



Advanced Apparel production Level – III

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Standard



Module Title: Measuring and Cutting Commercially Tailored Garments

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L #36	LO #1- Measure and interpret garment dimensions
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Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Occupational safety and health
- Obtaining client measurements
- Interpreting garment measurements
- Observing ergonomic arrangement

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Follow OHS practices
- Obtain client measurements
- Interpret garment measurements
- Observe ergonomic arrangement of the workplace

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.



Information sheet-1

Occupational safety and health (OSH)

1.1 Occupational safety and health (OSH)

“**Occupation**” is the kind of job a person performed at his or her place of work. These jobs are described in many ways. Some are patternmaking, sewing, finishing, etc.

Occupational health and safety (OHS) primarily seeks to maintain the working ability of the labor force as well as to identify, assess and prevent hazards within the working environment. Ergonomics, on the other hand, combines all of these issues to improve workers' efficiency and well being and maintain industrial production through the design of an improved workplace. OHS and ergonomic applications therefore work together to satisfy the needs of changing local people's attitudes, local work methods and/or traditional ways of doing things. These issues are important for many developing countries, because the effects of poor health and lack of safety facilities, and non ergonomics conditions exist in various workplaces are a hindrance to the national economy and social progress. Since implementing the full concept of OHS and ergonomics application is a priority, understanding the meaning of the terms related to OHS and ergonomics applications is a major source of workplace improvement.

1.1.1 manual handling techniques

As an employer, you must protect your workers from the risk of injury and ill health from hazardous manual handling tasks in the workplace. This leaflet will help you do that. It includes simple risk filters to help you identify which manual handling activities are hazardous.

Manual handling means transporting or supporting a load by hand or bodily force. It includes lifting, lowering, pushing, pulling, moving or carrying a load. A load is a moveable object, such as a box or package, a person or an animal, or something being pushed or pulled, such as a roll cage or pallet truck



What's the problem?

Manual handling injuries are part of a wider group of musculoskeletal disorders (MSDs). The term 'musculoskeletal disorders' includes injuries and conditions that can cause pain to the back, joints and limbs.

This leaflet focuses on manual handling, which is one of the main causes in the development of musculoskeletal disorders, particularly back pain. For the latest statistics, visit the HSE website.

Manual handling risks can be found across all kinds of workplaces – on farms and building sites, in factories, offices, warehouses, hospitals and while making deliveries. Heavy manual labour, repetitive handling, awkward postures and previous or existing injuries or conditions are all risk factors for developing MSDs. Work may also make worse an injury which was not caused at work, such as a sports injury. There is more advice on MSDs on the HSE website.¹

Taking the action described here will help prevent injuries and ill health, but you can't prevent all MSDs. Encourage workers to report any signs and symptoms to you or their worker representative at an early stage, before they become more serious, so you can take steps to reduce the risk.

If your workers have developed symptoms, consider taking advice from an occupational health provider on a worker's fitness for work and any restrictions or adaptations to their work that may be required.

1.1.2 standard operating procedures

Standard operating procedure (SOP) is not a new thing for the garment industry. The SOP is well known and is widely used by many organized factories.

SOP can be defined as a step-by-step written procedure about how to do a job that gives the desired result and maintains consistency in results. SOP can also be defined as a checklist for the user (operator) who is going to do a particular job. An SOP is a sure success method of doing a job.



More than just written instructions SOP can be also made using illustrations and flow charts. For some processes factory only needs to provide detailed instructions to perform a task, where some processes required instruction as well as decision making based on the result of intermediate steps.

1.1.3 personal protective equipment

Personal protective equipment (PPE) is protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection. The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter.

1.1.4 safe materials handling

Unlike in conventional manufacturing operations, where unfinished garments are carried, dragged, or wheeled on specially-designed carts between workstations, a computer-controlled overhead conveyor (UPS) may be used to move partially assembled garments from one workstation to the next. The UPS reduces horizontal reach requirements and eliminates heavy lifting by the operators. It resulted, however, in increased vertical reach requirements and increased wrist pronation during acquisition of materials. A survey among UPS users indicated slightly higher frequencies of hand and leg discomfort than among their counterparts who utilized conventional materials handling. Also some operators complained about a perceived increase in the noise level (95-97dB) and reported temporary auditory threshold shifts during and after the workday.

In contrast, PBU system has problems of heavy lifting by helpers or supervisors and upper body movements (operators twisting their upper body to reach for garment bundles).

1.1.5 taking of rest breaks

A rest break is an uninterrupted period of at least 20 minutes, during which work should not be undertaken. You should be able to take it away from your workstation. Your



employer is not allowed to make the rest break up to 20 minutes by offering several short breaks of under twenty minutes. The break should be continuous.

A period of downtime when you are allowed to stop working but must stay in contact with your employer is not a rest break, even if it turns out at the end of the break that it was uninterrupted. Rest periods include breaks during the working day, breaks between working days, and weekly rest periods.

1.1.6 ergonomic arrangement of workplaces

Ergonomics is the process of designing or arranging workplaces, products and systems so they fit the people who use them. This means producing a workspace to accommodate for worker's health needs. Ergonomics, in fact, is a branch of science. It aims to learn about human abilities and limitations, and then apply this learning to improve people's interaction with products, systems and environments. It aims to improve workspaces and environments to minimise the risk of injury or harm. As technologies change, we need to ensure what we use is designed for our body's requirements.

In the workplace, according to Safe Work Australia, the total economic cost of work-related injuries and illness is estimated to be \$60 billion dollars. Recent research has shown that lower back pain is the world's most common work-related disability, affecting employees from offices, building sites and in the high-risk category, agriculture. Ergonomics aims to create safe, comfortable and productive workspaces by bringing people's abilities and limitations into the design of a workspace. This includes the individual's body size, strength, skill, speed, sensory abilities (vision, hearing), and even attitudes.

For ergonomics to be researched and produced successfully, it needs to use other scientific areas, including, engineering, physiology and psychology. For the best design, ergonomists use the data and techniques from several other areas:

- Anthropometry: body sizes, shapes; populations and variations
- Biomechanics: muscles, levers, forces, strength



- Environmental physics: noise, light, heat, cold, radiation, vibration body systems: hearing, vision, sensations
- Applied psychology: skill, learning, errors, differences
- Social psychology: groups, communication, learning, behaviours

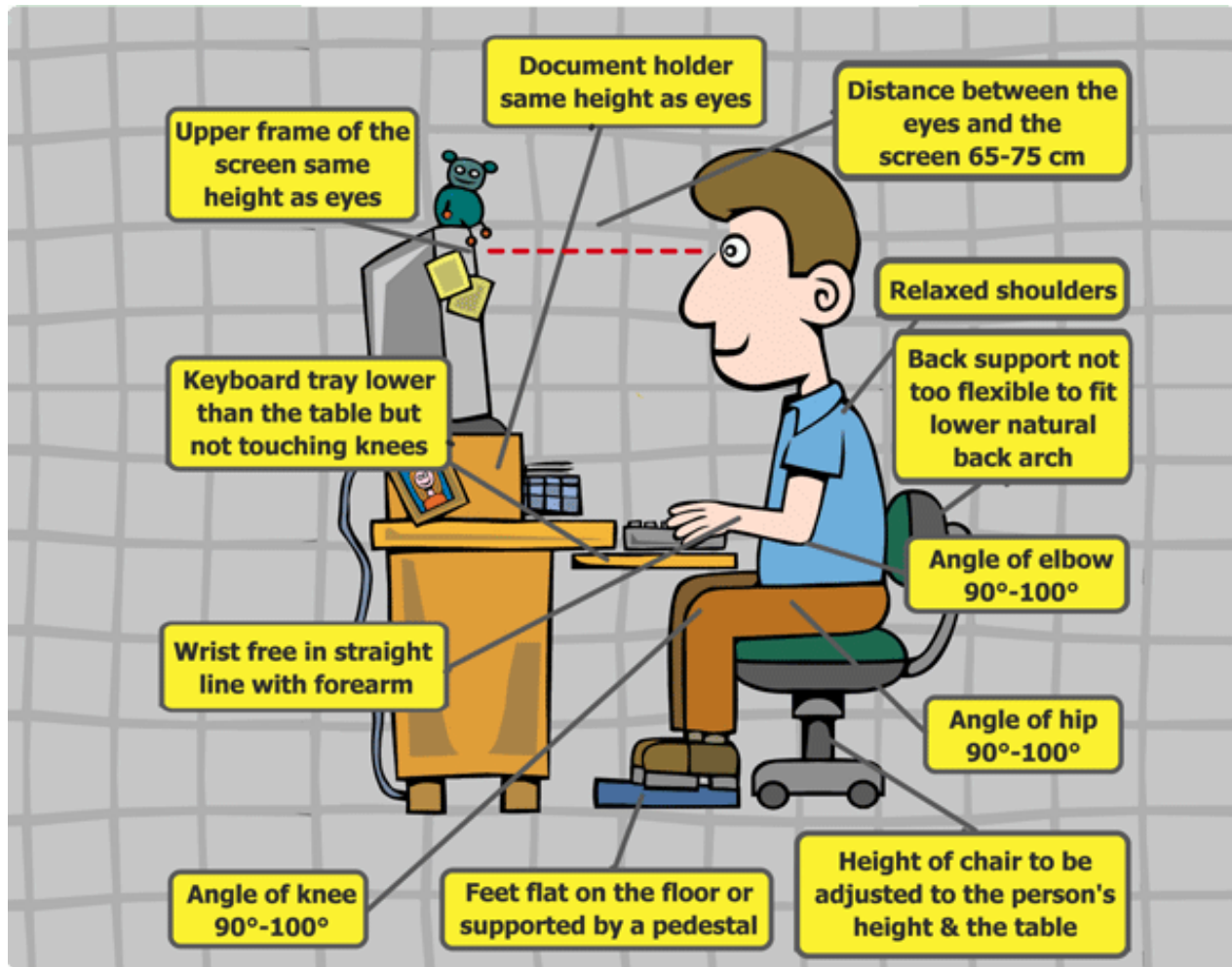


Figure 1: sitting position

POSTURE

- Maintain proper posture, paying careful attention to positioning of head, neck/spine, arms/wrists, hips/thighs and feet
 - ✓ Ensure your back is supported, your shoulders relaxed (not slumped, not elevated), and that there is no pressure on your thighs



- Alternate between different postures on a regular basis
- When keyboarding, use minimum force while striking the keys
- Keep a neutral position, where the forearms, wrists and hands are in a straight line
- Avoid awkward reaching for work tools such as telephone, mouse and reference materials
- Avoid resting elbows, forearms or wrists on hard surfaces or sharp edges
- Take frequent mini-breaks throughout the day to give muscles and joints a chance to rest and recover
- Alternate between work activities which use different muscle groups to avoid overuse
- Give eyes a break by closing them momentarily, gazing at a distant object and blinking frequently
- Proper exercises are a complement to a complete office ergonomics program. Consult with us to select appropriate exercises

LIGHTING

- Maintain appropriate light levels for specific tasks. More illumination is usually needed to read a document than a computer screen
- Reduce or eliminate glare by using window shades, diffusers on overhead lighting and anti-glare filters for computers
- Adjust the contrast and brightness on your computer screen to a comfortable level
 - ✓ Get a regular eye exam and if necessary, wear corrective lenses
 - ✓ Tell your eye specialist how often you use the computer
- Clean the computer screen and other surfaces regularly
- Reduce the number of dust-collecting items like papers and files on your desk
- If necessary, use a portable air cleaner to reduce airborne particles like dust, pollen and mould
- Maintain a comfortable temperature by using layers of clothing or a portable fan or heater



- Be considerate of others working in the area and conduct meetings and conversations in appropriate areas
- Position fabric partitions to reduce noise from conversations, foot traffic and equipment, like copiers and printers
- Identify distracting noises and try headphones, ear plugs, soft music or a quiet fan to reduce or mask the noise

WORK STYLE

- Reduce stress by planning ahead and setting realistic expectations for what you can accomplish during the workday
- Organise your workload to help even out busy and slow times, to avoid feeling 'swamped'
- Vary tasks to make the day more interesting
 - ✓ Alternate computer works with other tasks like phone calls, filing, copying and meetings
- Organise equipment, supplies and furniture in the most efficient arrangement for daily tasks
- Enhance privacy by using office partitions and privacy filters for computer screens or documents
- Acknowledge ideas and accomplishments of co-workers on a regular basis
- Develop stress reduction and relaxation techniques which work for you at the office and at home
- Personalise your office with a few favourite items, like artwork, photos and plants
- Take mini-breaks that re-energise, invigorate and refresh
- Follow these same ergonomic guidelines at home, in meetings and while travelling

1.1.7 following marked walkways

What is Floor Marking?



Walkway (Floor) marking is the process of using visual cues such as lines, shapes, and signs on floors to make a space easier for people to navigate. These cues divide spaces, highlight hazards, outline workstations and storage locations, direct traffic, and convey important safety or instructional information. Floor marking is often part of a larger visual communication system that includes wall signs and labels.

Ensure Your OHS Floor Marking Colours are Correct

Running a warehouse or factory, your Occupational Health and Safety requirements are often forefront in your mind. Keeping staff members safe while at work is extremely important and one of the best ways to do this is to ensure your floor marking colours are correct.



Figure 2

While some businesses will have their own colours marking out certain parts of their warehouse or factory flooring, there are some standard colours used across the world to mark out certain areas. By utilising these standard marking colours, anyone with the knowledge could walk into your workplace and instantly know what areas are caution or danger areas, where vehicles go and areas that need to be kept clear.



Why is Floor Marking Important?

Floor markings are an important part of OHS regulations in factories, warehouses and other workplaces. Having a floor marking plan is important – it allows you to have a balance between having enough (and the correct) floor markings without it being cluttered and confusing.

These floor markings are important in keeping pedestrians and vehicles safe and away from each other. They can prevent accidents between forklifts and other vehicles, show pedestrians where they should be walking and cut down on all the paperwork you need to fill out if there is an accident.

If it's time to redo your OHS floor marking colours, following this guide is a great way to start.

Standard OHS Floor Marking Colours

Yellow – Yellow is used to notify people that it is an area to proceed with caution. It is used in walkways and aisles, often in areas that lead through work areas. It ensures people are on the lookout for other people working at heights, moving boxes or working on forklifts and other vehicles.

Red – Red is used to signify danger and is often related to fire. It is used to alert people they need to stop and look, whether on foot or in a vehicle. In case of a fire, it is used to notify where firefighting equipment is, allowing people to extinguish a fire quickly.

Blue – Blue generally tends to be used to mark out areas of information, or areas where equipment that is currently out of order or not in use is placed.

Green – The colour of safety. Green is utilised to mark out first aid areas, as well as safe walkways away from vehicles and other danger.



Orange – Used to mark out zones where vehicles are stored or operated, orange can be combined with both yellow and red to create an organised traffic system to keep everyone safe.

Black/Yellow – One of the most standard colours used, the black and yellow combination marks out health and safety hazards, advising vehicles and pedestrians to proceed with caution. In factories and warehouses, this colour is often used to mark out where dangerous chemicals are kept or often in use.

Red/White – Another combination that is often seen, the red/white markings indicates emergency areas or electrical points. These are areas that need to stay clear of obstructions in case of an emergency.

White – White is used as an indication that production is going on in the area. This is often used to indicate working areas.

Black – Warehouses and factories often use a black marked area to indicate where goods that have been sorted, packed or finished are stored. This area may combine with other colours allowing for the safe access of delivery trucks to pick up shipped stock.

A lot of businesses choose to go with reflective or coloured tape to mark out their floor area, and this is a good option if you regularly need to change your layout to fit growth or certain times of the year. However, if your work areas are fairly standard and you have no real need to change them in the future, you can have these areas marked out when your epoxy flooring is done.

If you'd like to find out more about permanent safety colour markings to meet OHS requirements, Epoxy Flooring Perth would love to hear from you. With years of experience in the epoxy flooring industry, we can work with you to get your OHS requirements met.



1.1.8 safe storage of equipment

It includes safe handling of materials used in pattern making and cutting. i.e. pattern paper, fabrics and other materials used in cutting and also proper storage of all tools and equipments used in pattern making and cutting.

1.1.9 housekeeping

Housekeeping means general care, cleanliness, orderliness, and maintenance of business or property. Good housekeeping is an important consideration in underwriting of fire hazard and other forms of insurance, as well as in certification by fire, health, and industrial safety agencies.

1.1.10 reporting accidents and incidents

Accurate and timely reporting of relevant information related to hazards, incidents, or accidents is a fundamental activity of safety management. You may hear the words accident and incident to refer to events in the news. These words are easy to confuse, but they are not exactly the same! Incident is more general, and accident is more specific.

Incident can refer to any event – big or small, good or bad, intentional or unintentional. A bank robbery a funny or controversial situation, an argument between celebrities, etc.

An accident is a bad event caused by error or by chance. Accidents are always unintentional, and they usually result in some damage or injury. A car crash is one example of an accident. If some equipment malfunctions in a factory and injures the workers, that is also an accident. Examples of very minor accidents are when you step on someone's foot or spill your coffee on someone else. You didn't want or plan to do it.

All accidents can ALSO be described as incidents – but NOT all incidents are accidents.

If a drunk driver runs his car into a group of people, that is an accident (he did not intend to do it; it was caused by alcohol and chance). It could also be described as an incident ("The incident occurred on Main Street at around 2:30 AM"). If three people were



arrested after fighting in a bar, that is an incident (but not an accident – because the fight was not by chance; they intended to fight).

1.1.11 OHS practices relevant to the job and enterprise

OHS practices include hazard identification and control, risk assessment and implementation of risk reduction measures specific to the tasks.



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page. (2 point each)

1. _____ is the kind of job a person performed at his or her place of work.
2. _____ means transporting or supporting a load by hand or bodily force.
3. _____ a step-by-step written procedure about how to do a job that gives the desired result and maintains consistency in results.
4. _____ is the process of designing or arranging workplaces, products and systems

Note: Satisfactory rating – 8 points

Unsatisfactory - below 8 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____



Information Sheet-2

Obtaining client measurements

1.2 Obtaining client measurements

How to Take Body Measurements for Perfect Fit

Taking accurate body measurements is one of the keys to great fit. Whether you choose to make your pattern block from a commercial fitting pattern or draft it from measurements, having accurate measurements is critical to the success of your block. (And a well-fitting block is critical to the success of everything you make!)

All you need is a tape measure! While it's easiest to have someone else take your measurements, it can be done by yourself. Just stand in front of a mirror so that you can see that you have the tape in the right position.

