier sessions the inspection report comes under quality reports. But fabric inspection report is also one important report for the fabric checker to maintain and supervisor and top management to monitor the quality of fabric rolls. As all produced fabric rolls are not acceptable if a certain quality level is not maintained. It is the fabric inspection department's responsibility to categorise a good quality fabric roll and seconds fabric roll. The inspection report displays the number of rolls inspected and the calculation of defects following the four point system. Refer four point system discussed in earlier session.

Customer :		Style No. :		Colour :		No. of Rolls :		B/C Inspect
Order No. :		Fabric :		Lot No. :		Total Weight		QC :

Yarn Supplier		Delta Value (De)	P/F
Count/Quality		Appearance Vs. Original	P/F
Yarn Lot #		Appearance Vs. Pre. Lots	P/F
Knitter		Hand Feel/ Softness	P/F
Dia/Gauge		Streaks/Batches	P/F
Wet processor		Crease Mark	P/F
Vessol No.		Pilling	P/F
No. of Ports		Yarn Uniformity	P/F
Padding Width		Padding Line	P/F

Performance	Requirement	Observed	Result
Shade Change A/C			P/F
Finishing Width 1			P/F
Finishing Width 2			P/F
GSM			P/F
Shrinkage (LXW)			P/F
Seriality %			P/F
Wet Rub Fastness			P/F
Dry Rub Fastness			P/F

Visual Examination (B 4 Compacting)			
	Roll 1	Roll 2	Roll 3
Roll No.			
Weight (Kgs)			
Width Rqrd. -cm			
Width (cm)			
GSM			
Length in Yards			

Total Roll Wt. :	
Total Points :	
Norms :	
Total Length	
Points / 100	
Sqr. Yard :	
Result	
Pass/Fall/Hold	

Visual Examination				
	Sample 1	Sample 2	Sample 3	Sample 4
Roll No.				
Weight (Kgs)				
Width Rqrd.				
Width (cm)				
GSM				
Length (Yds)				

Defects	Roll 1	Roll 2	Roll 3	Point / Defect	Total Points
				Total Points	

Defects	Sample 1	Sample 2	Sample 3	Sample 4

QA Sign : Fabric Incharge

Supplier Sign : Merchandiser QAM

QA Sign :

Fabric Incharge :

Fabric Inspection Report

Serial No. ..... Supplier ..... Fabric Description ..... Order Nr ..... Style Nr ..... Quantity Recd. ..... Audit Rolls / Qty. : ..... Date : .....

Roll No.	Col.	Width			Colour Shade			Reed/Pick			Defects										Points	Points Per 100 Mtr	Status
		Beg.	Mid	End	Beg.	Mid	End	Beg.	Mid	End	Weave				Patta	Water Mark	Hole	Stain	Shade Variation	Print			
											1	2	3	4	4	4	4	4	Reject	1/2/3/4			

TOTAL PENALTY POINTS ALLOWED (100 sq mtr.)					
	Cotton	Wool	Synthetic	Single Jersey	Double Jersey
Individual Roll	24	14	21	22	26
Average Shipment	22	12	16	16	21
Actual Qty. / Points					

Fig.: 3.14: Fabric Inspection Report

7. REJECTION REPORT:

Rejection Analysis Sheet

Unit / Production Line		Material Description	

Sr. No.	Date	Customer	Order No.	Order	R.M. Rejection	Material Handling Rejection	Process Stage 01	Process Stage 02	Process Stage 03	Finishing Process 04	Inspection Process 05	Packing Process 06	Customer Rejection	Total Sty Rejection	% QTY
				QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
Total															

Fig.: 3.15: Rejection Report

This report contains information such as – rolls from each lot that had most defects and therefore were categorised as seconds or low quality rolls. The segregated rolls of seconds and good quality rolls from each lot. The number of rolls per lot received for inspection. This information is essential because if you have a list of rejected or second's rolls the fabric checker can inform the supervisor the shortage of rolls to fulfil the given consignment and the supervisor can further inform the fabric manufacturing department about the same.

8. FABRIC ROLL INVENTORY REPORT:

Month Machine Utilization Summary Report

Month/Year_____

PARTICULARS	TOTAL TIME	MINUTES	HOURS	% OF UTILIZATION
TOTAL AVAILABLE TIME				
NET OPERATING TIME				
NO ELECTRICITY				
PREVENTIVE MAINTENANCE				
NO MATERIAL SCHEDULE/PLANNING				
BREAK DOWN TIME				
SETUP TIME				
MANUFACTURING LINES				
MATERIAL	QTY (NOS. PCS.)	WEIGHT	TOTAL	NOS. OF BOXES
PRODUCTION TARGET CALCULATION				
TYPE OF PARAMETERS	WORKING HOURS	PRODUCTION (NOS.)	ON SPEED	MAX. LIMITS HOURS
PARAMETER-I				
PARAMETER-II				
PARAMETER-III				
PARAMETER-IV				

Fig.: 3.16: FABRIC ROLL INVENTORY REPORT

Once the status of fabric checking, efficiency, and quality report part is over, fabric checker and supervisor look into fabric lot per consignment and its availability status. We know that complete organised inventory is the one major reason for shipment delay and breaking the delivery schedule. This report carries information such as date wise segregation of the fabric rolls to be inspected and already inspected status in detail with expected in house date for balance fabric lots.

STOCK INVENTORY COUNT SHEET

COMPANY : XYZ COMPANY

DATE: 10/12/2011 SIGNATURE:_____

Performed By- .....

ITEM INFORMATION			STORAGE INFORMATION		PURCHASE INFORMATION			ACTUAL INVENTORY			
INVENTORY ID/ ---- NUMBER	NAME	DESCRIPTION	AREA	---------	SUPPLIER	LUPPLIER ---- NUMBER	UNITS	QTY.	LOCATION	---------- -----	QTY.
12123-32	12123-32	12123-32	12123-32	----------	----------	----------	----------	----------			
12125-39	12125-39	12125-39	12125-39	----------	----------	----------	----------	----------			

Fig.: 3.17: Stock Inventory Count Sheet

1. FABRIC SHRINKAGE REPORT:

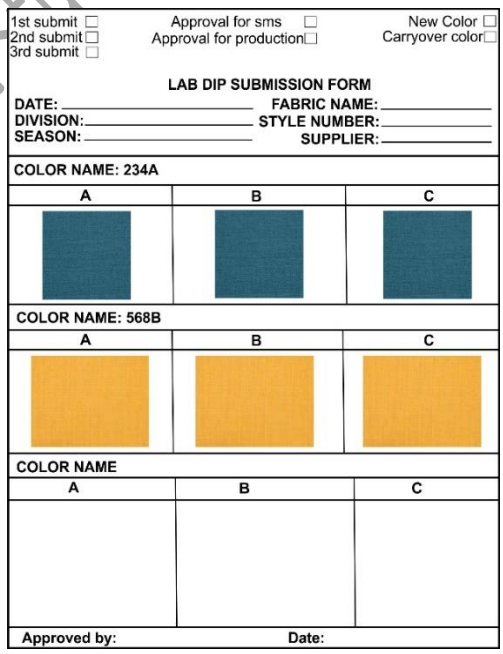
A 100% Shrinkage report is submitted for all styles and the washing shrinkage has to be performed as per the wash type required for the bulk. Garment fit is a very important factor in the purchase decision of the customer. Misfit at any stage of the life of garment can lead to premature rejection and earn a bad perception for the brand. A garment is supposed to be washed after every use and expected to retain the same fit and appearance during the lifetime of the garment. To fulfill this fabric has to be tested for dimensional stability. For this shrinkage tests are carried out is order to manipulate the patterns in the same

ratio to avoid any measurement problems after garment washing.

Measurements				Warp Diff	Weft Diff	Warp % Diff.	Weft % Diff.
Warp Original	Weft Original	Warp After wash	Weft After wash				
12.5"	12.5"	12 1/8	12 3/8	3/8	1/8	3%	1%
12.5"	12.5"	12 ¼	12 1/8	2/8	3/8	2%	3%
12.5"	12.5"	12 1/4	12 3/8	2/8	1/8	2%	1%
			Total	7/8	5/8	7%	5%
			Number of measures	3	3	3	3
			Average (total divide by # measures)	2.33/8	1.67/8	2.33%	1.67%

2. FABRIC SHADE BAND REPORT:

For styles those required garment washing, before and after wash fabric samples are submitted (3 sets each) covering all rolls and it is attached in the shade continuity card. A 100% shade band covering all rolls & all colours pertaining to a certain style / Consignment is made and get approved prior to cutting of bulk Fabric.


1st submit ☐ Approval for sms ☐ New Color ☐
2nd submit ☐ Approval for production ☐ Carryover color ☐
3rd submit ☐

LAB DIP SUBMISSION FORM

DATE: _____ FABRIC NAME: _____
DIVISION: _____ STYLE NUMBER: _____
SEASON: _____ SUPPLIER: _____

COLOR NAME: 234A

A	B	C

COLOR NAME: 568B

A	B	C

COLOR NAME

A	B	C

Approved by: Date:

Fig.: 3.18: Fabric Shade Band Report

3.5 REPORTING FABRIC AND MACHINE DEFECTS

One of the keys to function a textile industry smoothly is its proper and timely service and maintenance. This includes the care and maintenance of all the machines and equipments used in the industry used in various departments. Maintenance can be defined as the consecutive activities or as the development of systematic activities done for keeping the machine or equipments at the heat level for its well running or its proper services. It is helpful for maintain machine and equipments at optimum operation speed & production efficiency. It also ensures best possible level of quality of product. It minimizes the idle time resulting from the machinery break down, and therefore also helps to reduce the unnecessary cost. Maintenance also increases the life time cycle of machinery & equipment. Better or superior quality for the product. It also results in higher productivity of machines. It helps in economization of the process.

Activities

Activity

Visit a textile manufacturing industry and prepare a report on their management reporting system. Highlight on the role done by fabric checker.

MATERIALS REQUIRED

1. Basic stationery: Ruler, eraser, pencil, highlighter pen, sketch pens to make it vibrant and easy to understand)
2. A4 sheets to create a reporting system observed at the industry.

PROCEDURE:

1. Visit the industry and keep observing and noting the important points to add in your report.
2. With permission of the in charge in factory click pictures to support your observation and also to add in your report.

Check Your Progress

Fill in the Blanks

i. _____ is aimed to help members of the administration by providing well-timed and relevant information.

ii. MRS stands for_____

iii. _____are the two types of reports.

iv. _____explains how many fabric checkers and supervisors are present on a particular day.

v. _____carries information about the current day's hourly fabric inspection output.

B. Questions

1. Explain objectives of maintaining the reports.
2. Discuss reporting system in textile industry. What is the need for reporting system.
3. Explain system of maintenance in detail.
4. Discuss about inspection and reporting related documentation.
5. Discuss any three types of reports and its importance?

Module 4	Maintain a Clean and Hazard Free Working Area

Module Overview

A clean workplace means more than just having a fresh surrounding area. Clean workplace encompasses various elements:

- Walking surfaces
- Light Fixtures
- Air quality

A clean and hazard free workplace ensures the safety and health of the employees and visitors. Clean walking surfaces, suitable footwear, and appropriate speed of walking are important to preventing falling accidently. Stairways and aisles that are clean and dry are also vital in reducing accidents and ensuring a safe workplace. Clean light fixtures improve lighting efficiency in the workplace. Good air quality greatly influences work environment as well as the health of the employees.

The negative effects of the unclean environment are as follows:

- A build-up of dust, lint, and grease can create breathing problems for everyone in the working area, resulting in asthma attacks, stuffy noses that may lead to serious health issues.
- A dirty work environment is breeding ground for various germs and allergens.
- Workstations, tools and equipment, machinery, materials, and the progressive bundling system of production systems are all poorly constructed, increasing the risk of musculoskeletal injury and stress-related disorders.
- Fire dangers are typically caused by overcrowding and incorrect storage of flammable goods.
- The significant health and safety risks are caused by bad sanitation and a lack of effective maintenance procedures.

Two most common ways to tackle it are:

- Use of disinfectants to prevent the spread of germs and microbes.
- Proper disposal of waste and recyclable materials keeps work areas clutter-free.

Therefore, the major health and safety concerns of the apparel industry are related to general conditions of the work environment.

Proper maintenance procedures are a must to ensure a clean and safe working environment.

Learning Outcomes
After completing this module, you will be able to: • Identify Importance of routine maintenance and its procedures • Explain how to Maintain cleanliness • Analyze handling of machinery, equipment and tools safely and correctly • Describe Effective oral and written communication at workplace

Module Structure	
Session:1	Importance of routine maintenance and its procedures
Session:2	Maintaining cleanliness
Session:3	Operation of machinery, equipment and tools safely and correctly
Session:4	Effective oral and written communication at workplace

Session 1: Importance of Routine Maintenance and Its Procedures

MAINTENANCE PROCEDURES

Maintenance is defined as the group of systematic activities carried out to keep the machines or equipment in proper running condition.

Proper working condition of machines is a must to produce good quality products in time. Therefore, there is a need to establish a maintenance department in every factory to ensure timely production. Moreover, it is required to document the process and procedures for assistance of auditor.

Good maintenance includes the regular upkeep of material, equipment, machinery and good housekeeping, e.g. trolleys are used extensively throughout the industry and play a major part in reducing manual handling. Systematic cleaning and maintenance of wheels ensure that risks of injury are minimized. Clean floors benefit by ensuring ease of movement

THE IMPORTANCE OF RUNNING MAINTENANCE

Running maintenance means routine maintenance, inspection and servicing of machines and systems to ensure smooth functioning and efficient production. Running maintenance also means routine maintenance irrespective of presence of problem in any of the machines or systems.

The major reasons for running maintenance are as follows:

1. To increase the life and productivity of machinery, equipment and tools.
2. To avoid delays in production due to malfunctioning of machines
3. To ensure better or superior quality for the product.
4. To control and reduce the wastage.

Effective maintenance program plays an important role in the manufacturing processes. The importance of running maintenance can be understood from following points:

- It effectively reduces waste and run an efficient and continuous manufacturing / service operation.
- The cost of routine maintenance is very less than the cost of repair of a major breakdown.
- Daily inspections, cleaning, lubrication and minor adjustments can be detected and corrected before they become a major problem and may result in complete shut-down of a production line.

The running maintenance is one of the three maintenance systems present in apparel industry. The maintenance systems are as follows:

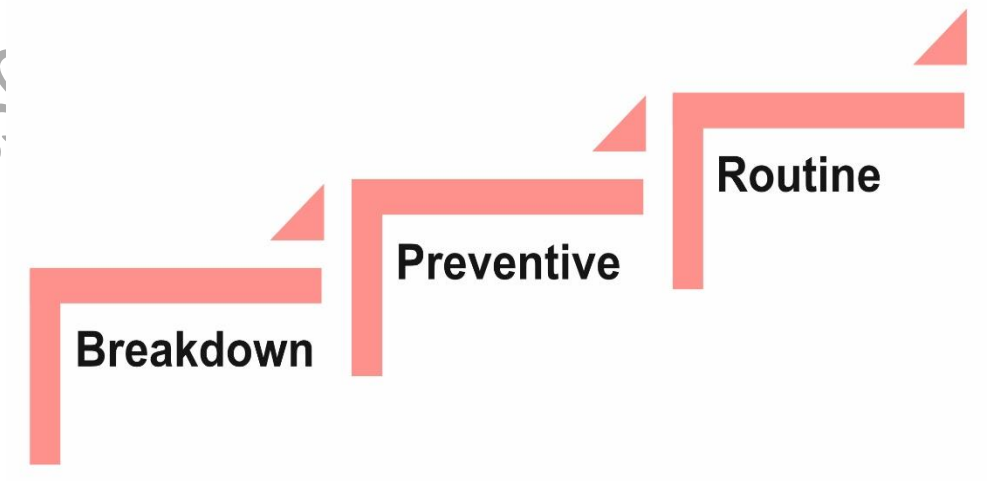


Fig.: 4.1 - Types of Maintenance Systems

a. Breakdown Maintenance

Breakdown Maintenance is the repair process carried out after the equipment stops functioning.

Machine breakdown time should be recorded and tracked to see mechanic performance. It is carried out only when evident problems occur. These are unpredictable type of maintenance and difficult to schedule. The equipment is either repaired or replaced. They are important because machine breakdown time is considered as loss time in garments manufacturing.

b. Preventive Maintenance

Preventive maintenance is periodical and timely inspection which includes daily, weekly, monthly based cleaning, inspection, equipment condition diagnosis, oiling and alignment, and servicing activities.

Maintenance team carries out preventive maintenance as per their maintenance schedule.

c. Routine Maintenance

Routine maintenance consists of periodical and timely inspection, servicing, lubrication and cleaning of the equipments. It might also involve replacing certain parts to prevent sudden failure and avoid problems to ensure un-interrupted working condition of all machines.

SAFETY PRACTICES

The maintenance systems are inadequate to ensure safe and clean working environment until they are complemented by the various safety practices. Presence of hot steamers, electrical equipment, and sharp tools and devices combined with the busy schedule make it important to work carefully and pay constant attention to safety practices. The various safety practices are as follows:

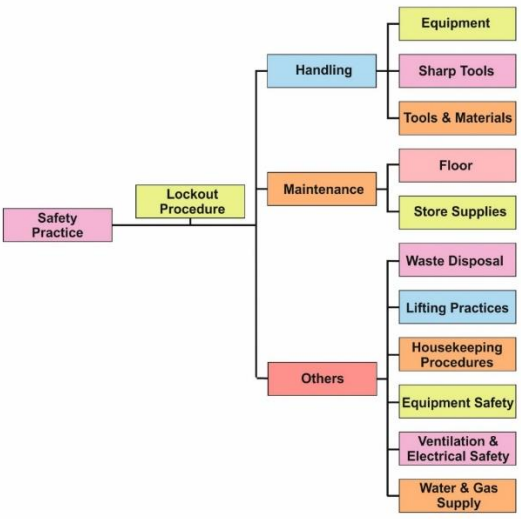


Fig.: 4.2 Safety Practices

1. Lock-out procedures

Locking out a machine means disconnection of the power feeding the machine.

The designated person carrying out the maintenance or repair is in charge of the key to the lock of power supply. Before turning the power off, this person ensures the work on the machine has been completed.

The person in charge reports early before the shift timings and removes the power lock of all the machines. This allows the power supply to make machine functional again. It is the duty of the person in charge to lock the machines during the lunch and tea breaks.

To safeguard the key, lock-out poster or signage must be posted near the equipment, so that no one can accidently restore power without the person in charge's knowledge.

The steps listed below must be followed before repairs or maintenance is carried out.

Steps of Lockout Procedure:

1. Notify all workers on duty about the lockout and the reason for it.
2. If the equipment is operating, switch it off.
3. The power cables must be unplugged. Grounding, repositioning, blocking, and bleeding down must all be used to dissipate or release stored energy in capacitors, springs, raised machine members, revolving fly wheels, hydraulic systems, and air, gas, steam, or water pressure.
4. Operate the push button or other usual working controls to guarantee that the equipment is not functional after ensuring that no workers are exposed and that the energy sources have been disconnected.
5. The equipment is now locked out.

Restoring Equipment to Service:

1. When the repair / maintenance job is completed and the equipment is ready for testing or normal service, a check of the equipment area is carried out to ensure that no one is exposed.
2. When equipment area is clear, all locks are removed. Power cables can be then reconnected.

2. Equipment handling

The points to be kept in mind while handling the equipment are as follows:

1. Do not use any machine if not trained to use.
2. Ensure the machine is switched off before cleaning or adjusting any machine.
3. Ensure fingers, hands, tools, etc., are away from moving parts. Please wait until machine fully stops.

4. Care must be taken while cleaning the cloth cutting and drilling machines. The steps followed are as follows:
    i. Pull the plug from switch board.
    ii. Do not touch the edge of the blade.
    iii. Clean the blade moving from the Centre towards the outer edge.
    iv. Clean the inside edge of the blade with a stick that has a cloth wrapped around one end.
5. Do not start a machine until the parts are locked in place and the attachments are securely fastened.
6. Use a wooden plunger (rather than hands) or other metallic tools to clean the machine.
7. Ensure awareness of the lock-out procedures that are to be followed before repairing or cleaning any machine.
8. Do not wear rings, large size wristwatch, bangles, or a tie while operating electrical power equipment.

3. Sharp tools Handling

The points to be kept in mind are as follows:

1. Use the right cutter or knife for the job.
2. Avoid close proximity to falling cutters or scissors. When a knife starts to fall, jump backward to get out of the way.
3. Always carry a cutters or scissors with the tip pointing downward, with the cutting edge turned away from the body.
4. Never talk while holding a cutters or scissors in the hand.
5. While cutting with any cutters or scissors, always cut away from the body.
6. Place cutters or scissors in drawers or in racks for proper storage.
7. Always use a sharp knife; it is much safer than a dull one.
8. Take a firm grip on a knife handle and always make sure that the handle is free of grease or any other slippery substance.

Fig.: 4.3 - Sharp tools

4. Tools & Materials handling:

The points to be kept in mind are as follows:

1. Use dry towels while handling hot openers, steamer covers/doors as wet cloth conducts heat more readily than dry cloth.
2. Avoid splashing grease on top of the range. Grease will ignite quickly, causing a fire. Do not throw water on a grease or fat fire. Use a foam based extinguisher or a wet towel.
3. Remove the lids of iron steamer or washers slowly. Lift the side of the lid that is away from operator so the steam does not rush out too quickly, causing burns to the hands or face.
4. One should Know the location of fire extinguishers; know how and when to operate them.

5. Floor Maintenance

The points to be kept in mind are as follows:

1. Wet floors are dangerous. Keep them dry.
2. Wipe out any spilled water or other similar liquids immediately.
3. Walk. Do not run or slide across the floor.
4. Never leave tools and rags on the floor.
5. Keep all path areas clear of boxes, garbage cans, portable equipment, mops and brooms, etc.
6. Using rubber mats behind the range is a good practice. Mats must be kept in good condition by daily cleaning.

6. Store supplies Safety and Maintenance

The points to be kept in mind are as follows:

1. Always store heavy materials on bottom shelves, medium-weight materials next and light-weight items on top shelves.
2. Clean all dirt, grease, and trash daily to reduce fire hazards and to eliminate breeding places for rats and cockroaches.
3. Use ladders, not boxes or chairs, to get things from high shelves.

7. Waste Disposal

The points to be kept in mind are as follows:

1. Place cloth and other scraps in proper containers.
2. Do not allow containers to overflow. Empty them before they are completely full.
3. Report broken or defective containers.
4. Wear gloves while disposing off expired washing chemicals or similar liquid trash.
5. Wash and sanitize hands properly

6. Push garbage down using a tamper or other tool. Do not push it down with hand or foot.

8. Lifting Practices

The points to be kept in mind are as follows:

1. Keep back straight, but not necessarily vertical. Have a firm grip on the object.
2. Keep the object close to the body.
3. Bend the knees before lifting.
4. Lift the object by pushing weights on legs.
5. Call for help to lift or move heavy boxes or containers.
6. Use of trolley is advisable for heavy objects.

9. Good housekeeping procedures

The points to be kept in mind are as follows:

1. Do not block exits.
2. Maintain a clean, dry, and grease-free work environment.
3. Maintain the condition of your steps and ladders.
4. Keep emergency equipment clean and unobstructed.
5. Ensure that all warning signs and labels are in good working order and are easily visible.

