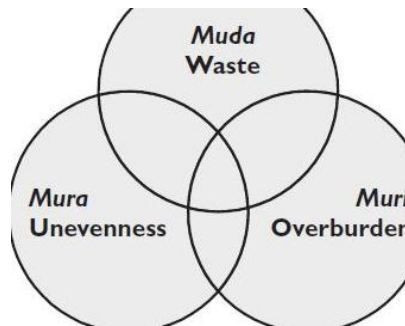


# GARMENT PRODUCTION

## Level-II

Based on March, 2022 Curriculum Version-1



**Module Title: Prevent and eliminate MUDA**

**Module code: IND GAP2 M01 0322**

**Nominal duration: 25 Hour**

**Prepared by: Ministry of Labour and Skill**

**August, 2022**

**Addis Ababa, Ethiopia**

## Acknowledgment

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## MODULE INTRODUCTION

In garment production filed; *this module assists to attain the learning objectives stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to*

The Concept of Muda/Waste ,Methods for categorizing types of waste/Muda, Causes and effects of 7 types of wastes, Waste/Muda Identification ,Reporting methods and formats/checklists for Muda identification, Muda is a Japanese word meaning Wasteful Activity.

This module is designed to meet the industry requirement under the garment production

Occupational standard, particularly for the unit of competency: Prevent and eliminate MUDA

This module covers the units

- Prepare for work
- Identify MUDA and problem
- Analyze causes of a problem
- Eliminate MUDA and Assess effectiveness of the solution.
- Prevent occurrence of wastes and sustain operation

Learning Objective of the Module

- Working Prepare
- Identifying MUDA
- problem Analyzing
- Eliminating MUDA and Assess effectiveness of the solution.
- Preventing occurrence of wastes and sustain operation

### Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit

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## Unit one: work prepare

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

- Using work instructions
- Reading and interpreting job specifications
- Observing OHS requirements,
- Selecting appropriate material
- Identifying and checking safety equipment and tools.

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

- work instructions
- Observe OHS requirements,
- Select appropriate material
- Check safety equipment and tools.

### 1.1 work instructions

Work instruction is a description of the specific tasks and activities within an organization. A work instruction in a business will generally outline all of the different jobs needed for the operation of the firm in great detail and is a key element to running a business smoothly.

In other words it is a document containing detailed instructions that specify exactly what steps to follow to carry out an activity. It contains much more detail than a Procedure and is only created if very detailed instructions are needed. For example, describing precisely how a Request for Change record is created in the Change Management software support tool.

### 1.2 interpreting job specifications

A statement of employee/workers characteristics and qualifications required for satisfactory performance of defined duties and tasks comprising a specific job or function.

Procedures vs. Work Instructions

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Many people confuse “procedures” with “work instructions”. In fact, most people write work instructions and call them procedures. Knowing the differences of procedures vs. work instructions can help you understand the documentation process much better and, therefore, procedure documentation.

Procedures describe a process, while a work instruction describes how to perform the conversion itself. Process descriptions include details about the inputs, what conversion takes place (of inputs into outputs), the outputs, and the feedback necessary to ensure consistent results. The PDCA process approach (Plan, Do, Check, Act) is used to capture the relevant information.



**Figure 1.1 PDCA cycle**

### 1.3 Observing OHS requirements

OHS requirements are legislation/regulations/codes of practice and enterprise safety policies and procedures. This may include protective clothing and equipment, use of tooling and equipment, workplace environment and safety, handling of material, use of fire-fighting equipment, enterprise first aid, hazard control and hazardous materials and substances.

Personal protective equipment includes those prescribed under legislation/ regulations/codes of practice and workplace policies and practices. Safe operating procedures include the conduct of operational risk assessment and treatments associated with workplace organization. Emergency procedures include emergency shutdown and stopping of equipment, extinguishing fires, enterprise first aid requirements and site evacuation.