How to Measure for accurate body measurements

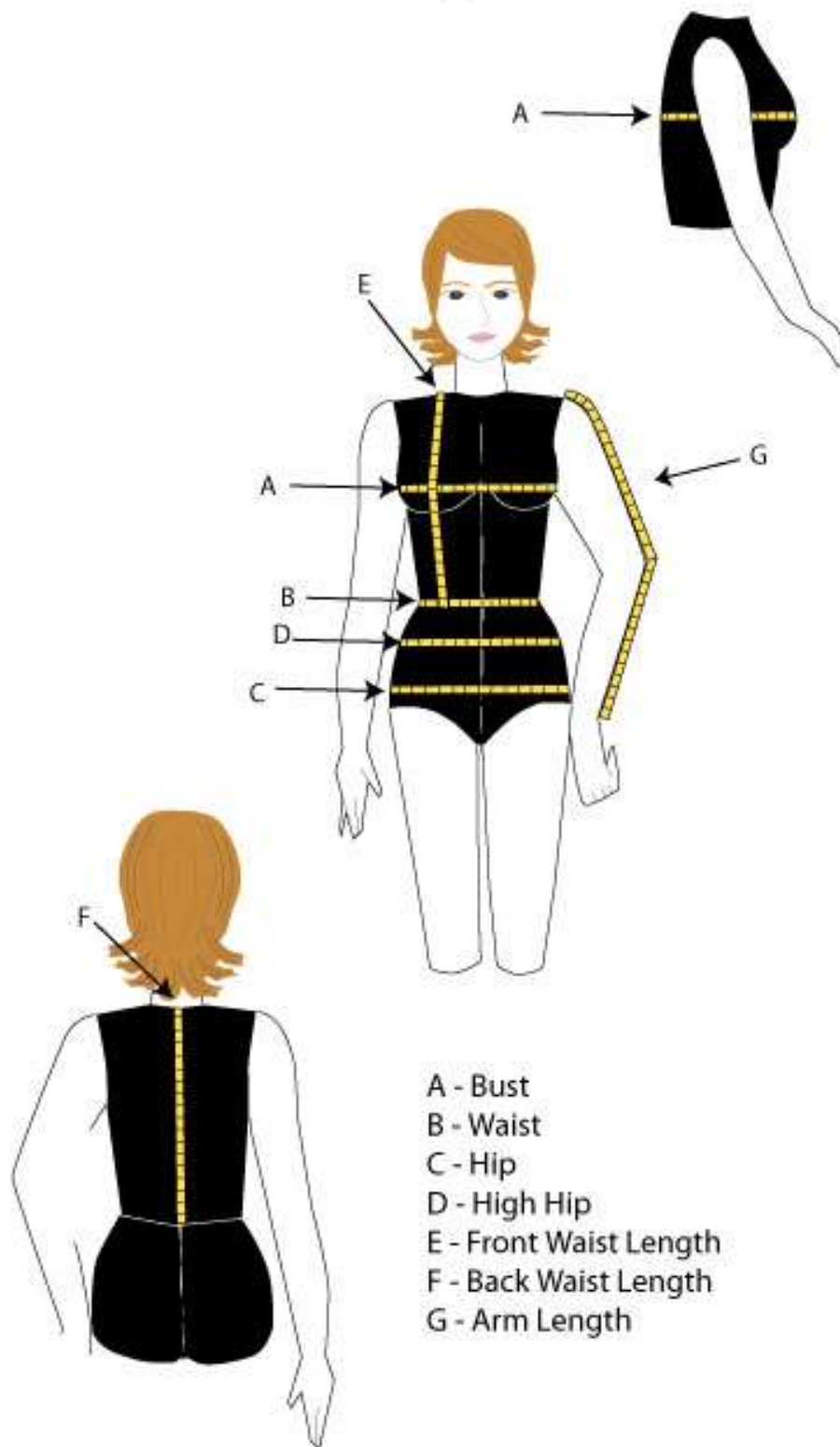


Figure 3: Measuring the body



A - Bust - Measure the bust at the fullest part. Measure all around the body (total circumference).

B - Waist - Measure the waist where the body bends. It helps to bend side to side to identify exactly where to measure. You can put an elastic band around the waist to mark the correct placement.

C - Hip - Measure the hips at the fullest part, usually around the seat.

D - High Hip - Measure around the fullest part, about 3 - 4" below the waist. This is helpful when fitting a slim skirt or pants (to get an accurate idea of the shape of the hip, or the belly).

E - Front Waist Length - Start at the shoulder (right next to the base of the neck), and measure to the waist, measuring over the fullest part of the bust.

F - Back Waist Length - Measure from the base of the neck (in the center, not the side), to the center of the waistline.

G - Arm Length - Measure from the top of the arm (find the bone at the shoulder/top of arm) to the wrist (find the bone at the side of the wrist), WITH THE ELBOW BENT. It's important to keep the elbow bent to allow for movement when you make a sleeve.

Body Measurements & Finished Garment Measurements

Body measurements are taken at the bust, waist, and hips to determine sizing, and give you an idea of the dimensions that you'll be designing for.



Measurements			Sizes	
Chest	Waist	Hips	US	US (letter named)
31.5-32	23.5-24	34-34.5	0	X-Small
32.5-33	24.5-25	35-35.5	2	X-Small
33.5-34	25.5-26	36-36.5	4	Small
34.5-35	26.5-27	37-37.5	6	Small
35.5-36	27.5-28	38-38.5	8	Medium
36.5-37	28.5-29	39-39.5	10	Medium
37.5-38.5	29.5-30	40-41	12	Large
39-40	31-32	41.5-42.5	14	Large
40.5-41.5	32.5-33.5	43-44	16	X-Large
42-43.5	34-35.5	44.5-46	18	1X
44-45.5	26-27.5	46.5-48	20	2X

Figure 4: Body Measurements

As you may have guessed from the name, finished garment measurements are the measurements of the actual garment. They are also taken at the bust-line, waist, and hips, plus 10 or more other points needed to make a pattern. Typically, they have room for ease. The FGM tells you how a garment will fit at the end of production.

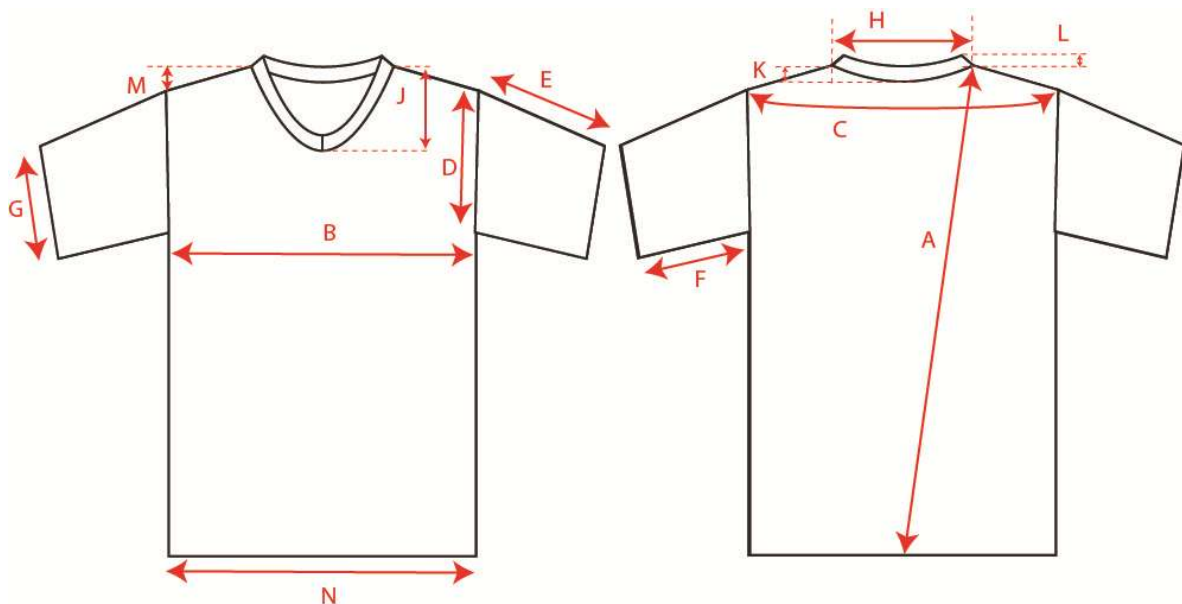


Figure 5: spec pom



How much these two measurements differ depends on the structure of the garment you are creating, and the fabric you choose to use. If it is a fitted look, then these two measurements will be very similar. If you were creating a body-con look or leggings with fabric that is meant to stretch then the finished garment measurements might even be smaller than the average body measurements.



Figure 6: Design Studio- measurements

Now, if you were creating a voluminous dress, it would be a little different. The finished garment measurements would be bigger than the body measurements. The ease of a garment dramatically changes the way it fits. The ease on a garment could be distributed evenly, or it could have more ease in the waist, but a fitted bust.



Figure 7: Measurements- dress

These different factors illustrate why it's important to have a back-line body measurement that corresponds to your customer, before creating the finished garment measurements.



Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page.

1. What is the difference between body measurements, vs. finished garment measurements? (5 point)

Note: Satisfactory rating – 5 points

Unsatisfactory - below 5 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____



Information Sheet-3

Interpreting garment measurements

1.3 Interpreting garment measurements

Clothing comes in various sizes which if comfortable can be easily worn, but it is the fit of the garment that makes the garment more appealing to the eye. For a properly fitted garment, it is the initial body measurement that plays a vital role. Thus, it is crucial for someone be it a student, a dressmaker, designer to have a thorough knowledge of the correct procedure for taking body measurements.

The measuring of a human figure starts with the knowledge of anthropometric measurement. The term anthropometric is derived from a Greek word Anthropos meaning human figure and metric meaning measurement. Thus, it is the systematic collection of measurement of the human body and garment construction need that measurement of an individual or a dress form's different parts to construct a garment of proper fit.

Following are some points describing the importance of a proper measurement:

1. It is very important for taking measuring and thus creating a standard scale.
2. Anthropometric data are used in the Readymade Garment Industry.
3. Detailed measurements are very useful for standard drafting and making paper patterns.
4. Measurements are also important for proper fit as no two people's figures are alike.
5. The final look, silhouette, and fit of the garment principally depend upon the measurement taken.
6. Measurement is needed for calculating the exact quantity of fabric required, to avoid fabric wastage. Before taking measurement there are certain guidelines that should be followed to avoid any abnormality, mistake, or miscalculation related to fitting in the measurement. The guidelines are as follows:



Before measurement, one should find out the client's requirement regarding the fit, style, shape, pocket, collars, etc before taking the measurement. An initial talk with the client and showing patterns and fashion pictures and stitched garments can help out a lot.

1. It is very important to observe the figure of the client carefully to look upon and record any kind of abnormality or deviation from the normal figure and it should be calculated while taking measurement and pattern making.
2. While taking the measurement the client should be advised to stand erect in the natural pose and if possible, in front of the mirror.
3. Measurements should be taken with a proper tape without keeping it too tight or too loose against the body.
4. Measurement should be taken in proper order and in a certain sequence and should be recorded simultaneously.
5. All girth measurements should be taken with the right ease as an allowance for movements or change in figure.
6. Repeat of the measurement for conformation.
7. Before starting with the measurement location of the structural lines of the garment should be taken care of. It can be done by tying a cord at the waistline, scye line, and neck.
8. Measurement should be taken over well-fitted undergarments or over outer garments only if it is fairly fitted.
9. Care should be taken at the start and finish of the measurement to avoid extra measurement.
10. While taking length measurement tape should be kept absolutely flat, smooth and straight i.e. parallel to the spine or centre front.
11. While taking width measurements to be sure that tape does not sag and tape should be parallel to the floor.
12. Arc measurement should be taken from centre line to side seam.

One should avoid taking too many measurements or relying on elaborate methods of measuring which can create more mistakes.



Taking body measurement:

Bodice measurement: the various bodice measurement are as follows

1. Bust: Measurement has to be taken about the fullest part of the chest/bust by raising the measuring tape to a level slightly below the shoulder blades at the back.
2. Waist: Measurement has to be taken tightly around the waist with the tape straight.
3. Neck: Measurement has to be taken around the neck, by keeping the tape slightly above the collar front and along the base of the neck at the back
4. Shoulder: Measurement has to be taken from the neck joint to the arm joint along the middle of the shoulder (A to B in Figure).
5. Front waist length: Measurement has to be taken down from the high point shoulder (HPS) to waist line through the fullest part of the bust (A to C Figure).
6. Shoulder to bust: Measurement has to be taken down from the HPS to the tip of the bust (A to D in figure).
7. Separation of bust point: Measurement has to be taken between the two bust/chest points (D to E Figure).
8. Across back measurement: Measurement has to be taken across the back between armholes about 3" below the base of the neck (P to Q in Figure).
9. Back unit length: Size has to be measured from the base of the neck at the centre back position to the waistline (R to S in the Figure).
10. Armscye depth: Measurement has to be taken from the base of the neck at the centre of the back to a point directly below it and in level with the bottom of the arm where it joins the body (R to T in Figure).

Sleeve measurements

1. Upper arm circumference: Measurement has to be taken around the fullest part of the arm.
2. Lower arm: For the lower arm, measurement has to be taken around the arm at the desired level corresponding to the lower edge of the sleeve.



3. Elbow circumference: Measurement has to be taken around the arm at the elbow.
4. Wrist: Measurement has to be taken around the wrist.
5. Sleeve length: For short sleeves, the length has to be measured from point B to F. For elbow length sleeve, measurement has to be taken from the top of the arm to the elbow point (B to G in figure). For full length, the elbow has to bend slightly and measurement has to be taken down from the top of the arm to the back of the wrist passing the tape over the elbow point (B to H in the figure).

Skirt measurements

1. Waist: Measurement has to be taken tightly around the waist with the tape in a horizontal manner and parallel to the floor.
2. Hip: Measurement has to be taken around the fullest part of the hip horizontally (7-9" from waist approximately).
3. Waist to hip: Measurement has to be taken from the waist at the centre of the back to the fullest part of the hip (S to U in the figure).
4. Skirt length: Measurement has to be taken at the centre of the back from the waist to the length of the skirt as required (To V in Figure).

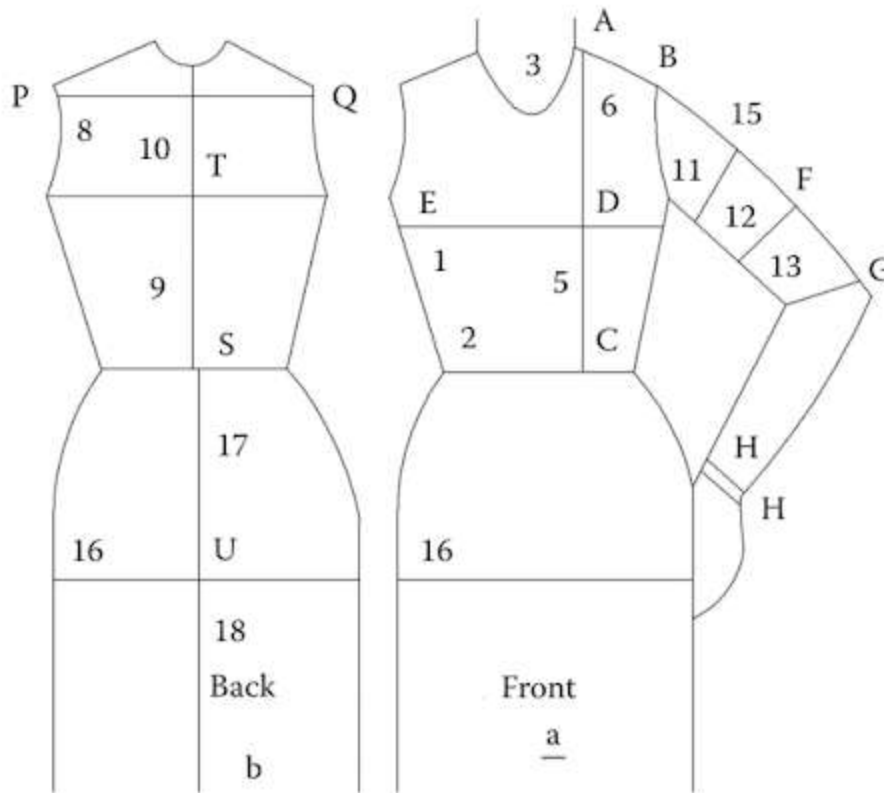


Fig: Body measurement

Also, there are calculations that are based on anthropometrics where only the chest circumference can be used to calculate other measurements of the body. Following is the table of determining other dimensions from chest circumference.

Measurements	Women	Men
Waist	Chest – (4-5")	Chest – (5-7")
Hip	Chest +(1-2")	Chest+(2-4")
Shoulder (half)	$\frac{1}{4}$ Chest – $\frac{1}{2}$ "	$\frac{1}{6}$ Chest + (1-2")
Armseye depth	$\frac{1}{8}$ Chest + 1"	$\frac{1}{8}$ Chest + (2-2½")
Neck	$\frac{1}{3}$ Chest + (2-3")	$\frac{1}{3}$ Chest + (2-2½")

After taking the measurements there is only one thing left to do before drafting into a pattern. That is the addition of an ease allowance that is added for comfortable movement, ease of action, and comfort in wearing. Normally these are the following ease allowance added to various parts of the body

- Bust – 3-5" (3" for a tight-fitting garment and 5" for loose-fitting).
- Waist – ½".



- Hips –3-5".
- Upper arm –3-4"
- Armhole depth –1".

This completes the process of taking proper measurements of a human figure or client. This will be followed by drafting and cutting the pattern, tracing onto the fabric, and finally sewing to complete the garment.



Self-Check -3	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page.

1. What is the term anthropometric mean? (4 point)
2. List the body taking measurements needed for sleeve measurements. (5 point)

Note: Satisfactory rating – 9 points Unsatisfactory - below 9 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



Information Sheet-4

Observing ergonomic arrangement

1.4 Observing ergonomic arrangement

Ergonomics aims to make sure that tasks, equipment, information and the environment suit each worker. It is a field of study that has contributed to the understanding of work-related stresses and solutions, anatomy and physiology, anthropometrics, biomechanics, psychology, and industrial design and engineering. Industrial Engineering Terminology, defines ergonomics as: “The application of a body of knowledge (life sciences, physical science, engineering, etc.) dealing with the interactions between man and the total working environment, such as atmosphere, heat, light and sound, as well as all tools and equipment of the workplace.” It is indeed a highly interdisciplinary field which helps the worker to attain higher productivity due to less fatigue, safer working environment (fewer accidents), lesser absenteeism and reduced labour turnover.

‘Is the job fit for the worker and is the worker fit for the job’? – Sir Thomas Legge,
Britain’s first Chief Medical Inspector of Factories

Are as of ergonomic intervention include the human-machine interface, environment, hardware and work posture. Some of the factors that affect ergonomic interests are: Climate (Temperature, Humidity and Airflow – Ventilation); Noise, Illumination, Vibration and Radiation; besides Work Time/Shift, Work Overload, Ageing, Material Handling, Stress or Strain and Load.



Fig:1.4 ETON overhead material handling in UPS (Unit Production System)



Self-Check -4	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page.

1. How the industrial engineering terminology, defines ergonomics? (4 point)

.

Note: Satisfactory rating – 4 points

Unsatisfactory - below 4 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____



L #37	LO #2- Determine / confirm design and pattern requirements
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Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Discussing types and performance characteristics of fabrics
- Discussing and agreeing garment design and preferred material or fabric.
- Incorporating special needs.
- Selecting/ modifying design in to the pattern

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Discuss types and performance characteristics of fabrics with client
- Discuss and agree garment design and preferred material or fabric with client
- Incorporate special needs of the client
- Select/ modify design in to the pattern

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets” .



Information Sheet-1	Discussing types and performance characteristics of fabrics
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2.1 Discussing types and performance characteristics of fabrics

Fibres and Fabrics

Fibres are the basic components of textile fabrics. Each has a unique characteristic that it lends to the fabrics made from it. Although fabric's character can be altered by yarn structure, by the type of weave and also by the finish that is given to the fabric, the original personality is still evident in the final fabric and is important to its uses and its care. Before this century all the fabrics were made from natural sources. In recent years a plethora of new fabrics have come into the market, which are products of chemical laboratories or, in other words are man-made. There is a variety of fabrics available in the market; these can be broadly divided into three major categories:

- i) Natural
- ii) Man made
- iii) Blends of natural and man made



Natural fabrics are further categorized into fabrics that are procured from animals and those, which originate from plants. The commonly available and used animal fabrics are silk, wool, fur, leather etc. However, some experts do not include fur and leather in textile fabrics technically, as they are skins of animals. On the other hand, some do include them, as they are widely used as an alternative to textile fabrics both for garments and household products. The most commonly available and used plant fabrics are cotton and linen.