10. Equipment Safety

Extreme care should be taken while operating equipment. Before operating any tool or piece of equipment, one must be fully trained. Make sure that all guards are in place and function properly and that all electrical connections are properly made.

- Precautions taken while using equipment are,

1. Understand the correct operating procedures and safety precautions before operating the equipment.
2. Ensure that all guards are in place and functioning before any machine is started.
3. Report defective or unsafe equipment to a responsible individual to prevent serious injury.
4. Keep edge-cutting tools properly sharpened. Store the same in safety covers.
5. Use tools only for their intended use and make sure the size of the tool is right for the job.
6. Lock the machines before lubricating.

7. Do not wear loose clothing, jewelry, or keep long hair open may around machines which increase the risk of being caught in the machinery.
8. Approach the supervisor for any queries about a machine safety.

11. Ventilation systems

The environment in which the workers work should be free from smoke, fumes and steam. Industries should have ventilation equipment with suppression systems to release fresh air.

Many industries use emergency shutdown systems or "panic buttons." These are installed so that a single switch can be used to turn off the power to a large number of pieces of equipment.

These devices are intended to be employed in the situation in which a person is electrocuted or becomes caught in a piece of machinery. In these conditions, quick action is required. The points to be kept in mind are:

- Hit the panic button.
- Locate and learn how to use the emergency shutdown.

12. Electrical safety

The points to be kept in mind are as follows:

- As human body is sensitive to relatively small values of current, worker can receive a shock or burn from any common electrical circuit.
- Worker should be made aware of the location of the main panel or sub-panels being used, and learn how to shut them off in case of an emergency. Notify the supervisor right away.
- Obtain permission from the electrician before using a new service.
- Electrical extension cords, if they need to be used, should be orderly and not allowed to become tangled. Such cords should be taped to the floor whenever possible as this will reduce the chance of someone tripping over them

13. Water supply

If a pipe breaks or bursts, the water may damage material, tools, and equipment or work already done. In addition, water may create an electrical hazard if it comes in contact with electrical panels or outlets. Locate water shut off point of the industry, shut the water off and notify supervisor at once.

14. Gas supply

Escaping gas can cause an explosion that could injure anybody or cause severe damage. When the valve handle is running parallel with the gas line, the supply of gas is flowing and on. Locate the gas shutoff in the industry, shut the gas off and notify supervisor immediately.

CARRY OUT RUNNING MAINTENANCE WITHIN AGREED SCHEDULES

Maintenance is the action to retain, fix or restore an item in a state where it can perform its required function by the combination of all technical administrative, managerial and supervision actions.

The maintenance strategy has a significant impact on the industry's bottom line, but many maintenance managers have trouble selecting an appropriate strategy or overlook their approach altogether. Benefits of optimizing maintenance strategy include extending asset life, reducing asset failures and downtime, minimizing repair costs, and improving health and safety.

It's important to follow agreed schedules to maintain the assets properly and ensure that they remain in working order. Cutting, sewing, washing, ironing, folding, packing and finishing machines are important for the production of garments. So it is necessary to keep them in the best operating condition at economical cost.

1. Maintenance department activities in garment industry

The maintenance department is mainly responsible to look after the machines and other production equipment in proper working condition and take corrective action against any environmental pollution

a. Functions of Maintenance Department

1. Inspection of all machines and other machinery in the industry, repairing and up gradation.
2. Maintaining and ensuring continuous power supply in the factory.
3. Maintaining the water plant, compressors, air conditioning systems, Generators and boiler.
4. Planning, design and implement any kind of expansion of the industry.
5. Purchase of new machinery.
6. Issuing of different spare parts and accessories according to the production requirement.
7. Housekeeping.

2. Responsibilities of machine mechanic

a. Daily basis work of machine mechanic

1. Check machine setting correct or not
2. Check oil level and oil leaks of the machine

3. Check un-usual noise of the machine
4. Check safety equipment
5. Check machine allocation
6. Check production plan
7. Check for any loose nuts or bolts.

b. Monthly basis work of machine mechanic

1. Cleaning of whole machine by opening parts
2. Check back/ front cover
3. Check Oil lubrication, Oil level/ oil filter condition
4. Check functioning of machine
5. Check condition of Machine table
6. Cleaning and blowing
7. Check Power on/ off switch
8. Check Motor and control box condition
9. Observe abnormal sound Connections

3. Machinery maintenance schedule and procedure

a. Daily maintenance

If a machine breaks down during its operation, floor mechanics are called in to repair it. If this is not achievable in a reasonable amount of time, the machine is relocated to the maintenance room and replaced by another machine, with the appropriate steps done to repair it. The daily record of maintenance work is kept in a systematic format. Following are few of the maintenance work which are conducted daily.

Activities carried out daily:

1. Check speed and working of the machine.
2. Complete cleaning of the machine.
3. Check un-usual noise of the machine.

Activities carried out every four hours:

- Check for oil leaks.
- Clean machine parts.

b. Monthly maintenance

It is a preventive maintenance to reduce machinery problem and increase machine life, execute as per predetermined schedule fixed at the starting of the year by regular basis. This maintenance program covers total servicing of the all machine, oil change, oil filter change, or change of any defective parts. Records of monthly maintenance works must be kept in specified format.

HAZARDS LIKELY TO BE ENCOUNTERED WHEN CONDUCTING ROUTINE MAINTENANCE

Regular maintenance is essential to keep equipment, machines and the work environment safe and reliable. Maintenance workers are more likely to be exposed to various hazards.

Potential hazards could be:

A. Dangerous substances.

B. Confined spaces.

C. Working at height.

D. Awkward positions.

E. Plant under pressure.

F. Moving parts of machinery.

G. Unexpected start-ups.

H. Chemical substances or dust in the air.

Insufficient maintenance can result in unsafe circumstances, accidents, and health issues. Working alongside a running operation and in close proximity to machinery makes maintenance a high-risk activity with distinct dangers and risks.

In contrast to regular operation, direct contact between the worker and the machine cannot be decreased significantly in maintenance activities, where workers must be in close proximity to the processes.

Maintenance activities are critical for the health and safety of maintenance staff. They may also be critical for others, in particular, for the equipment users or the production operators.

According to the relationships between maintenance and production, some accidents can be traced back to maintenance failures, such as insufficient, inappropriate, or late maintenance. For example, if maintenance is not performed on a regular basis, the equipment or installation can become dangerous to maintenance and production personnel. Other accidents may

result from the co-activity of the two types of operators for example repair without interrupting operation.

Maintenance operations include both disassembly and reassembly, often involving complicated machinery and working at height. These can be associated with a greater risk of human error, increasing the accident risk.

Maintenance often involves unusual work, non-routine tasks and it is often performed in exceptional conditions, such as working in confined spaces. Working in confined spaces may expose workers to risks, which are:

1. Exposure to harmful gas, fumes, vapours or lack of oxygen
2. Risk of drowning in water or free-flowing solids
3. Risk of getting injured due to fire or explosion.
4. Risk of getting burned by high temperature machines

The hazards are commonly grouped as physical, chemical, biological and psychosocial. The hazards may vary significantly between planned, preventive and repair or corrective maintenance tasks.

- Type of hazards are as follows:

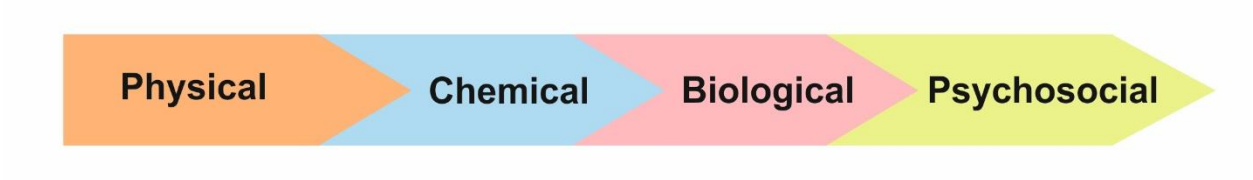


Fig.: 4.4 – Types of Hazards

1. Physical Hazard
   a. Mechanical movement - rotating elements e.g. flywheels, compressed springs, unexpected start-ups e.g. blockages cleared, trapped air in lines operating valves, restoration of power, computerized auto-start, failure of sub-standard parts and sewing machines
   b. Electrical - capacitors; high voltage; static
   c. Hydraulics - high pressure fluids
   d. Pneumatic - high pressure steam, gases, vapors
   e. Engulfment - oxygen deficient atmospheres
   f. Fire/explosion - extreme heat/cold, noise, vibration
   g. Work at Height – visibility, loading, unloading, etc.

2. Chemical Hazards

   a. Dusts and fibres e.g. heavily starched fabric materials, accumulated polluted air within production line, fibre/fabric dust and tiny fabric rags.

   b. Dangerous substances e.g. chlorine, oxygen, hydrogen

   c. Toxic, oxidizing, explosive, flammable, corrosive

   d. Hydraulic fluids, oils, acids, alkalis, organic solvents

3. Biological Hazards

   a. Pathogenic bacteria, viruses, parasites, insects, moulds and fungi.

4. Psychosocial Hazards

   a. Time pressure, long hours, shift work

   b. Poor work organisation, unsocial working hours

Activities

ACTIVITY 1

Visit a Garment manufacturing firm, discuss with maintenance team and prepare a report on various types of maintenance conducted by them.

Materials Required:

1. Writing material
2. Ruler
3. Adhesive

Procedure:

1. Make a group of 4 students each.
2. Visit a garment manufacturing firm
3. Enquire about its maintenance activities.
4. Prepare a report of your observation with pictures.
5. Submit the report to the teacher for evaluation and feedback.

Check Your Progress

A. Fill in the Blanks:

1. A clean and hazard free workplace ensures the _____and health of the employees and visitors.
2. Overcrowding, together with improper storage of flammable materials, frequently creates serious _____hazards.
3. _____maintenance means routine maintenance, inspection and servicing of machines and systems to ensure smooth functioning and efficient production.
4. Locking out a machine means _____of the power feeding the machine.
5. The environment in which the workers work should be free from _____and steam.

B. Write short answers for the following:

1. What is maintenance? Briefly explain running maintenance.
2. What are hazards? Enlist different types of hazards.

C. Write long answers for the following:

1. Briefly explain activities of maintenance department.
2. What are the types of running maintenance?

Session 2: Maintaining Cleanliness

Maintaining clean and organized premises is one of the biggest struggles of the job. Keeping the machines in the production line clean and in perfect working order and the aisles of work area free of debris with the minimum of effort is very essential. It requires a bit of effort and forward planning which can pay back several times with increased productivity.

The benefits of maintaining cleanliness

Working environment that is clean, safe, and efficient, motivates employees to take pleasure in their work. A place when clean also helps to make place look more organised and contributes to worker's efficiency.

COMPLIANCE WITH HEALTH AND SAFETY REGULATIONS /GUIDELINES

Section 11 of The Factories Act, 1948 suggests "Every factory shall be kept clean and free from effluvia arising from any drain, privy or other nuisance."

Whereas Section 12 advise that effective provisions should be established in every factory for the treatment of wastes and effluents resulting from the industrial process carried out therein, so that they can be rendered harmless and disposed of.

Section 13 specifies that effective and acceptable provisions should be provided in every factory for securing and maintaining enough ventilation via the circulation of fresh air, as well as such a temperature as will provide reasonable conditions of comfort to workers and prevent danger to health.

Section 14 suggest how dust and fumes to be handled in a factory as- Every factory where, as a result of the manufacturing process, dust, fumes, or other contaminants of such a nature and to such an amount as to be hurtful or objectionable to the employees employed within are released.

CLEANING PRACTICES

The types of work perform in the industry premises will determine how frequently it needs to be cleaned, but one should perform two kinds of cleaning schedule- deep and regular cleaning.

1. Deep cleaning

Over time, the floor of industry gets dirty; dust and grunge also gets accumulated on equipment, which can affect productivity. In this case machinery needs to be cleaned deeply. Time required in cleaning depends on what kind of work is performed, and may be different for each section of the production processes.

Deep cleaning of working area takes several hours to clean surface, tools and machines, using heavy duty cleaning equipment.

To perform the deep clean, each cleaning / housekeeping staff should be assigned an area of the premises, in order to ensure accountability. Each housekeeping staff should then be provided with the equipment and supplies they need to thoroughly clean everything in their designated area. They should be provided training to use any special cleaning equipment if they require. One should schedule the deep clean during a slow production period or a non-working day, so that there won't be any loss of productive work hours.

2. Regular cleaning

A messy work environment doesn't reflect well on the business and may have an impact on work quality and production speed.

Frequency of performing regular cleaning depends majorly on two factors, which are:

i. Type of work performed in the industry

ii. Frequency of visit of clients and suppliers in the working area.

Following are the suggestion for Regular cleaning activities:

1. Employees should be instructed to clean up any spills, debris, rubbish, etc. as they appear to prevent them from causing any sort of health / safety hazards.
2. Providing employees with a buffer time of around 5 minutes, at the end of every shift, to get their workspace clean and tidy so the next person can use it straight away.
3. Providing employees with the suitable cleaning equipment and supplies like cloth, dustpan, brush, paper towels, etc. to clean up any spills and messes on their own.
4. Management should ensure the presence of waste and recycling bins at each work station. Management should also encourage the staff to dispose of waste as soon as it appears rather than leaving it to build up. They should also set up a rotation for emptying the waste bins so they don't overflow and become a hazard themselves.
5. Equipment not used regularly, should be kept covered and cleaned once a week, to prevent dust accumulation which may potentially affect its performance.

6. Management should invest in cleaning equipment because it helps in making regular cleaning routines easier, faster and efficient as possible.
7. Make an inventory of every item that needs to be cleaned in the industry that could help the staff to clean it more efficiently.
8. A regular cleaning routine chart can also be maintained by the management to keep a track of cleaning schedules.

DIFFERENT TYPES OF CLEANING EQUIPMENT, SUBSTANCES AND THEIR USE

A variety of necessary and vital cleaning equipment and substances are designed and available in various colours, materials, mechanisms, shapes, sizes and styles to meet a cleaning need. They are used to clean easily, effectively and efficiently.

Types and uses of cleaning equipment:

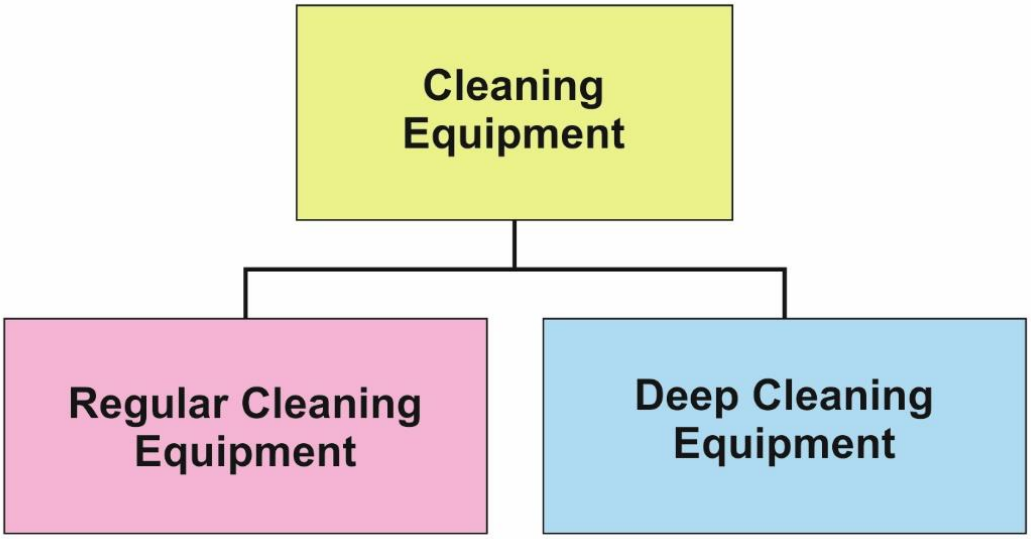


Fig.: 4.5 - Types of Cleaning Equipment

1. Regular Cleaning Equipments

1. Broom – It is a cleaning equipment made of bundle of straws or twigs attached to a long handle used to sweep the floor area.

2. Dustpan- A cleaning tool used to scoop the dirt and wastes from the floor.

3. Water Hoses – It is used to supply the water in washing, toilets and other cleaning units.

4. Bucket and mug - To carry water or any other cleaning substances within the premises area and to clean the work areas.

5. Scrubber - A scrubber is a type of wide brush with a long shaft used for cleaning hard floors or surfaces. At the end of shaft attached soft bristles to sweep dirt away and hard bristles for brushing. It may be used wet, with water or cleaning fluids. There may also be a detachable mechanism to fix mop cloth, either soaked in water for cleaning or dry for wiping dry surfaces.

6. Dust cloth – Dust cloth is used to clean all fine dust build up on any surface.

7. Sponge - A sponge is a soft, porous cleaning device that is used to clean impermeable surfaces. Sponges excel in absorbing water and other water-based solutions.

8. Tissue paper- Tissue is a type of absorbent and disposable paper. They can be used for the same things as regular towels: drying hands, wiping windows and other surfaces, dusting, and cleaning up spills. They're commonly found in public restrooms, where paper towels are thought to be more hygienic than hot-air hand dryers.

2. Deep Cleaning Equipments

1. Spray cum vacuum suctioning cleaner– Cleaning is done automatically. It is used in professional cleaning to apply a pressured, diluted cleaning solution to filthy or contaminated surfaces, followed by vacuum suctioning to remove the applied liquid, as well as the suspended solids and dissolved pollutants.

2. A floor scrubber – It is a floor cleaning device that cleans bigger areas by injecting water with cleaning solution, scraping, and removing the residue off the floor as a floor mop or floor brush.

3. Auto floor scrubber – Auto floor scrubbers are used to scrub a floor, clean of light debris, dust, oil, grease or other marks on floor. These machines have an automated system for dispensing cleaning solution and then vacuuming it up.

4. Washing machine - For bulk washing, the industry uses a high- capacity washing machine. For washing a smaller number of garments and sample pieces, the domestic washing machine is used for removing dirt of soiled mop clothes and other materials.

5. Vacuum washer - A wash-head of a vacuum washer sprays water without detergent and quickly suctions it out, generating a swirl of water. The drying time is substantially reduced by instantly reabsorbing the wash water. This cleaning approach is appropriate for both intermediate and basic cleaning.

The technique works on all water-resistant surfaces, such as carpet, upholstered furniture, wooden floors, stone, plastics, and so on.

6. Vacuum cleaner - Both scrap and dust vacuum cleaners are used to clean all production line floors to remove the scraps and dust quickly to keep the working area clean and tidy.

Cleaning substances

Cleaning substances are hard-surface cleaners available in the form of liquids, powders, sprays, or granules and are used to remove dirt, including dust, stains, bad smells and clutter on surfaces. Purposes of cleaning agents include health, beauty, removing offensive odor and avoiding the spread of dirt and contaminants of work areas.

Disinfectants are cleaning agents that can kill bacteria or other microbes on surface of commonly used items like door handles, working tables etc. Other cleaning substance is degreaser which contain organic solvents and help to dissolve oils and fats.

a. Types of cleaning substances are:

1. Detergents

Detergents contain significant quantities of a group of chemicals known as 'Surfactants' They are similar to soap but are more soluble in hard water. It works by breaking up dirt or soil, making it easy to wash it away. Detergents are commonly available as powders or concentrated solutions. Detergents are also foaming agents of varying degrees.

2. Degreasers

Degreaser is used to remove grease from surface such as machine tops, counters and grill backsplashes. Methylated spirits or white spirit is commonly used for degreasing. It usually consists of strong alkalis, which can dissolve proteins and disperse grease or similar substances. It is generally based on caustic soda or sodium metasilicate. Sodium carbonate is also used as stain remover and for clearing blocked drains, cleaning all types of washers and other industrial equipment.

3. Abrasives

Abrasives are chemicals used to clean dirt from hard surfaces. In commercial industries abrasives are used to clean floors, pots and pans. The cleaning action of abrasives depends on the presence of fine particles which when rubbed over a soiled hard surface, dislodges the soil, remove tarnishing and surface scratches.

The various types of Abrasives are as follows:

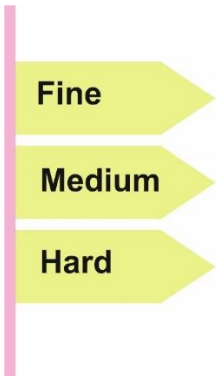


Fig.: 4.6 - Types Of Abrasives

Fine abrasives are preferred over coarser ones. For example nylon pads, powdered pumice, feldspar, fine ash, filtered chalk, etc. are available in liquid, paste or powdered form.

Examples of Medium abrasives include rottenstone, salt, scouring powder and scouring paste. Scouring powders are made up of fine particles of pumice mixed with soap/ detergent, alkali and bleach.

Examples of Hard /coarse abrasives include bath bricks, sandpaper, powdered pumice, steel wool and emery paper. Abrasives are used along with other substances such as bleaches, anionic surfactants, alkaline builders and perfumes.

4. Acids

Acid cleaners are used to remove mineral deposits and for descaling or removing rust from any surfaces. Often, surfactants and corrosion inhibitors are also added to the acid. Acids dissolve metals and are thus used to remove metal stains, stains from deposits around taps, and tarnish on copper and brass, among other things.

Vinegar can also be used to clean hard surfaces and remove Calcium deposits.

a. Acidic drain cleaners use sulphuric acid to unblock clogged pipes by dissolving greases, proteins and even carbohydrate-containing substances such as toilet tissue.

b. Hydrochloric acid (HCL) is a common mineral acid. Stubborn hard-water deposits are removed by concentrated HCL. **Dilute HCL** is used for removing stubborn scales and deposits from sanitary ware.

c. To remove tarnish and stains from metals such as copper and brass, acetic acid is used.

d. Toilet cleansers use their acid content to clean and sanitise the W/C pan while also removing metal stains. They come in a variety of forms, including crystalline, powdered, and liquid.

- Powder toilet cleaners are in the form of solid salts, such as Sodium Hydrogen Sulphate.
- Liquid toilet cleaners contain other acids like dilute hydrochloric, phosphoric or formic acid.

These acids can convert the calcium carbonate into salts that are soluble in water and can easily be rinsed away. The toilet brush is used to scrub the toilet, remove stubborn stains and biological debris.

5. Alkalis

These are used in the form of liquid and powders. Many alkalis have bleaching properties. Alkaline cleaning chemicals include bleach and ammonia. These are dispersants that keep dissolved dirt and rust from resettling.

Caustic alkalis are very strong alkalis. Cleaning products based on caustic soda are used to unclog drains and clean industrial equipment. Fats, such as grease, oils, and protein-based compounds, can be dissolved by alkaline cleaners. Strong bases, such as sodium hydroxide or potassium hydroxide, are found in cleaning products.

6. Neutral

Non-ionic surfactants are used in neutral washing products to disperse various types of dirt. Water is the most popular cleaning agent that, even when used alone, can dissolve some type of dirt. It becomes more effective when combined with additional cleaning agents, such as a detergent.

Water is used to carry the cleaning materials to the soil, suspend the soil, remove the suspended soil from the cleaning site and rinse the detergent solution from the surface.

7. Organic Solvents

These are substances that dissolve fats, oils, grease, wax, and other similar substances. Methylated spirit, white spirit (turpentine replacement), carbon tetrachloride, and other kinds of alcohol such as isopropyl alcohol and rubbing alcohol are all examples of organic solvents. The first two are extremely flammable, whereas carbon tetrachloride is toxic if inhaled and should never be used in a confined space. Many of them are commonly used to remove stains. They are irritating to the skin and might cause fires.