Occupational safety and health (OSH) also commonly referred to as occupational health and safety (OHS) or workplace health and safety (WHS) is an area concerned with

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the safety, health and welfare of people engaged in work or employment. The goals of occupational safety and health programs include fostering a safe and healthy work environment. OSH may also protect co-workers, family members, employers, customers, and many others who might be affected by the workplace environment. In the United States the term occupational health and safety is referred to as occupational health and occupational and non-occupational safety and includes safety for activities outside work.

Occupational safety and health can be important for moral, legal, and financial reasons. In common-law jurisdictions, employers have a common law duty (reflecting an underlying moral obligation) to take reasonable care for the safety of their employees. Statute law may build upon this to impose additional general duties, introduce specific duties and create government bodies with powers to regulate workplace safety issues: details of this will vary from jurisdiction to jurisdiction. Good OSH practices can also reduce employee injury and illness related costs, including medical care, sick leave and disability benefit costs.

## 1.4 Selecting appropriate material

Tools and Equipment are required to identify and measure Waste/Muda in work stations. The following are some tools and equipment used to identify and measure Waste/Muda:

- Tape (any length measuring device)
- Stop watch
- Photo Camera
- Video Camera
- Calculator

### 1.4.1 Safety equipment and tools

- Dust masks/goggles
- Glove
- Working cloth
- First aid and
- Safety shoes

## 1.5 Tools and Equipment used to implement

You are required to prepare and use tools and equipment to implement sort, set in order and shine activities in to your work station. The following are some tools and equipment that help you in the implementation of

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### Tools and materials used to implement Sort activity

Tools and materials are required to implement sort, set in order and shine activities in work stations. The following are some tools and materials used to implement the first pillar of 5S-Sort.

- red tags
  - hook
  - shelves
  - sponge
  - pencil
  -
- sticker
  - nails
  - chip wood
  - broom
  - shadow board/ tools board

Self-Check 1.1	Written Test
----------------	--------------

1. What is OHS represents for (2 point)
2. List at least two examples of OHS requirements in your work areas. (10 points)
3. List at least four workplace hazards? (4 points)
4. List at least four tools and equipment used to identify and measure Muda. (12 points).

## Unit Two: Identify MUDA

This unit to provide you the necessary information regarding the following content coverage and topics:

- Preparing plan of MUDA and implementing problem identification
- Discussing causes and effects of MUDA
- Listing possible problems related to the process /Kaizen elements using statistical tools and techniques.
- Identifying and listing problems of kaizen on Visual Management Board/Kaizen Board.
- Using tools and techniques
- Identifying and measuring wastes/MUDA based on relevant procedures.
- Reporting identified and measured wastes

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

- Prepare plan of MUDA
- List possible problems related to the process
- Identify and measuring wastes
- Report identified and measured wastes

### 2.1 Preparing plan of MUDA and implementing problem identification

Conditions using the arrow diagram. *Select the product to be analyzed-* Choose products with a large output and those with many production problems as starting points for your analysis of current

*Prepare a factory layout diagram-* Include the entire factory layout, indicating the position of machines, worktables and other equipment. Store the original in a safe place so that you can make a copy of it each time you want to analyze another product line.

*Make the arrow diagram-* Do this on the factory floor. Use the symbols below to show the different types of activities that occur. The map will make the waste more obvious to you and your team than when you are simply standing on the factory floor observing standard operations. Connect the symbols with lines that show the direction of the flow and the sequence of product through each operation. Create other symbols as you need to.

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At all conveyance points, note the conveyance distance and type of conveyance. At all retention points, note average work-in- process inventory.