Characteristics

Natural fibres have the irregularities and sensitivity inherent in natural things. These contribute to the beauty of natural fabrics. Advantages: These fibres, due to their natural character, have common qualities of being absorbent and breathe due to the porous structure. Thus, they are more responsive to climatic changes in temperature and humidity and are hence more comfortable to wear under a variety of climatic conditions. The disadvantage of natural fabrics, especially for cotton and linen, which is also an inherent quality, is that due to less elasticity they tend to wrinkle. This is also being



overcome with a variety of wrinkle-resistant finishes, though at the cost of some comfort.

Mercerized cotton is a common example of wrinkle-resistant finish without the application of chemicals, where cotton fibre is spun at very high tension to produce sheen in the yarn and make it more supple thus making it wrinkle-resistant.

Synthetic fabrics have their beginnings in chemical solutions that are forced through tiny holes into chemical bath or air chamber; these harden into long ropes of fibres that are later woven into fabrics. Advantages: All synthetic fibres are elastic hence they are wrinkle-resistant. Disadvantage: On the other hand almost all manmade fibres are less porous hence they are uncomfortable in hot and humid weather. Certain synthetics like Nylon are thermoplastic and hence can be moulded at controlled temperature and pressure to create interesting textures and design variations; they are called heat-set designs. An all time favourite of this design is heat set pleats. Japanese designers have explored a lot in this technique and have mastered the art of heat set pleating. This pleating can be done at any stage in fabric production at fibre stage, yarn stage or on the final fabric.

Blended Fabrics are combinations of two or more different fabrics. Usually the fibre present in higher percentage dominates the characteristics of the final fabric, but a successful blend will have desirable qualities of all fabrics. One such successful and popular fabric is Terry cot® which is a blend of 65% Cotton and 35% Terylene. A common problem with the synthetics is the large number of terms used to identify them. For example, Acrylic may be called Orlon® & Acrilan® as they are the registered trademarks of some companies which generally confuse the consumers. In India, the consumer generally recognises the fabrics by the trade names or the common group terms by which a shopkeeper might be referring to them. Another problem is the fact of the common consumer being misled by shopkeepers selling polyester blended silk as Khadi silk and claiming it to be pure silk. The consumer, therefore, needs to learn to identify commonly used fabrics, as most fabrics cannot be identified by their appearance



alone. The information on the fabric bolt can be read, as it is compulsory for the manufacturer to print it on the fabric

Underlying fabrics

Underlining is a lightweight fabric that is applied to the wrong side of the garment fabric primarily to give additional strength, support, and durability to the garment. Underlining also helps to maintain the shape of the garment and to reinforce its seams. An additional benefit of underlining; it will give a degree of opaqueness to the garment fabric. This keeps the inner construction details and stitching from showing through to the outside the garment. Underlining fabrics are made from various fibres, finished in several different hands (soft, medium, and crisp), and available in a wide range of colours. There are also other fabrics, such as organza, tricot, and lightweight blouse and lining fabrics that are not classified as underlining but can serve the same purposes.

(a) Interfacings

An interfacing is a special type of fabric applied to the inside of a garment to give it shape, body, and support. Since it is usually a sturdier fabric than is used for underlining, its effect on the garment fabric is more apparent and definite. An interfacing may be applied to the entire garment but is usually applied only to parts, such as collars, front or back openings, lapels, and hems, and to such details as pocket flaps.

Interfacings are made from many different fibres in several weights and degrees of crispness; they may be woven or non-woven. A comparatively new category of interfacings, fusible interfacings, instead of being stitched to the garment fabric, are ironed onto it. Fusible, too, may be woven or non- woven. The wide range makes it possible to choose an interfacing that will be compatible with any type of garment fabric. Two considerations are critical in selecting interfacing: (1) it should complement and reinforce the garment fabric without overpowering it; (2) though the two fabrics need not be identical in fibre content, it is always best that they should have the same care requirements.



(b) Interlining

Interlining is a layer of fabric inserted between the face or shell and the lining of the garment. It is similar to batting, a thick layer of fibre designed to provide insulation to heavy winter jackets. Depending on the application, the materials in this layer can be woven, knitted, or created by fusing fibres together. Silk, wool, and artificial fibres with good insulating qualities are common choices for interlining. Interlinings can be soft, thick, or flexible. Some are designed to be fused, while others are intended to be sewn to one or both layers of the textile. As an inner lining within textiles, it is used in a number of applications. Though the consumer never sees it, it is the difference between a good winter coat and a great one. Interlining is applied to a garment to supply warmth during wear.

(c) Linings

A lining is applied to the inside of a garment to finish it and to hide the garment's inner construction. No matter what type of garment, it is used for the in-dress, coat, jacket, pants- a lining is a luxurious as well as functional finishing touch. Most often made from a relatively slippery fabric, a lining can match or contrast with the colour of the garment. It can even be made of a printed fabric, as long as it does not show through to the outside of the garment. Lining adds a degree of warmth to a garment as well as making it easier to put the garment on and take it off. Though lining fabrics may be of many different fibres, any specific choice should be limited to fabrics that are compatible with the care requirements of the rest of the garment. Besides this, a lining should be sufficiently opaque to conceal the garment's inner construction. Its qualities should be appropriate to the type of garment it is being applied to.

Selection of Underlying Fabric

In considering which of the underlying fabrics are advisable or necessary for the garment being constructed, it is much easier to decide about a lining or interlining than about underlining and interfacing. Lining and interlinings are, in effect, extras added to a garment for comfort and, in the case of lining to conceal the inside of a garment. Neither



of these helps in any way, however, to build in or maintain the shape of the garment. This is done by Underlining and interfacing.

There are two determining factors with that affect the type of underlining:

- (1) The shape or body intended by the garment design
 - (2) The support needed in order to achieve that design in the desired fabric.
- Generally speaking, the more structured and detailed a design or style is, there greater the need for an underlining and interfacing. The weight of the garment fabric is a factor too the lighter in weight or softer the fabric is the more support it needs.



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page.

1. The fabrics can be characterized into _____, _____ and _____fabrics.(3 points)
2. The inter lining in the garment is for providing _____ and _____ to the garment. (2 points)
3. Underlying fabrics are _____& _____(2 points)
4. A lining should be sufficiently _____ to conceal the garment's _____ construction(2 points)
5. Interlining is added in between the _____ and _____ of the garment. (2 points)
6. Name 2 fabrics that serve the purpose of underlining (2 points)

Note: Satisfactory rating – 13 points

Unsatisfactory - below 13 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



Information sheet-2

Discussing and agreeing garment design and preferred material or fabric.

2.2 Discussing and agreeing garment design and preferred material or fabric.

Materials and design strategies to provide appropriate movement performance

Fabric properties and garment design are the two primary, interacting factors that contribute to, or impede garment comfort. Material properties that have an effect on movement include weight, thickness, stiffness, stretch, and recovery. Fabrics inherently have a certain degree of flex, but the amount varies greatly. Woven fabrics are generally more rigid than knits, as knitted fabrics have inherent flexibility due to the interlaced structure of the yarns in knits. According to Hatch (1993), the appropriate range of percent elongation for textile materials for tailored clothing is between 15%–25%, for sportswear is between 20%–35%, for active wear is between 35%–50%, and for form fitting garments is between 30%–40%. Joseph (1981) identifies the amount of elongation for regular wear as between 10% and 25%, and for more active wear between 35% and 50%. It is essential that the fabrics also have a high level of recovery, generally in the range of 95% to 98%.

Fabrics used in protective clothing are often extremely rigid compared to these ranges, due to the thickness of yarns with desired properties and fabric structures or coatings designed to protect against environmental challenges. Overall, the interaction of fabric properties, garment design, and sizing and fit determine the range of movement possible in a garment.

One common solution to provide movement, when more rigid fabrics are desired for their specific properties, is to design sections in a garment that are more flexible in areas where more movement is needed. This can be done by introducing more flexible fabrics (i.e., a stretch fabric in a panel under the arm in a rain jacket), by increasing the flexibility of a fabric with design features (i.e., pleating or gathers), or by treating a fabric differently in different areas (i.e. a knitted gardening glove with rubberized areas and



untreated, more flexible areas). Incorporating flexible areas in a garment design is a particularly useful strategy when a garment must be tethered to the body, and therefore cannot move freely over the surface of the body

Another design element often used to provide 'slip' of the garment over the body as the wearer moves is the use of lining fabrics with little friction. Such linings can add greatly to the comfort of a garment, reducing the 'grab' of fabrics and seam areas that have greater frictional force that can impact the skin or layers of garments. Garment layers binding together because of frictional drag forces can increase the difficulty of movement. Teitlebaum and Goldman (1972), in a study of a seven layer arctic clothing system, found that metabolic cost was approximately 16% greater than the metabolic cost when wearing a combination of underwear and one layer of clothing, and attributed this increase to either the 'friction drag' between layers or the interference with joint movement produced by the bulk of the clothing. It is important in a garment of many layers (or in ensembles made up of many layers of clothing) to consider the frictional properties of the layers, and also to carefully engineer the fit of each layer on top of the previous one, so that outer layers are not too tight and movement is not compromised (see Fig.8 below).

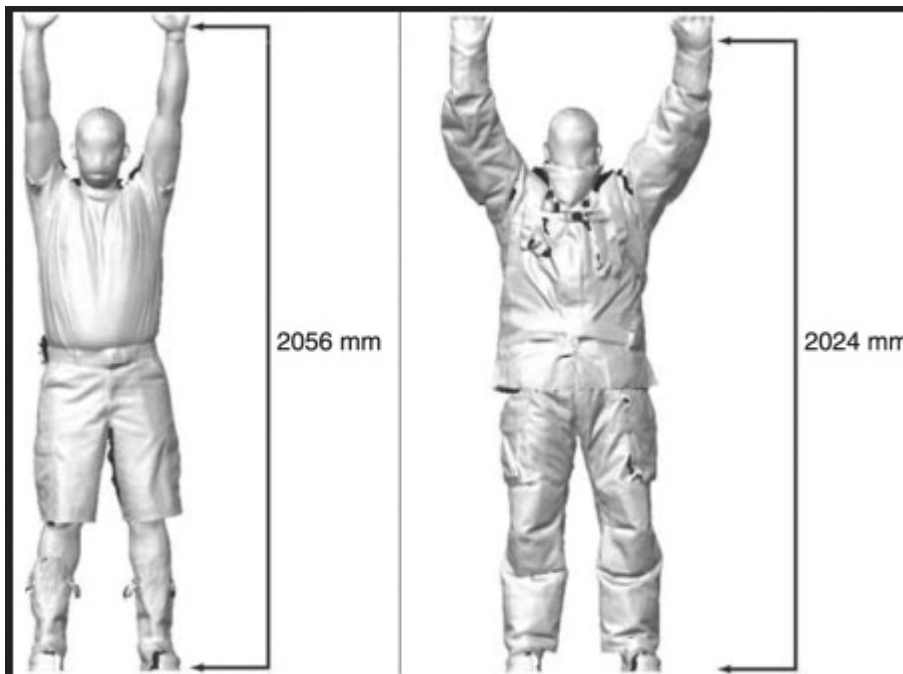


Figure 8



Fig.8 Firefighters' uniforms are made of many layers of fabric which are carefully engineered to provide thermal protection, which can impede movement. This uniform has reduced the range of movement of the wearer.

The amount of frictional force of a fabric can increase as the moisture in the fabric and on the skin increases as a result of sweating, resulting in both thermal discomfort and binding of the garment with movement. Restrictions to movement from a garment also have the effect of increasing the metabolic cost of wearing the garment overall. On the other hand, in a well designed and well fitted garment the 'bellows effect' generated by movement can decrease the thermal load. Air in the garment structure can be moved through the openings of the garment in a pumping action that ventilates the body.

Proper fit is also essential to create garments of any type that move and balance well on the active body. Good design of clothing requires the development of garment shapes that provide proper ease (the added circumference or length of the garment that allows the body to move) and proper set (the 'balance' of the garment that keeps it in place so that the interaction of gravity and frictional properties of the fabric do not displace the garment on the body with movement). This can be difficult to achieve, especially in a heavy garment with many layers such as a firefighter's turnout gear. Multiple prototypes and testing of the garment in active positions are necessary to create a well balanced and well fitted garment appropriate for a wide range of body sizes and proportions.

One design strategy that works well for active wear and some types of work wear is to create pattern shapes for active positions. Bike shorts that fit and move well when the wearer is on the bicycle, but are baggy and bind when the wearer walks are a good example of this design strategy (see Fig.9). Well designed gloves will generally have fingers that are curved, as most of the movements of the fingers and hand are in a flexed position. A glove that is designed in a flat configuration will require the wearer to overcome the resistance to flex the glove to the neutral hand and finger position, before the further flexion required for most hand activities begins.



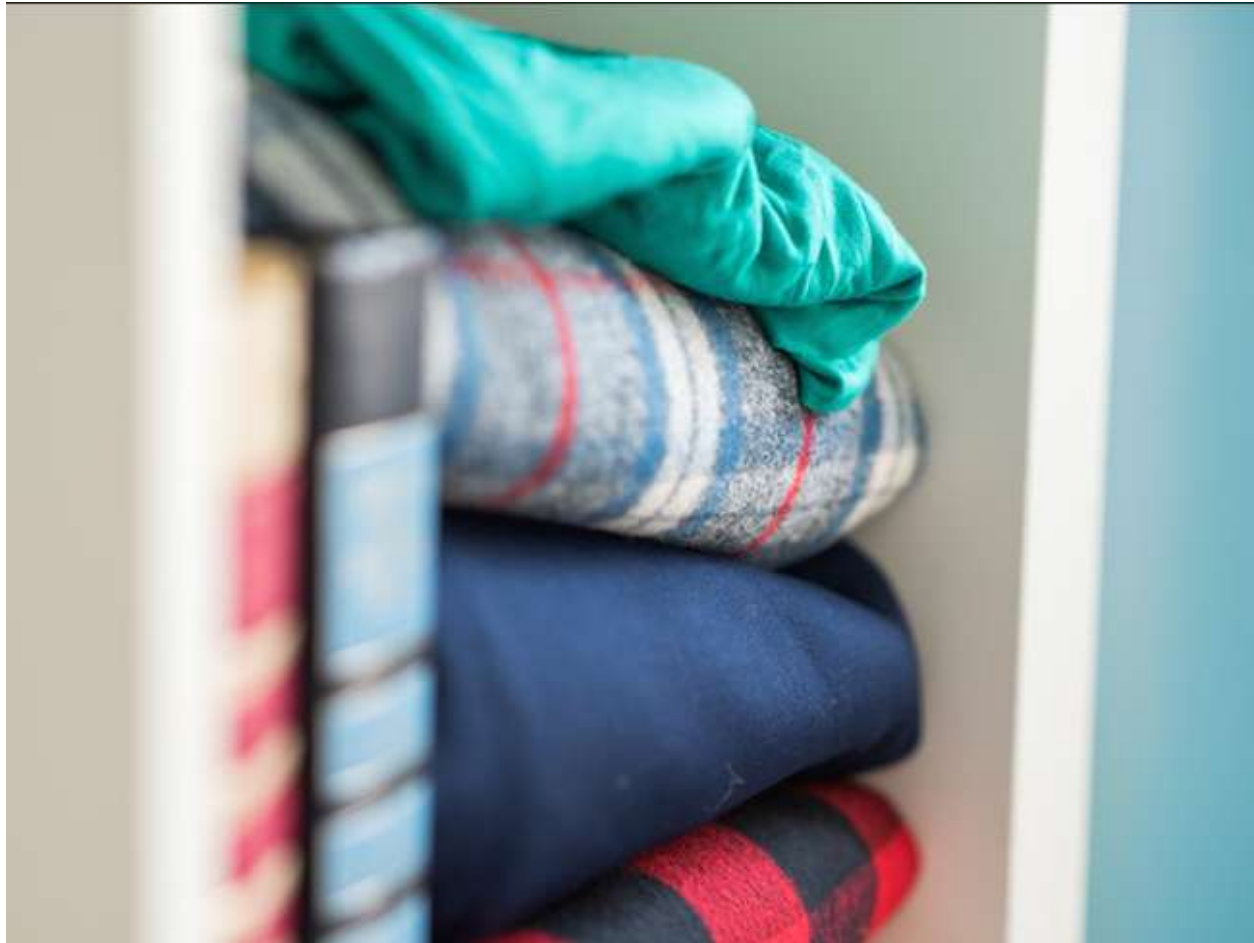
Figure 9

Fig.9. Patterns for bike shorts are shaped in an active position so that they fit well when the rider is on the bike. The shorts without the body inside will be the same bent shape as when they are on the body.

Many other creative design strategies can be applied to increase movement in clothing, such as overlapping segments or stacking segments of inflexible materials next to one another, isolating segments from one another and tethering them directly to the moving body part, or creating rigid joints that can roll, slide, rotate, or twist.



How to Choose the Perfect Fabric and Patterns Every Time



Choosing fabric is the most important step in sewing a garment — making the wrong choice can mean a big disappointment. Fortunately, there’s usually more than one “right” fabric for any pattern, and with a few pointers you can easily hit the mark.

How to Choose Fabric for Clothes

When starting a sewing project, you’ll begin in one of two places: either you’ll have fallen in love with a pattern and need fabric to make it, or you’ll have fallen in love with a fabric and need to find a suitable pattern.



Picking Fabric for a Pattern

Picking fabric for patterns is simple, as patterns tell you which types of fabric they were designed for. Although there are no sewing police to come arrest you if you deviate from the suggested fabrics, beginning sewists especially will want to stick to the list. The fabrics listed will have properties (in terms of weight, stretch and drape) that complement the design of the pattern.

12 types of fabric commonly used for garment sewing:

- **Cotton voile:** Voile is a lightweight, semi-sheer fabric with a great drape.
- **Cotton lawn:** Lawn is very similar to cotton voile but is slightly crisper.
- **Rayon challis:** Rayon challis is a smooth, lightweight fabric. It drapes well and is slightly heavier than other lightweight fabrics, like cotton voile and cotton lawn.
- **Chambray:** Chambray is another smooth, lightweight fabric. It doesn't drape as well as rayon challis, cotton voile or cotton lawn.
- **Denim:** Denim is a heavy-weight fabric with very little drape or stretch.
- **Double gauze:** Double gauze is a unique fabric in that it is literally two layers of gauze woven together. The double layer of fabric eradicates the main problem of sewing clothing from gauze (the sheerness), while retaining the good qualities (extremely light and breathable).
- **Knit:** In the knit fabric category, there are several types of knit, varying from lightweight to medium weight. Knit fabric is your go-to for any garment that needs to have a great deal of stretch. Patterns are designed for either woven fabric or knit fabric, and patterns sized for knit fabric will often specify the degree of stretch needed in the fabric.