8. Other Cleansing Agents

1. Polishes

They smooth out the unevenness of the article's surface by applying a thin coating of wax on it. On the surface, it also serves as a protective layer.

a. Metal polishes - They come in the form of a liquid or a paste. Plate powder, mentholated spirit, and Ammonia are examples of fine abrasives waxed with grease solvent and occasionally with an acid. When abrasive is rubbed on the metal's surface, friction is created, which removes tarnish and produces a shine.

b. Floor polishes – Spirit-based polishes, which come in paste or liquid form, may contain Silicon. It is suitable for wood, cork, linoleum, and magnesite floors. Water-based polishes are emulsions made up of fine natural and synthetic wax particles mixed in water. They can be used on thermoplastic, rubber, PVC, asphalt, and combination floors, as well as wood, cork, magnesite, and linoleum that has been sealed.

2. Floor Seals

These are placed as a semi-permanent finish to flooring surfaces to act as a protective barrier against dirt, germs, fluids, grease, stains, and bacteria. They protect the surface from scratches and make it easy to clean.

3. Bleaches

Bleaches are alkaline stabilised sodium hypochlorite solutions that are excellent for cleaning stained sinks, W/C pans, and other surfaces. They contain germicidal and whitening effects. With oxidation, bleaches can break down the tough stains. Sodium perborate is a common ingredient in detergents for washing fabrics.

4. Disinfectants and De-odorants

Disinfectants, antiseptics, and deodorants are not cleaning agents, but they are frequently used in cleaning operations. With their fragrance characteristics, these help to keep rooms free of infections and fresh.

a. Air sanitizer – It is a disinfectant/sanitizer that is used to disinfect or sanitise inanimate surfaces in the institutional and/or commercial environment by limiting or moderating the growth or development of microbiological organisms such as bacteria, fungi, or viruses. Some glycol vapours, such as tri-ethylene glycol, can operate as an air sanitizer.

b. Deodorants – It can hide unpleasant odours by interacting chemically with the particle that causes the odour or by having its own scent dominate. Restrooms, guestrooms, guest bathrooms, store rooms, and public areas such as lobbies all use them. Aerosol sprays, liquids, powders, and crystalline blocks are the most common forms.

c. Carbolic soap – It is also known as red soap, and is a mildly antiseptic soap that contains carbolic acid and/or cresylic acid, both of which are phenols and is derived from coal tar or petroleum. Carbolic acid is a skin irritant that is utilised in a wide range of industrial and consumer products.

5. Glass Cleaners

Glass cleaner comes in sprays or liquid form and is made up of water-miscible solvents. It's frequently used with isopropyl alcohol, as well as modest amounts of surfactants and alkali, to boost the cleanser's polishing effect. It can be sprayed directly onto windows, mirrors, and other glass surfaces, or it can be applied with a soft cloth and then rubbed off with a soft, lint-free glass cloth.

6. Metal cleaners

Metal cleansers contain chelating agents, abrasives, and surfactants for cleaning stainless steel sinks, faucets, metal trim, silverware, and other ferrous metals. These agents include citric and phosphoric acids, which are nonaggressive. Stainless steel, nickel and chromium cleaners contain lactic, citric or phosphoric acid.

Nonferrous metal cleaners contain ammonia, ammonium oleate, stearate and chelating agents like ammonium citrate and oxalate.

7. Absorbents

They carry out the action by absorbing the stain or grease. They are used only when the quantity of strain is too much. e.g. starch powder, fuller's earth, bran, French chalk powder, etc.

8. Anti-mildew agent

The chemical which protect the fabric material and garments from mould and mildew namely zinc chloride. It is used in textile / garments store and industries.

9. All-purpose cleaners -

All-purpose cleaners are usually concentrated solutions of surfactants and water softeners, which enhance the behaviour of surfactant when used with hard water. Common examples could be alkyl benzene sulfonates, anionic detergent and modified fatty alcohols.

SAFE WORKING PRACTICES FOR CLEANING AND THE METHOD OF CARRYING THEM OUT

Safe work practices are steps that guide a worker to perform a task with minimum risk to people, equipment, materials, environment and processes.

Safe working practices for cleaning are:

1. Understand the risks and hazards of the workplace during cleaning hours and take necessary steps to reduce risk of work-related injury.
2. Measures must be taken to ensure that cleaning operations can be carried out safely.
3. Use mechanical aids for cleaning, wherever possible.
4. Use ergonomically designed cleaning equipment, and re-arrange the work area so that everything is within easy reach.
5. Use necessary tools and personal protective equipment to carry out safe cleaning and maintenance
6. Wear protective equipment to suit the cleaning tasks. Gloves, full-face mask and apron can reduce risk of injury from concentrated cleaning substances and sharp equipment. Respirators may be used while cleaning filters.

Fig.: 4.7 – Personal Protective Equipments

7. Surrounding windows must have curtains or blinds which workers can adjust to prevent reflected glare during cleaning of production floors and machineries.

8. Humidity- It is important to maintain ventilation and humidity at a level which keeps the cleaner comfortable.

Methods for cleaning

It is the best practice to use a two or three-bucket system for mopping. This can be facilitated by using a cleaning cart or on a separate trolley, if a full cleaning cart is not available. The various methods and tools used in the cleaning process are as follows:

1) Two-bucket system – It is used for routine cleaning with one bucket containing a detergent or cleaning solution and the other with rinse water.

2) Three-bucket system- It is used to for disinfection. The detergent or cleaning solution is in one bucket, the rinse water is in another and the disinfection or disinfecting solution is in the third.

3) The rinse water bucket is used to rinse and wring out the mop before re-dipping it into the prepared solution. This extends the solution's useful life, saving both time and money.

The points to be kept in mind along to ensure proper cleaning are as follows:

1. Cleaning staff should be trained on appropriate use, application and removal of PPE for all environmental cleaning procedures and tasks for which they are responsible.
2. Put on all parts of PPE before entering a working area and remove it (for disposal or reprocessing, if reusable) before leaving that area.
3. Include required PPE for specific tasks in standard operating procedures and other visual job aids.
4. All PPE parts (reusable and disposable) should be available in sufficient quantity, well maintained (good quality, appropriately stored stocks) and clean before use.
5. Reprocess (i.e. clean and disinfect) all reusable PPE, at least once a day
6. Use reusable rubber gloves for cleaning.
7. To avoid interfering with gloves or affecting hand hygiene, keep sleeves at or above the elbow.
8. Wear rubber-soled closed toe shoes or boots (but not sandals), to prevent accidental injury.
9. Regularly reprocess all reusable items (i.e. thoroughly clean, disinfect, and dry).

10. Whenever a solution is changed, thoroughly clean, disinfect, and rinse equipment such as buckets and containers. To allow full drying, store them upside down.
11. Launder mop heads, floor cloths and soiled cleaning cloths at least once a day (e.g. at the end of the day) and allow them to fully dry before storage and reuse.
12. As directed by the manufacturer, reprocess all reusable materials and equipment in a separate area that is not used for other purposes.
13. Cleaning aids and products should be disinfected by thoroughly immersing them in boiling water or a disinfectant solution for the required contact time, then rinsing with clean water to eliminate any residue.
14. All reusable supplies and equipment should be kept clean and in good operating condition at all times. All reusable equipment should be evaluated on a regular basis and replaced or repaired as needed.

CARRYING OUT CLEANING ACCORDING TO SCHEDULES AND LIMITS OF RESPONSIBILITY

During the whole Garment production process, management should ensure that maintenance is coordinated, scheduled and performed correctly as per plan, and that the equipment or workplace is left in a safe condition for continued operation.

Environmental Cleaning guidelines deal with cleaning of the physical environment as it relates to the prevention and control of infections. Administrators, supervisors of housekeeping departments, infection prevention and control experts, construction/maintenance project supervisors, and public health officers are among those who fall into this category.

Cleaning according to schedule and responsibility

1. Written procedures for cleaning and disinfection of working areas and equipment should be followed.

- Defined responsibility for specific items and areas
- Clearly defined lines of accountability
- Procedures for daily and terminal cleaning
- Procedures for outbreak management
- Cleaning and disinfection standards
- Frequency of cleaning and disinfection.

2. Regular cleaning is necessary to maintain a standard of cleanliness.

3. Thorough and timely cleaning.

4. Monitoring of environmental cleanliness.

5. Ongoing review of cleaning procedures.

6. Cleaning schedules should be revised and developed, depending on:

- Surfaces of high-touch or low-touch items / equipment,
- The type of activity taking place in the area and the infection risk associated with it,
- The vulnerability of the cleaning staff working in the area.

7. Each health care facility should have written rules and procedures for proper cleaning that clearly identify the frequency and amount of cleaning, as well as the cleaning authority.

8. Institutions should have in place systems with regard to frequency of cleaning. They should periodically conduct audits to ensure a clean environment during working hours.

9. Cleaning audit results should be evaluated and analysed, and cleaning employees should be given feedback.

10. To detect and solve cleaning issues, an action plan should be developed.

11. Knowledge of Personal Protective Equipment (PPE), hand hygiene and safe work practices is required for every cleaning staff.

12. All chemical cleaners and disinfectants should be properly labelled and kept to reduce the danger of contamination, inhalation, skin contact, or bodily damage.

13. Develop a facility-level monitoring and maintenance schedule that clearly describes the items, inspection frequency, and responsible personnel. Certain equipment, such as floor cleaners, may require regular maintenance checks by qualified personnel, as directed by the manufacturer.

14. Prepare and keep a service record, and make it available to the cleaning programme manager for examination.

Storage of cleaning substances

Cleaning agents with a longer shelf life are bought in bulk because of the reduced costs.

Points to be considered for storage of cleaning substances are:

a. Storage racks should be strong enough to carry the weight of the items. Heavier containers must be kept on the bottom shelf.

b. The store-room should always be well lit, well ventilated and clean.

c. Ensure that the lids of the containers are tightly fitted.

d. While issuing cleaning substances, use appropriate dispensers and measuring apparatus.

b) Ensure that no residual deposits of the cleaning substance is left around the rims of the containers.

c) Spillage should be avoided. And if spill occurs, it should be cleaned immediately.

d) A systematic procedure should be followed for rotating stocks.

e) Organic solvents, strong reagents and polishes should be kept away from heat sources.

f) Stock check should be conducted at regular intervals.

g) Store should be locked when not in use.

Activities

ACTIVITY 1

Prepare a geographical poster on PPE kit for safety.

Materials Required:

1. Writing material
2. Ruler
3. Adhesive

Procedure:

1. Based on your understanding, prepare a graphical and interactive poster on PPE kit for safety.
2. Display the same in your class.

Check Your Progress

A. Fill in the Blanks:

1. Working environment that is clean, safe, and efficient, _____ employees to take pleasure in their work.
2. _____cleaning of working area takes several hours to clean surface, tools and machines, using heavy duty cleaning equipment.
3. _____are cleaning agents that can kill bacteria or other microbes on surface of commonly used items like door handles, working tables etc.
4. _____is used to remove grease from surface such as machine tops, counters and grill backsplashes.

5. _____cleaning is necessary to maintain a standard of cleanliness.

B. Write short answers for the following:

1. What are the benefits of maintaining cleanliness in apparel industry?
2. Describe various cleaning practices.

C. Write long answers for the following:

1. Briefly explain different types of cleaning substances.

Session 3: Operation of Machinery, Equipment and Tools Safely and Correctly

The most important concept to remember is that - one is responsible for one's own safety and the safety of others. Most safety practices are though very common, unfortunately can be forgotten or overlooked unless one makes safe practices a habit or an instinct.

GENERAL SAFETY

By following the right procedures, workers will commit themselves to safety on the job and with that everyone will be benefited. Accidents may occur in many ways but most often can be based on ignorance or carelessness.

Safety precautions to be followed in work area are as follows:

1. Walk instead of running - People who rush around in the work area tend to increase the likelihood of an accident.

2. Concentrate on work - Stay completely alert on the job. Lack of interest, personal problems, and distraction by others can all lead to serious accidents in the working area.

3. Understand all the rules for operating equipments. Never operate the equipment until trained

4. Never work under the influence of drugs or alcohol.

5. Pay attention to moving objects, such as equipment, cloth cutter and driller, trolleys etc.

6. Avoid back strain by lifting the materials in proper position.

Accidents are caused due to overlooking of situations involved with risk. They are the result of not knowing the proper way to do a task, carelessly performing an operation or job, or not being consciously aware during the performance of a task.

The most common accidents in the working area are as follows:

a. Cuts

Cuts are too common in the industry because cutter, needle and other cutting equipment and tools are constantly in use. These cuts, as well as the severity of the cuts, can be avoided by following the right safety standards and following proper cutting methods.

Accidental cuts can be prevented if the expertise of using a cutter has been mastered. If they do occur, however, they should be treated safely and promptly. If infection sets in, it can result in more serious consequences.

b. Burns

Two types of burns occur in the working area-

- Minor
- Major

Minor burns occur when an exposed body part comes into contact with a hot surface, such as a steamer, a hot air oven, or concentrated chemical compounds.

When grease and chemicals are spilled, steam is discharged too quickly, or gas is released unintentionally, major burns occur.

Burns are more painful and take longer to heal than cuts. If a blister forms as a result of the burn, it should be treated as soon as possible by skilled medical staff.

c. Falls

Falls can cause some of the most serious injuries in the commercial industry. They may disable or incapacitate a person for life.

Falls are caused by extreme carelessness, wet floors and aisles, spilled materials, rags, grease, and by torn mats or spread rags and floor boards.

d. Strains

Strains are very painful and can cost you a lot of time at work. They are caused by carrying excessively heavy loads and using inappropriate lifting techniques. The majority of strains do not require medical attention, but they do necessitate time and care in order to heal properly.

HANDLING MATERIALS, MACHINERY, EQUIPMENT AND TOOLS SAFELY AND CORRECTLY

Employers are legally required to ensure that all equipment and materials supplied and used for work purposes are safe and does not pose a long-term hazard or risk to employee's health. Employees must have sufficient knowledge and training to handle materials, machinery, equipment and tools safely.

Safe practices to handle machinery, equipment and tools are:

1. Worker should possess the required know how of machinery, equipment and tools used for the job.
2. Routine maintenance must be carried out for all machines, equipment and tools.
3. Inspection at regular intervals to avoid wear and tear that might compromise safety.
4. Proper inspection of machines before use if the equipment's safety depends on installation

5. Noise and vibration levels should be checked and should not affect the operator and others.
6. Use hand-held tools safely- Anyone who uses a hand-held tool might be at risk of injury.
7. Band knives can cause serious wounds unless effectively protected. The circular knife of portable cutting machines should also be similarly protected.
8. If power presses are used, adequate machinery guarding, preferably fixed, is necessary to keep hands out of the danger area. Guards which prevent the pressure head from coming in close contact (most importantly, the hand) comes within the area are to be used. All presses, with their steam and pneumatic supplies, must be frequently inspected.
9. The drive motors and the needle are the two most dangerous parts of a sewing machine. Long lines of machines are still driven by under bench shafting in several places. When workers bend under benches to grab goods or fix belts, many entanglement mishaps might occur, so it's vital that this shafting is effectively protected by enclosure or close railing. Several different types of needle guard, which keep fingers out of the area of risk, should be used.
10. Handling old equipment - Ensure that it is safely and properly handled, stored, transported and recovered or disposed-off. If the equipment contains hazardous components, follow additional requirements under hazardous waste legislation.
11. Personal Protective equipment -Workers in many activities may require special protective equipment at work like helmets, bump caps or hair nets for the head crash and climbing. Hearing protection should be worn if exposed to high noise levels. Safety glasses, goggles and face shields can also be used to prevent eye hazards. As a standard, everyone should wear safety spectacles, goggles and face shields while using hand or power tools. Other PPE types likes Safety boots or shoes, gloves, gauntlets, mitts, cuffs, armlets or elbow protectors, overalls, boiler suits, high visibility clothing, leggings and gaiters for different activities in production line are required. Cutting machine operators must wear a protective glove, preferably of metal mesh.
12. Amputation and Caught-in Hazards – Machine guards are mounted on machines to protect employees from moving parts. Every day, equipment should be checked carefully to confirm that all guards are in place.
13. Chemical Hazards – Chemical-processing equipment can be a source of a variety of risks. Leaks can result in slipping dangers and chemical exposure. Chemical-leaking hoses could cause respiratory problems for workers working nearby. As a result, caution must be given when using such devices.
14. Sharp Edges – Walking very close to machinery area, may be hazardous if sharp edges are not guarded. Hence equipment mounting brackets,

signages and control boxes should be checked regularly to see if sharp edges are present.

15. Ensure that all equipment are well maintained and checked regularly. All equipment should be removed from the platform, at the end of the working day, and all power supplies should also be switched off.
16. Risks caused by workplace equipment - Cutting equipment, forklift trucks, equipment using heat or bright light, can cause risks not just during the normal operation of the equipment but also during installation, maintenance, repairs, breakdowns and servicing. Hence, use of appropriate warning signs is advisable.

Tool safety

Workers should be taught how to use tools in a safe manner. When tools are misplaced or handled incorrectly by workers, they can be dangerous.

Following are some suggestions for safe handling of tools are:

a. Tools should never be tossed but should be properly passed from one employee to the next. Pointed tools should be passed with the handles facing the receiver or in their carrier.

b. Workers carrying large tools or equipment on their shoulders should pay particular attention to the workspace clearances.

c. Cutter and screwdrivers should never be carried in a worker's pocket. In a toolbox, pointed down in a tool belt / pocket tool bag, or in the hand with the tip always held away from the body are all acceptable ways to carry them.

d. Tools should always be put away, when not in use. Leaving tools on an elevated structure such as a scaffold, poses a significant risk to workers working below the elevated structure.

e. Fabric cutting tools - Cutting tool guard must be correctly set in order to give the necessary protection to the hand positioning the material, otherwise it may have a risk of accidental cuts. Supporting and maneuvering a cutting machine, while stretching across the cutting table, can present a risk of neck, upper-extremity and back disorders.

f. Handling rolls of fabric, which can weigh up to 32 kg and must be lifted above the head onto a rack for spreading, also poses muscular hazards. Proper material-handling equipment can eliminate or reduce these risks.

g. Sewing machine operators who operate in a seated position at poorly built workstations, executing the same operation throughout the workday with highly repetitive, time-pressured work are at a significant

risk of acquiring musculoskeletal disorders. It is necessary to take proper precautions.

h. Adjustable seats and worktables have the ability to reduce the dangers connected with using a sewing machine.

i. Finishing workers, such as pressers, are frequently required to work standing and in static positions. Many of these occupations can benefit from the addition of chairs, stools, or sit-stand chairs. With a slanted mechanism, table tops may be adjusted to the correct height for the operator, allowing them to work in a more comfortable position. Hands, wrists, and arms can be relieved of some stress by padded table edges and appropriately made and sized equipment.

j. Burns and ergonomic dangers can occur when using presses and irons. The majority of the presses are constructed with two-handed controls, which eliminates the risk of a hand becoming stuck in the press. Working on a pressing machine also puts you at risk for shoulder, neck, and back injuries due to repeated overhead reaching and standing while using the foot pedals. By properly situating the worker at the machine make this task safer and minimise the excessive stress.

k. Ticketers who use manual ticketing guns to place tags on finished garments, are at risk of hand and wrist injury with highly repetitive operations. Automatic ticketing guns can decrease the force required to perform the operation, hence reducing stress and strain on the operator's fingers and hands.

l. Many injuries in warehouse activities, such as lifting and overhead work, are caused by manual material handling. Mechanical material handling equipment such as forklifts and hoists, can reduce injuries caused by lifting heavy lifts. This can also be reduced by designing the distribution workplace with adequate material handling, such as positioning of conveyors and worktables at appropriate heights.

m. Chemical exposure - Workers at every stage of apparel production may be exposed to the chemicals used in fabric finishing, the most common is formaldehyde. Formaldehyde releases into the air from fabric in the form of a gas. Workers may also have skin exposure to formaldehyde as they handle the fabric. Exposure to formaldehyde can be prevented by allowing the fabric to blow off-gas in a well-ventilated area before it is handled. Workers must wear gloves or apply protective cream.

Instruction for Safety at work place are as follows:

1. Keep the work area clean, tidy, well swept/washed and well lit. Floor should be level and must have a non-slippery surface.
2. Do not remove any guarding device; before operating, the operator must ensure that guarding devices are in position and good working condition.

3. Before measuring, cleaning, maintaining, or adjusting the machinery, follow the lock-out procedures.
4. Check and adjust all safety devices before operation.
5. Wear appropriate personal protective gear as prescribed, including CSA-approved safety glasses with side shields.
6. Ensure that all cutting tools and blades are clean, sharp and rust free and should be able to cut freely without extra effort.
7. Ensure there is enough space around the machine for operator, maintenance team and cleaning staff to do their job freely.
8. Ensure that all stationary equipment /machines are anchored securely to the floor.
9. Maintain distance with the cutting head and all moving parts of the machine, to avoid any accident.
10. Avoid awkward positions and postures as sudden slips could cause the hand getting harmed by the cutting tool or blade.
11. Do not leave machines unattended: turn OFF the power, when not in use.
12. Avoid distracting the operator; horseplay can lead to hazard and injuries.
13. Wearing loose-fitting clothing, gloves, neckties, rings, bracelets, or other jewellery that could get tangled in moving parts is not a good idea. Long hair should be kept out of the way, and rags should not be used near the machine's moving parts.
14. Return all portable tools to their proper storage place after use.
15. Clean all tools after use.
16. Use a vacuum cleaner or a brush to remove any rag cuttings.
17. Do not use compressed air, to blow debris from machines or from worker's clothes.
18. Keep the tools out of the aisles and out of the way of other workers. Knives and scissors must be sharp; dull equipment pose a greater risk than sharp ones. Cracked saw blades must be removed from service immediately; else, an accident may occur.
19. In the presence of combustible substances, iron or steel hand tools may produce sparks, which could lead to an ignition. Spark-resistant instruments made of nonferrous materials should be used near flammable gases, highly volatile liquids, and other explosive chemicals wherever this hazard exists.
20. Because power tools can be exceedingly dangerous if handled incorrectly, they must be equipped with guards and safety switches. Electric, pneumatic, liquid fuel based, hydraulic, and powder-actuated power tools are classified according to their power source.

USE CORRECT LIFTING AND HANDLING PROCEDURES

Musculoskeletal problems often emerge from poor work place or job design. Among the most common risky activities are as follows:

- Heavy loads
- Difficulty in gripping
- Excessive use of force
- Repetition
- Twisting and other awkward postures.

Some of these problems can be prevented in following ways:

1. **Manual handling of fabric rolls often close to machinery**, e.g. lifting to and from store room, in storage and dispatch areas, shelves, racks, trolleys and stillage, in quality control areas, reduces the risk of hazard.

Fig.:: 4.8 - Manual Handling of Fabric Rolls

a. Mechanical methods of handling the rolls, for e.g. on a conveyor and mounting on roller tracks.

b. Organize rolls according to weight, so that heavier rolls are stored at a convenient height for handling. Stackers with adjustable widths are ideal for lifting and lowering rolls in storage facilities. A roller track attached to the top of two support arms allows rolls to be passed easily to and from storage racks. The height of the trolley, which is supported by wheels, may be simply modified using a foot pump. The trolley is especially designed for transporting and moving rolls in the confined spaces of cutting section.

c. Rolls exceeding a specific weight can be routed to a truck pick-up point for loading, while lighter rolls are diverted to a manual pick-up

station, where personnel can pick up the roll before bringing it to the vehicle.