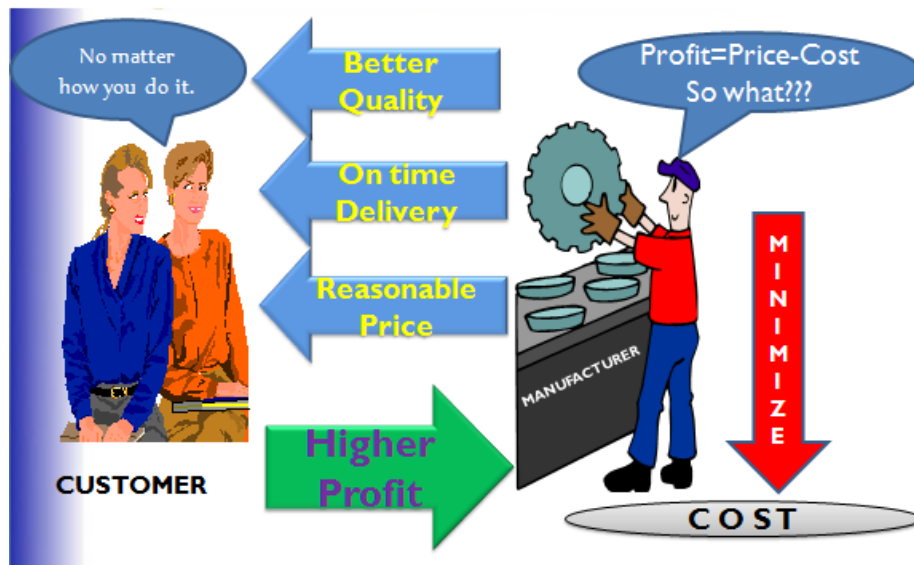


Figure 2.1 costumer identification

## 2.2 possible problems related to the process /Kaizen elements using statistical tools and techniques.

- Overproduction
- Inventory
- Motion
- Conveyance/Transportation
- Waiting/ Idle time
- Defect making
- Processing

## 2.3 causes and effects of MUDA Causes of Muda of Overproduction

- Large-lot production
- Anticipatory production (producing product in advance of demand)
- Inability to achieve short changeover times with the large equipment used in mass production systems
- Creating enough stock to replace the number of defective parts produced

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- Overstaffing or too much equipment
- Machines that turn out parts too quickly

### **Effects of Muda of Overproduction**

Companies often have overproduction as a result of large-lot manufacturing methods or mass production. There is several unfortunate effects of over production:

- Anticipatory buying of parts and materials
- Blocked flow of goods
- Increased inventory
- No flexibility in planning
- Occurance of defects

### **Causes of Muda of Inventory**

- Acceptance of inventory as normal or as a “necessary evil”
- Poor equipment lay out
- Long changeover times
- Shish-kabob or large lot production
- Obstructed flow of goods
- Anticipatory production
- Defective parts
- Upstream process is too fast for the downstream process.

### **Effects of Muda of Inventory**

- Waste of space
- Needs for inspection, and transportation
- Expansion of working fund
- Shelf life may expire
- It ties up cash
- Makes FIFO inventory management more difficult

### **Causes of Muda of motion**

- Isolated operations
- Low employee morale
- Poor work layout
- Lack of training

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- Undeveloped skill

### **Effects of Muda of motion**

- Increase in manpower and processing
- Unstable operation
- Increases production time
- Can cause injury

### **Causes of Muda of Conveyance/Transportation**

- Poor layout
- Shish-skilled workers
- Sitting to perform operations
- The need for conveyance systems is assumed

### **Effects of Muda of Conveyance/Transportation**

- Waste of space
- Production deterioration
- Expansion of transportation facilities
- Occurrence of scratches
- Increase production time and cost
- wastes time and energy

### **Causes of Muda of Waiting/ Idle time**

- Obstruction of flow
- Poor equipment layout
- Trouble at the upstream process
- Capacity imbalances
- Large Lot-production

### **Effects of Muda of Waiting/ Idle time**

- Waste of manpower, time, & machines
- Increase in the in-process inventory

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- Failed delivery dates
- Poor workflow continuity

### **Causes of Muda of Defect making**

- Emphasis on downstream inspection
- No standard for inspection work
- Omission of standard operations
- Material handling and conveyance

### **Effects of Muda of Defect making**

- Increase in material cost
- Productivity deterioration
- Increase in personnel & processes for inspection
- Increase in defects and claims
- Invite reworking costs
- Inadequate study of processes
- Inadequate study of operations
- Incomplete standardization
- Materials are not studied

### **Effects of Muda of Processing**

- Unnecessary processes or operation
- Increase in manpower and man-hour
- Lower workability
- Increase in defects
- Can reduce life of component

## **2.3 Identified and measured wastes**

### **Classification of Waste**

A number of methods for categorizing types of waste have emerged. We will review some of these models to get a deeper understanding of what waste is and how to find it and eliminate it.