- **Silk:** Silk is a lightweight, delicate fabric that drapes well. It has a slightly shimmery appearance. Silk can be slippery and more difficult to work with. It also makes a great lining fabric.
- **Satin:** Satin can vary from lightweight to heavyweight, depending on the type of satin. Like silk, it has a glossy appearance.
- **Linen:** Linen is a medium-weight fabric with little elasticity (hence the wrinkles). But it conducts heat very well, which is why it's a popular choice for warm-weather anything.
- **Wool:** There are over 200 different types of wool, coming from 40 different breeds of sheep, so the weight will vary depending on the type of wool. Wool is extremely hard-wearing and versatile. It's also very warm and a good choice for colder weather garments.
- **Flannel:** Flannel is a soft, lightweight fabric. It works well for colder-temperature shirts, pants and jackets.



2.3 Incorporating special needs.

Designing “Adaptive Clothing” For Those With Special Needs

Companies are releasing new inclusive lines that solve some of the dressing challenges that people with physical and mental disabilities face



Figure 10

“We design the garments around what parents want for their children, what occupational therapists are asking for, what children are saying they’re most comfortable in,” says Sasha Radwan, founder of SpecialKids.Company.

Most of us don’t think a whole lot about getting dressed. Sure, we might care about our style, but the actual process of putting on clothes—pants one leg at a time, button through the button hole—is as automatic as breathing.



But imagine you only have one arm. How do you button your shirt now? What if you receive nutrition through a feeding tube implanted in your stomach? Wearing that cute dress means you can't eat in public, lest you flash everyone in the room. Think about what the tight waistband of your jeans might feel like if you were autistic and had magnified sensitivity to touch.

For years, people with disabilities and special needs have had to improvise. Those with cerebral palsy that affected their hand coordination might replace sleeve buttons with Velcro. Parents of autistic kids would cut the scratchy tags out of their children's t-shirts. But now, a slew of companies both new and established are creating "adaptive clothing" to meet these needs.

Target has been at the forefront, with a line of adaptive clothing for children, designed by a mom with a special needs daughter. The clothing come without tags or seams, a boon for children who find new textures irritating. Body suits are easy access for diaper changes, while wheelchair-friendly jackets have side-openings and zip-on sleeves for easier dressing. This year, the company added lines for adults with physical and mental disabilities as well. Tommy Hilfiger, best known for its high-end sportswear, just launched Tommy Adaptive, a line of clothing for children and adults with various needs, from jeans that fit over prosthetic legs to shirts with easy-open necklines. The shoe e-retail giant Zappos has also started selling adaptive shoes and clothing, from stability-enhancing sneakers to shirts with magnetic buttons. In 2015, Nike created the Fly Ease, an easy-on zippered athletic sneaker inspired by a letter from a teenager with cerebral palsy who struggled with regular sports shoes. The company now makes the shoe in men's, women's and children's sizes.

But while the large companies are only starting to see the potential of adaptive clothing, smaller retailers have been targeting the market for years.

Sasha Radwan, founder of SpecialKids.Company, was inspired to launch the online adaptive clothing retailer after learning about an extended family member in her parents' native Egypt who was disabled. She was institutionalized at 18 and died 10 years later.



After leaving a corporate job, the Australian-born Radwan wanted a career that gave back. So she tried to think of something that would help people with disabilities be better integrated into society.

“There was a big gap in the clothing market where the needs of these children were not being met,” she realized.

SpecialKids.Company sells clothing for kids with a variety of physical and mental challenges. There are one-piece suits that help keep children from accessing the contents of their diapers, a common behavior among children with certain developmental delays. There are garments with flaps on the midsection for accessing feeding tubes. There are socks with loops to help children with coordination problems pull them up.

“We design the garments around what parents want for their children, what occupational therapists are asking for, what children are saying they’re most comfortable in,” Radwan says.

Importantly, the designs are age-appropriate. While a 12-year-old may need to wear a one-piece garment, they likely wouldn’t appreciate one that looks like a baby onesie. So the clothing at SpecialKids.Company have stylish details like polo collars and raglan sleeves.

Kevin Iverson appreciates the consideration. A 49-year-old in the UK, he has various lifelong disabilities. Before finding SpecialKids.Company, he would scour the web for garments adapted to his needs. He struggles with incontinence and has a short stature. Though the company specializes in kid’s apparel, he finds their clothing a perfect fit.

Other adaptive clothing companies focus more on high-fashion. Russia-based Bezgraniz Couture has shown their fashion-forward adaptive designs at fashion weeks across the world, featuring models who were amputees, in wheelchairs, had Down syndrome or cerebral palsy. British designer Lucy Jones has won numerous accolades in recent years for her “Seated Design” collections created for wheelchair users,



including designs for garments like pantyhose that are difficult to get on for even the most able-bodied wearers. To create her designs, Jones had to take into account things like how seams might chafe legs constantly in the seated position, and the angle of the pelvis when seated.

Thinking about fashion in these new ways can be an innovation challenge. For nearly four years, designers, engineers, occupational therapists and people with various disabilities have gathered at Open Style Lab, currently sponsored by Parsons School of Design, to create disability-friendly clothing that doesn't sacrifice stylishness. Each summer the team produces bespoke outfits for four or five people, who have disabilities ranging from nerve sensitivity to paralysis.



Information sheet-4

Selecting/ modifying design in to the pattern

2.4 Selecting/ modifying design in to the pattern

How to select a design pattern

As there are 23 patterns in the catalog it will be difficult to choose a design pattern. It might become hard to find the design pattern that solves our problem, especially if the catalog is new and unfamiliar to you. Below is a list of approaches we can use to choose the appropriate design pattern:

Consider how design patterns solve design problems:

Considering how design patterns help you find appropriate objects, determine object granularity, specify object interfaces and several other ways in which design patterns solve the problems will let you choose the appropriate design pattern.

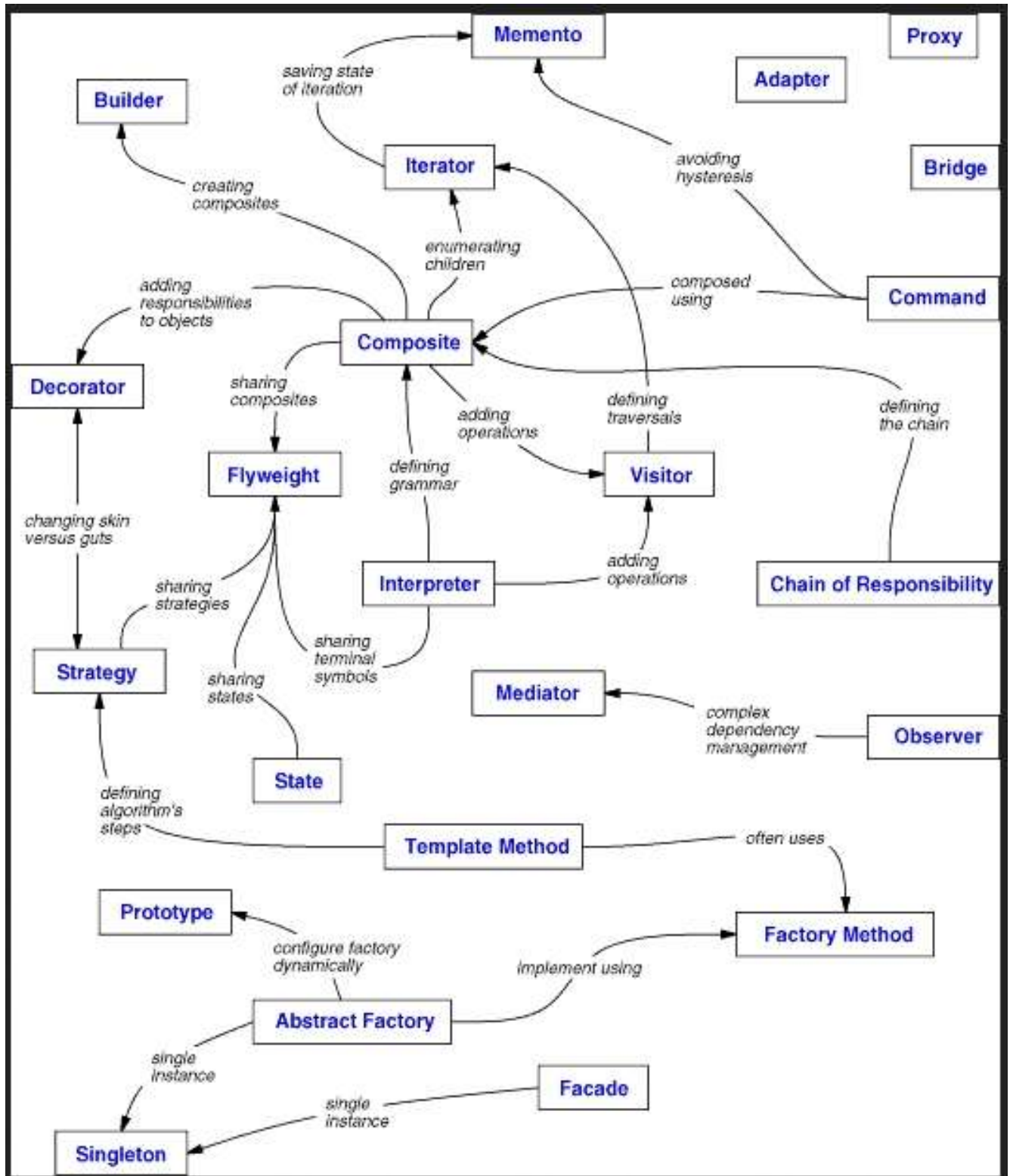
Scan intent sections:

Looking at the intent section of each design pattern's specification lets us choose the appropriate design pattern.

Study how patterns interrelate:

The relationships between the patterns will direct us to choose the right patterns or group of patterns.

Below figure will guide you in remembering the related patterns:



**Study patterns of like purpose:**

Each design pattern specification will conclude with a comparison of that pattern with other related patterns. This will give you an insight into the similarities and differences between patterns of like purpose.

Examine a cause of redesign:

Look at your problem and identify if there are any causes of redesign. Then look at the catalog of patterns that will help you avoid the causes of redesign.

Consider what should be variable in your design:

Consider what you want to be able to change without redesign. The focus here is on encapsulating the concept that varies.



L #38	LO #3- Lay-up and cut material
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Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Checking materials quality.
- Laying up material
- checking material alignment
- Cutting materials
- Handling materials

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Check material for quality, faults, width, selvages, dye lot and marking
- Check material laid-up and alignment
- Cut material
- Handle material based on its characteristics

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets” .



Information Sheet-1

Checking materials quality

3.1 Checking materials quality

As a garment importer touring your supplier's factory, you likely have one thing on your mind: the anticipation of customer satisfaction as they buy an item from your product line. But there's a problem.

The "quality" fabric from your supplier doesn't meet your standards. In fact, it has a lot of problems. Fabric inspection reveals countless defects ranging from drop stitches to color shading variation.

The scale of defects makes it clear the garment manufacturer will have to cut around the issues to use the fabric, wasting material in the process.

The 4-point system is the industry standard for evaluating fabric quality in the inspection industry. This system assigns penalty points to a roll of fabric according to defect size, quality and significance.

But you must understand the different types of fabric defects to look for before you can use the 4-point system.

1. Horizontal lines

This fabric defect is defined by irregular lines that run from side to side. Horizontal lines are generally caused by:

- Faults in the bobbin (the barrel used to hold yarn in place)
- Irregular thread tension

Causes and prevention of horizontal lines

Preventing the appearance of horizontal lines in fabric is quite straightforward. Regularly replace the bobbin and frequently check thread tension and positioning.



2. Shade variation

One of the more obvious visual defects that can be found on raw textiles, shade variation is defined by a difference in depth of shade and color from roll to roll or piece to piece. Shade variation in fabric is caused by:

- Mixing of fabrics used in production
- Variations in the production process with regard to time and speed
- Improper cutting, bundling and/or numbering
- Unequal fabric stretching





Causes and prevention of shade variation

Using the same base material and set of parameters for each production lot can effectively prevent shade variation.

When visiting a factory that manufactures raw textiles, it's critical to ensure workers are only combining garments of the same color and not taking shortcuts when cutting and bundling. Properly numbering textile types prevents mistakenly combining cuts that vary in shade.

3. Dirt/stains

Stains are fairly common among dyed textiles and are defined as spots or patches of differing color. Textiles are never truly safe from stains because they can occur anytime during or after production if they're not kept in an area with adequate protection.

Stains can appear on fabrics from just about any source. Dirt from the factory floor, oil from machinery and dyes are all known sources. Stains are relatively easy to identify and prevent so long as suppliers are vigilant about fabric quality.



Causes and prevention of dirt/stains

Your manufacturer can prevent stains during production by regularly cleaning production machines and equipment to ensure no random oils, grease or dyes make their way onto the textile.



Wrapping the finished rolls of fabric in plastic and storing them in a separate area away from the dying area can help avoid post-production stains.

4. Uneven dyeing/printing/dye marks

Dye marks are irregular patches on the surface of raw textiles. Dye marks are typically the result of:

- Low quality base fabric
- Improper leveling agents
- Incorrect pH in the production process
- Dye machine entanglement



Causes and prevention of dyeing/printing/dye marks

Ensuring there are no initial problems with the base fabric prior to stitching can help prevent dye marks. Any issues missed will be present in later production processes.

Other preventative measures include maintaining the correct pH level, using an appropriate dying agent and using a backup power generator to ensure production machines don't shut down during use.

5. Drop stitches

One of the most common quality issues found in raw textiles, drop stitches are holes or missed stitches that appear randomly in the fabric. Drop stitches are typically caused by:

- Incorrect set-up of yarn carriers
- Slubs and knots



- Yarn overfeeding or underfeeding
- Loose stitching during the production process



Causes and prevention of drop stitching

Checking the yarn carrier and any other machines to verify they're set to the right tension during production can prevent drop stitches. You can minimize the occurrence of drop stitching in your fabric or textile by regulating the yarn feed rate.

Resetting the pattern chain can fix this issue.

6. Misprinting, off printing or absence of printing

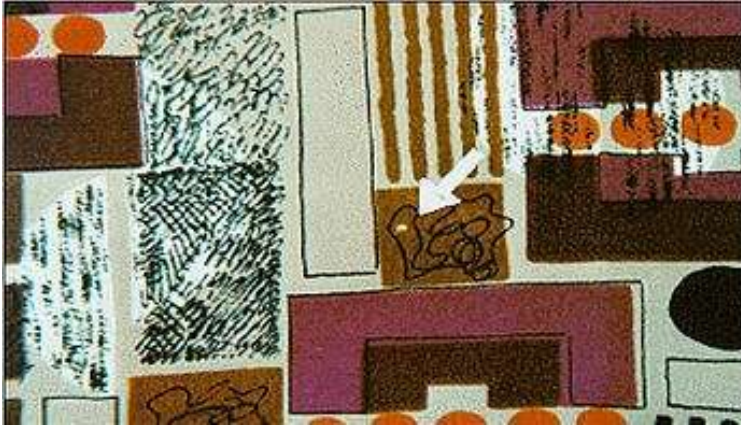
Misprint defects are only relevant to printed fabrics. Misprint is when the print of the fabric does not match your specified design. This is usually displayed in one of the following ways:

- Colors and/or patterns are completely or partially missing
- Colors and patterns are incorrectly positioned relative to each other

Causes and prevention of misprinting

Misprints are most often the result of:

- Wrong dyeing recipe
- Wrong leveling agent
- Incorrect dye combinations in lots
- Improper scouring of grey fabric



Implementing uniform dyeing, leveling and scouring processes can help prevent misprinting.

If you're sourcing a printed fabric, make sure to provide clear specifications regarding the colors and patterns of your printed fabric to your factory. Consider providing pantone color numbers and design files as a guide for your supplier.

7. Crease marks

A crease mark is a visible deformation in fabric. A crease mark differs from a crease streak, as it's unlikely to appear for an entire roll. Rather, it appears in just one spot on the fabric.

If final pressing cannot restore fabric to the original condition, a crease mark will be left on the final product. Discoloration can also be a problem associated with this fabric defect.





Causes and prevention of crease mark

Crease marks often happen when fabric passes through squeeze rollers in the dyeing process. Creasing is inevitable as fabric is fed through machines in rope form. But if properly handled, crease marks should not be permanent.

Crease marks can be caused by:

- Inadequate preparation, relaxation or bulking of fabric
- Poor quality of fabric: a tight construction, high twist yarns or dense weight
- Poor suitability of machine: not moving folds properly
- Incorrect loading of fabric into machine, resulting in twisted or knotted rope
- Excessively rapid heating or cooling rates

Along with rectifying these issues, using anti-crease agents during the scouring process prior to dyeing can help prevent crease marks.

8. Barre

A barre is an unintentional, repetitive visual pattern of continuous bars and stripes.

Barre will typically appear as a horizontal streak of light or dark bars running the width of the fabric. The bars must appear in a repetitive pattern to be considered barre. Barre is typically found parallel to the filling of woven fabric or to the courses of circular knit fabric.

Barre is usually not detected until after the processing of fabric at the end of production.





Causes and prevention of barre

Barre is a result of physical, optical or dye differences in yarns or geometric differences in fabric structure. Any combination of these differences can cause this fabric defect.

Like many fabric defects, it's easier to prevent barre than to try and rectify it after production. Consistency in raw material organization and labeling can help prevent mix-ups leading to barre, as well as continual equipment maintenance. Following a First In First Out (FIFO) inventory system can help ensure consistent material flow and usage.

9. Neps/knots

Neps are small, tightly tangled knot-like masses of unorganized fibers that form a pinhead shape. These knots are usually comprised of dead or immature fibers.

Neps can be categorized into three types:

- **Biological:** Found in raw materials, these neps contain foreign material such as seed coat fragments, leaf or stem materials. The manufacturer can usually remove them through wet processing.
- **Mechanical:** Found in ginned lint, card web, yarns and cloth, these neps are largely a result of mechanical processing.
- **White speck neps:** Generally not visible until dyeing, white speck neps contain immature clusters of fibers and are considered the most severe type of neps.





Causes and prevention of neps

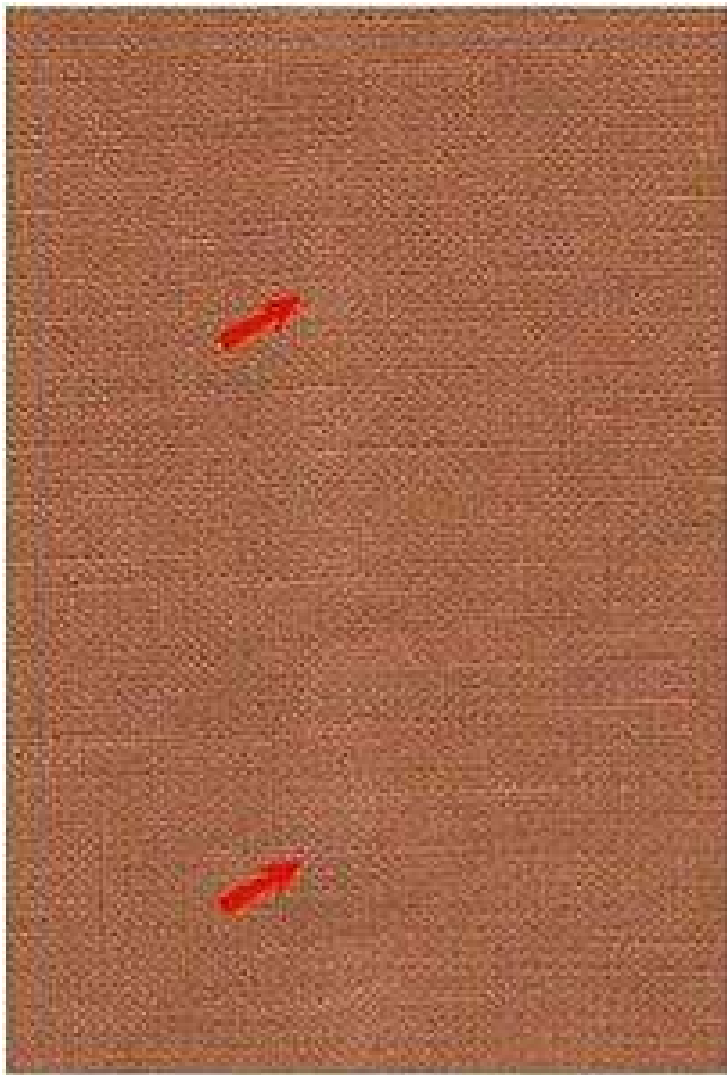
Neps are caused when spools of yarn are tied together. This might be a result of:

- Accumulation of fly and fluff on machinery
- Poor lint cleaning
- Poor carding and incomplete removal of neps before processing

To prevent neps and knots, ensure proper maintenance and cleaning of machinery and roller clearers. Neps can be removed through combing before processing, so early detection of neps is critical to preventing neps in finished fabrics.