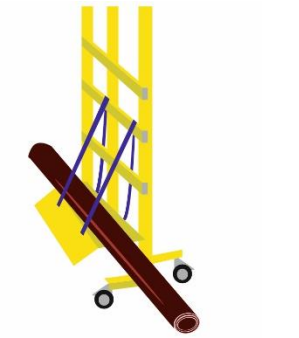


Fig.:: 4.9 – Mechanical handling of fabric rolls

2. **Handling loosely folded cloth at intermediate stages of the production process,** e.g. moving cloth to or from machines, inspection and quality control areas, including lifting to or from weighing scales.

   A lightweight 'stretcher-board' can be utilised to reduce the distance through which the load is lifted as well as increase its stability and give a more uniform distribution of weight between two lifters. It also helps with grip and the ability to implement the proper force during the lift.

3. **Handling boxes** –It happens mainly in delivery and storage areas, loading and unloading from vehicles. Suspended overhead rail system allows the load to move freely within the storage area. Pneumatic grippers grasp the box securely and scales built into a roller conveyor to compensate for the weight of the load, allowing it to be moved with minimal effort. The device can be adapted to suit a range of different items and containers. Use of mechanized procedures reduces the risks.

4. **Lifting to and from bins, stillage, trolleys and machinery**- Trolley fitted with a self-leveling base can be used. As the material is removed, the suspended base rises, maintaining a constant height from which to lift an inner lining thereby preventing material from being caught in the springs.

5. **Working around machinery**- Use a mechanical handling device suspended from an overhead support or rail that grabs the package's centre and assists with lifting and manoeuvring by balancing and supporting the load.

6. Maintenance tasks can lead to some of the most hazardous handling operations. Flexible multi-purpose handling devices like tool-box trolley can be more practical during machine installation to minimize repetitive lifting of heavy loads at work place.

7. Do not attempt to lift by bending forward. Bend your hips and knees to squat down to load, keep it close to the body and straighten the legs to lift.

8. Any heavy object should never be lifted above shoulder level.

9. Avoid turning or twisting of body, while lifting or holding a heavy object.

10. **Work safely at height or in a confined space** -Plan work to be carried out at height. Plan steps to reduce the risks of all falls liable to cause personal injury or to anyone on the premises / site, e.g. employees, visitors and contractors. Make sure roofs, working platforms and walkways are safe.

MAINTENANCE OF TOOLS AND EQUIPMENT

A competent employee must regularly inspect, test and maintain the machine's guards and safety control system with reference to manufacturer's instructions. This will ensure the reliability and integrity of the safety system.

Maintenance and repair program should specify -

1. Where, how much, what type of and how often servicing is required?

2. Responsible worker for conducting the repair and maintenance program.

3. What standards to be used for performance testing and evaluation?

4. Program should be reviewed regularly to ensure their effectiveness. Develop, implement and maintain an accurate record of maintenance.

Following are the suggestions for Maintenance of machinery and tools

1. Carry out cleaning according to schedules and limits of responsibility.
2. Workers should take all practical steps to make sure all hazardous machineries are switched-off, before any cleaning or maintenance is done and whether it is safe to clean, maintain and repair. Standard procedures must be followed by trained workers for these activities to be performed safely.
3. Establish and follow a safe work system.

4. The machine should run at the slowest practical operating speed for cleaning, loading and setting up.
5. Restrict access and control of danger areas to one person only.
6. Emergency stop controls can be set within immediate reach.
7. Employers should maintain and keep machinery in sound operating condition at all times. They can manage the maintenance using:
    a. Preventive maintenance schedules.
    b .Regular inspections.
    c. Unsafe condition reports and feedback.
8. Carry out running maintenance within agreed schedules.
9. Carry out maintenance and cleaning within one's responsibility.
10. Report unsafe equipment and other dangerous occurrences.
11. Ensure that the machine guards are in proper place.
12. Use correct lifting and handling procedures for the tools and equipment.
13. Store cleaning equipment and tools safely after use.

Activities

ACTIVITY 1

Visit a Garment manufacturing firm, discuss with the safety officer / team and prepare a report on safety measures adopted by them.

Materials Required:

1. Writing material
2. Ruler
3. Adhesive
4. Camera for clicking pictures

Procedure:

1. Make a group of 4 students each.
2. Visit a garment manufacturing firm
3. Enquire about its safety measures.
4. Prepare a report of your observation with pictures.

5. Submit the report to the teacher for evaluation and feedback.

Check Your Progress

A. Write TRUE/FALSE the following:

1. People who rush around in the work area tend to decrease the likelihood of an accident.
2. Accidental cuts can be prevented if the expertise of using a cutter has been mastered.
3. Equipment mounting brackets, signages and control boxes can not be checked regularly to see if sharp edges are present.
4. Mechanical material handling equipment such as forklifts and hoists, can reduce injuries caused by lifting heavy lifts.
5. Workers should take all practical steps to make sure all hazardous machineries are switched-off, before any cleaning or maintenance is done and whether it is safe to clean, maintain and repair.

B. Write short answers for the following:

1. Enlist precautions which are taken while handling sharp objects.
2. What is safety? Why is safety important while working with machines?

Session: 4 Effective Oral And Written Communication At Workplace

Effective Oral and Written Communication not only helps in communicating one's thoughts clearly and concisely, but also to create focus, energy, and passion. Clear messages help to build trust and integrity between the writer and the reader. Well-written communication helps to define goals, identify problems and arrive at solutions. Employees must clearly write and talk so that other staff understand the situation without confusion.

Effective writing allows the reader to thoroughly understand everything that one is not able to say. Listening, reading, writing and talking are collectively known as effective communication skills. Good communicators have a wide range of skills and are able to adjust their communication style in response to the many variables they face at a given time.

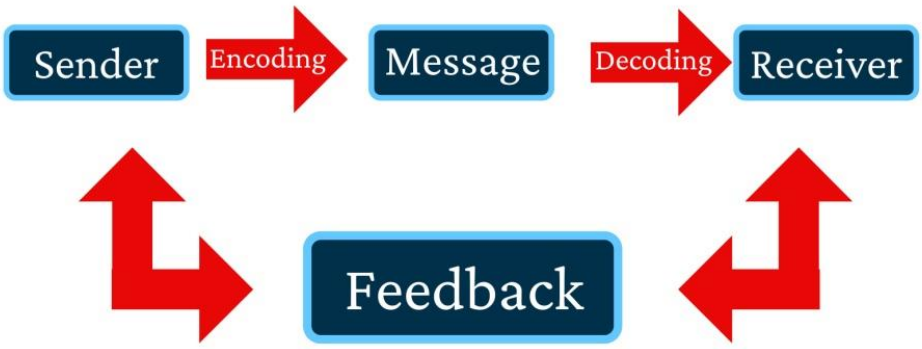


Fig: 4.10 – Communication Process

The Communication Process includes the following:

1. Sender

The sender bears the responsibility for ensuring that the message is understood and that the expectations for deliverables are clear. The sender should also consider any obstacles that may prevent the recipients from understanding the message. Languages, ethnic cultural beliefs, degree of education, and/or experience are all barriers.

2. Message

Verbal, non-verbal and written communications are affected by the sender's tone and method of communication. While sending a written message, the sender must be sure that it is professional, precise, clear and in simple

language. Written communications are open to interpretation by receiver. Proof the written communication for typographical errors, grammar, punctuation and sentence structure to reduce the chances of miscommunication.

3. Method and Environment

Messages are conveyed through channels. These channels are affected by the method and environment which is chosen to communicate. All written communications are one-way communication, as there is no opportunity for people to ask questions, provide feedback, express concern or gain clarification during or immediately after communication.

4. Receiver

Messages are delivered to the concerned receivers. Receiver enters into the communication process with ideas and feelings that influence his understanding of the message and send their response.

One of the indicators of a high-performance culture is open communication in the workplace. Workplace communication is the process of exchanging information and ideas within a company. Effective communication, on the other hand, occurs when a message is sent and received correctly.

a. Effective communication at workplace is center of all business goals. Its benefits are :-

- It avoids confusion
- It provides purpose
- It builds a positive company culture
- It creates accountability

b. Skills that employers mostly seek are:

- Oral communication
- Listening
- Written communication
- Public speaking
- Adaptability

c. The importance of good communication at workplace

At all levels of an organisation, effective communication is critical to attain productivity and maintaining healthy relationships. Employers who devote time and effort to establish open lines of communication will quickly gain employee trust, resulting in increased productivity, output, and morale. Employees should be able to effectively communicate with their co-workers, managers, and customers. The message is the outcome of the encoding, which takes the form of verbal, nonverbal, or written language.

THE LINES OF COMMUNICATION, AUTHORITY AND REPORTING PROCEDURES AT WORK PLACE

Lines of communication can include a chain-of-command that requires employees to communicate only with their direct superior. Workplace communication is the process of exchanging information and ideas, both verbal and non-verbal, between one person/group and another person/group within an organisation. To establish and manage, various lines of communication within a business is essential so that all workers and managers can contact the communicator, for example a manager communicating to an employee and an employee to a customer.

Protocol is a set of guidelines regarding the chain of command for how various members of an organisation must communicate with each other.

1) Owner to Manager

The company owner provides directions to manager as well as any update or news he wants to give employees through manager.

2) Manager to Employee

Managers must delegate specific duties to workers and provide directions about work projects. A manager commonly communicates through regular meetings with the entire department. Manager may also schedule yearly employee review sessions with individual workers to discuss performance and productivity.

For example a flow chart of reporting and conducting maintenance in an industrial set-up is given as below:

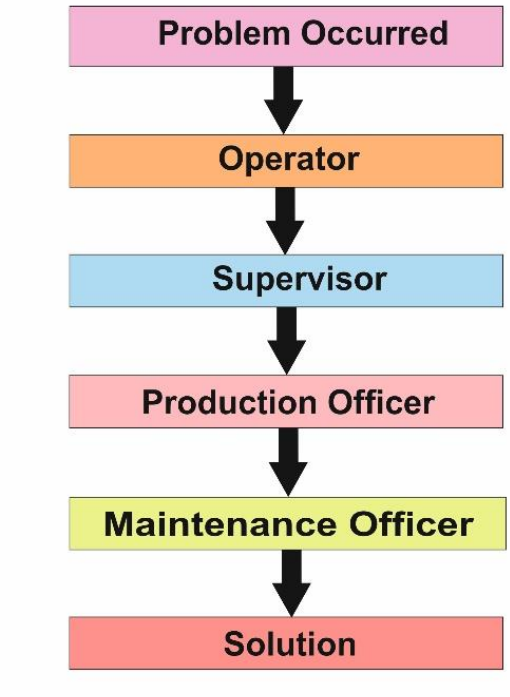


Fig.: 4.11 - Flow Chart of Maintenance

3) Employee

A line of communication is also established between employees / managers and outside business contacts. Certain employees of a manufacturing unit may have to communicate directly with representatives of companies to supply raw materials, submit orders or request information.

4) Communication with Customers

Possibly the most important line of communication at a business is between the employees of a business and its customers. In some cases, certain employees are authorized to speak to clients for business contacts.

Reporting procedures at work place

Effective communication in the workplace is imperative in a leadership role. Having effective communication skills is the key to good leadership. In turn line of communication begins in descending order, i.e. reporting procedure begin from customers to employee, employee to supervisor, supervisor to manager and from manager to industry owner.

Ways of reporting procedures for effective communication at workplace are as follows:-

1. Open Meeting

It is easier to communicate in the work place situation via open meetings. In this kind of forum, workers will hear, see and feel it. This oral communication is one of the best approaches to communicate effectively with a team.

2. Emails

In official settings, written communication via email remains potent. It will enable to pass messages to the members of the team without pulling them out of their workstations.

3. One to One

Workers understand better when we talk to them on a one-to-one basis. Ensure to maintain eye contact with them to enable the message to sink in.

4. Create a Receptive Atmosphere

To effectively communicate with the team, one must create an interesting atmosphere which is open for communication.

5. Display Confidence and Seriousness

Ensure that one must display confidence and seriousness because if team members notice any uncertainty and lack of seriousness while communicating with them, they are likely to treat the information with disregard.

6. Use Simple Words

To be effective in the communications with the team members, use words that are easily understood.

7. Use Visuals

Place visuals at strategic positions around the work place of the team. Delivering messages both through sight and sound gives room for better comprehension.

8. Listen to the Team Members

Encourage team members to open up so that the leader can be well informed while communicating with them.

9. Use Body Language

The message will be conveyed much more quickly and effectively through body language. When communicating with your team, master the skill of utilizing body language. Smiles, handshakes, and eye contact should all be used.

10. Use the Appropriate Tone of Voice

Use the appropriate tone of voice to communicate the message to the team so that the message is not misunderstood and discourage / frighten the receivers. Voice modulation in such scenarios help to be beneficial.

11. Be clear

Being clear to communicate to the team members makes it easier for them to understand the message. Make a message to the point for better comprehension. Keep the focus of point to be conveyed straight forward.

12. Encourage Feedback

Do not just talk and walk away, give room for feedback so that one can measure the effectiveness of the style of communication. It will also afford the privilege of knowing if the message was well understood.

13. Gesticulate

Use the hands to demonstrate the message. Make hand motions and signals to establish the seriousness of the subject matter while communicating with the team members.

14. Be Appreciative

Always remember to thank the listeners for their time after each communication session. Working hard on these communication strategies and establishing ground rules to keep everyone up to date will ensure a smooth project conclusion. Lines of communication make it easier to not only express the information effectively, but also to respond quickly in order to avoid missed opportunities or late work delivery.

THE IMPORTANCE OF COMPLYING WITH WRITTEN INSTRUCTIONS

A written communication is always put into writing form and used when the audience is at a distance or when record is required or where its preservation is essential and required as an evidence. It is in the form of

instruction, orders, rules and regulations, policies, procedures, posters, memos, reports and information bulletins.

1. The importance of written instructions is mentioned as below:
   a. It keeps evidence of what has occurred or what was stated.
   b. It keeps permanent record for future use.
   c. It reduces the chances for misinterpretation and distortion of information.
   d. It is more reliable when transmitting lengthy information on financial, production or other important data.
   e. It provides an opportunity to put up their grievance in writing and get it supported by facts.

2. Comply with industries written instructions
   a. Carry out work functions in regulatory and accordance with legislation and organisational regulations, guidelines and procedures.
   b. Seek and obtain clarifications on policies and procedures, from the authorized person.
   c. Apply and follow the policies and procedures within work practices.
   d. Provide support to the supervisor and team members in enforcing these considerations.
   e. Comply with health and safety and security related instructions applicable at workplace.
   f. Use and maintain personal protective equipment as per protocol
   g. Carry out own activities in line with approved guidelines and procedures.

3. Writing Care Instructions

Care instructions should be written in the form of notices or signages to help employees remind of care or caution to be followed with regard to machinery or wet floor or any hazardous situations.

Equipment operating procedures / manufacturer's instructions

The manufacturer of machines, as well as the operator, both should take all technical and organisational measures, in order to ensure the safety of machine operators. It includes the general rules for approaching safety issues that should be taken into account by machinery designers in the design process e.g. inherently safe design, safeguarding and protective

measures, information for use, mode of application, conformity assessment procedures etc. Use of machine operating manuals should be encouraged to employee designated to use particular machine.

Implementation of safety measures by the manufacturer

The manufacturer of machinery should eliminate hazards or reduce risks associated with these hazards by applying safety measures in the following order:

1. Inherently safe design

Hazard can be eliminated through the right choice of the machine design and features and minimizing personal exposure to hazards, through reduction of the number of un-necessary interventions within the danger zones. All accessible parts of the machine should have no sharp edges, sharp corners, rough surfaces, protruding parts, etc. Many hazards of the machine can be eliminated by means of choosing proper shapes and employing proper arrangement of mechanical parts.

2. Safeguarding

The hazards that cannot be eliminated using the inherently safe design approach should be reduced by means of the application of guards or protective devices. Covers, doors, fences, etc. also perform guarding functions. Guards should be difficult to remove or switch off, situated at a proper distance from the danger zone and allow performance of required operations like installation, tool changing or maintenance, guard locking, providing only limited access to the area where the operations are to be performed and without the necessity for removal.

3. Protective device

Protective devices that do not create actual physical barriers perform their protective functions by means of generating a signal that stops a dangerous motion of a given machine element. When it is impossible to apply guards, sensitive protective devices are used to reduce risk. There are several types of these devices. Optoelectronic protective devices such as light curtains, scanning devices like laser scanners and pressure-sensitive devices, mats, trip bars, trip wires etc. are often used.

4. Functional safety of machinery control system

If failure of a control function performed by a control system can result in an immediate increase in risk, then this function is named a “safety function”. Generally, safety functions can be implemented for the reduction of risk

associated with the improper machine operation, failure of technological processes and mechanical hazards.

The safety functions included in manufacturer's instructions are:

a. Safety-related stop function initiated by a safeguard
b. Manual reset function
c. Start/restart function
d. Local control function
e. Muting function
f. Monitoring of safety-related input values
g. Response time
h. Monitoring of safety-related parameters such as speed, temperature or pressure
i. Reaction to fluctuations, loss and restoration of power sources.
j. Common cause failure factor
k. Components and elements to achieve emergency stop function
l. Measures for escape and rescue of trapped persons
m. Measures for isolation and energy dissipation
n. Provisions for easy and safe handling of machines and parts
o. Measures for safe access to machinery.

5. Information for use

Despite the adoption of measures for inherent safe design, safeguarding and protection, the user is informed about machine design and their parts, running and maintenance of machine.

a. The information may be in the form of accompanying documents and instruction manual, on the machine itself, on the packaging and by other means, such as signals and warnings outside the machine. Information and warnings on machinery is provided in the form of readily understandable symbols or pictograms. The operator must have facilities to check the operation of the warning devices all the time.

b. Visual signals, such as flashing lights and audible signals such as sirens may be used to warn of an impending hazardous event, such as machine start-up or over-speed.

c. All the necessary markings on machine itself

- For unambiguous identification,
- In order to indicate compliance with mandatory requirements,
- For safe use.

d. The instruction handbook or other written instructions includes all information for safe commissioning, operating, adjusting and maintenance of the machine.

e. Implementation of safety measures by the user of machinery and work equipment. Work equipment should be properly adapted to the work without impairment to their safety or health.

6. Additional safeguarding

The employer should ensure that work equipment is installed, located and used in a way ensuring that the risks to the operators and other workers have been reduced. In particular, sufficient space between moving parts of work equipment and fixed or moving parts should be allowed with movable guards or protective devices.

7. Use of personal protective equipment

Technical safety measures comprise personal protective equipment. These are devices or equipment designed to protect worker against single or multiple risks that may affect health or safety at work.

Personal protective equipment also comprises,

1. A unit constituted by several devices or appliances which have been integrally combined by the manufacturer for the protection of an individual against one or more simultaneous risks, e.g. a helmet coupled with a visor and/or hearing protection.
2. A protective device or appliance combined or separately, with personal non-protective equipment worn or held by an individual for the execution of a specific activity e.g. clothing or knee protectors included in trousers used for performing work while kneeling.
3. Personal protective equipment should include the items such as:

1) Clothing - Well-fitted pants and jackets with all buttons fastened. Sleeves should be close fitting, hair nets and Aprons made of non-combustible and flame-resistant materials.

2) Footwear – Approved and sturdy footwear with non-slip sole and a closed toe and closed back.

3) Hand protection - Natural rubber latex gloves, synthetic rubber gloves, and vinyl gloves or thick plastic gloves.

4) Eye protection - Safety goggles or masks

5) Respirators - Properly fitted to provide the best protection from inhaling harmful fumes or vapours.

8. Work organisation and procedures

Proper work organisation is important in ensuring safe operation of the work equipment. All operations should be performed according to established safe working procedures. The employer should take necessary measures to ensure that the use of work equipment is restricted solely to persons given the task of using it. Written permission for conducting high risk works should be issued namely, repairs, modifications, maintenance or servicing.

SUGGESTIVE STANDARD OPERATING PROCEDURES OR INSTRUCTIONS

a. SOP for machine inventory including spares, tools and tackles.

- Receipt of material against packing list/indent.
- Machine taken for installation as per requirement.
- After installation machine is numbered. Record is to be maintained in Asset register / computer excel sheet.
- Machine is not issued to production until the numbering is complete.

b. SOP for machine installation

- Arrange the related person from agencies to install the machine**.**
- After installation arrange to train production from company technician.
- Hand over the bobbin/bobbin case or related material use to run machine to production department.

c. SOP for maintenance of utilities - air/water/steam related

- Making indent for materials for installation.
- After receiving of materials from vendors, installation from vender.
- Looking After the maintenance of Steam Generator and Air compressor.
- Operating of steam generator and air compressor in shift timing.

d. SOP for machine's preventive maintenance

- Preventive maintenance schedule is prepared.
- As per schedule, preventive maintenance is done and record is maintained
- All weighing scales shall be calibrated once a year and certificate is obtained.
- Maintenance department shall inform the purchase department regarding renewal of AMC (Annual Maintenance Contract) at least 1 month prior to its expiry.

e. SOP for machine breakdown maintenance

- Breakdown intimation is received from concerned department.
- Breakdown maintenance is done considering type of fault.
- Record of breakdown maintenance is maintained in the breakdown maintenance register.
- Electrician repairs all electrical faults and maintains a register for electrical repair and breakdowns.
- A machine history record shall be maintained for all machines.

f. SOP for calibration of measuring instrument &Light Illuminations record

- Any machine having measuring instrument should be calibrated yearly.
- The calibration check list shall be maintained for all such instruments.
- The maintenance in charge shall keep the certificates of calibration in a file.
- Actual date of calibration shall be maintained in the machine history sheet.
- Monthly light illumination shall be recorded in all working area on the production floor.
- At least once in 6 months, illumination checking is done and record is maintained

Activities

Activity 1:

Prepare a graphical poster on SOP instructions.

Materials Required:

1. Writing material
2. Ruler
3. Adhesive
4. Camera for clicking pictures

Procedure:

1. Based on your understanding, prepare a graphical and interactive poster on SOP instructions.
2. Display the same in your class.

Check Your Progress

A. Fill in the Blanks:

1. Well-written _____helps to define goals, identify problems and arrive at solutions.
2. Verbal, non-verbal and written communications are affected by the sender's _____and _____of communication.
3. Use of _____manuals should be encouraged to employee designated to use particular machine.
4. When it is impossible to apply guards, _____devices are used to reduce risk.
5. Written permission for conducting high risk works should be issued namely, _____or servicing.

B. Write short answers for the following:

1. Which are the ways to create effective communication at workplace?
2. What are SOPs? Briefly enlist SOP for maintenance of a needle detector machine.

Module 5	Health, Safety and Security at Workplace

Module Overview

Health, safety and security are one of the most important aspects of human concern at the workplace. Therefore, we should aim at building a working environment which provides and maintains highest degree of physical, mental and social well-being for workers in all occupations.

Industries and organisations should focus on health and safety related practices at workplace and should ensure availability of all the basic facilities like safe and clean drinking water, clean rest rooms, proper ventilation and lighting facilities etc.

With the advent of technical advancements in the form of imported machineries and others services in the apparel industry, we should give more emphasis on the principles of ergonomics and occupational psychosocial factors.