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- The three Mus
- The 5M + Q + S
- The flow of goods
- The seven deadly wastes

### 2.3.1 The Three MUs

In this way of thinking about waste, the goal is to achieve a condition where capacity and load are about equal. In other words, there are just the right amount of workers, materials and machines to make just the right amount of product that is being ordered and deliver it on time to the customer. In Japanese this is expressed with the terms muda, mura and muri.

- Muda(waste) = Capacity exceeds load.
- Mura (inconsistency or variation) = capacity sometimes exceeds the load and the load sometimes exceeds capacity.

**Table 1 Overproduction Waste-finding Checklist**

Overproduction Waste-finding Checklist					
Process:		Date:			
Description of waste		Yes	No	Magnitude	Causes and/or Improvement plans
1	No production schedule of control boards.				
2	No leveling of production schedule.				
3	Productions not in synchronize with production schedule.				
4	Items missing				
5	Defective goods produced.				
6	Equipment breakdowns.				
7	Too much manual assistance required.				

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8	Machines have too much capacity.				
9	Lots are grouped in to batches.				
10	Using “Push” production.				
11	Caravan style operations.				
12	Not balanced with tne next process.				
<b>Total</b>					

Self-Check 2.1	<b>Written Test</b>
----------------	---------------------

**Instructions:** Answer all the questions listed below. Write your answers in the sheet provided in the next page.

1. Describe the 3MU’s and their relationships. (9 points)
2. What are the seven deadly wastes/Muda (7 points)
3. Describe the seven deadly wastes/Muda (7 points)
4. What are the focus areas of 5M + Q + S ? (7 points)
5. What are the four things going on during the flow of goods? (4 points)
6. Explain the four things going on during the flow of goods in relation to waste? (8 points)



## Unit Three: Analyze causes of a problem

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

- Selecting the root cause directly related to the problem
- Listing all possible ways using creative idea generation
- Testing and evaluating The suggested solutions

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

- Listing all possible causes of a problem
- Identifying causes of the problems
- Testing and evaluating The suggested solutions
- Selecting the root cause directly related to the problem

### 3.1 Select the root cause directly related to the problem

The Workshop Checklist for Major Waste Finding allows you to identify – in a more general way – the seven types of waste in a work area. You might want to use this checklist before using the detailed checklists.

**Table 2 root cause recording**

Workshop Checklist for Major Waste Finding											
Workshop Name:								Date:			
#	Process Name	1 Overproduction waste	2 Inventory waste	3 Conveyance waste	4 Defect waste	5 Processing waste	6 Operation waste	7 Idle time waste	Waste Magnitude Total	Improvement Ranking	Improvement Ideas and Comments

### 3.2 Listing all possible ways using creative idea generation

**Table 3** Arrow Diagram symbols

Analysis Factors	Symbols	Description	Amount of waste
Retention		When the WIP flow is stopped (for other than Conveyance, Processing or Inspection)	Large
Conveyance		When the WIP flow is moved from one place to another.	Large
Processing		When the WIP is changed physically or chemically for added value.	There may be some waste in the process
Inspection		When goods are inspected for conformance to Quality and dimensional standards.	Large

### 3.2 Tools that used to give solutions for the problems

- ✓ Plant Layout
- ✓ Process flow
- ✓ Other Analysis tools
- ✓ Do time study by work element

- ✓ Measure Travel distance
- ✓ Take a photo of workplace
- ✓ Measure Total steps
- ✓ Make list of items/products, who produces them and who uses them & those in warehouses, storages etc.
- ✓ Focal points to Check and find out existing problems
  - ✓ 5S
  - ✓ Layout improvement
  - ✓ Brainstorming
  - ✓ U-line