10. Abrasion marks

An abrasion mark is a discolored area damaged by friction or rubbing. Abrasion marks are sometimes also referred to as chafe marks or bruised places.



Causes and prevention of abrasion marks

Chafing or impact with a hard or rough surface usually causes abrasion marks. For instance, scratches on the breast beam of the loom might cause chafing.

Abrasion resistance is the ability of a fabric to withstand surface wear and rubbing. Fiber, yarn and fabric properties and finishing processes are the main factors that determine abrasion resistance.

Using fabrics that are more abrasion resistant can help reduce abrasion marks. Nylon is generally regarded as having the best abrasion resistance, followed by polyester.

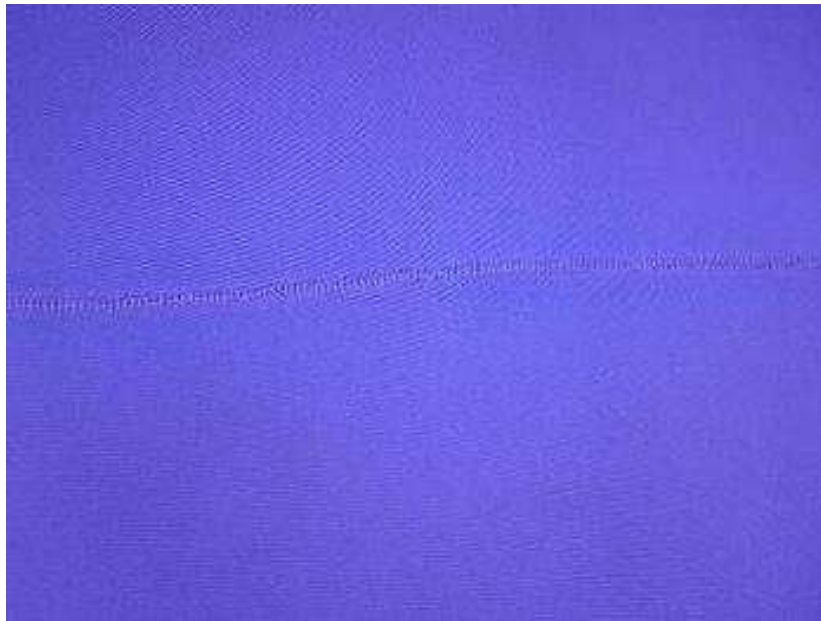
11. Splicing



Splicing is the overlapping of the cut ends of two pieces of fabric (the end of one length of fabric and the beginning of another) to ensure continuous spreading. Splicing is necessary as one roll of fabric finishes and the next is taken into use.

But these overlapping ends of fabric produce a waste material in manufacturing. Splicing losses can vary up to five percent of total fabric usage. Importers can ensure greater manufacturing efficiency by minimizing splicing in their fabric.

Many importers assign four penalty points under the 4-point system for each splice found during fabric inspection.



Causes and prevention of splicing

The position of the splice in a roll of fabric often depends on the overall fabric quality. Splicing is often used to compensate for other fabric defects, like stains or holes, by removing these from the final roll.

So improving overall fabric quality and preventing other fabric defects can often help to minimize splicing losses.

Setting a maximum length tolerance for splicing in each roll of fabric with your supplier can help to clarify your expectations (e.g. no more than one splice every 30



meters). Be sure to consult your supplier on this tolerance before production to ensure it is achievable.

12. Holes

A hole is an imperfection where one or more yarns are sufficiently damaged to create an opening in the fabric.

Holes are typically treated as a major defect in the fabric and are assigned either two or four penalty points during fabric inspection, depending on their size.



Causes and prevention of hole

Holes are usually caused by an accidental cut or tear to the fabric. Broken needles or rough mechanical parts are common culprits for fabric tearing during manufacturing.

Prevent future holes by ensuring your supplier has procedures in place to regularly check needles and machinery prior to production.

13. Defective selvage (cut, waved or creased)

Selvage is the densely woven edge of a piece of fabric. Most often used in reference to woven fabrics, the selvage is supposed to keep the fabric from unraveling or fraying.



Selvage can be defective in a number of ways, including cut, waved or creased. Cut selvage might also be referred to as broken selvage or ripped selvage.



Causes and prevention of defective selvage

There are two main culprits for defective selvage:

- An incorrect loom adjustment during weaving
- Improper edge construction

Correctly adjusting the loom and properly constructing the edges of the fabric should prevent this defect.

14. Snags

A snag is a part of the yarn that is accidentally pulled or plucked from the surface. Usually it appears as a large loop of yarn above the surface of the fabric.

In warp knits, the snag occurs in the wale direction. In weft knits, the snag occurs in the course direction.



Causes and prevention of snag

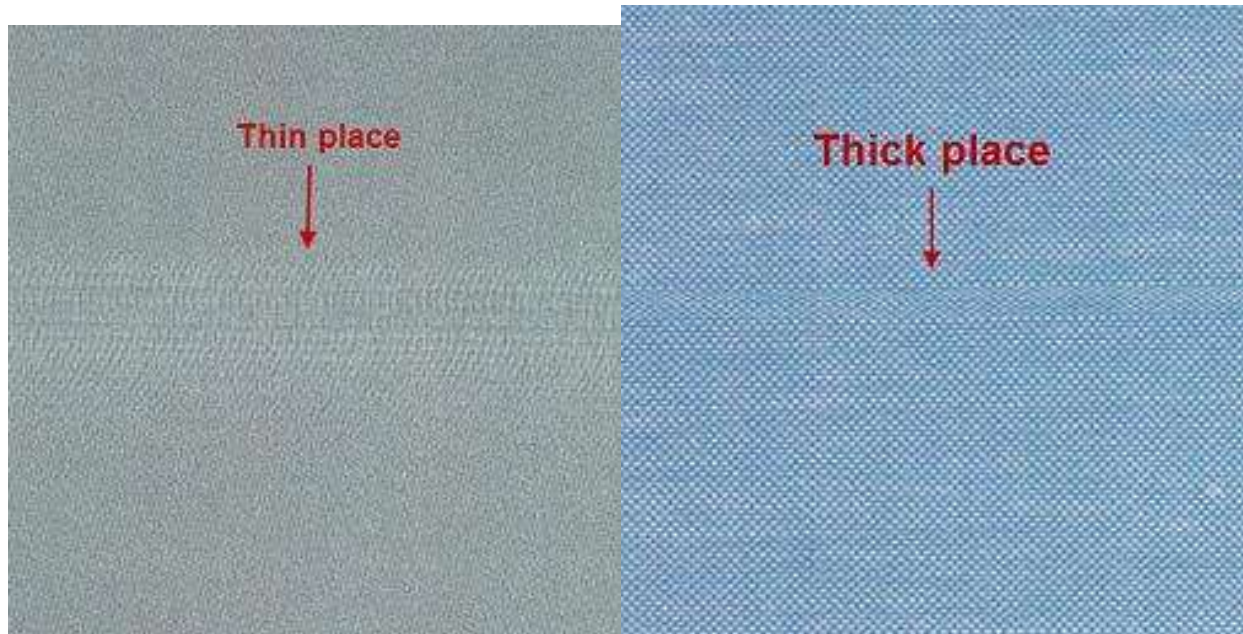
In the case of continuous filament yarns, snagging is typically caused by mechanical strain during knitting. Sharp points and objects can cause the fabric snag at any time. Inspect the fabric contact points on all the processing machines to identify and fix any sharp points.

Some fabrics are more prone to snagging than others due to their composition. You can conduct a mace snag test to determine a fabric's resistance to snagging. During this test, a miniature mace (a spiked ball) will track randomly across a fabric sample to predict actual wear and snagging.

15. Thick place/thin place

These are unintentional changes in fabric appearance as compared to adjacent construction. If the thick or thin place is more than one inch wide, it is typically classified as a major defect in fabric inspection.

A thick place will appear as a small area of more closely spaced yarns or by a congregation of thick yarns. A thin place is the opposite, as the fabric will appear to have loosely spaced yarns or a congregation of thin yarns.



Causes and prevention of thick place/thin place

Main causes of thick and thin places include:

- Irregular let-off
- Incorrect setting of holding and releasing pawls on the ratchet wheel of take-up motion
- Gears of take-up motion not meshing properly
- Gear wheel teeth worn out or broken

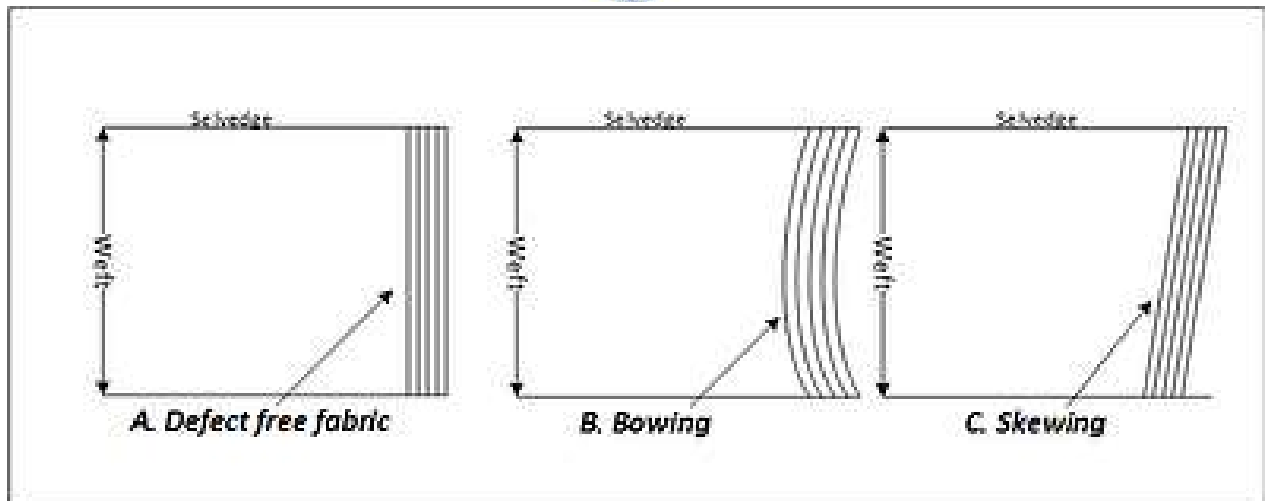
Ensuring proper training of factory personnel to set the let-off and/or take-up motion properly can help prevent this fabric defect.

16. Bowing and skewing

Bowing is a condition in woven textiles where filling yarns are displaced from a line perpendicular to the selvages and lie in an arc across the width of the fabric. Bowing appears as rows of courses or yarn-dyed stripes forming a bow shaped curvature along the fabric width.

Skewing is a similar condition in which filling yarns are angularly displaced from a line perpendicular to the edge or side of the fabric.

Bowing and skewing affects striped or patterned fabric quality more than for solid color fabrics, as the greater contrast in patterns makes the distortion more prominent.



Causes and prevention of bowing and skewing

Bowing and skewing can be caused by an uneven distribution of tension across the fabric width during dyeing or finishing processes. Improper stretching during scouring, dyeing or finishing might also cause bowing or skewing.

Correcting the tension settings on processing machines should rectify these defects. You can also ask your supplier to fix bowing and skewing found during fabric inspection by reprocessing the fabric through a compactor or straightening machine.

17. Needle lines

Needle lines appear in weft knit fabrics, and appear as prominent vertical streaks or lines in the fabric.

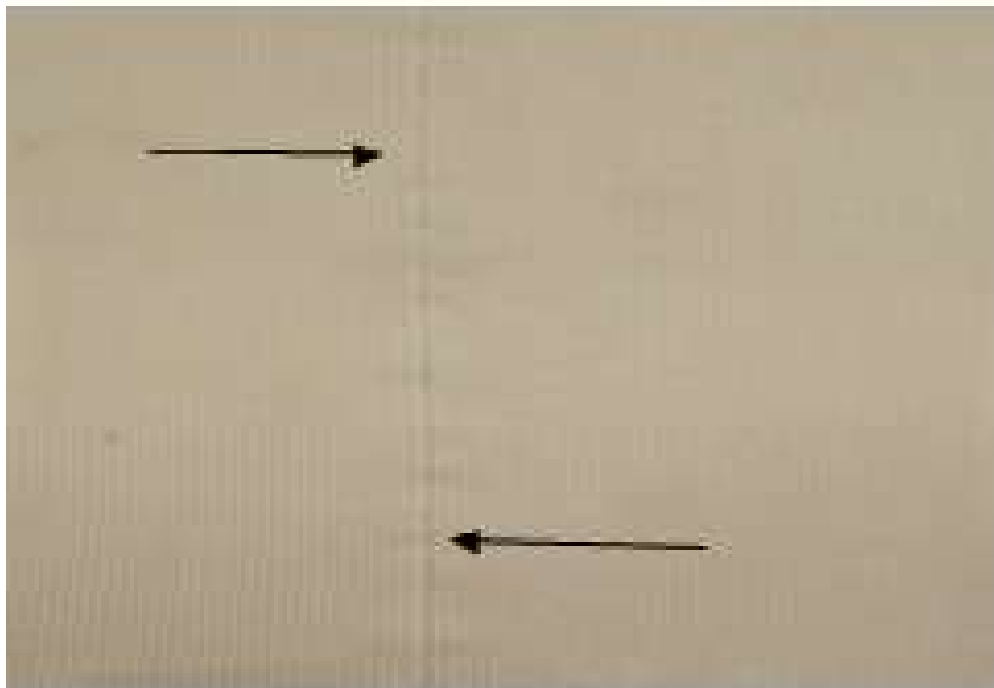
Causes and prevention of needle lines

Defective needles are a direct cause for needle lines. Needle latches, hooks or stems might be:

- Mixed
- New
- Dirty or contaminated with lint
- Bent



- Worn



If needle lines occur individually, you'll likely only need to trace the needle line to the associated defective needle and replace it to prevent further needle lines. If needle lines appear in a band, you'll likely need to replace multiple defective needles.

An improper dial or cylinder condition with the machine might also cause needle lines. Verify that your supplier has established and maintained proper maintenance and cleaning policies to prevent future issues with needles and equipment.

18. Coarse pick

A coarse pick is where the filling yarn used in the fabric is unusually large in diameter. This defect is also known as coarse filling or thick filling.

Coarse pick is usually classified as a major defect during fabric inspection.



Causes and prevention of coarse pick

Probable causes for coarse pick include:

- Lashing of broken end with adjoining end at roving frame
- Disturbed weight of back-top rollers at roving frame and ring frame cause the material to slip under the back-top roller and crease a coarse yarn

19. Coarse end

Coarse end appears in fabric with warp yarn.

Also known as heavy end, this is when the warp end is larger than normal in diameter, even sometimes double in size. The opposite is a fine end, when the warp end is smaller in diameter than normal.

The diameter of the yarn is too large, irregular or contains foreign material, which inhibits a smooth, even fabric.



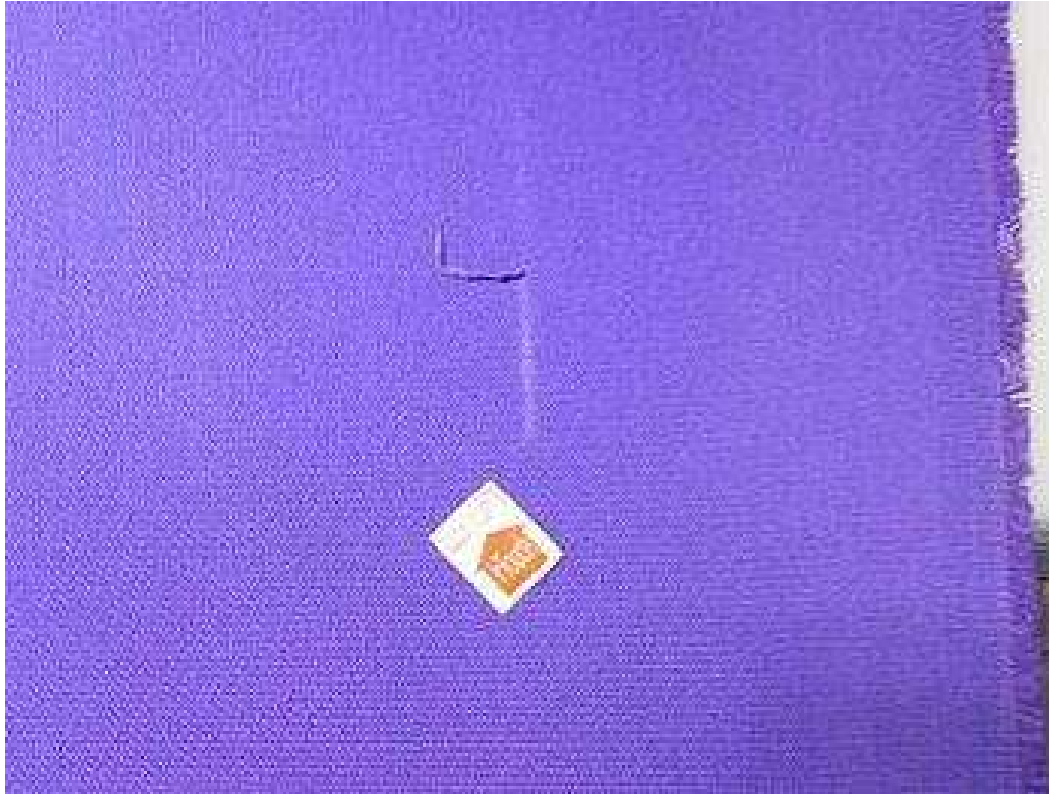
Causes and prevention of coarse end

Coarse end is caused when two bobbins of roving (wool that has been run through a mill on a carding machine) are running together during spinning. The process of running two bobbins together during spinning is commonly referred to as doubling and is used to remove variations in thickness.

To prevent coarse ends, ensure there are no knots, irregularities or foreign materials in the roving prior to doubling.

20. Broken pick

This defect appears as a broken filling yarn in the fabric weaving. It appears as a sharp discontinuity in the weave pattern over the pick length.