Thus, the benefit of maintaining occupational health, safety and security are:

i. Reduced work related injuries

ii. Make the working conditions healthy and safe in the interest of workers, employers, as well as the public/society at large

iii. Reduce the risk of potential accidents and emergencies

iv. Preparedness with suitable responses to accidents and hazards

Hence, workers should be trained to identify and report to seniors/supervisors or any other authorized personnel in case of any malfunctions in machinery and equipments, emergencies and take necessary corrective actions for the same.

Learning Outcomes
After completing this module, you will be able to: • Analyze Compliance to health, safety and security requirements at workplace • Explain Potential safety risks and emergencies • Identify and report malfunctions in machinery and equipment or any other hazard at workplace • Explain reporting emergency situations

Module Structure	
Session:1	Compliance to health, safety and security requirements at workplace
Session:2	Potential safety risks and emergencies
Session:3	Identifying and reporting malfunctions in machinery and equipment or any other hazard at workplace
Session:4	Reporting emergency situations

Session 1: Compliance to Health, Safety and Security Requirements at Workplace

Safety and security of the workplace greatly depends on the enforcement of safety policies and rules of the industry which also ensures compliance with health and safety standards. Compliance is obtained through specific efforts made to reduce the risk of potential hazards and accidents at the workplace.

It is increasingly observed that the health, safety and security of workers are subject to a variety of risks. Inculcation of safety culture in the working environment along with strict guidelines on safe work procedures significantly reduces the risk of potential hazards/accidents.

HEALTH AND SAFETY RELATED PRACTICES APPLICABLE AT WORKPLACE

Apparel industry is a labour oriented industry. Workers are the main resources and all companies must follow certain practices applicable at workplace for maintaining health and security of their workforce.

Following points must be taken care–

- Ensuring availability of fully stocked first aid boxes at every designated location according to the floor plan/layout.

- Fire extinguishers should be placed at clearly marked areas at regular intervals

Fig.: 5.1 (a & b) - HEALTH AND SAFETY RELATED PRACTICES

- It is advisable to maintain an accident register. This helps in record keeping of various accidents, their causes and the damages. The information in accident registers can be useful in prevention of accidents in future.
- Factories should ensure proper positioning of emergency lights on work floor leading the pathway to exit.
- It is essential to ensure that all fire-fighting equipment such as extinguishers are regularly inspected and kept in good working order.
- Exit signs should be clearly marked and displayed.

Fig.: 5.2 – Exit Sign

- Yellow lines should be marked on the factory floor to demarcate the pedestrian pathway from the space allocated for machines.

Fig.: 5.3 – Yellow Demarcation for Pedestrian Pathway

- Aisles should be designed wide enough and should not have any obstruction in between to prevent any accidents during movement of men and material.
- Cables /Wires should never be left loose or visible hanging at the floor.
- Proper lighting with well-distributed artificial light to ensure effective use of available daylight should be arranged.
- Good general ventilation plus local exhaust ventilation to remove air contaminants at the source should be ensured.
- A clean lunch room commonly called as canteen area for employees to have their meals should be allocated.
- Oily floors are a common cause of accidents and fire hazard. Splash guards and drip pans should be installed wherever oil spills or drips may occur. Prevent accidents by keeping oil and grease off the floor.
- Adequate supply of clean and pure drinking water must be ensured for all workers.
- Workers should be encouraged to use mask and gloves wherever required.
- Provision must be made for clean washrooms/restrooms for workers and staff members
- Mock drills must be performed with the workers at regular intervals for them to be prepared in case of any spills, fire, and explosion.
- It is advisable to carry out the regular maintenance of the factory if something gets broken or damaged. It must be ensured that same be replaced or immediately corrected/fixed, for example - defective ladders, broken handrails, steps, etc.

- Factories should have a provision of regular maintenance programmes like inspection, lubrication, upkeep and repair of tools, equipment, machines and processes.

Compliance to health, safety and security requirements at workplace will help in eliminating risk related to potential accidents and hazards caused by unfavourable conditions and thus, will lead to efficient, smooth and uninterrupted production cycle and safe and secure work environment.

ACCESS TO CLEANDRINKING WATER AND SANITARY FACILITIES

Welfare facilities like access to clean drinking water, hygienic and well ventilated wash rooms or rest rooms are a vital part of good working conditions in an industry.

Clean Drinking Water -

Provision of safe and clean drinking water, beverages or an adequate meal is mandatory for a healthy workforce.

Availability of clean drinking water is indispensable for all workers. Mostly in hot weather conditions a lot of water is lost from the body in the form of sweat or evaporation. If appropriate arrangements are not provided then the workers might have to make the arrangements by themselves or leave the workplace often in search of clean and safe drinking water.

In case of impure or contaminated water being made available for the workers, it can be a cause of frequent transmission of diseases among them. If the workers get dehydrated, they can be tired, exhausted or fatigued and will be less productive in their outcome. Thus, provision of clean and pure drinking water should be made near the workstations. Preferably, cool drinking water must be provided specially in hot weather conditions. For example - Arrangements of water coolers or water dispenser with clean and cold drinking water can be done at regular intervals near the workstations.

Sanitary Facility –

All industries must ensure appropriate sanitary facilities for workers within the working premises. Hygienic and disinfected toilets/restrooms are very important. It is also requisite to equip adequate number of washrooms as per the number of workers/staff working in an industry and ensure their maintenance and cleanliness.

To ensure mental and physical well-being of workers and to prevent spread of any diseases within the working premises, it is vital to have proper sanitary facilities. These facilities also helps in improving rate of production as healthy workers are more efficient in their working and it simultaneously leads to lower rates of absenteeism within the workforce.

Therefore, developments in sanitary facilities should be undertaken and materials incorporated should be durable, easy to clean and quick drying likes tiles. Frequent cleaning and maintenance of toilets is also recommended.

The following points must be considered-

i. Sanitary facility must be within easy access from the work site.

ii. These facilities must be well enclosed, well lit and adequately ventillated.

iii. Proper supply of toilet paper and other hygiene supplies must be ensured.

iv. It must be equipped with a covered garbage bin.

v. Hand claning facility like a wash basin along with soap and a sanitary way to dry hands must be installed in every single toilet facility.

Activities

Activity 1

Prepare a report on various types of health and safety related practices applicable at a work place. Place it a file and submit the same.

Materials Required:

1. Writing material
2. Adhesive
3. Ruler

Procedure:

1. Visit an apparel industry, learn and understand about the health and safety related practices being followed.
2. Make a report on the same.
3. Submit the report in your class.

Check Your Progress

A. Fill in the Blanks –

1. _____, safety and _____are one of the most important aspects of human concern at the workplace.
2. _____ should be placed at clearly marked areas at regular intervals.

3. Factories should ensure proper positioning of _____lights on work floor leading the pathway to exit.
4. _____ floors are a common cause of accidents and fire hazard.
5. _____ leads to lower rates of absenteeism within the workforce.

B. Write short answers for the following –

1. Mention points that must be taken care for maintaining health and safety related practices at workplace. (Any Five)
2. Write about the importance of having access to clean drinking water and sanitary facilities at the workplace.

Session: 2 Potential Safety Risks And Emergencies

Safety risks are chances of any detrimental or unfavourable result/outcome or anticipated losses (For example – Deaths or injuries caused due to malfunction of a machine in a factory) caused due to natural or human induced causes.

Emergency is an unforeseen and unexpected incident demanding instant/immediate response. It may be caused due to natural, technological or human causes/forces.

Preparedness against any potential safety risk or emergency is essential to protect the workers against any damage of life and property. The impact of any emergency crisis can be substantially reduced by active participation of employees and employers in safety related practices at workplace.

RESPONSE TO POTENTIAL ACCIDENTS AND EMERGENCIES

Ergonomically designed work areas have several benefits like:

- Increased human comfort
- Reduced stress and fatigue
- Increased workers rate of production
- Reduced risks of potential accidents/hazards.
-

Some of the factors that must be considered to be prepared are as follows –

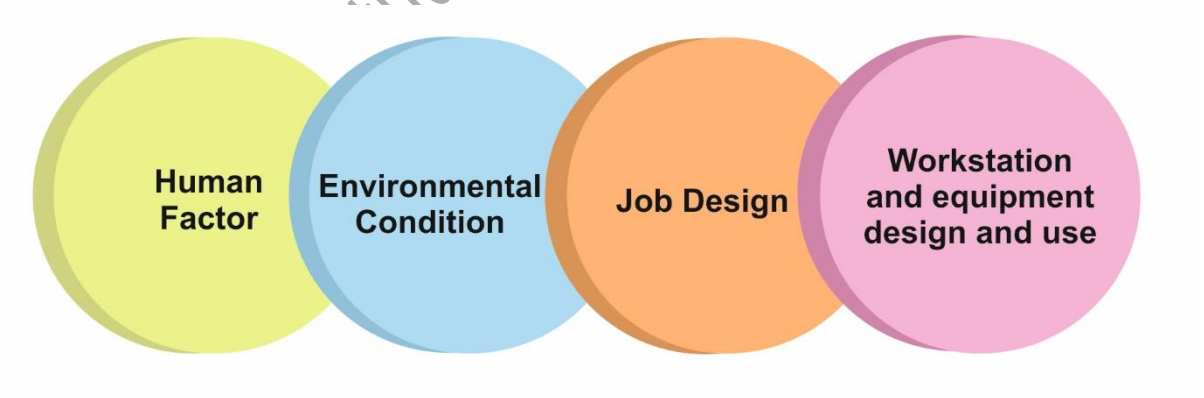


Fig.: 5.4 – Factors Responsible for Potential Accidents

1. **Human factors**

Major human factors that affect are:

- Physiological

- Psychological
- Physical
- Cognitive

Human factors mostly include all physiological and psychological factors. Workers dimensions like reach, posture and strength must be considered while considering the human factors. Physical injury can cause a negative impact on employee's work performance and lead to increase cases of absenteeism. Cognitive factors equally affect the job performance. For Example – Lack of proper guidance and feedback from supervisors or lack of autonomy can often cause stress and result in lack of motivation among workers to perform well.

2. Environmental conditions

Environmental Conditions in particular like proper lighting facilities, sound & vibrations, extreme temperature, humidity and poor air quality may affect the workers performance. Undesirable and unpleasant levels of a fore mentioned condition can be detrimental to workers health and safety.

3. Job Design

A job must be designed keeping in mind the anthropometric characteristics such as age, gender, height, weight and ethnic differences. Proper use of ergonomics is advised as tasks can be either static or dynamic. Static tasks need a sustained position which can cause stress and pain in the lower back, neck and shoulder areas. Whereas, dynamic tasks require continuous body movements, very fast movements can cause fatigue, pain, weakness and sometimes lead to injury if performed with excessive force. Poor job designs and lack of proper training to workers can often be cited as an underlying cause of injuries among workers.

4. **Workstation & Equipment Design and Use**

A workstation should be designed keeping in mind factors such as workable heights, placement, reach, requirements and postures. Adjustable equipments make it possible to adapt it in accordance to individual requirements. Tools and equipments must also have flexibility of usage and it should not force the workers to use an unnatural body posture or motion while using it. All equipments and workstation should work together in a well-coordinated system to ensure a smooth flow of production and safety of workers.

The following points are mostly the main sources of accidents at the workplace

- Spills

- Slippery surfaces
- Obstructions (Unclear Pathways)
- Broken equipments/tools.
- Machineries which are not regularly checked/maintained and kept unrepaired.
- Areas lacking safety signages (Fire and Emergency Exits)

Therefore, workers and employers must take collective active measures to adhere to an accident prevention plan. The following points must be considered to strengthen the safety practices at work and be prepared with response to any emergency situation –

1. Regular programmes and training sessions must be conducted on safety related practices at workplace for workers. It can be held in the form of mock drills for evacuation during fire hazards or any chemical spills, quick response training during accidents/emergencies etc.

2. Ensuring installation of proper lighting system, to have a well-lit and clear visible job site/ workstation, to avoid any potential risk associated with darkness around the workplace.

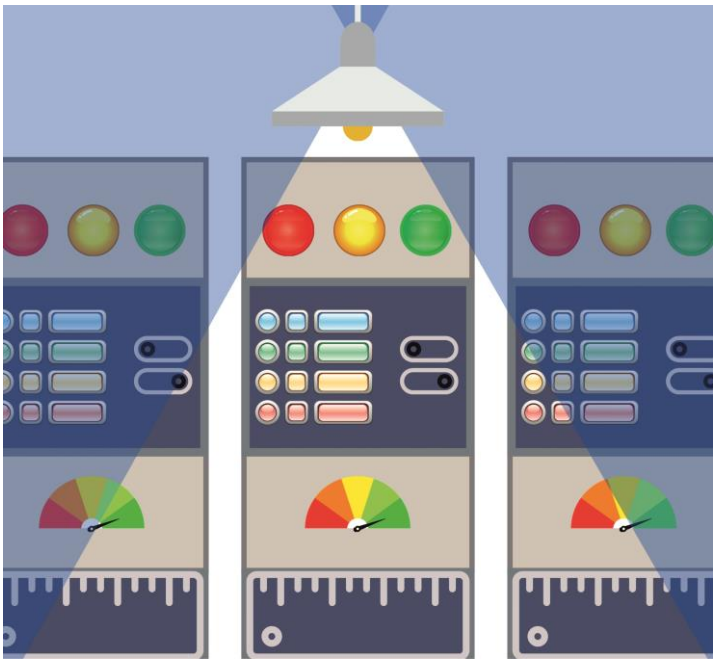


Fig.: 5.5 – Proper Lighting System

3. Clearly visible and demarcated safety signs must be placed/ installed wherever necessary, which will help in clear identification of hazardous areas and associated risk like obstacles in pathway, toxic chemicals being stored, slippery floor, emergency exit doors etc.

4. In case of a chemical or any hazardous spill, ensure to always suppress and hold the spill and always keep the cleaning equipment at an easily accessible location.

5. Ensure to conduct routine audits and checks for all potential safety hazards and emergencies to prevent any actual loss.

6. In case of an emergency/ accident, evacuate the premises and helps fellow workers in need.

7. Proper ventilation facilities must be ensured throughout the working place to avoid inhalation of any toxic chemical or foreign particles by the employees at the time of any chemical leak.

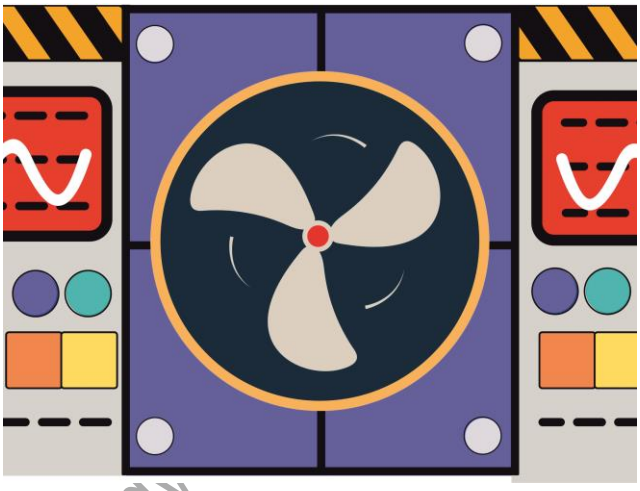


Fig.: 5.6 – Proper Ventilation System

8. Workers must be instructed to follow all the rules with regards to the attire/uniform permitted for their job role. For example- Workers working in the dyeing unit must wear slippage resistant shoes to prevent any fall or trips which can lead to injury.

9. Employees in an apparel or home furnishing industry need to spend long hours in the sitting posture which can cause soreness in back and reduced circulation in legs. Therefore, to avoid any pain or injury, adjustable chairs must be provided to ensure easily adjustable heights, seat tilt and backrest positions.

10. Chairs with a cushioned/contoured seat, which distributes the worker's weight ensuring no body part feels all the pressure must be preferred.

11. To minimise awkward body postures, chair should also be placed at an appropriate distance from the workstation, so that the workers can perform their tasks without stretching their elbows away from the body.

12. Workstation design must ensure that all the tools and materials are positioned to reduce risk of tilting too far or leading to an awkward body position. It can increase the level of stress/strain in arms, shoulders and the neck. This greatly increases the risk of injury which can be avoided by proper preventive actions and adhering to ergonomically designed principles of work.

13. Workers who need to stand for prolonged hours must be provided with anti-fatigue mats. These mats help in better circulation and reduce fatigue in lower body parts.

14. Emphasis should be given on frequent short breaks to stretch and change body positions. It allows legs, beck, neck and eyes to rest in between long working hours. Shorter breaks often reduce the risk of discomfort, fatigue and injury among the workforce.

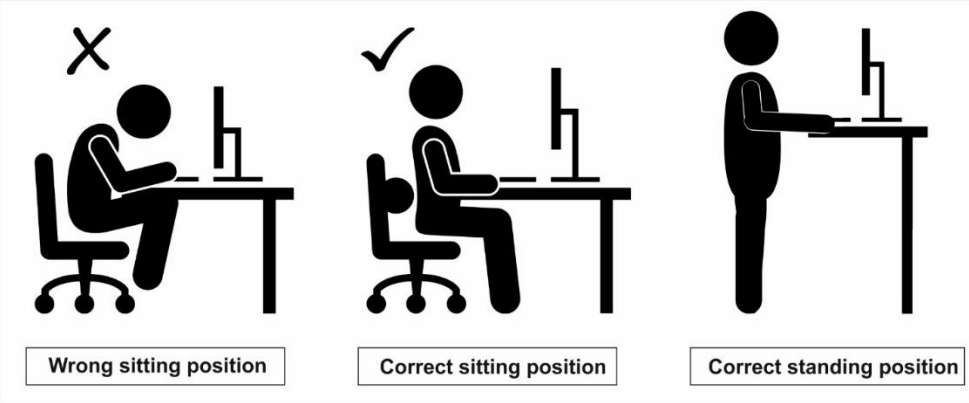


Fig.: 5.7 – Correct Body Positions

MAINTENANCE AND STORAGE OF PROTECTIVE EQUIPMENTS

An effective system of maintenance and storage of protective equipments and tools is crucial to provide the level of protection they are intended or designed for. Therefore, one must always maintain an inspection schedule for all the protective equipments and tools including its shelf life. Inspection must include thorough check against any breaks, tears or any other visible sign of damage.

Maintenance also includes cleaning, examining, repairing, testing and replacing (in case it cannot be repaired) tools and equipment on a scheduled

basis. Some Examples of Protective equipment are – Gloves, masks, protective helmet, safety shoes/boots, protective eye wear, ear plugs etc.

Adequate and proper storage facilities for storing of all protective equipments and tools when not in use is must. Employers must provide for a clean and safe place for the same. For example – Pegs for hanging clothing or safety helmets, case for safety glasses, a zip lock bags, shelves or racks for storing of ear muffs, gloves, masks etc.

The facility of storage must be appropriate and sufficient to protect the protective equipments from any kind of contamination, loss or damage due to coming in contact of water or sunlight. The place should be dry, clean and well sanitized and should also not be subjected to extreme temperatures.

It should protect the equipments against ageing and damaging. For hygiene purposes, one must consider separate storage from ordinary clothing storage in cases where protective equipments may become contaminated during use.

Duties of the workers in respect to protective equipments –

1. All the protective equipments must be worn by the workers in accordance to the work requirements and instructions provided.
2. Workers must ensure that all the protective equipments must be stored back carefully to their designated/ allocated storage areas after use.
3. All the protective equipments must be inspected before use and any defect observed must be reported to the supervisor.
4. It is the responsibility of the worker/employee to take due care of the protective equipments provided to them and do not make any modifications to the same them unless and until they are authorized and trained for its maintenance activities.

Fig.: 5.8 – Proper Storage Facility for PPEs

Activities

Activity 1

Prepare a chart with details of potential hazards and their possible solutions applicable at a workplace.

Materials Required:

1. Writing material
2. Coloured pencils/pens
3. Eraser
4. Ruler

Procedure:

1. Collect information about the potential hazards and their possible solutions applicable at a workplace.
2. Take a chart paper and prepare the chart by placing the collected information on it.
3. Display the chart in your classroom.

Check Your Progress

A. Fill in the following blanks –

1. _____ is an unforeseen and unexpected incident demanding instant/immediate response.
2. _____ to a worker can cause a negative impact on his/her work performance and lead to increase cases of absenteeism.
3. A _____should be designed keeping in mind factors such as workable heights, placement, reach, requirements and postures.
4. To minimise awkward body postures _____should also be placed at an appropriate distance from the workstation.
5. Shorter _____often reduce the risk of discomfort, fatigue and injury among the workforce.

B. State weather the following statements are True/False.

1. Tools and equipments should not have flexibility of usage and it should force the workers to use an unnatural body posture or motion.
2. Workers and employers must take collective active measures to adhere to an accident prevention plan.
3. Safety signs must not be displayed clearly.
4. Routine audits and checks for all potential safety hazards and emergencies are not necessary.
5. Workers must be instructed to follow all the rules in regard to the attire/uniform permitted for their job role.
6. Emphasis should be given on frequent short breaks to stretch and change body positions.
7. The facility of storage for protective equipments must be appropriate and sufficient to protect the protective equipments from any kind of contamination, loss or damage.
8. Workers must not ensure that all the protective equipments must be stored back carefully to their designated/ allocated storage areas after use.

Session: 3 Identifying and Reporting Malfunctions in Machinery and Equipment or any other Hazard at Workplace

Identification of malfunction in machinery/equipment or any other hazard at a workplace is an indispensable component of the health and safety management system. It is the first step in development of the safety procedures for prevention and controlling of any hazard.

A hazard is a source of any potential damage.

Identification of hazards includes the following:

- Identifying both existing and prospective workplace hazard
- Assessing or calculating the risks involved
- Determining and implementing the control measures
- Reviewing the situation

Workers must be trained to identify all the possible hazards associated with their job role and also know the control measures during an emergency situation to prevent any injury to people, property or environment from the same.

Workers must follow all the safety practices which comply with the standard operating procedures. They must regularly check/inspect the workplace, equipments, machines, tools for any abnormal changes, conditions or unanticipated emissions/leaks for identification of any perilous conditions. In case of an unsafe condition they must report them to their supervisor or authorized personnel and collectively work towards resolving the same.

Workers are exposed to various potential hazards while working near or on a machine. There is a risk of injury caused due to entanglement, friction or abrasion, cutting, stabbing or getting trapped in the moving parts of the machines. Therefore, it is suggested that workers must follow guidelines related to dress code/uniform/using protective equipments and safe working practices applicable while working near or on a machine.

Risk is also associated with noise, vibrations and radiations generated by the machines. Levels of the aforementioned must be monitored to prevent any health issues among workers. Workers must be also able to identify and report any sparks or loose fitting which can cause fire accidents or electric shocks, over speeding or under speeding of parts of machines etc.

The following points must be checked for identification of possible hazards linked with machines, equipments, tools and services –

1. Identify use of the machine by considering the following points-
   - Cycle time & rate of production.
   - Intended use of the machine.
   - Different types of materials being used on it.
   - Amount of force being generated.
   - Range of motion or moving parts of the machine.
   -

2. Identification of space required by the machine for safe operation of **all** tasks including access for maintenance and repairs.

3. Identifying the environmental limits of the machine such as the operating temperatures, humidity levels, and noise generation level.

4. Consideration of all the tasks performed by and on the machine such as – trial runs including
   - Regular operations
   - Change of tools
   - Scheduled maintenance of machine
   - Recovery from crashes/timeouts.

5. Identification of operation/ motions of machine such as –
   - Parts of the machine which are movable.
   - Range of motion of moving parts.
   - Type of motion (e.g., rotation, shearing, bending, cutting, punching)

6. Identify the entanglement hazards of the machine that can be caused due to coming in contact with rotating or moving parts of the machine.