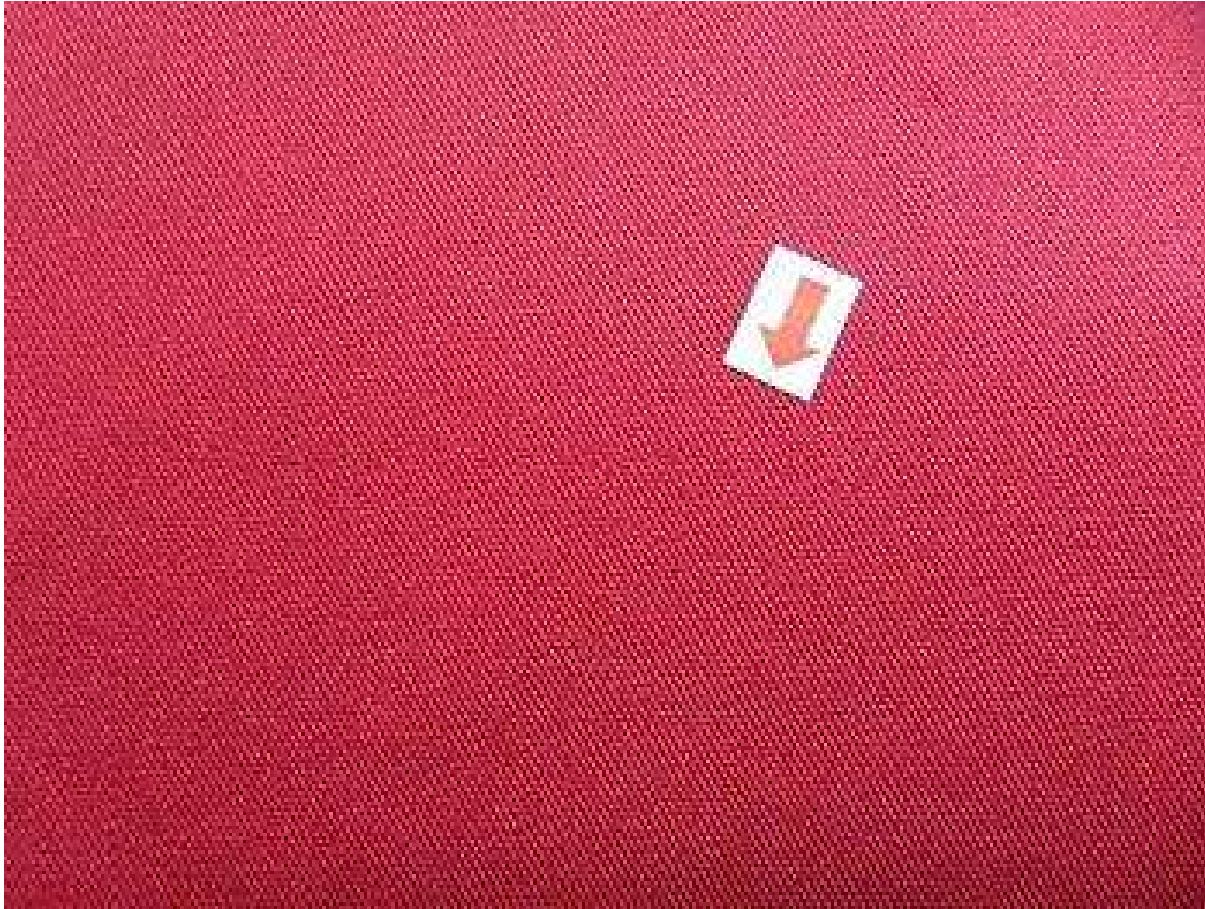
Causes and prevention of broken pick

A broken pick is the result of a break or cut in filling yarn, which results in the insertion of a partial pick in the fabric. This can happen after weft break, weft exhaustion or a faulty weft fork mechanism. Correcting weft stop motion will ensure broken picks are detected before they're inserted into the fabric.

Ensuring weaving personnel are trained to identify and replace a broken pick during production can also help prevent the appearance of this defect in the finished goods.

21. Broken end

A broken end appears as a broken, untied warp end of a fabric. The yarn is usually broken during weaving or finishing. Broken ends appear as equidistant horizontal lines along the fabric width.



Causes and prevention of broken end

This defect is caused by yarn breakage. When the yarn breaks during weaving or finishing and is then woven into fabric the result is a broken end.

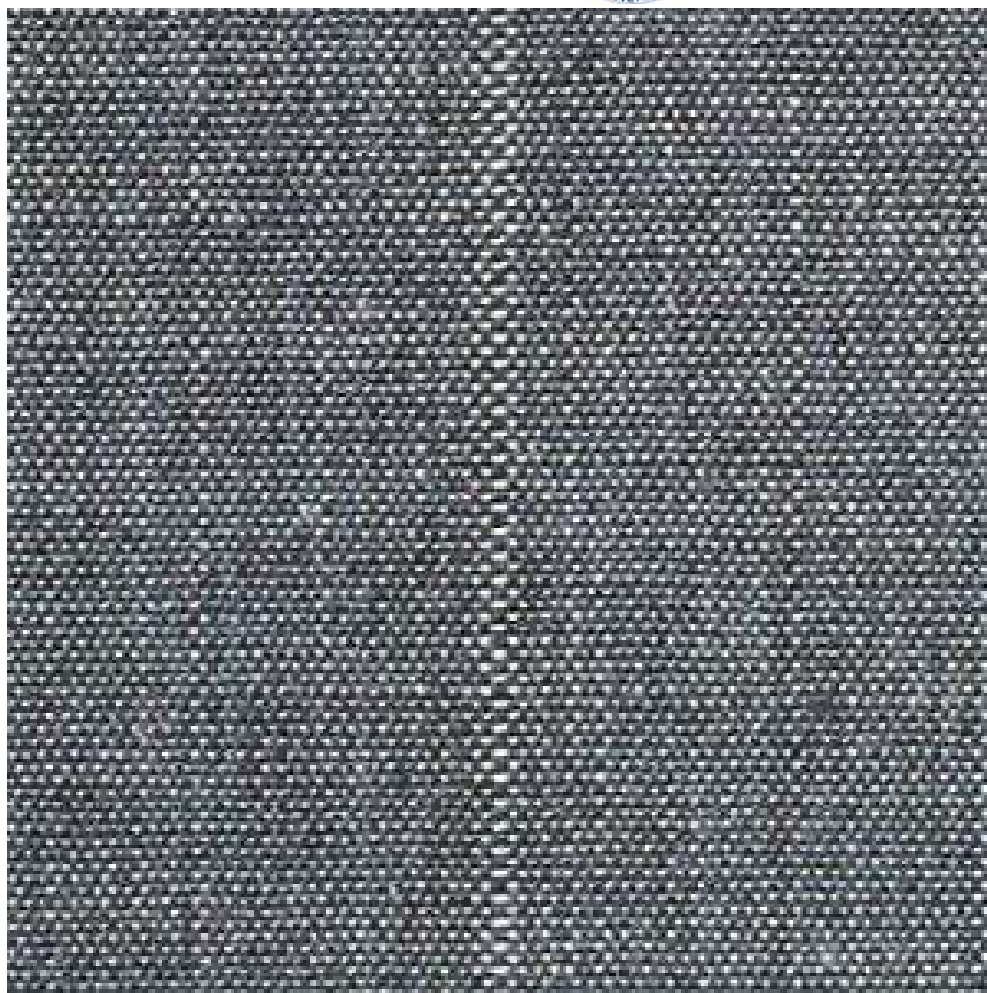
Some possible causes for broken ends include:

- Poor preparation
- Weak or irregular yarn
- Excessive warp tension

22. Missing end/end out

This defect will appear in fabric as a fine warp-way crack until the weaver rectifies it.

A missing end typically appears at the selvage of the fabric. Missing end is also known as “end out” and is typically classified as a major defect during fabric inspection.



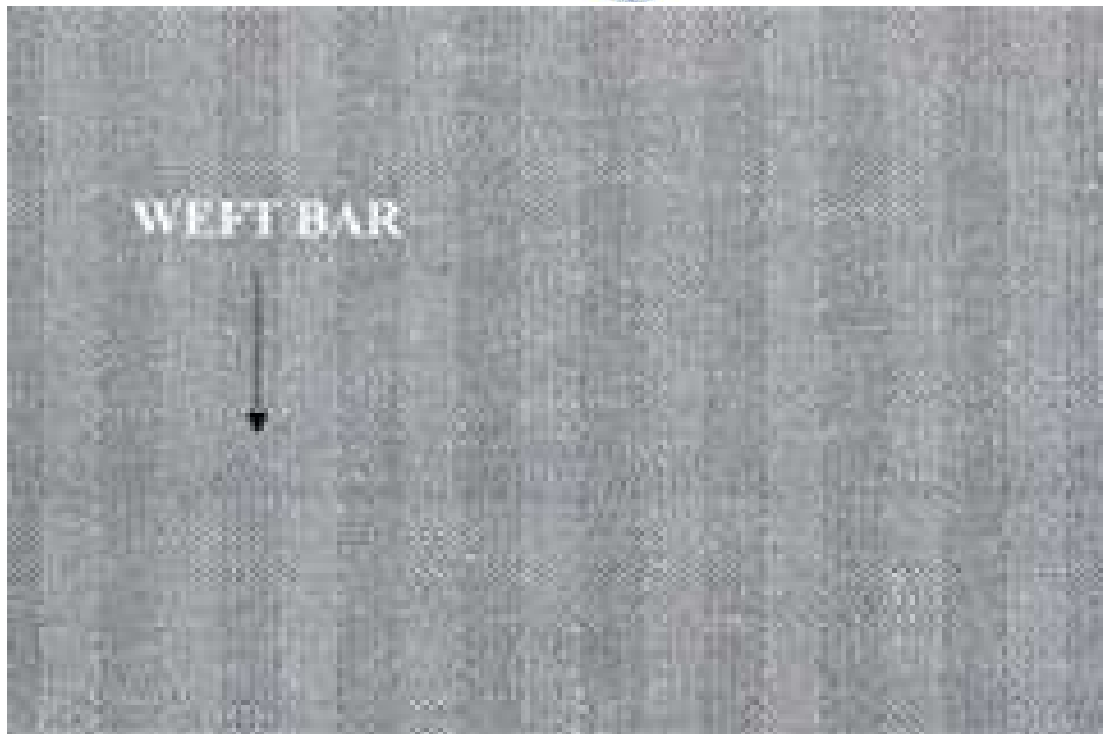
Causes and prevention of missing end

A missing end occurs when an extra piece of filling yarn is jerked into the fabric by the shuttle. This happens when a warp yarn is broken or missing during weaving.

Your fabric may end up with missing ends if a weaver improperly draws broken ends in place or the warp stop motion isn't properly functioning. Weaving should stop immediately when a yarn breaks to prevent introducing missing ends into the fabric.

23. Filling bar

A filling bar, also known as a weft bar, is a visual band or bar across the full width of fabric. The area will contain less than the normal number of picks, appearing different from the rest of the fabric.



Causes and prevention of filling bar

There are three main causes of a filling bar:

- Defective spinning processes that lead to a variation in the count of weft yarn
- Mixing of different counts or different twist yarns
- Faulty take up motion on the looms

Ensure your supplier has proper controls and organizational processes to eliminate mix-ups and segregate yarn to prevent this fabric defect. In addition, ensure proper operation of spinning and loom machinery to eliminate mechanical causes.



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page.

1. List five different types of fabric defects and define them. (10 points)

Note: Satisfactory rating – 10 points

Unsatisfactory - below 10 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____



Information Sheet-2

Laing up material

3.2 Laing up material

How to make a layout?

In the industry, this is the specialised task for which most of the companies that work on developing, pattern making softwares for the clothing industry have been working for a long time and have successfully created a number of dedicated softwares. On the computer all the pattern pieces of the garment are either digitized or drafted and a lay of the garment is made. A rectangle of the dimensions of the fabric is made and the pattern pieces are placed on it in exactly the same manner as one would on a fabric keeping in mind whether a piece is to be cut on fold, on bias or on a cross grain. One can do this exercise manually by cutting or drawing a similar rectangle on a small scale and placing or drawing the pattern pieces also on small scale in it. This exercise would be more scientific, precise and accurate for fabric calculation. An example of the same is given below:

It takes time and effort to fit together all the pieces of pattern. It is like playing a giant puzzle. The game is to place all the pattern pieces on grain in such a manner so as to be able to use the entire width and the length most economically. For such purposes it is advisable to keep on hand several lengths of wrapping paper cut to standard widths of fabric on scale.

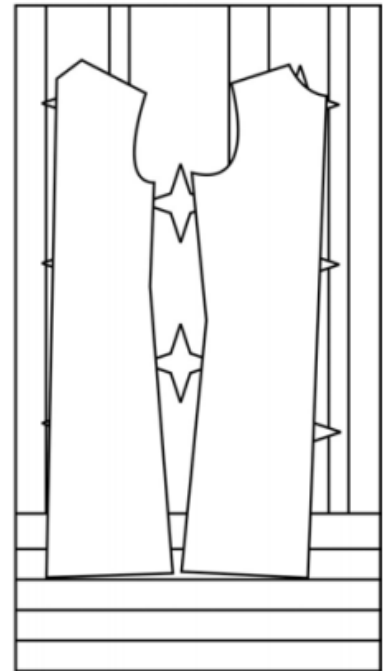
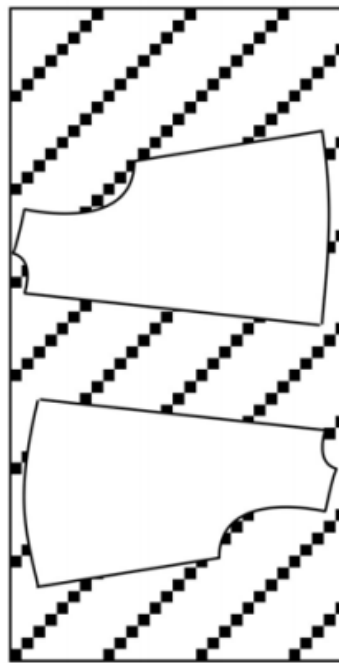
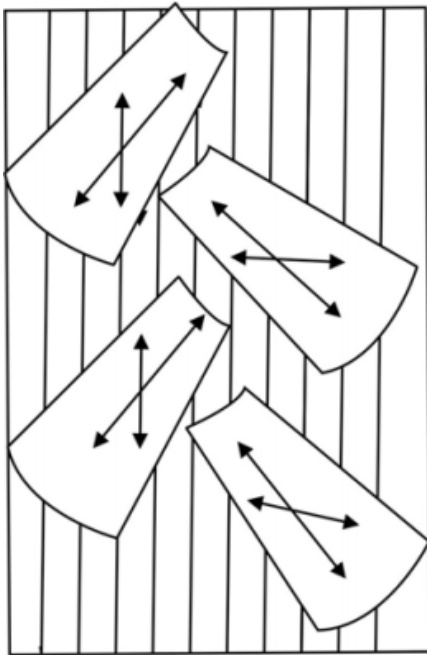
Place the fabric on a flat surface. Line up its straightened edges with the straight edges of the cutting surface. Place the pattern in position. Start with one end of the fabric. Support the weight of the cloth at the other end of the cutting area. When the pattern pieces have been temporarily pinned on the material check if you could adjust the pattern pieces and save more fabric.

Remember to place the pieces on the right grain and close to each other. Spaces between them may result in wastage of as much as five to six inches of fabric. Always place the largest piece first, then the ones that may need to be cut on fold.



Fit in the smaller pieces. Fit in the shapes against each other, locking them whenever possible. This saves a lot of fabric. Arrange the pattern pieces in such a manner that if any fabric is left, it is in one usable piece, either at an end or middle.

The pattern pieces have to be laid out in such a way that it takes into account directional properties of fabric, such as fabric design and fabric grain. The quality of a product is affected significantly by the accuracy of fabric matching also called mitering that is very important for fabrics with checks or stripes. Mitering is the perfect matching of check or stripes even other directional prints on the side seam, centre back and centre front seam or any seam that might be running across in the garment like a yoke or waistline seam. This might require more fabric consumption and great deal of time and effort, for a perfectly mitered garment is a joy and pride of a designer and master tailor.





Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page.

1. What is mitering? (3 points)

Note: Satisfactory rating – 3 points

Unsatisfactory - below 3 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____



Information Sheet-3

Checking material alignment

3.3 Checking material alignment

Pattern alignment and cutting system

A pattern alignment system for use during the garment development process prior to the cutting operation includes a table with work surface. There is a digitizer located with the surface. The operator establishes a perimeter of a hide or other fabric piece that has been positioned on the surface with a stylus that presents position signals to a controller in real time. The controller has signals corresponding to a marker and further includes algorithms to compose the drawn lines or points into an electronic representation of the piece perimeter. Defects, textures or the like in the piece are identified in a similar manner. The system includes algorithms which enable the operator to reposition one or more garment segment patterns in the marker to avoid defects or otherwise optimize the segment position on the piece.

Alignment of fabric ply:

During fabric spreading, all plies should be spread according to the marker dimension. Here, the length and width of the fabric must be equal to the marker length and width.

Fabric Cutting Tips: Alignment

There's a woodworking adage that goes, 'measure twice, cut once'. The same is definitely true of sewing. Cutting is arguably the most difficult and crucial of steps in any sewing project. While seams can be ripped and re-sewn many times, cutting is forever.

There are three main things to consider when cutting your fabric:

1. Alignment
2. Marking
3. Cutting

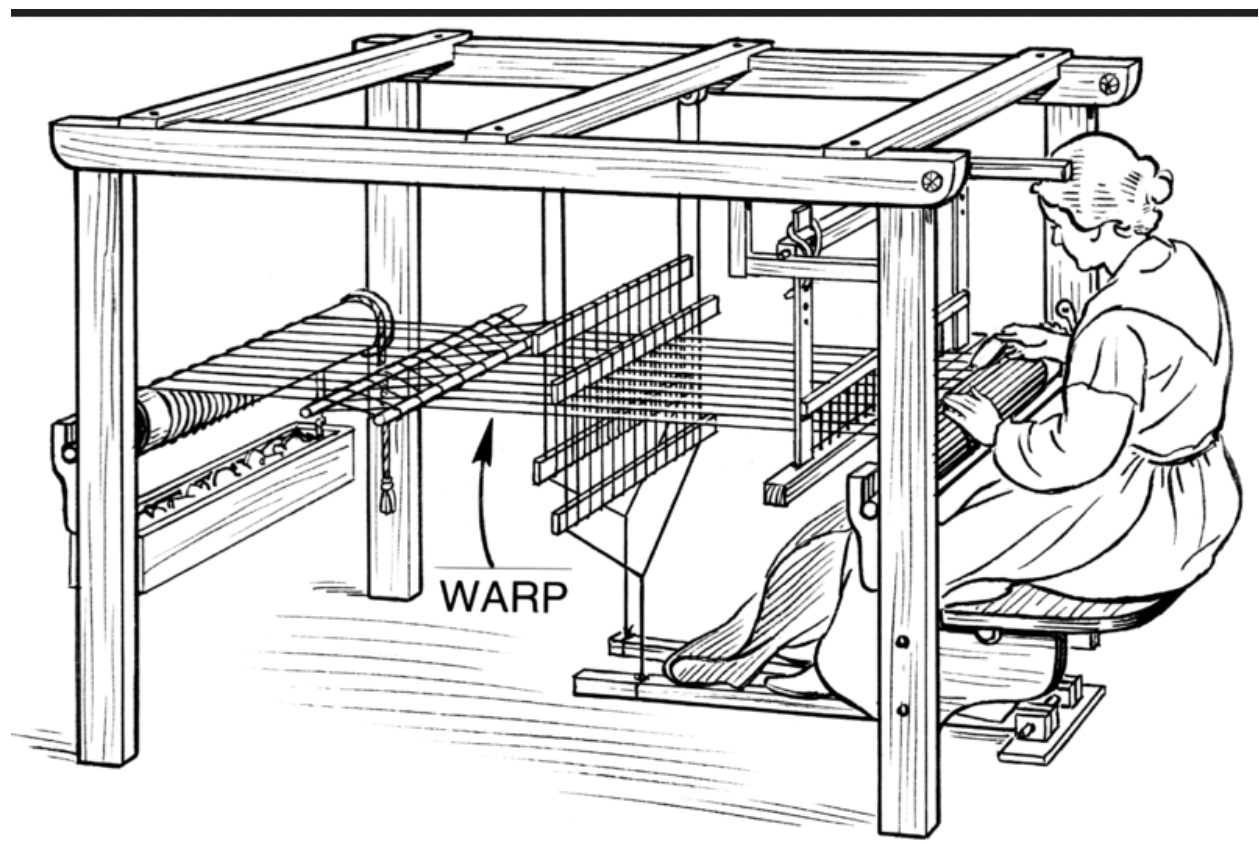


Alignment

Even wonder why after sewing something the final garment doesn't hang or sit quite right or a sleeve hem or edge becomes uneven? Or perhaps you notice that the print on your fabric is going in different directions on each piece?

Aligning your fabric properly for cutting will save you time and frustration and help you create a better looking and fitting garment.

In order to better understand why alignment is so important, let's talk a bit about fabric grain.



Woven fabric refers to fabric that is woven on a loom. (When we talk about grain, we're talking primarily about *woven* fabric. Knit fabric has a different set of parameters. We'll cover that in a future tutorial!) Many fabrics you encounter in stores are woven. In weaving, fabric is created by setting up long vertical threads (called the Warp) and then



weaving horizontally through these threads (called the Weft). When we talk about fabric grain, we are referring to the lengthwise threads (the warp) of the fabric. The lengthwise grain is stable, with a little bit of stretch on the cross grain (the weft) and a bit more stretch on the bias (diagonal grain).

When laying out your pattern, it is important to line up pieces properly with the grain. Your pattern will indicate where its 'grain line' is. Easy right? Well, there's more...

Most patterns have you fold your fabric in half before you lay out your pieces. Now imagine you cut out your pieces through two layers of fabric. The top layer seems properly aligned, but perhaps the bottom layer is slightly askew. This will result in uneven pattern pieces which can throw off the fit or distort your fabric print (especially for stripes or plaids!) Even worse, sometimes pattern cut on fabric where the grain is distorted will return to the natural grain alignment after washing, resulting in wonky looking garment.





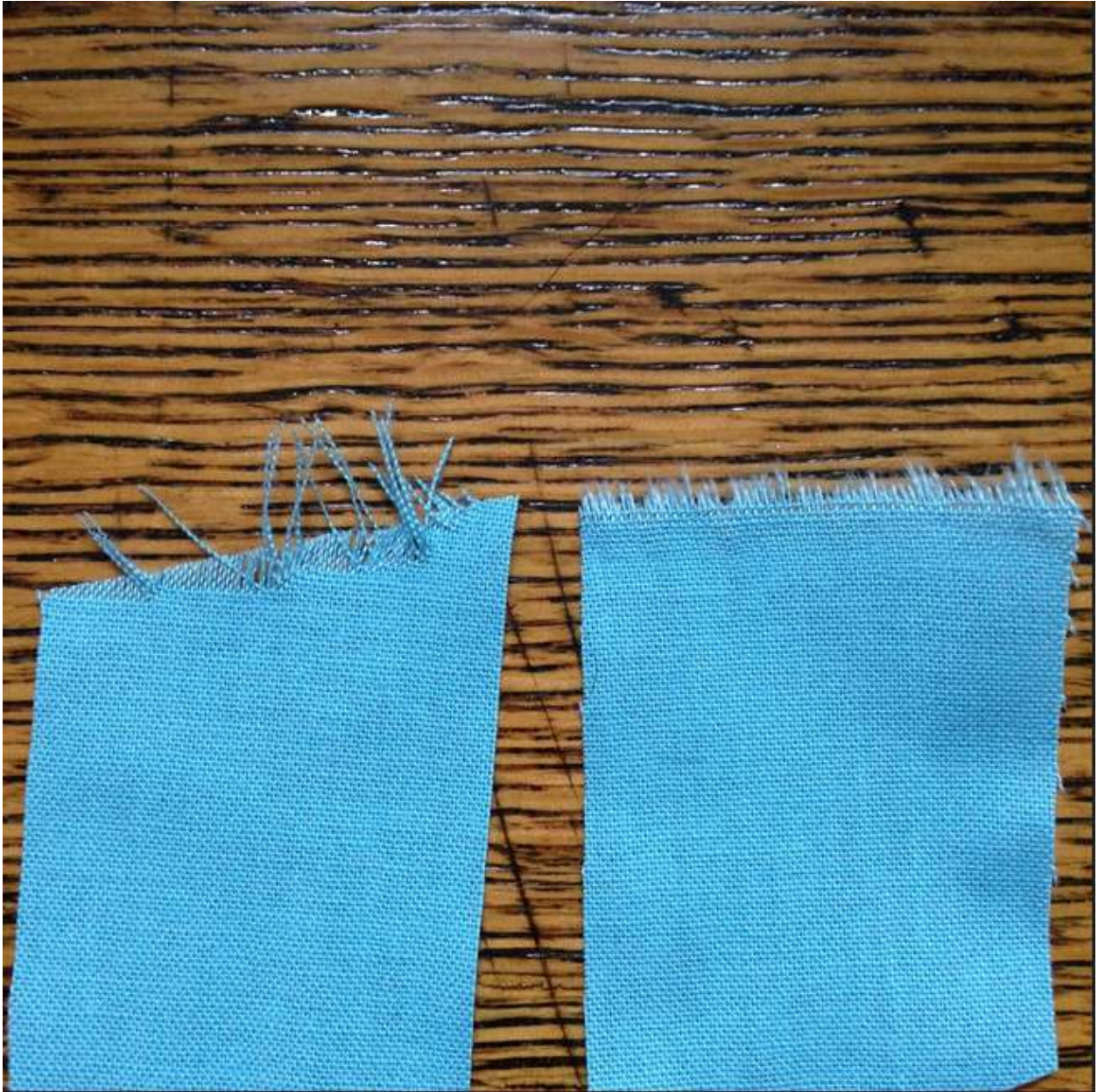
In gingham (a 'yarn dyed' fabric, meaning that the stripes are made from weaving different color yarns, not printed) it is easy to see if the grain is in alignment.

The same fabric, but 'off grain', meaning that the grain has skewed or shifted, throwing the pattern, and the fabric, out of alignment.

Some fabric that you bring home from the store may have a grain that is slightly out of wack - often a result of the process used to wind the fabric onto the bolt. Additionally, sometimes the fabric is cut unevenly at the store. This can cause the nice new fabric to be out of alignment from the get go.



On the plaid above, also 'yarn dyed', it is easy to see when the fabric is cut unevenly. It can be trickier to tell if the edge is evenly cut on solid and printed fabrics.



On the left, you can see threads of the fabric fraying. On the right, since the fabric is cut along the grain, the fabric 'frays' evenly without any stray threads, though you could pull away one single thread of the weft.

If you notice there are a lot of loose threads coming off of your cut edge, this could be an indicator of an uneven cut. Fabric cut on the grain will have minimum fraying, since the weft threads run all the way across.



To remedy this, it is best to align your fabric before laying out your pieces and cutting.

Fixing your fabric grain:

Pre-wash your fabric. This is a great rule of thumb with every project. It takes care of potential shrinkage, dye bleeding, or fading and will often 'reset' a weird grain. Wash and dry your fabric however you plan to wash and dry the final item.

After pre-washing, you'll want to re-cut one raw edge of your fabric along the cross grain. If you are using a plain woven fabric that is not too loosely woven, you can rip your fabric right along the grain line! Sounds crazy but it works. (It is always best to test the rip before you try it for real. Some fabrics don't respond to this technique. If in doubt, skip to the next option!)

To rip along the grain:

1. Snip your fabric at the selvedge about 2" from the cut line.





2. Holding both sides firmly, rip your fabric in a quick, consistent motion. Each time you rip, hold on near each side of the end of the last ripped section.



Rip in short, quick tugs. It should rip cleanly along one thread of the fabric.



Once you've ripped all the way through, you may have some long, loose threads. These are the weft threads on either side, and can be pulled away for a clean edge.

If your fabric is not a good candidate for ripping, here's another trick:

1. Snip into your selvedge. Pull apart the fabric to reveal a few little loose threads.





2. Holding onto one thread firmly, pull it and scrunch the fabric along the thread. This should create a ripple along the cross grain of your fabric. With printed fabrics, you can often see a line created by this pull.



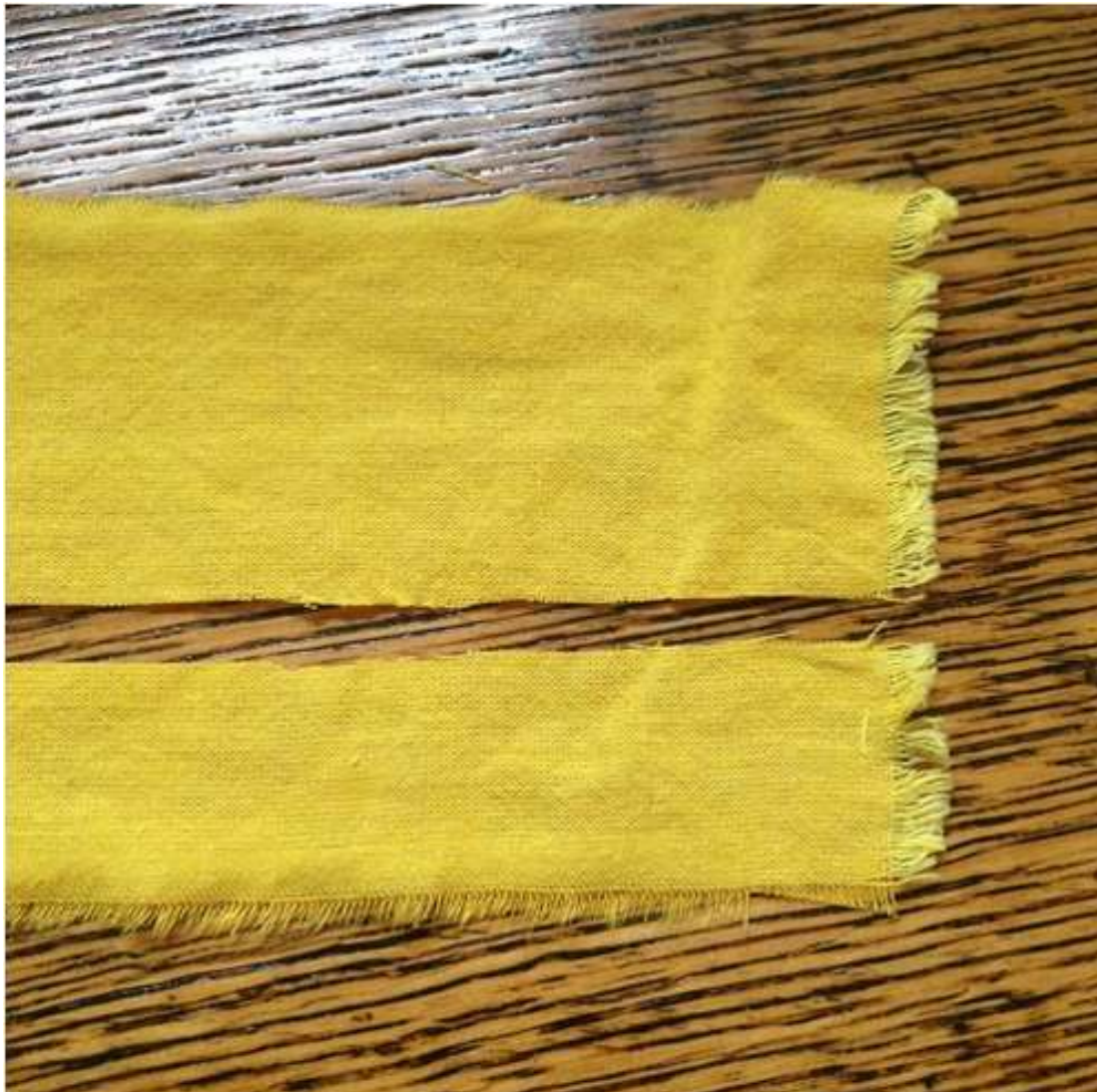


3. Cut along this ripple across the fabric. With tightly woven fabric, or if the thread you are pulling breaks, you may have to repeat this a few times, scrunching, cutting, and finding the loose thread.

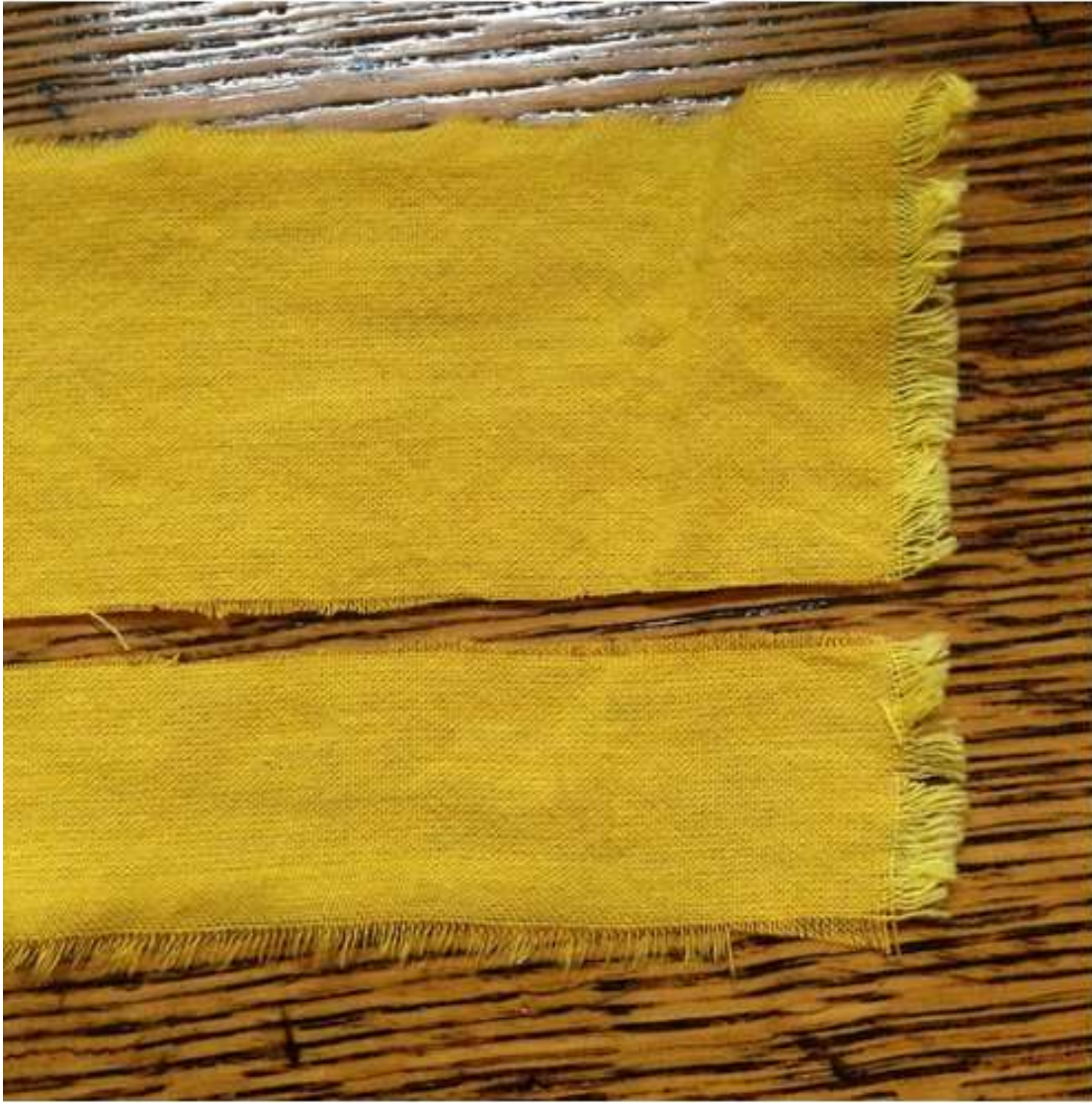




4. You may result with a slightly uneven edge, but the overall cut will be true to your grain line. Pull back a few threads and the grain will be revealed!



Slightly uneven edge



Pull away the loose threads to reveal the fabric grain! Trim if necessary.



Or, if your fabric is a yarn dyed stripe or plaid, simply cut along the pattern.



Cutting along the edge of the green stripe of the fabric to find the grain.

Finally, fold your fabric in half, matching up this new on-the-grain cut edge as well as the selvedge.



Using a gridded cutting mat or table is a great way to check if your fabric is aligned. Once folded, it should match up with the lines on the table, just like in the pink gingham swatch shown in the beginning.

If your fabric folds up perfectly into an even little rectangle, you're in luck! You should have nice smooth fabric at the fold without any wrinkles.



If the fold of your fabric has big wrinkles or folds, even once the cut edge and selvedge are matched up, your fabric is off-grain. Here's how to fix it:



1. Make a note of which direction the wrinkles are 'pointing'. Place a safety pin in the corner that the wrinkles point to.
2. Unfold your fabric and grab opposite corners without the safety pin, and give them a nice hard tug. You may need to do this across the bias (diagonal) grain in a few places if you have a big fabric piece.



3. Realign your fabric to check if the grain has been fixed.
4. If not, try folding in half again and steaming with your iron above the fabric. Smooth the fabric into the desired position and let dry.

Once aligned, your fabric should look like the folded fabric in the first picture. If your fabric looks like this, move on to the next section!

To line up your pattern pieces with the grain:

1. Identify the grain lines on your pattern. The 'fold line' represents the grain on pieces cut on the fold. This is because, ideally, your fabric fold should be right on the grain.
2. Position your pieces as indicated on the pattern.