7. Identify hazards due to cutting, where a worker can come in contact with cutting tools, saws, routers, knives, or any other sharp material.

8. Identify any potential hazard due to slips or fall in and around the machine due to the spills on the floor surface such as lubricating oils, grease, water etc.

9. Identifying any ergonomic issues caused while operating the machine. Ensure the following -

- Workers do not have to reach exclusively.
- Workers do not have to use excessive force.
- Workers do not have to perform movements at a very high speed.
- Machine cycle must be planned in accordance with the workers capacity
- Workers can perform work in multiple positions that promote a neutral body position.
- Work surface is adjustable according to the workers requirements.
- Worker has enough room space to move without striking anything.

10. Identify all the work that a worker must perform while operating the machine such as -

- Feeding stock into the machine
- Removal of final products from the machine
- Removal of scrap
- Scheduled and regular cleaning parts of the machine.
- Pre and Post shift safety checks.

Therefore, it is advisable to identify, report and correct any prospective risk which can lead to a hazard at a workplace, thereby ensuring prevention and control of any injury or loss.

SAFETY SIGNS AT WORK PLACE AND THEIR MEANING

1. First aid:

It is an emergency treatment given to a sick or injured person. The main aim of first aid is to preserve life, prevent from further harm or injury and to start the recovery process. A first aid kit is used in giving the first aid. The sign of first aid which is mostly used is as follows –

Fig.: 5.9 – First Aid Sign

2. Fire exit:

This sign marks the way to nearest exit point during a fire accident.

Fig.: 5.10 – Fire Exit Sign

3. Assembly points:

This signage marks the area where the workers need to assemble in case of any hazard or emergency.

Fig.: 5.11 – Emergency Assembly Sign

4. Fire equipment:

This sign marks the location of storage area of firefighting equipments such as fire extinguisher, fire blankets etc.

Fig.: 5.12 – Fire Equipment Sign

5. Smoking ban signs:

This signs mark areas/location where smoking is not allowed/prohibited.

Fig.: 5.13 – Smoking Prohibited Sign

6. Machinery Hazards:

These signs mark the areas near the machinery where one needs to be cautious of his/her movements and actions for safety purposes.

Fig.: 5.14 – Machinery Hazards Sign

7. Hazardous substance:

This sign marks the areas where any hazardous or toxic substance is stored.

Fig.: 5.15 - Hazardous Substance Sign

8. Pedestrian access and no access:

These signs indicate where pedestrians can and cannot access respectively.

Fig.: 5.16 – No Pedestrians access Sign

9. Flammable substance:

This signs denotes the location of any extremely flammable substance being stored there.

Fig.: 5.17 - Flammable substance Sign

10. Wet floor :

This sign marks the areas with wet/ slippery floor to be cautious while crossing it.

Fig.: 5.18 - Wet Floor Sign

Activities

ACTIVITY 1

Prepare a report with pictures and details of all the safety signs applicable at workplace.

Materials Required:

1. Writing material
2. Pictures of safety signs
3. Coloured pencils/pens
4. Ruler
5. Adhesive

Procedure:

1. Collect pictures and information about all the safety signs applicable at workplace.
2. Prepare a report with all the details.
3. Submit the same in your class.

Check Your Progress

A. Fill in the Blanks :

1. A _____is a source of any potential damage.
2. _____ of hazard is the first step in development of the safety procedures for prevention and controlling of any hazard.
3. _____ hazards of the machine can arise due to coming in contact with rotating or moving parts of the machine.

4. _____ is an emergency treatment given to a sick or injured person.
5. _____ signage marks the area where the workers need to assemble in case of any hazard or emergency.

B. Write short answers for the following –

1. Mention points to be considered for identification of possible hazards in a workplace. (Any Five)

2. Identify and name the following safety signs –

-  .....
-  .....
-  .....
-  .....

Session : 4 Reporting Emergency Situations

Identifying and reporting all hazards/emergency situations is of vital importance for the safety and security of the workplace. All such unsafe incidents must be immediately and directly reported to a supervisor or any other concerned authority. All the workers must be trained so that in case of any hazard or potential emergency situation, the standard procedure could be followed like reporting it to the supervisors expeditiously.

Employers must develop and set up a hazard reporting system for the workers. Implementation of such a system will make the workplace a safer and secure place to perform and work well.

All the workers must be trained in hazard identification and its control measures. They must be trained on the following points –

- Identification of an unsafe condition – This involves recognising any incident that might cause harm or damage to the people, machinery, tools or property. For example - Containers that are not labelled properly, insufficient stairway lighting, broken machine guards etc.

- Identification of an unsafe act that must be reported – This involves any inappropriate behaviour that could lead to an accident/cause an injury or any other damage. For Example – Worker using equipments in a careless manner or not using PPE while running a machine.

- Procedure followed if any unsafe condition is witnessed - Any such unsafe situation should be immediately reported to the supervisor. It can be in a form of a verbal complain, a hard copy of a form to be filled or an online complain system on the website of the company.

- Follow up action post reporting the incident – Workers must expect that the corrective and preventive measures will be taken within the expected time frame. In case of any delay, they must report it again till any necessary action is taken for the same.

Taking necessary preventive actions can save from potential injuries or any significant losses caused due to sheer negligence. Reporting of hazards ensures that employees are involved in the safety management system of the company and are aware of the safety guidelines followed in the company.

For making the reporting by the workers smooth and easy, the following points can be considered –

1. Making reporting procedures easy and possible.

2. Ensure that there is no negative impact or punishment linked with the process of reporting an emergency.

3. Workers who report the hazards or any unsafe incident should be rewarded or recognised for the same.

4. Posters or signs to encourage reporting of any unsafe practices at work can be placed within the work premises.

REPORTING PROTOCOL AND REQUIRED DOCUMENTATION

In case of any hazardous condition, all workers are responsible for reporting it to their supervisors. Supervisor is responsible to take corrective steps and in case of serious conditions, must fill the hazard reporting form along with the assistance of the worker. The following steps must be followed –

- Workers who identifies an emergency condition/concern must report to his supervisor immediately.

- The supervisor must respond promptly, take necessary actions to resolve the matter within the reasonable time limits.

- If the supervisor is not able to solve the situation, then he/she must report the matter to the manager or to concerned senior authority.

- The employee is responsible to draft a document/fill the form (Depending on the rules of the company) outlining the concerns and fact.

- The senior committee members will investigate the matter and ensure correction of the unsafe conditions.

The process of reporting the hazard immediately allows the workers to report the unsafe conditions immediately. This process allows a fast response and prevent further damage. Hazards can be reported verbally or by filling a form, generally called as a hazard reporting form.

Hazard reporting form is a document which is used to report an unsafe incident/ accident at the workplace and ensures that it has been reported formally and necessary corrective steps have been taken. It is used by the first line workers – such as factory workers.

Hazards Reporting Form

Use this form to report safety concerns

Employee Name		Employee Number
Department / Area		Supervisor Name
Describe Fully the safety concern or hazard:		
What can be done to make this situation Safe?		
YES		
YES	NO	Has the supervisor in that area been notified of the safety concern or hazards?
YES	NO	Has the maintenance team been notified of the safety concern or hazards?
Employee Signature		Report Date:

Fig.:: 5.19 – Hazard Reporting Form

EMERGENCY RESPONSES DURING A HAZARD/EMEGENCY

Any kind of hazard or emergency can occur anywhere and at anytime. To prevent the amount of loss and damage caused due to such unwanted incidents, employers need to provide relevant training to their employees to be adequately prepared to deal with any undesirable circumstances.

Emergency response training can be very advantageous for the employees to acquire knowledge on how to respond to an emergency situation. Employees must learn life-saving skills and acquire knowledge to save themselves and co-workers during the course of any emergency.

It is advisable to designate roles and responsibilities to every employee in the form of tasks they must perform during an emergency and train them to be specialised to fulfil the requirements of specific roles, For example – specific employee may be trained to perform first aid in the

event of any injury or specific group of employees must be trained to handle fire-fighting equipments in case of fire.

Details about the following equipments, people and locations must be displayed clearly at every workstation for reference for use during any emergency situations –

Location of emergency equipments -

- Fire alarm
- Fire extinguisher
- Fire hose
- First Aid
- Panic alarm
- Personal Protective Equipments

Emergency contact numbers -

- Fire station and employee trained in fix hazard handling
- Ambulance and first aid attendant
- Police
- Hospital

EMERGENCY RESPONSE PLAN

An emergency action plan involves allocating designated actions that all the employees need to take for their safety during an emergency situation. Some of the suggested actions to be taken in case of an emergency like a fire or chemical hazard, injury etc. are as follows –

- In case of a fire accident or a chemical spill, one must try to move quickly towards the nearest accessible exit door.
- Walk, do not run during an emergency and do not use elevators.
- Help other co-workers to evacuate along the way to exit.
- In case of fire, if the fire alarm does not ring automatically, try activating the alarm manually for notification of all other employees.
- Exit the building/factory premises and assemble in the allocated area of assembling during an emergency.
- If any person gets caught in fire then try to extinguish their burning clothes by using the drop and roll technique, dousing with some cold water and using an emergency shower or using a fire blanket.

- If caught in the area filled with smoke, then try and stay in lower positions as smoke will rise to ceiling level first. Drop down to your hands and knees and crawl toward the nearest accessible exit point.

Fig.: 5.20 – Emergency Response plan

- In case of any toxic spill or leak, alert all workers in the immediate area of spill.
- Wear your required personal protective equipments (PPE) like gloves, protective eye wear etc.
- In case of a minor spill try to contain the spill with spill absorbent material and clean the area where the spill occurred.
- Try to seek immediate medical help in case of any exposure to the spill contents.
- In case of a chemical exposure to the skin or eyes, try to immediately clean it with cool water for at least 15 minutes.
- Do not attempt to move or reposition a victim in case of a muscle, joint or bone injury, sprain or fracture as it can further deteriorate/worsen the condition.
- If there is any open wound injury or bleeding wound, then try to cover the wound with dressing/first aid at the earliest.

Activities

Activity 1

Prepare a sample report of an emergency situation at the workplace.

Materials Required:

1. Writing material
2. Ruler

Procedure:

1. Study an emergency situation at a workplace.
2. Prepare a sample report of the emergency situation.
3. Submit the same in your class.

Check Your Progress

A. Fill in the Blanks:

1. All unsafe incidents must be immediately and directly reported to a _____.
2. _____training can be very advantageous for the employees to acquire knowledge on how to respond to an emergency situation.
3. An _____action plan involves allocating designated actions that all the employees need to take for their safety during an emergency situation.
4. In case of a fire accident or a chemical spill, one must try to move quickly towards the nearest accessible_____.

B. Write short answers for the following –

1. Describe briefly about how the workers must be trained in hazard identification and its control.
2. Mention suggested actions to be taken in case of an emergency. (Any Five)

Module 6 Industry and Organisational Requirements

Module Overview

The Indian garment industry is well established and recognized worldwide and also enjoys a considerable demand from both domestic as well as global market. The growth of manufacturers and suppliers from developing countries like India, China, Pakistan, Bangladesh and others, and zeal to compete and offer products at competitive prices, the manufacturers have compromised with working conditions, safety and rights of workers. The recognition to Labour Standards and worker's rights, most of the international apparel buyers started focusing and pressurizing manufacturers to comply with the Labour Standards and Worker's rights. This resulted in increased awareness and compliance to code of conduct policies among Indian garment factories.

Indian apparel manufacturers and suppliers are not only bound to follow government guidelines but they also must comply with Social Compliance Standards and Code of Ethics. Such compliance is mandatory not only for the manufacturers but also for their vendors, distributors and other collaborators involved in the supply chain.

Learning Outcomes
After completing this module, you will be able to: • Define Standard organisational compliance and related documents • Explain Customer specific regulations and requirements • Describe Ethical compliance and related documents • Explain Documentation and reporting of compliance deviation

Module Structure	
Session:1	Standard organisational compliance and related documents
Session:2	Customer specific regulations and requirements
Session:3	Ethical compliance and related documents
Session:4	Documentation and reporting of compliance deviation

Session: 1 Standard Organisational Compliance and Related Documents

WHAT IS ORGANISATIONAL COMPLIANCE?

Compliance means conforming to a rule. Compliance helps in better organisational control as it is a set of processes to ensure that the organisation as a whole abide by these set of regulations.

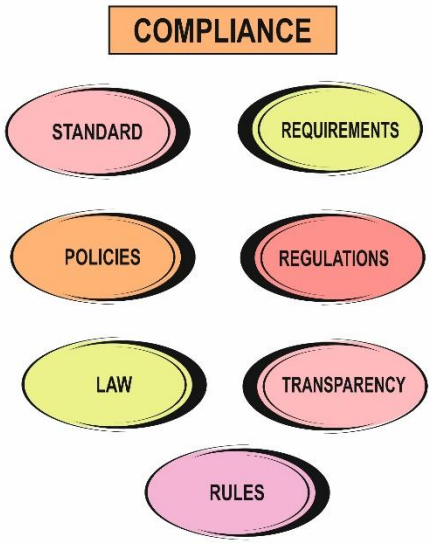


Fig.: 6.1 – Organizational Compliance

SIGNIFICANCE OF COMPLIANCE IN INDIAN GARMENT INDUSTRY

Compliance with respect to the garment industry must meet the audit requirements and refers to the following:

1. Quality of products
2. Safe and comfortable working environment

Apart from quality of products, International buyers are also demanding ethical manufacturing of products, which leads to the compliance of standards by garment manufacturers. The rise in export of garment products increases the demand for social compliance has also increased in the Indian Garment Industry.

Social Compliance

Social compliance refers to compliance in respect to social responsibility, ethical treatment of employees and the working environment. A code of

conduct is followed regarding employee wages, working hours and work conditions. In order to keep a check on compliance by manufacturing unit, regarding various environmental standards, a compliance audit is conducted regularly. Some of the common requirements of social compliance are as follows-

i. **Child Labour-**Organisations must ensure no child under the age of 15 is employed.

ii. **Forced Labour-** No person should be employed under any threat and if they have not offered their services voluntarily.

iii. **Discrimination-** An organisation must not discriminate among its employees on factors like remuneration, promotion, training facilities etc.

iv. **Working hours-** An organisation must comply with government rules and industry standards on working hours, break timings, public holidays etc.

v. **Disciplinary Practices-** An organisation must not use any mental or physical abuse against the employees in the name of punishment.

Fig.: 6.2 – Social Compliance

INTRODUCTION TO AUDIT

Audit means to officially inspect, check or examine. Thus audit in organisational terms means check or inspection of various departments, resources and finances of an organisation. Audit is conducted regularly to ensure that no fraud or scam is caused by the organisation.

Audits and assessments ensure safety management, Security Management, and Risk Management. Aim of Auditing is to adhere to the prescribed policies and procedures and to verify compliance with regulatory requirements and industry standards. It helps to ensure that all programs are properly designed and implemented. Further, audits also helps in identifying programme deficiencies so that recommendations can be developed for corrective action.

Audit in Garment Industry:

Audit can be done by:

1. Internal Auditor - Employees or heads of a particular department
2. External Auditor - An outside firm or an independent auditor.

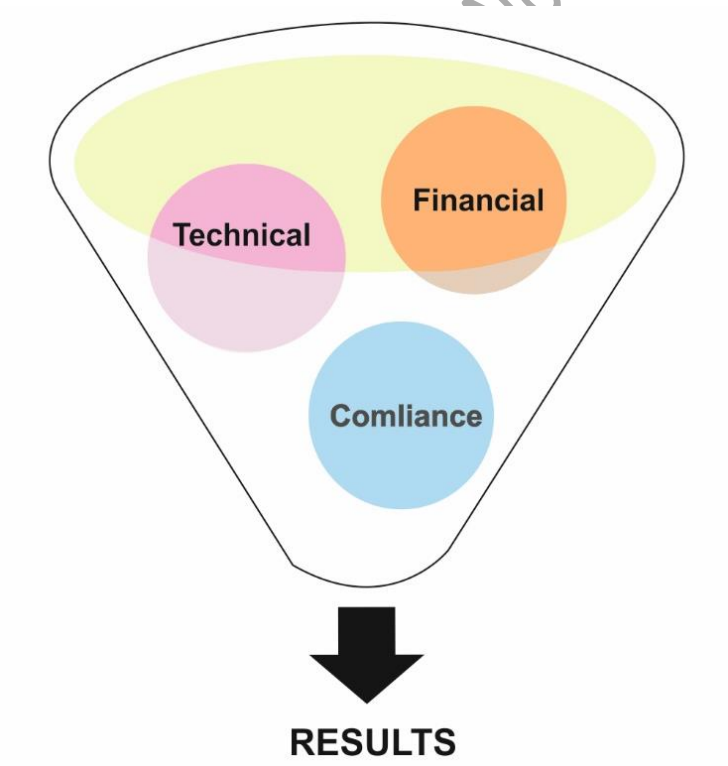


Fig.: 6.3 – Types of Audit

Compliance Audit

A basic Compliance audit may require the auditor to examine the rules, regulations, orders and instructions for their legality, adequacy,

transparency and prudence. Auditors gather information through visual observation at the site, review of document and interviewing staff. This collected data is then compared with the applicable permits and regulations to evaluate the compliance to the applicable legal requirements.

Following information may be collected and reviewed by an auditor during compliance audit-

1. Licenses, permits and facility information
2. Child labour
3. Forced labour and discrimination
4. Freedom of association and collective bargaining
5. Right of worker
6. Disciplinary practice
7. Working hours
8. Wages, benefits & compensation
9. Workplace safety
10. Occupational health & welfare
11. Environment management
12. Management practice & sub-contractor /supplier control
13. Training records
14. Company policies

Technical Audit

Technical Audit (TA) is a very crucial task for garment manufacturing unit. Every buyer conducts a technical audit before confirming an order to any garment factory. Many garment buyers have their own technical audit checklist, which may vary from buyer to buyer. Audit must be conducted in a routine manner at different stages of garment manufacturing. Through Technical Audit, auditors check the ability of a manufacturing unit to make export quality garments as per order and specifications. The initial step of a Technical Audit is to check the plant outline and its suitability to complete the order. The objective is to pick the right manufacturing unit for the order.

Following information is collected by an Auditor during Technical Audit-

- General Information about the Plant like number of staff members, production facility, location etc.
- Production capacity
- Versatility in product manufacturing

- Quality control of raw Materials
- In-house quality system
- Production planning &executions
- Process control
- Availability of in-house testing facility
- Availability of in-house design team
- Housekeeping and maintenance of instruments
- Quality assurance process
- Lighting, fire safety etc.

Financial Audit

Financial audit is an examination or inspection of accounts books by an auditor. It is then compared with physical checking of inventory to make sure that proper documentation is being followed. The objective is to confirm the accuracy of financial statements prepared by the organisation. All the public listed firms are required to get their financial accounts audited by an independent auditor, before the results for any quarter is declared.

The idea behind financial audit is to check and verify the accounts by an independent authority to ensure that all books of accounts are maintained in a fair manner and there is no misrepresentation or fraud being conducted.

In India, independent financial audit for any organisation is conducted by chartered accountants licensed by The Institute of Chartered Accountants of India (ICAI).

Steps in auditing process:

Following are the four main steps in the auditing process:

1. **Defining the auditor's role and the terms of engagement**. It could be in the form of a work / authorization letter which is duly signed by the buyer.
2. **Planning the audit**. It includes detailed planning of deadlines and the departments the auditor would cover. Duration of audit may vary depending upon nature and area of work.
3. **Compilation of the information collected from the audit.** When an auditor audits the department, findings are usually put out in a report or compiled in a systematic manner.
4. **Reporting the result**. The results are documented in the auditor's report.

Phases of Audit:

There are three main phases of compliance audit in India:

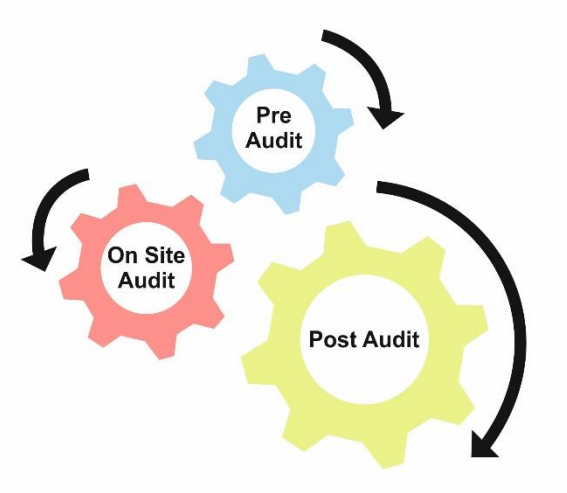


Fig.: 6.4 – Phases of Audit

i. Pre-Audit Phase

- Planning and organising the audit
- Establishing the audit objectives
- Scope and etiquette
- Reviewing the design of the programme by inspecting documentation.

ii. On-site Audit Phase

- Conducting personal interviews
- Reviewing records
- Making observations to assess programme implementation.

iii. Post-audit Phase

- Briefing the management about audit findings
- Preparation of Final report.

CORE LABOUR STANDARDS

International labour organisation has set rules for core labour standards, to protect the rights of workers and to ensure that worker get good working conditions.

Rules are set of four fundamental and universal Human Rights, as conceived by International Labour Organisation:

i. Freedom from forced labour

ii. Freedom from child labour

iii. Freedom from discrimination at work

iv. Freedom of association and right to bargain collectively.

In most countries, all the export-import trade agreements require both the seller and buyer to meet the International labour Standards specially on the issues linked with Child labour and rights of workers.

These are the minimum 'enabling rights' which workers need to defend in order to improve their working conditions, to work in freedom and dignity.

The aim behind this concept is to make sure that the apparel industries have labour contractors which don't engage forced or child labourand get the supply chain of the suppliers audited.

Apparel Export Promotion Council (AEPC), which is an apex body of Indian apparel exporters, has designed a garment factory compliance program called 'Disha' (Driving Industry towards Sustainable Human Capital Advancement), with an aim to make India a global benchmark for social compliance in apparel manufacturing and export business. This Common Compliance Code project will prepare the Indian apparel manufacturers and exporters on a common platform towards a more social and environmentally compliant industrial environment.

Common Compliance Code

The common compliance code gives opportunity for the industry to negate international claims against child labour promotion in the garment industry. It also helps to improve the image of the industry and win more international businesses.

Some of the common compliance code guidelines for Indian Garment industry are:

- Employers must not be involved in unfair labour practices including child labour and forced labour.
- There should be no discrimination among workers' remuneration for work of equal value on the basis of gender, race, religion, age, disability, sexual orientation, nationality, political opinion, or social or ethnic origin.
- Employers should not threaten female workers with dismissal or any other employment decision that may affects their employment status negatively, in order to prevent them from getting married or becoming pregnant.
- Employers should ensure that proper air ventilation systems are installed within their factory premises to prevent airborne diseases among workers.

- If workers wish to form organisations or participate in union activities, including strikes, employer shall not restrict the workers in doing so by use any form of physical or psychological violence, threats, harassment, or abuse.
- Workers should be entitled to at a day rest in a week. If workers are required to work on a rest day, an alternative rest day must be provided in next week.
- Workers should be provided with paid annual leaves as per local laws, regulations and procedures. Employer shall not impose any undue restrictions on workers' use of annual leave or sick leave or maternity leave.
- Workers should be paid at least the legal minimum wage or the prevailing industry wage, whichever is higher.
- Employers should compensate workers for the hours they have worked. Workers engaged on a per piece rate payment scheme or any other incentive scheme, must be paid accordingly.
- There should not be any sort of unreasonable restrain in the freedom of movement of workers, including movement in canteen during breaks, using toilets, accessing water, or to access necessary medical attention.
- Garment exporters or manufacturer must ensure that none of their workers is less than 14 years of age, as per the guidelines for non-hazardous employment. Child labour is the most important concern in Indian Industries nowadays. Further, each worker shall have the right to enter into and to terminate their employment freely.

  Indian apparel manufacturers must follow all the compliance related guidelines to comply with global standards. Compliance to such codes or guidelines also helps the industries to boost their image or to project a positive image and protect their goodwill in the market. The Indian garment industry must stress on strong compliance rather than competition of manufacturing cheaper garments.

INTERNATIONAL LABOUR STANDARDS

International labour standard is a set of legal standards and guidelines which set up basic principles and worker's rights at workplace. These standards aim at improving working conditions on a global scale.

Functions of International Labour Standards:

i. To prevent disruptive competition through the defence of particular workers group and setting minimum wage and working conditions.

ii. To promote constructive competition through definite rights, for e.g. workers involvement in decision-making, improvements in productivity and motivation of workers, increasing aggregate demand and promoting the creation of jobs, active labour market policies and ways of adjusting socially desirable measures.

Corporate Social Responsibility

What is Social Responsibility?

Social responsibility is "an organisation's obligation to increase its positive impact and reduce its negative impact on the society". It can also be known as "the concept that business entities should also be concerned with the welfare of the society at large".

The social responsibility of an organisation is referred to as 'Corporate Social Responsibility'.

Corporate social responsibility (CSR)essentially means that the organisation should work in an ethical manner and it should also be in the best interest of the various stakeholders. Nowadays, this concept of Corporate Social Responsibility in Indian garment industry is gaining great popularity. More and more organisations are trying to work in a way to protect the interests of the society at large along with the interest of its stakeholders including employees, customers and the suppliers.

Social Responsibility can be divided into two types:

a. Human responsibility refers to the responsibilities of the organisation towards the various 'stakeholders' in business parlance, including employees, shareholders, the government, customers, investors, suppliers, competitors and the society at large.

b. Environmental responsibility refers to the responsibilities of the organisation towards environment protection.

The scope of social responsibility extends beyond the legal responsibilities of an organisation. It has to be voluntarily fulfilled by the organisation; however there also are legal obligations.

Social Responsibility in the Garment Industry

The garment and textile industry is one of the largest industries in the world. It is also the biggest employer in India after agriculture. Globalization has made clothing affordable for all and competitive low prices. However, it has major negative impact on environment and society throughout the product life cycle. Production of textiles and garments requires consumption of vast energy. A considerable amount of wastes including sewage and discarded clothing is also generated which leads to the burden on the environment. Moreover, poor labour standards and poor working cum living conditions are additional outcomes of the ready-made Garment industry. Poor labour standards may include low wages, long working hours, hazardous work environment, workplace abuse and being excluded from unions.

Buyer companies in developed countries prefer outsourcing the production from overseas suppliers especially from countries where labour cost is considerably low, in order to keep the costing at the lower side as much as possible and also to avoid the ill effects of production and industrialization. Working conditions of labour and their human rights are a matter of great concern in developing countries such as in India, China, Bangladesh, Pakistan and other Asian countries. This poor condition leads to many tragedies like factory fire and labour abuse that again results in poor life for workers and even death.

Textiles and garment firms are realising their responsibilities towards its stakeholders, environment and society. The ways in which a textile firm can fulfil its responsibility towards various stakeholders are similar to those of firms in other industries, as is evident from the suggestive points mentioned below:

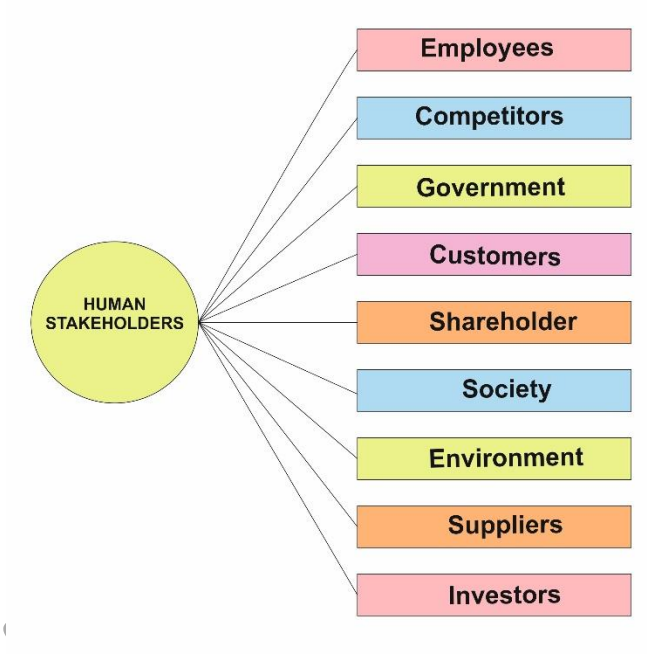


Fig.: 6.5 – Stakeholders in Garment Industry

1.Towards employees:

- By having ethical recruitment, remuneration, promotion and other policies.
- By providing opportunities to the employees to voice their opinion and complaints and have an effective policy for the solution of these complaints.
- Ensuring a safe working environment for the employees.
- Having fair policies for the solution of employee disputes.

2. Towards shareholders:

- By representing a fair picture of the company's financial position and profit/loss to the shareholders.

- By rewarding them with a fair rate of dividend.

3.Towards the government:

- By providing the necessary information to the government as and when required.
- By paying taxes and dues timely.
- By abiding by the laws and regulations of the area in which the firm operates.
- Contributing to the economy through exports.

4.Towards customers:

- By providing quality products to the customers at reasonable prices.
- By undertaking constant research and development and coming up with innovative and more useful products from time.

5. Towards investors:

- By giving the investors a true and fair picture of the financial condition of the business.
- By ensuring a fair ROI (Return on Investment)

6. Towards suppliers:

- By ensuring timely and fair payment to the suppliers.
- By maintaining a good relationship with the suppliers.

7. Towards competitors:

- By indulging in fair and ethical practices, thereby raising the spirit of fair competition

8. Towards society:

- By involvement in activities that ensure development of area and society at large.
- By having a philanthropy arm to take care of the needs of the under-privileged.
- By creating job opportunities.

9. **Towards environment:**

- By ensuring the purchase of environment-friendly supplies. By ensuring a pollution-free process of production. By establishing a system of efficient disposal.
- By adopting practices which make the production and product eco-friendly.
- By adopting eco-friendly packaging.

Activities

Activity 1

Make a PowerPoint presentation on CSR activities of a Firm.

Materials Required:

1. Writing material
2. Computer / laptop for PPT

Procedure:

1. Make a group of 4 students each.
3. Select a garment manufacturing firm
4. Enquire about its CSR activities through published literature or internet. (Volunteer in CSR activities if opportunity available)
5. Prepare a presentation document (preferably a PPT)
6. Present the presentation to the class.

Check Your Progress

A. Fill in the Blanks:

1. _____is conducted regularly to ensure that no fraud or scam is caused by the organisation
2. A _____ audit may require the auditor to examine the rules, regulations, orders and instructions for their legality, adequacy, transparency and prudence.
3. Compliance audit, Technical audit and _____ audit are three types of audits.
4. Pre-Audit, _____ audit and Post-audit are three phases of audit.

B. Write short answers for the following:

1. What are the three phases of audit? Explain.
2. What do you mean by audit? Explain its importance.
3. What is the significance of compliance in Garment Industry?

C. Write long answers for the following:

1. Explain types of audit.
2. Explain Corporate Social Responsibility.
3. Explain Core Labour Standards.

Session: 2 Customer Specific Regulations and Requirements

Customer specific regulations and requirements are the requirements developed by the customer with the expectations that the supplier will identify, implement and audit these requirements.

These requirements fall into following categories:

i. Material specific requirement
ii. Delivery requirements
iii. General requirements
iv. Process requirements (ex: calendaring)

Customers specific requirement cannot be ignored and seek to expand the standard or define how a customer wants a portion of the standard to be met.

Country specific regulations for sector and their importance:

There are several country based regulations and requirements which a manufacturer / supplier needs to comply with. Some of these regulations could be mandatory while the rest could be voluntary / suggestive which the companies are expected to follow. Compliance to all the regulations might give a company some competitive edge over others. There could be certain requirements specific for a market or specific to a product category.

1. MANDATORY REGULATIONS

There are several mandatory requirements that manufacturers and exporters need to comply with. This includes legal requirements concerning product safety, use of chemicals, product quality and labelling. Additionally, many buyers have created their own non-negotiable terms and conditions which all their suppliers are bound to follow. These requirements could be non-legal, but still mandatory. Following are the few textiles and apparel related mandatory regulations / guidelines followed worldwide:

i. REACH

REACH stands for Registration, Evaluation, Authorization and Restriction of Chemicals and applies to all products including textile and apparels to be exported to European Union.

Hundreds of chemicals are used at different stages of textile and apparel manufacturing. Some of these chemicals could be harmful to the user. Hence, it is essential to follow REACH regulations to avoid the possible harm to the user of the product. This restriction is imposed over a wide range of chemicals used in textile and leather and such restrictions could limit the use of these chemicals completely or partially as measured by weight.

A list of some of the important chemicals banned for textile and apparel sector is as follows:

a. **Azo dyes and its aromatic amines**–

   Currently, around 60%-70% of dyes used for industrial purposes belong to the family of azo dyes due to its economic efficiency and usability. They are widely used in the textile industry to give vibrant colors to almost all materials including cotton, silk, wool, leather and other fibers. Overexposure to azo dyes can cause diseases like bladder cancers, liver cancers, and hematuria.

   India has published legislation prohibiting the handling of a total of 112 azo and benzidine based dyes. In 1993, the Government of India prohibited the handling of 42 benzidine-based dyes. The Ministry of Environment and Forests further prohibited the handling of an additional 70 azo dyes in 1997.

   According to the Indian import policy, import of textiles and textile articles is permitted subject to the condition that they do not contain any of the hazardous dyes (azo dyes) whose handling, production, carriage or use is prohibited in India under the provisions of the Environment (Protection) Act, 1986.

b. **Tris (2,3-dibromopropyl) phosphate, tris (aziridinyl) phosphinoxide, and polybrominated biphenyls (PBB)** – Used as waterproofing and stain-repelling chemicals.

c. **Perfluoro octane sulfonic acid and its derivatives (PFOS)** – Used as biocide and preservatives

d. **Dioctyl tin (DOT) compounds, tributyltin (TBT) compounds, and pentachlorophenol (PCP)** – Used in metal trims and accessories (zippers, buttons, jewellery)

e. **Polycyclic-aromatic hydrocarbons (PAHs), and phthalates** – Used in leather products

f. **Persistent Organic Pollutants (POPs)** - used to make waterproof Textile material or flame-retardant fabric, and for leather finishing.

iii. ORR Chem stands for Chemical Risk Reduction Ordinance and is a regulation from Switzerland regarding use of chemicals. ORR Chem totally bans certain chemicals while allow them only for certain applications when no other substitute is available. The idea is to minimize the risk and possible harm from chemicals by limiting their use.

Similarly, Austria, Denmark, Finland, Norway, Germany and the Netherlands also have specific regulations for the use of some chemicals like Formaldehyde and PCP.

iv. Stockholm Convention is a global regulation to protect human health and the environment from chemicals that remain intact in the environment for longer periods, become widely distributed geographically, accumulate in the fatty tissue of humans and animals, and have harmful impacts on human health and the environment.

iv. Product Safety Regulations

It is buyer's responsibility to provide design of the product which is legally safe for consumers to use. However if a manufacturer / exporter is not sure about the safety of the product, he must discuss this with the buyer or check with the safety guidelines of the importer country. Before manufacturing a product for export, an exporter may always ask its suppliers for fabric, trims and accessories if they have exported their material before or are familiar with the legal safety requirements of apparel export.

a. Children's clothing regulations

Generally such regulations are formulated for children below 14 years of age. The idea is to avoid fatal incidents, strangulation and choking hazards. A few regulations have been developed by various countries as listed below:

- The European Union has a Specific Standard for the Safety of Children's Wear including bathrobes, pyjamas, nightshirts, etc. It does not apply to baby's nightwear. This standard does not require additional labelling on the product. General product safety directive of European Union restricts the presence of certain heavy material in packaging of children's clothing, including lead, mercury, chromium, and others.

  EN 14682 – Cords and drawstrings on children's clothing, **EN 14878 Textiles** – Burning behaviour of children's nightwear – Specification and **ASTM F1816-97** – Standard Safety Specification for Drawstrings.

- Similarly, UK has The Nightwear (Safety) Regulations 1985, for children's clothing. The United Kingdom's **BS 4578 Standard** devises test methods for hardness and air permeability for infants' pillows.

- The Washington Children's Safe Products Act (CSPA) requires manufacturers or importers of children's products to report to the Department of Ecology of Washington, before placing in the market products that contain chemicals that are included on the "List of Chemicals of High Concern to Children".

- Similarly, State of Vermont Act 188 also stipulates that manufacturers or importers of children's products should report to the Health Department when these products contain chemical.
- substances recorded in the "**List of Chemicals of High Concern to Children".**

b. Flammability or Fire Safety Standards

Countries like UK, Ireland, Netherland and Switzerland have specific legal requirements regarding apparel flammability. Flame retarding chemicals are used to avoid fabric flammability but this again is restricted under REACH, Hence a manufacturer / exporter has to check both REACH and Flammability guidelines for textile and apparel products.

There are national standards concerning the flammability of textile and apparel products in several countries. For ex: Standard for protective clothing, standard for protective gloves for firefighters, fire safety standard for bedding, standard for protective clothing with limited flame spread properties etc.

c. Standard for Personal Protective Equipment

CE stands for "European Conformity" and is an administrative marking which indicates conformity with health, safety and environmental protection. While exporting Personal Protective Equipment (PPE) to European Union, exporter is required to comply with the specific safety standards for the design, manufacturing, material use, testing and user instructions concerning PPE. The exporter is required to affix CE marking to indicate that the product is in line with the PPE safety requirements. CE marking is required only if one or more of the 25 CE marking directives cover the products being exported.

d. Biocide related regulations

If biocides are added to textiles to protect it from pests or bacteria, it must comply with the Biocidal Product Regulation (BPR) as well as REACH.

v. Labelling Requirements

With an aim to inform the consumer about the kind of apparel they are buying, it is required to affix a label to the product. It also educates the consumer about the material content, country of origin / 'Made in', product care, washing instructions, etc.

According to EU Textile and clothing regulation, products have to be labelled or marked before they are made available in the market for sale.

As per a Notification issued by the Ministry of Commerce on November 24, 2000, all pre-packaged products (intended for direct retail sale only) imported into India must carry the following declarations on the label: • name and address of the importer • generic or common name of the commodity packed • net quantity in terms of standard unit of weights and measurement (in metric) / size if garment • month and year of packing in which the commodity is manufactured, packed or imported, and the maximum retail sales price (MRP) • fibre content Footwear: Similar guidelines are applicable to footwear, which includes sizing and listing which standards are used. India follows the British size system for footwear. India has a voluntary Eco-Labelling scheme known as 'Eco-mark', which provides for easy identification of environment-friendly products. Criteria for the Eco-mark have been set for 16 product categories, including textiles and leather.

Following are some key points of labelling requirements:

a. Full fibre composition must be mentioned on the label of textile products. For example, Silk, wool, Nylon, Polyester, Cotton, Spandex etc. There is no mandatory standard for mentioning the fibre composition in most countries. However it is suggested as best practice to show the percentage of each fibre on the label. As per the mandatory labelling guidelines for textile and apparel products under the **Textile Labelling Act (TLA) of Canada**, it is mandatory to disclose fibre content information expressed in percentages by mass and the dealer identity information on the label.

Fig.: 6.6 – Fibre Content and Country of Origin label

b. Non-textile parts of animal origin must be clearly mentioned in the label (such as fur or leather)

c. The label should not contain abbreviations with the exception of mechanized processing codes.

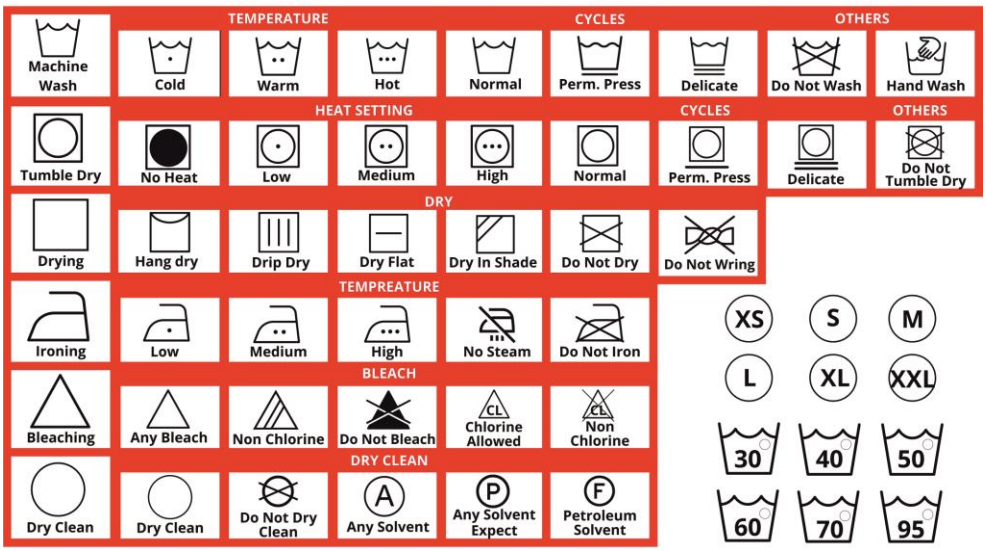


Fig.: 6.7 – Care Labels Symbols

d. Care instruction label is not mandatory under EU textiles regulation. However, if an exporter wishes to include them, care must be taken to use symbols as acceptable in the importer country.

Fig.: 6.8 – Care Labels

An ideal care instruction label must include information on:

- General care and warnings
- Washing
- Drying
- Ironing
- Dry-cleaning

e. Country of Origin is not a mandatory standard for exporting to most countries, however if an exporter wishes to include, it should be clearly labelled and should not be deceptive. For example, a product imported from China, must not be labelled as 'Made in India'.

Fig.: 6.9 – Brand, Size and Fibre Content Labels

f. Apparel products must carry a durable, legible, easily visible and accessible label, either on the product or on its packaging. Language of the label is preferably the language of the country of importer. For example, while exporting to Germany, the preferred language should be German. For apparels to be sold in Canadian markets, the care label should be in both English and French.

g. Size mentioning is not obligatory but expected on labels. Australia has defined size standards apparels too, which are:

- **AS 1344-1997**: Size coding scheme for women's clothing- Underwear, outerwear and foundation garments
- **AS 1954:1976**: Size coding scheme for men's clothing(including multiple fitting outerwear and industrial wear)
- **AS 1182:1997**: Size coding scheme for infants' and children's clothing- Underwear and outerwear

vi. Intellectual Property Rights (IPR)

Intellectual property (IP) is a legal concept which refers to creations of the mind for which exclusive rights are recognized. Under intellectual property law, owners are granted certain exclusive rights to a variety of intangible assets, such as musical, literary, and artistic works; discoveries and inventions; and words, phrases, symbols, and designs. Common types of intellectual property rights include copyright, trademarks, patents,

industrial design rights, trade dress, and in some jurisdictions trade secrets. Illegal copy of registered apparel trademarks or design is considered as infringement to IPR. While selling own designs or apparels under a trademark, an exporter must make sure that no Intellectual Property Rights are being violated. Similarly if designs are provided by the buyer, they will also be liable in case it is found to violate any IPR.

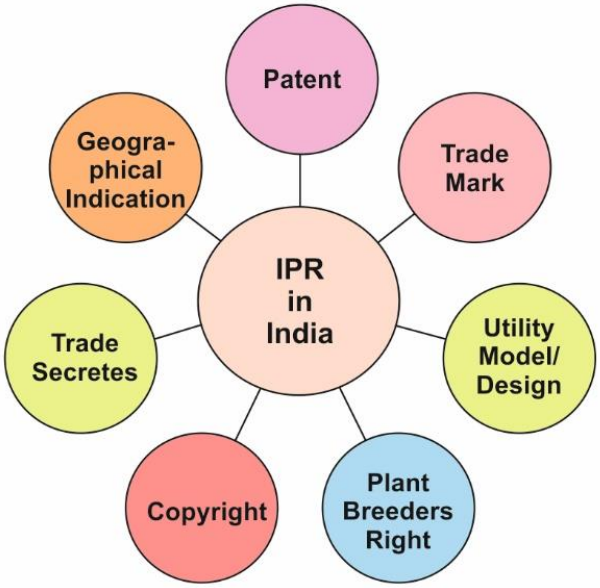


Fig.: 6.10 – IPR in India

2. VOLUNTARY STANDARDS

In addition to mandatory standards (including legal and non-legal), there are many services that buyers implicitly expect or at least highly appreciate if an exporter intends to do business with them.

A voluntary consensus safety standard (also known as a "non-government consensus standard") is a safety standard for consumer products that establishes consumer product safety practices recommended to be followed by product manufacturers, distributors and sellers.

Buyers set their own standards for products. The exported products must comply to such standards along with the mandatory standard requirements. These standards can be based on the end use of the product or may be based on the product processing etc.. Such standards and implemented by the buyer to meet their business goals of desirable quality product and desirable manufacturing for the product. These standards are different for different buyers.

For example:- The EU has a voluntary standard for Textiles known as **The Burning Behaviour of Children's Nightwear**, which helps in complying with the GPSD.

CUSTOMER SPECIFIC REQUIREMENTS MANDATED AS A PART OF WORK PROCESS

As we have country specific regulations in this sector for export of textiles and apparel related products, similarly, there could be few customer / company specific requirements / regulations, which exporter/ manufacturer needs to fulfil in order to do business with that customer.

Following are few basic types of customer specific requirements

1. Restricted Substances Lists (RSLs)

Apart from REACH guidelines, many fashion brands and retailers have created their own list of restricted substances, which they impress upon their suppliers to follow. Such company specific Restricted Substances Lists may be stricter than REACH. Suppliers intending to work with these firms are required to comply with these customer specific RSL along with other Country specific regulations.

Customer Specific Standards are often based on **Zero Discharge of Hazardous Chemicals (ZDHC)** guidelines on safe chemicals use.

2. Product design and development

Generally buyers have their own design team and provide new designs to suppliers. However, suppliers or manufacturers can also maintain their design team and suggest the buyers about new designs ideas. Buyers will always appreciate new designs, materials or production methods to make them stand out in the market and have a competitive edge over other brands.

3. Garment Care Preferences

Most customers prefer an easy handling fabric which can be hand washed or machine washed and easy to care.

4. Smaller Lead Time

Some apparel brands/buyers work on fast fashion concept and prefer a supplier / manufacturer who can work on deadlines and smaller lead time.

5. Complexities

Factories usually try to get easier work order based on available fabric, simple designs and large lead time. However, brands in order to stand out in

the market might ask for complex designs and innovative fabrics. To work with such buyers / brands and to supply those with their specific requirements could be difficult. Also manufacturers / exporters are required to be flexible with workmanship, Minimum Order Quantity (MOQ) and price.