3. Going piece by piece, measure from one end of your grain line to either the selvedge or the fold of the fabric.



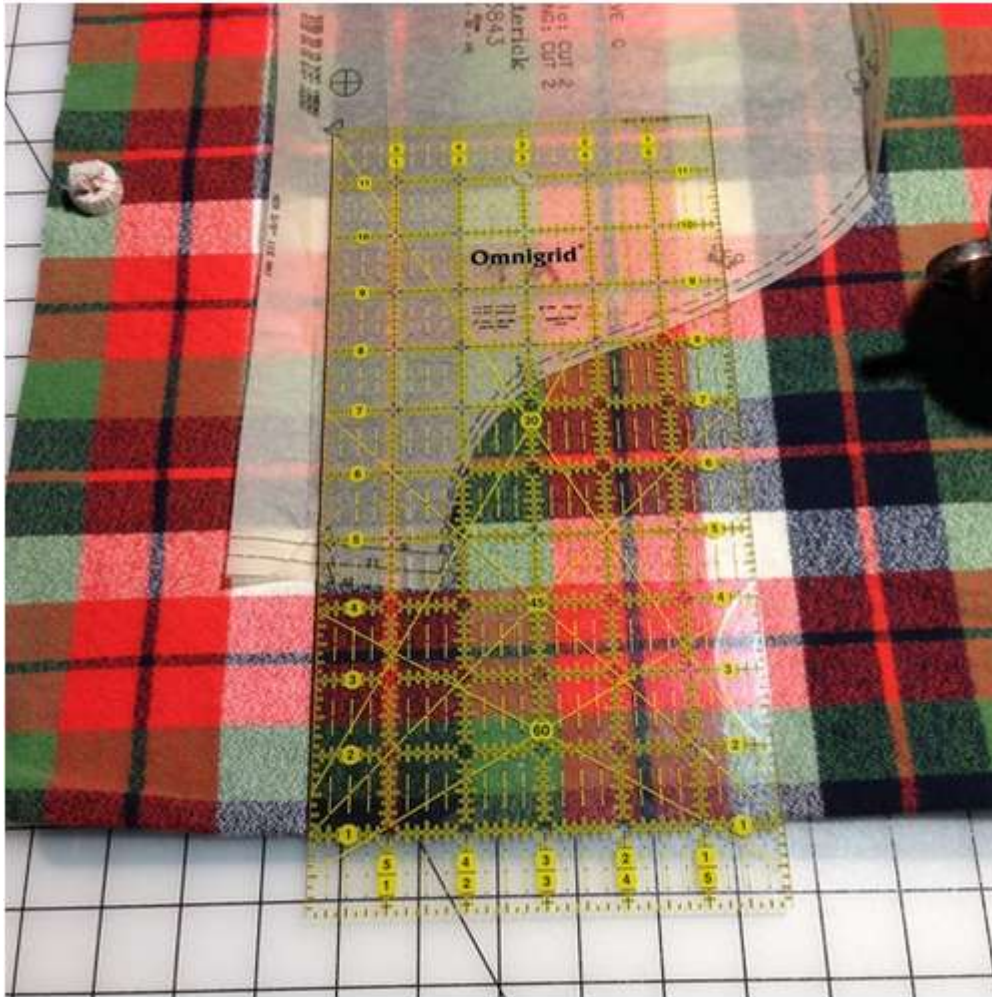
4. Measure from the other end of the grainline to the selvedge/fold. If it is not equal to the 1st measurement, adjust it so it is.

OR

1. Take a square, clear ruler (like those used for quilting) and align one side with the grain.



Not lined up with grain



Lined up with grain.

2. Line the opposite side, or a measurement along the ruler, with either the selvedge or fold line.
3. Secure your pieces with pins or pattern weights.

Now you are ready to mark and cut!



Self-Check -3	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page.

1. What is mitering? (3 points)

Note: Satisfactory rating – 3 points

Unsatisfactory - below 3 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____



Information Sheet-4

Cutting materials

3.4 Cutting materials

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

What is Fabric Cutting?

The first stage in the manufacturing of garments is the cutting and for that pattern, making is the base. Cutting is separating of the garment into its components and in a general form, it is the production process of separating (sectioning, curving, severing) a spread into garment parts that are the precise size and shape of the pattern pieces on a marker. The cutting process may also involve transferring marks and notches from the garment parts to assist operators in sewing, chopping or sectioning a spread into blocks of pieces goods many precede precision cutting of individual patter shapes. This is done to allow for accurate matching of fabric design or easier manufacturing of a cutting knife.

Once the marker is made, pattern pieces must be cut out of the specified fabric, a process called “cutting.” Currently, several cutting techniques exist, ranging from low- to high-tech. Although scissors are used very rarely-only when working with very small batches or sensitive fabrics-cutting continues to be done by hand, particularly in many lower volume establishments. Here, cutters guide electric cutting machines around the perimeter of pattern pieces, cutting through the fabric stack. An electric drill may be used to make pattern notches. The accuracy and efficiency of this system are considerably less than in computerized cutting systems.



Computerized cutting systems are achieving more widespread use as technology costs decrease and labor costs rise. These computer-driven automated cutters utilize vacuum technology to hold stacks of fabric in place while cutting. Cutting blades are sharpened automatically based on the type of fabric being cut. Gerber Garment Technology manufactures one of the most commonly used cutting systems. This technology has the advantage of being highly accurate and fast, but does cost considerably more than other cutting techniques.

Best Practices

The precision of cut: To ensure the cutting of fabric accurately according to the line drawn of the marker plan.

Clean edge: By avoiding the framing out of yarn from the fabric edge. Cutting edge must be smooth clean. The knife must be sharp for a smooth or clean edge.

Consistency in cutting: All the sizing safe of the cutting parts should be same of a knife should be operated of the right angle of the fabric layer.

Factors involved in Cutting Fabrics

Factors affect the cutting process for fabrics are as follows:-

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

Cutting Process

Fabric is the most costly item in garment manufacturing. About 60-70% cost of the garment is incurred in fabrics. For this reason, garment makers wisely utilize fabrics. Some of these fabric saving tips in the cutting room surely help garment makers to save fabric as well as money.



Figure 11: Bulk fabric cutting using a straight knife cutting machine

The bulk cutting is done by means of cutting machines. Different types of fabric cutting machines are available for bulk cutting. Before the cutting of fabric, cut order plan is prepared and the fabric is taken from the fabric store according to the requirement. Following steps are followed in the cutting section.

Fabric spreading: First the fabric rolls are opened and spread on a cutting table layer by layer. This process is done by hand or by using an automatic spreading machine. The length of the layer is decided based on the marker size and marker length. Multiple numbers of fabric layers are spread on the table and all the fabric layers are cut together. Depending on the fabric thickness number of plies in a lay is decided. Normally the height of the lay is kept according to the cutting machine blade height.

Marker making: For manual marker making, cutter use paper pattern for marking and use chalk to mark outlines of the patterns. After marking the outlines on the lay, patterns are removed and the cutter follows the outline to cut the garment parts.

Component numbering on the marker: Normally in a marker, more than one garment is cut and garment may be of different sizes. To avoid mixing of different garment sizes



during bundling and sorting, the size is marked on the top layer after manual marking. For automatic cutting or paper printed marker, this marking is not required, as all patterns are already come with style and size marking.

Lay Cutting: After marker making, the lay is cut by using a cutting machine. For a single ply and a small number of plies, hand scissors are used.

Ply numbering: Ply numbering is done to all the garment components. This process is included to avoid color variation in the garment components of the same garment. In single piece production system bundle numbering is not required. A hand machine is used for numbering the cut plies.

Sorting and Bundling: Cut components are sorted by size, color, and bundle size. Then bundling is done and stored in the cutting room. A ticket (bundle tag) is attached to the bundle to identify the component and style details.

Dispatch cuttings to stitching section: Cut bundle are sent to stitching section as per the need of sewing floor and loaded to the line. Some factories prefer to send the whole lay to stitching section and bundling of the layer are done on the production line.

Quality checking in cutting section: In the cutting section, quality of the cut components like notches, pattern shape, components measurement, and major fabric defects (hole in the fabric, cut mark etc.) are checked. Parts measurement is taken from the top, middle and bottom plies and compared with the actual patterns, and shapes etc.

Generally garment production starts with the cutting process. In this process, the fabric is being cut into components (shapes or patterns of different garment parts, i.e. front, back, sleeve, collar shapes etc.).



Cutting Room Process Flow

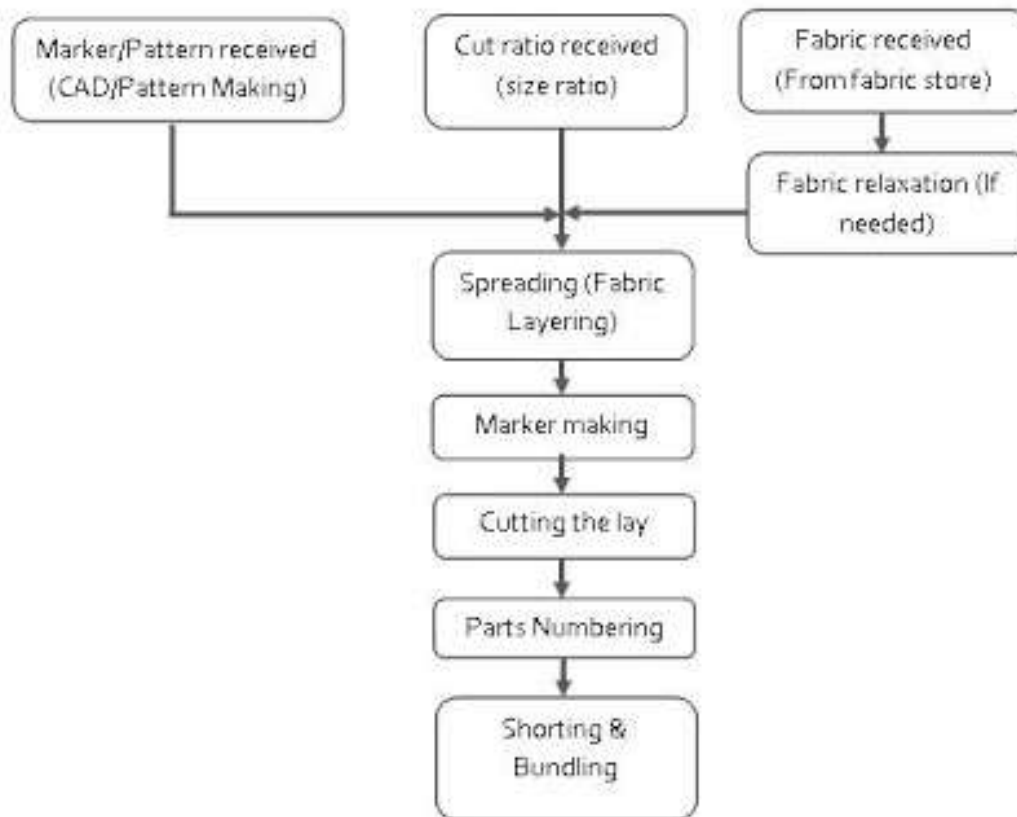


Figure 12: Cutting Room process Flow chart



Self-Check -4	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page.

1. What are the factors those affect the cutting process of fabrics? (4 point)

Note: Satisfactory rating – 4 points

Unsatisfactory - below 4 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____



Information Sheet-5

Handling materials

3.5 Handling materials

Different Kind of Material Handling Systems Used in the Garment Industry

Material handling system plays an important role in improved material flow and increasing production performance in the readymade garment industry. If you ever visited a garment factory, you might have seen various kind of material handling equipment used by them. In this post I'll be discussing different types of material handling systems found in the readymade garment industry.



Figure 13: Overhead material handling

At the time of new garment factory set up or improvising production system and factory layout, material handling system is taken into account for better factory performance and smooth material flow. A right material handling system across the factory departments reduces material transportation time, waiting time at work and delays.

Define material handling system



The means used for transporting work (like fabrics, cuttings, bundles, finished garments and general items) from one place to another, storing materials and protecting material from damage, are called material handling system. It may be an equipment, device or procedures. For better material handling, equipment are engineered according work place design.

As said above there are different type materials handling systems based on process requirement. Whether it is a new setup or an existing setup, factories have many options for choosing one out of available material handling. Common material handling systems found garment manufacturing units are listed here.

1. Material handling equipment for cutting department

Cutting department is responsible for cutting garment patterns/component from the fabric rolls. Cutting department has to handle lot of fabrics and cutting bundles. So they need material handling tool and equipment like these.

Trolleys: For transporting fabric from fabric store to cutting section. Forklifts are also used for this purpose.

Baker's trolley: For stacking cuttings and transporting cutting bundles to stitching floor

Plastic trays and trolleys: Cut pieces are placed on treys. Trays filled with garment with certain number of pieces are placed in trolley.

Fabric Bags: Cuttings are bagged into fabric bags or plastic bag and carried out to production section manually.

Racks: Racks used for storing cutting bundles (WIP).



Figure 14: Rack



Self-Check -5	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page.

1. What Define material handling system mean? (3 points)

2. _____ used for storing cutting bundles (WIP). (2 points)

Note: Satisfactory rating – 5 points

Unsatisfactory - below 5 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



L #39	LO #4- Maintain documentation
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Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- OHS practices
- Preparing all relevant paperwork and documentation.
- Filing or forwarding completed documents
- Observing housekeeping

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Follow OHS practices
- Prepare all relevant paperwork and documentation.
- File or forward completed documents to appropriate personnel
- Observe housekeeping

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.



Information Sheet-1

OHS practices

4.1 OHS practices

Risk assessments, safe working practices, standards, recommended practices

In a factory environment, the factors of risk are high since the workers constantly interact with numerous machinery, processes, and practices. The risk can be reduced by assessing and listing them, training the workers, introducing safety measures, emergency incident practice drills, displaying signboards, and following standard procedures and practices.

Keeping the textile workers safe

Health and safety at work is the responsibility of both employers and employees. Manufacturers are required by law to follow strict rules and regulations to make sure that the workers are protected from possible dangers and using machinery and handling materials. The workers must follow all safety rules and instructions to keep themselves and those around them safe.

Risk Assessment

The dangers, hazards or risks involved in making a product can be identified, described and listed. This is known as risk assessment. In the workplace, it is essential to know what might cause harm or injury to people or the environment, so that safety precautions and systems can be put in place to prevent accidents.

In the workplace a health and safety officer will:

- Carry out risk assessments
- Organize safety training, including first aid, for the workforce
- Display warning notices, safety rules and fire exit signs



- Ensure that machinery, equipment, tools and materials are stored safely, have safety guards and are safe for use, and are regularly tested for safety.
- Check that workers wear protective clothing, ear defenders, masks, safety gloves and footwear
- Ensure that all processes are safe and will not damage the health of the employees
- Ensure that chemicals used in manufacturing processes are recorded, stored and used safely, then recycled or disposed of safely
- Check that the environment is safe with clean and tidy work areas and adequate ventilation to remove dust and fumes, and has noise-level control

Risk Assessment in Apparel Manufacturing

Materials arrive in the factory are stored

- **Hazards:** Head injury from an overhead transport system. Trapped fingers and feet from moving conveyors, trolleys, and vehicles. Tripping over stacked materials, falling from steps and platforms.
- **Safety measures:** Hard hats are worn. Danger areas marked with black-and-yellow warning strips, designated walkways. Safety guards and protective clothing, gloves and footwear worn.

Fabric spread and pieces cut out using a band saw

- **Hazards:** Finger and hand injuries and spreading machine and cutting blades. Dust inhalation.
- **Safety measures:** Use finger guard, protective chainmail gloves and steel toe cap footwear.

Fusing interlinings

- **Hazards:** Burns to fingers and hands from hot plates, feeding and unloading machines, inhalation of vapors



- **Safety measures:** Use a press that is controlled by both hands, one person per machine. Ventilation to remove vapors.

Sewing

- **Hazards:** Finger and hand injuries from needles and blades, eye injuries from broken needles, pulled hair from thread or fabric feed. High noise level may damage hearing. Seating may cause back injuries.
- **Safety measures:** Finger guards and eye shields/goggles used. Long hair tied up and no loose clothing. Seats adjusted for correct posture.

Scissors, blades and needles

- **Hazards:** Cuts and pricks to fingers
- **Safety measures:** All sharp blades, scissors and sharps (needles and pins) stored safely. Finger guards used.

Pressing and steaming

- **Hazards:** Burns and scalds to fingers and hands from hot plates and steam, feeding and unloading machines, inhalation of vapors
- **Safety measures:** Use a press that is controlled by both hands, one person per machine. Use a steam room rather than steaming individual garments. Ventilation to remove vapors.

Cleaning and stain removal

- **Hazards:** Inhalation of solvent vapors, skin damage or reaction to contact with solvents. Fire hazard. Toxic chemicals.
- **Safety measures:** Ventilation to remove vapors. Solvent containers labeled with warnings. No sources of ignition.

Production line handling



- **Hazards:** Head injury from an overhead transport system. Trapped fingers and feet from moving conveyors, trolleys and vehicles. Tripping over stacked material.
- **Safety measures:** Hard hats are worn. Danger areas marked with black-and-yellow warning strips, designated walkways. Safety guards and protective clothing, gloves and footwear worn.

Packaging

- **Hazards:** Finger and hand injuries from cutting, folding and heat sealing during packaging
- **Safety measures:** Ventilation to remove vapors from heat sealers. Safety guards and protective clothing, gloves and footwear worn.

Automating the Risky Areas

Safety measures include the proper training of machine operators, which is essential throughout the production line and across the workplace.

Safety can be increased by using automated machinery and computers to assist in materials handling, particularly where loads are heavy, or with fast-running machinery where heat or sharp blades or needles are involved. Safety devices are used to check that machine setting are correct and to stop machinery in an emergency.



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page.

1. Health and safety at work is the responsibility of both _____. (2 points)
2. what is the hazard occurred during fabric spread and pieces cut out using a band saw. (2 points)

Note: Satisfactory rating – 4 points Unsatisfactory - below 4 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



Information Sheet-2

Preparing all relevant paperwork and documentation

4.2 Preparing all relevant paperwork and documentation

Preparing the documentation

In the setting up of the inspection process, the criteria were written first and then each criterion analysed to see what evidence was needed to show how the criterion was met. There are three sources of evidence: from interviews, from inspectors' observation and from documents, both paper and electronic.

The documentary evidence has been compiled under three stages, which relate to when the Accreditation Unit and/or inspectors see the documents:

Stage 1 which are sent with the application for inspection to the Accreditation Unit

Stage 2 which are sent to each inspector at least ten working days before the inspection and

Stage 3 which are available on site during the inspection.

If you do not understand why a particular document in the list is required, look back to the criterion and the documentary evidence required to show that it is met and this should help in your understanding.



Information Sheet-3

Filing or forwarding completed documents

4.3 Filing or forwarding completed documents

Sending the documentation

Stage 1: Inspection application documentation is submitted to the Accreditation Unit at the time of the application for the inspection.

Stage 2: Inspection preparation documentation is sent by you direct to each of the inspectors.

- Send the documents to reach each of the inspectors at least 10 working days before an inspection. (Staff will need time to get together the relevant documents.)
- Keep a copy of the Stage 2 documents for yourself for use during the inspection. This means that you will need to prepare at least three sets of the inspection preparation documents.
- Please label the documentation using the numbering in Handbook 4.3 Inspection documentation. If you have a document which fulfils or approximates the function of a listed document but has a different name, include it and annotate it with the relevant document number.
- If a document is included with another (e.g. in a staff handbook), just cross-refer.
- If possible, it is also helpful if you can give inspectors a list of documents which you will not be providing, particularly if you are able to say briefly why they are not available (e.g. 'not applicable' or 'not relevant').
- Some of the information must be presented on prescribed forms.
- Please note that some Stage 2 and Stage 3 documentation may now be made available electronically. Your reporting inspector will contact you to discuss the options.



- Please check with the reporting inspector on the best way of sending paper documentation – parcel post, registered post, courier and so on, as collection of undelivered items can be inconvenient for the inspectors.

Stage 3: Additional documentation is to be made available to inspectors during the inspection. Inspectors may ask for some of these documents to be sent in advance of the inspection.

The information you send in advance will help give the inspectors a picture of your provision and prepare for their visit. This will make the inspection process more efficient and more effective. Not all documents will apply to all providers. Send those which are relevant to you and consult the reporting inspector if you have any queries.



Information Sheet-4

Observing housekeeping

4.4 Observing housekeeping

Housekeeping means general care, cleanliness, orderliness, and maintenance of business or property. Good housekeeping is an important consideration in underwriting of fire hazard and other forms of insurance, as well as in certification by fire, health, and industrial safety agencies. It has an impact in initiating the workers toward their work and also helps producing quality outputs.



Self-Check -4	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define housekeeping.(3 point)

Note: Satisfactory rating - 3 points

Unsatisfactory - below 3 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____



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