6. Location of Factory in GSP

As per EU's Generalised System of Preferences (GSP) there are around 71 countries worldwide which are preferred over on listed countries to manufacture and export to EU buyers. EU Buyers are also benefited with removal of import duties. Thus, buyers might have specific requirements for manufacturer from a country listed in GSP.

Activities

Activity 1

Visit a Garment export unit and make a report on Country specific regulations which they follow.

Materials Required:

1. Writing Material
2. Ruler
3. Adhesive

Procedure:

1. Make a visit to any nearby garment export unit.
2. Enquire about the countries where they export their product.
3. Enquire and prepare a report about the country specific regulations being followed for any export order.

Check Your Progress

A. Fill in the Blanks –

1. _____ stands for Registration, Evaluation, Authorization and Restriction of Chemicals.
2. _____ is an administrative marking which indicates conformity with health, safety and environmental protection.
3. With an aim to inform the consumer about the kind of apparel they are buying, it is required to affix a _____to the product.
4. ZDHC stands for _____.

5. GSP stands for _____.

B. Write short answers for the following :

1. Explain 'Restricted Substances List'.
2. Give few examples of Children's clothing standards.

C. Write long answers for the following:

1. What are customer specific requirements?
2. Explain any 3 country specific mandatory regulations.

Session: 3 Ethical Compliance and Related Documents

Indian Garment industry is getting attention from consumers, social workers, welfare organisations and branded international buyers. Many international buyers are demanding their manufacturers / suppliers to comply with their 'Code of Conduct' and 'Code of Ethics' while placing an order.

Adherence to quality standards and employee satisfaction has become important parameters for measuring the organisation's performance. Manufacturers and organisations comply with regulations and codes, not only out of a need to act generously, but also for survival in a globally competitive environment.

In the light of growing competition among exporting countries and increasing demand for products that meet internationally recognised standards, it is essential for the manufacturers / suppliers to improve their safety and health compliance code and provide proper working environment in their factories.

Several countries have also developed various international compliance standards on health and safety compliance. Exporters should follow these compliance codes to survive in the global market. Moreover, regular practice of compliance with code of conduct would ensure higher price of products, less employee turnover rate, smooth industrial relation as well as global image & reputation.

In a consumer market, brand name and reputation are most critical assets. Companies should adopt Ethical compliance code to protect their goodwill in the market. The Indian garment industry needs to be tough on compliance rather than competing with other developing countries manufacturing cheaper garments.

WHY CODE OF ETHICS IS REQUIRED?

Code of Ethics represents an organisation's self-made constitution / regulation which aim to provide general behavioural guidelines. Such guidelines are generally towards safe working conditions, prohibition of child labour, environment protections, work hours and wage rate control, equality and discrimination issues, labour safety standards, bribery and corruption, unfair practices etc.

Codes of Ethics are generally not as detailed as Code of Conduct. Code of Ethics represents an organisation's culture and values. Large organisations usually have a dedicated department of Corporate Social Responsibility to take care of ethical practices of the organisation. Also it is a great tool for the organisation or the Brand to portray and improve brand image to the customers.

By following such ethical practices, it is conveyed that the brand is dedicated towards high quality products, comply with legal requirements and undertakes to protect the environment. Such message boost customers' confidence in the brand and products quality. Brands speak loud about their ethics and value on their websites and promotion campaigns to educate the customers and stand out in the market.

Attention to working conditions and labour related issues is also required as most of the buyers outsource their requirements from countries with lower wage rates in order to cut down on costs. But such manufacturer might not be following ethical and fair practices related with labour and environment. Hence, buyers link their code of ethics to work orders for manufacturers and compel them to respect all the labour and environment related guidelines which the buyer company believes in.

These ethics are required for:

- Increasing national competitiveness in terms of social compliance
- Increasing competitiveness of small scale manufacturers
- Reducing burden on manufacturers

In India, the **Apparel Export Promotion Council (AEPC)** is committed towards legal compliance and ethical business practices and encourages members / exporters to comply with all applicable laws and regulations of the country, to meet all the **International Compliance Standards**.

Further, the council has designed a garment factory compliance program 'DISHA' (Driving Industry towards Sustainable Human Capital Advancement) that aims to spread awareness regarding the importance of compliance among Indian garment exporters.

Some of the important compliance codes in Indian garment industry are listed below.

Fig.: 6.11 – Code of Ethics

1. Working Hour and Wage Rate Compliance

- Garment factory must ensure that employees should get at least minimum wages according to the domestic law and as per the time spent by them in the industry.
- Employer should pay equal wages to both men and women employees, for performing the same work or work of a similar nature.
- Worker employed for more than nine hours on any day or for more than 48 hours in any week, should be entitled to wages at premium legal rates for such overtime work.
- Every worker should be given one holiday (for a period of 24 consecutive hours) in a week. Whenever a worker is required to work on a weekly holiday, he is to be allowed a compensatory holiday for each holiday so lost.
- Every worker is to be allowed at least half an hour rest interval after a maximum working of 5 hours at a stretch.
- Overtime work should be voluntary for employees and should be supported by legally required rate of compensation for such overtime period.
- No worker should be employed below the age of 14 as per guidelines of International Labour Organisation.
- There should not be any sort of forced labour whether in the form of prison labour, indentured labour, bonded labour or otherwise.

2. Workplace and Work Environment Compliance

- Organizations should ensure proper ventilation, sufficient light and air to provide the employees with standard working environment.
- Indian garment industries should provide the workers with comfortable sitting chair with back support and proper leg space.
- All employees should be treated with dignity and respect. No employee should be subject to any physical, sexual, psychological or verbal harassment or abuse.
- Right of employees to form association and collective bargaining should be respected and recognized. No employee should be subject to any sort of harassment, intimidation or retaliation for engaging in association or collective bargaining.

3. Non-discrimination compliance

- Organizations should not discriminate employees on the basis of physical characteristics, beliefs and cultural characteristics. All the terms and conditions of employment should be based on an individual's ability to do the job. They should provide equal employment opportunities for all employees and associates irrespective of the

employees' race, colour, religion, age, sex, creed, national origin, marital status, etc.

- Women workers should receive equal remuneration, including benefits, equal treatment, equal evaluation of the quality of their work, and equal opportunity to fill all positions as male workers.
- Women workers who avail maternity leave, should not face dismissal or threat of dismissal or loss of seniority or deduction of wages, and should be allowed to return to their former employment at the same rate of pay and benefits.

4. Health and Safety Compliance in Indian Garment Industry

- Employees should not be exposed to hazards, including glues and solvents, which may endanger their safety, including their reproductive health.
- No employee should work on machines without adequate training, knowledge and supervision.
- Industries should comply with international standard code, such as ISO(Indian Standards Organisation) or importing countries standard code to become competitive in international markets.
- Wiring should be in good condition with no broken junctions or wires sticking out at the end.
- Eye-wear and face shields should be provided in areas with danger of sparks, glare, hazardous liquids and excessive dust.
- Ear plugs or muffs should be given in places with excessive noise such as generator rooms and rooms with embroidery machine.
- Headgear and protective shoes are necessary for workers involved in loading and unloading operations.
- Factories should have effective fire extinguisher with proper usage instructions.

Activities

ACTIVITY 1

Visit a Garment export unit and make a report on Code of Ethics which they follow.

Materials Required:

1. Writing material
2. Ruler

3. Adhesive

Procedure:

1. Make a visit to any nearby garment manufacturing unit.
2. Enquire about the countries where they export their product.
3. Enquire and prepare a report about the Code of Ethics being followed.

Check Your Progress

A. Fill in the Blanks :

1. Adherence to _____and employee satisfaction has become important parameters for measuring the organisation's performance.
2. _____represents an organisation's self-made constitution / regulation which aim to provide general behavioural guidelines.
3. Large organisations usually have a dedicated department of _____to take care of ethical practices of the organisation.
4. _____is committed towards legal compliance and ethical business practices.
5. Organizations should not _____employees on the basis of physical characteristics, beliefs and cultural characteristics.

B. Write short answers for the following –

1. Explain 'Code of Ethics'.
2. Explain in brief about workplace and work environment compliance in a garment unit.
3. Discuss about wage rates and working hour's compliance for workers in a garment unit.

C. Write long answers for the following-

1. Write short note on compliance code guidelines for Indian Garment Industry.
2. Explain Health and Safety compliance in Indian Garment Industry.

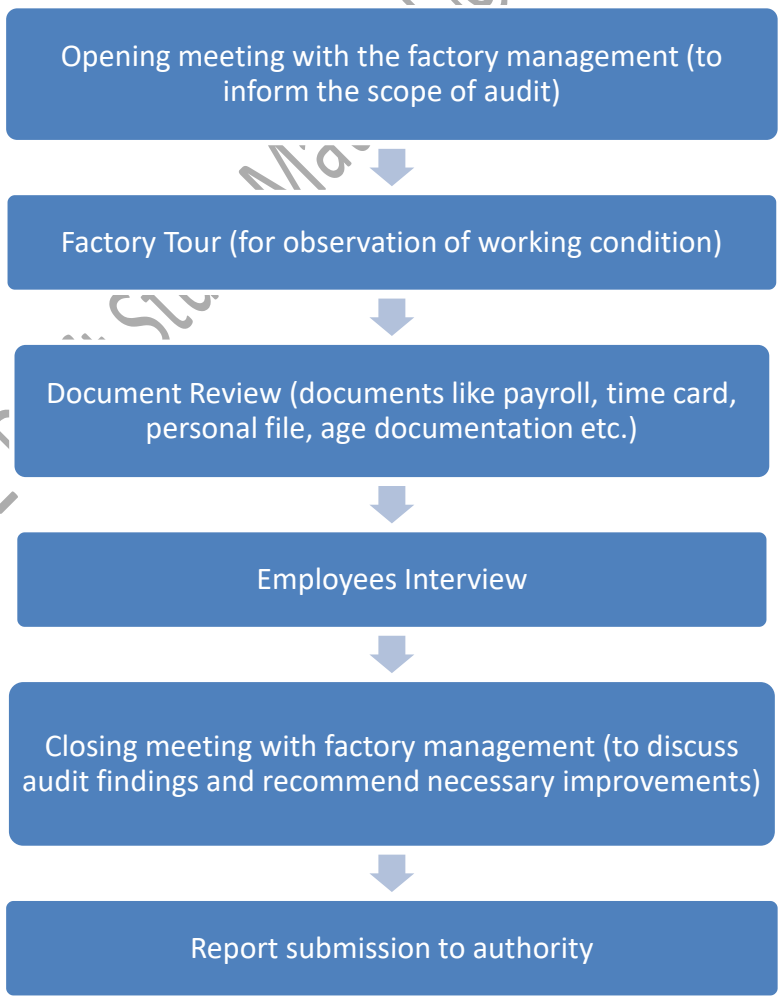
Session: 4 Documentation and Reporting of Compliance Deviation

INTRODUCTION

Social compliance deals with employee's health and safety, their legal rights and working environment from social perspective. To make a factory compliant to such national or International standards, it needs to follow local labour law and international social compliance requirements. Social compliance audit is generally related to child labour, forced labour, health and safety, abuse and discrimination, disciplinary practices, working hours, remuneration, freedom of association, management systems, etc.. Social compliance is a vital part of the apparel industry because it has an impact on a company's reputation and business.

IDENTIFICATION AND REPORTING OF ANY POSSIBLE DEVIATION

Social compliance audits conducted as per the Code of Ethics of different buyers are based on the following steps:



CORE LABOUR STANDARDS

COMPLIANCE CLUSTERS	COMPLIANCE POINTS
1. Child Labour	• Child Labourers • Documentation and Protection of young workers • Hazardous works and other worst forms
2. Discrimination	• Gender • Other grounds • Race and Origin • Religion and Political opinion
3. Forced Labour	• Bounded Labour • Coercion • Forced Labour and overtime • Prison Labour
4. Freedom of Association and collective Bargaining	• Collective bargaining • Freedom to Associate • Interference and discrimination • Strikes • Union Operations
5. Compensation	• Minimum wages • Overtime wages • Method of payment • Wage information, use and deduction • Paid leave • Social security and other benefits
6. Contrasts and Human Resources	• Employment contracts • Contracting procedures • Termination • Dialogue, Discipline and Disputes
7. Occupational safety and health	• OSH Management systems

	• Chemicals and hazardous substances • Workers Protection • Working Environment • Health services and First Aid • Welfare facilities • Workers Accommodation • Emergency preparedness
8. Working Time	• Regular Hours • Overtime • Leave

These are 8 major compliance cluster which are divided into compliance points. These points are required to be checked during audit. The audit checklist may vary from organisation to organisation but a suggestive checklist is shown below:

a. Checklist for Child labour and young workers:

1. Employer having a reliable system to check age of worker before hiring.
2. Employer complying to guidelines regarding fitness of worker
3. Maintenance of a register of workers below 18 years of age
4. Workers below 18 years of age performing work which is hazardous by nature.
5. Workers engaged for more than permissible working hours.
6. Engagement of employer in child labour.

b. Checklist regarding wages and working hours:

1. Workers are paid their wages on time
2. Worker's wages are paid correctly as per norms and minimum standards.
3. Women workers are paid for maternity leaves.
4. Workers are paid correctly for annual leaves
5. Workers are paid correctly for festival holidays.
6. Workers are paid correctly for sick leaves.
7. Workers are paid correctly for casual Leaves.

8. Workers are paid correctly for duration of work stoppages.
9. An accurate pay-roll record is maintained by the employer.

c. Checklist for social security and other benefits:

1. Employer has provided compulsory group insurance for workers?
2. Employer pays correct compensation in case of worker's death.
3. Workers are paid correct compensation for work related accidents and diseases.
4. Employer has established a Provident Fund and deposit employer's share for workers as per norms.
5. Festival bonuses are paid to workers as per norms.
6. Workers are provided with wage slips.
7. Any unauthorized deduction is not made by employer from worker's wages / salary.

d. Checklist for worker working with chemical and hazardous substances:

1. Workers engaged for working with chemical or hazardous substances are effectively trained.
2. Employer has taken action and precaution to prevent exposure to chemicals or hazardous substances.
3. All chemicals or hazardous substances are properly labelled.
4. Employer maintains an inventory of chemicals and hazardous substances at workplace.
5. All chemicals and hazardous substances are properly stored.
6. Availability of adequate washing and cleaning facility in case of exposure to hazardous substances.
7. Employer possesses license for storage and use of chemicals.

e. Checklist for emergency preparedness:

1. Workers are trained for firefighting and rescue.
2. Availability of emergency exit window and doors.
3. Availability of alternative stairs.
4. Availability of firefighting equipment.
5. Availability and functioning of fire detection and alarm system.
6. Emergency exists and escape routes are clearly marked.
7. All flammable materials are safely stored.

8. Possible sources of ignition are appropriately safeguarded.
9. Periodic emergency drills are conducted.

f. Checklist for Health services and first aid:

1. Availability of required health facility and staff.
2. Employer complying with medical check-ups of workers.
3. Workers are trained for first-aid and first-aid team is formed.
4. Availability of readily assessable first-aid boxes.

g. Checklist for welfare activities:

1. Availability of adequate day care facility
2. Availability of adequate lunch room / canteen.
3. Availability of adequate rest rooms
4. Availability of adequate washing facility
5. Availability of clean and safe drinking water
6. Accessible toilets and washrooms.

h. Checklist for working environment:

1. Noise levels are acceptable.
2. Temperature and ventilations are acceptable.
3. Workplace is clean and tidy.
4. Workplace is adequately lit.

PROCEDURE TO FOLLOW IN CASE OF DEVIATION

After the compliance audit, in case of any deviations are recorded, the auditor prepares a **Corrective Action Plan (CAP)**. Such plans are reviewed periodically and worked upon to avoid deviations before next audit.

Following are the aims of CAP:

1. To identify the most important shortcomings
2. To understand the root cause of the shortcomings
3. To assign a responsible person
4. To propose corrective action
5. To reach goals within time

In order to ensure that suggestions of CAP are implemented, follow-up audits are done as soon as a number of improvements are achieved. Third party audits can also help the manufacturer / exporter to get better suggestions and audit reports.

Exit meeting with management

The exit meeting with management takes place at the end of the factory visit. The aims of the exit meeting are:

- To get management on board to implement the process- to improve labour practices.
- To present the main audit findings to management, check whether management agrees with the findings and ask a response from their end with respect to findings thereby unveiling the possible causes of the problems which are identified.
- To propose corrective action plans for improvements, discuss with management whether improvements are feasible and within timeframe.
- To present main audit findings to factory level trade union representatives or elected worker representatives.

Activities

ACTIVITY 1

Visit a garment manufacturing unit and make a report on Corrective Action Plan which they follow in case of compliance deviation.

Materials Required:

1. Writing material
2. Ruler
3. Adhesive

Procedure:

1. Make a visit to any nearby garment export unit.
2. Enquire about the countries where they export their product.
3. Enquire and prepare a report about the Corrective Action Plan followed in case of compliance deviation.

Check Your Progress

A. Fill in the Blanks:

1. _____compliance deals with employee's health and safety, their legal rights and working environment from social perspective.
2. Social compliance audits are conducted as per the _____of different buyers.
3. These are ___ major compliance cluster which are divided into compliance points.
4. After the compliance audit, in case of any deviations are recorded, the auditor prepares a _____.

B. Write short answers for the following –

4. Explain in brief the process of auditing compliance standards in a garment unit.
5. What precautions are to be taken by a Garment unit where chemicals or hazardous substances are used?
6. What are the guidelines regarding employment of child labour and young workers?

C. Write long answers for the following-

7. What procedure to be followed in case of any deviation in compliance with standards?
8. How should a garment unit be prepared for emergency?

ANSWER KEY

MODULE 1

SESSION1

A. Fill in the blanks:

1) Weaving
2) Weft-Knitted , Warp-Knitted
3) Purl stitch

B. Identify the weave type of the given fabrics:

a) Satin Weave
b) Plain Weave
c) Basket Weave
d) Twill Weave

SESSION 2

A. Fill in the blanks:

1. HDPE, cotton, PP and Nylon
2. Industrial hand gloves
3. Geo textiles
4. Ahmedabad Textile Industry's Research Association,1947
5. Soft Luggage

SESSION 3

A. Fill in the blanks:

1. Finishing
2. Shearing
3. Mercerized, non mercerised

4. Calendering

5. Chitosan

SESSION 4

A. Fill in the blanks:

1. Bow and skew
2. 3 degrees
3. Fabric width
4. Relative weight , absolute weight
5. EPI,PPI

MODULE 2

SESSION1

Answer Key (Fill in the blanks)

1. Inspected, inspection
2. Dallas system
3. Four-Point Inspection System
4. Quality, acceptability
5. Ten-Point Inspection System

SESSION2

A. Fill in the blanks:

1. visual examination
2. quality, acceptability
3. guiding rollers
4. Fabric inspection
5. Maintenance

SESSION3

1. Critical Defects

2. Fuzz balls
3. Identify, analyse
4. Major Defects

MODULE 3

SESSION1

Fill in the blanks

i. Fabric defects
ii. Quality control or QC
iii. American Society for Testing and Materials
iv. Acceptable quality limit

SESSION2

Fill in the blanks

i. Fabric roll inspection report
ii. Supervisor
iii. Schedule Maintenance
iv. Centre Selvage Variation

SESSION3

i. Reporting system
ii. Management reporting system
iii. Static and dynamic.
iv. FABRIC CHECKERS ATTENDANCE REPORT:
v. Hourly inspection report

MODULE 4

SESSION-1

Fill in the blanks

1. Safety
2. Fire
3. Running
4. Disconnection
5. Smoke, fumes

SESSION-2

Fill in the blanks

1. Motivates
2. Deep
3. Disinfectants
4. Degreaser
5. Regular

SESSION-3

True/false

1. False
2. True
3. False
4. True
5. True

SESSION-4

Fill in the blanks

1. Communication
2. Tone , method
3. Machine operating
4. Sensitive protective
5. Repairs, modifications, maintenance

MODULE 5

SESSION-1

Fill in the blanks

1. Health, security
2. Fire extinguishers
3. Emergency
4. Oily
5. Proper sanitary facilities

SESSION-2

Fill in the blanks

1. Emergency
2. Physical injury
3. Workstation
4. Chair
5. Breaks

True/false

1. False
2. True
3. False
4. False
5. True
6. True
7. True
8. False

SESSION-3

Fill in the blanks

1. Hazard

2. Identification
3. Entanglement
4. First aid
5. Assembly points

Identify and name the safety signs

1. Wet floor
2. Smoking ban sign
3. Hazardous substance
4. Flammable substance

SESSION-4

Fill in the blanks

1. Supervisor
2. Emergency response
3. Emergency
4. Exit door

MODULE 6

SESSION-1

Fill in the blanks

1. Audit
2. *Compliance audit*
3. Financial
4. On-site

SESSION-2

Fill in the blanks

1. REACH
2. CE

3. Label
4. Zero discharge of hazardous chemicals
5. Generalised system of preferences

SESSION-3

Fill in the blanks

1. Quality standards
2. Code of ethics
3. Corporate social responsibility
4. Apparel export promotion council (AEPC)
5. Discriminate

SESSION-4

Fill in the blanks

1. Social
2. Code of Ethics
3. 8
4. Corrective action plan (CAP)

GLOSSARY

- **Abrasion mark-** Abrasion mark is a type of fabric defect that arises when a metallic or non-metallic object rubs on the fabric surface during weaving or processing.
- **Acceptable Quality Level-** The Acceptable Quality Level (AQL) is a quality control concept. It is the minimum level of faults acceptable in a sample of a manufactured product for the entire batch of the product to be accepted.
- **Air permeability-** The amount of air that passes through a specific area of a fabric is measured by its air permeability. This parameter has a significant impact on the thermal comfort properties of fabrics.
- **Antistatic-** Antistatic is a property of a textile material retaining sufficient moisture to provide a conducting path, thus avoiding the effects of static electricity.
- **Biodegradable-** A biodegradable material is one that can be decomposed by bacteria or other natural organisms without polluting the environment.
- **Crease resistance-** Crease resistance is a fabric characteristic that prevents the cloth from creasing.
- **Crimp-** The degree of variation from linearity of a non-straight fibre is thus referred to as crimp in a fibre.
- **Drape-** The drape of a fabric or material refers to how it appears and acquires shape when it is hung.
- **Elasticity-** Elasticity of a fabric is the result of stretching a fabric as far as it can go without deforming it.
- **Fabric-** Fabric is a cloth or other material made by weaving, knitting or other methods in which different types of yarns are used like cotton, nylon, wool, silk etc.
- **Felting-** Felting is the process of turning fibers such as sheep wool, alpaca, mohair, yak, etc. into a piece of fabric by connecting the individual fibers by the application of heat, moisture and pressure.
- **Garment-** A garment is a piece of clothing which is manufactured by fabric or textile materials.
- **Loom-** Loom is a frame or machine used to interlace two or more sets of threads or yarns at right angles to make a fabric.

- **Tearing strength-** The force necessary to begin or continue tearing a fabric in either the weft or warp direction under specific conditions is known as tearing strength.
- **Warp-** Warp is strands of yarn or thread in lengthwise direction onto (a loom) in preparation for weaving.
- **Wearability-** A garment's capacity to resist repeated use.
- **Weave-** A weave is to form a fabric on a loom by interlacing warp and filling threads
- **Weft-** Weft is the crosswise threads on a loom that are passed over and under the warp threads to make fabric.

List of Credits

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