Self-Check 3.1	Written Test
----------------	--------------

**Instructions:** Answer all the questions listed below.

1. What are the seven deadly wastes/Muda? (7 points)
2. Describe the seven deadly wastes/Muda? (7 points)
3. What are the focus areas of 5M + Q + S? (7 points)
4. What are the four things going on during the flow of goods? (4 points)
5. Explain the four things going on during the flow of goods in relation to waste? (8 points)
6. Describe the 3MU's and their relationships. (9 points)

## Unit Four: Eliminate MUDA and Assess effectiveness of the solution.

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

- Preparing and implementing Plan of MUDA elimination.
- Adopting necessary attitude and ten basic principles for improvement
- Reducing and eliminating Wastes/MUDA
- Comparing tangible results using various types of diagrams.
- Reporting improvements

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

- Implement Plan of MUDA elimination.
- Eliminating Wastes/MUDA.
- Reporting improvements

### 4.1 Preparing and implementing Plan of MUDA elimination.

There are four important methods you can use for maintaining a waste-free production environment:

- ✓ Standardization
- ✓ Visual controls
- ✓ Auditory controls
- ✓ 5W and 1H Sheet

5W1H signifies six words that begin questions that are needed to be answered in order to describe a fact correctly: what, when, where, who, why, and how. QCC people are recommended to follow and ask these questions in order to grasp the facts without any omission. 4M1E stands for the five elements needed in production (man, machine, materials, method, and environment). Four words start with the letter m, and one with e, thus it is called 4M1E.

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## 5W and 1H Sheet

	<b>Problem:</b> The line stopped.	
Why no. 1:	<b>Why no. 1:</b> Why did the line stop occur?	Why no. 1:
↓		
<b>Current status:</b>  <b>Why no. 2:</b>	<b>Current status:</b> The line stopped when a dimensional defect was found in a processed item.	<b>Current status:</b>  <b>Why no. 2:</b>
↓		
<b>Current status:</b>  <b>Why no. 3:</b>	<b>Current status:</b> Two work pieces got processed at once.	<b>Current status:</b>  <b>Why no. 3:</b>
↓		
<b>Current status:</b>  <b>Why no. 4:</b>	<b>Current status:</b> The two work pieces got stuck together.	<b>Current status:</b>  <b>Why no. 4:</b>
↓		
<b>Current status:</b>  <b>Why no 5:</b>	<b>Current status:</b> The wrong drill bit was used.	<b>Current status:</b>  <b>Why no 5:</b>
↓		
<b>Current status:</b>  <b>Improvement proposal (How):</b>	<b>Current status:</b> Drill bit storage is inadequate (drill bits are kept in a casual pile).	<b>Current status:</b>  <b>Improvement proposal (How):</b>
	<b>Improvement proposal (How):</b> Devise storage improvement and reinforce the 5S.	<b>Improvement proposal (How):</b>

**Table 4 ways of preventive muda**

## **4.2 Adopting necessary attitude and ten basic principles for improvement**

1. Throw out all of your fixed ideas about how to do things.
2. Think of how the new method will work-not how it will not.
3. Don't accept excuses. Totally deny the status quo.
4. Don't seek perfection. A 50 percent implementation rate is fine as long as it is done on the spot.
5. Correct mistakes the moment they are found.
6. Don't spend a lot of money on improvements.
7. Problems give you a chance to use your brain.
8. Ask "Why?" at least five times until you find the ultimate cause.
9. Ten people's ideas are better than one person's.
10. Improvement knows no limit.

### **4.2.1 The three Categories of Operation**

- ➔ (1 ) Net Operation/Value Adding Operation
- ➔ (2) Non-Value Adding Operation
- ➔ (3)" Muda"

## **4.3 Reducing and eliminating Wastes/MUDA**

In order to balance capacity and load without overproducing, you must implement the advanced methods of lean production:

- Full work
- Line balancing
- Pull production using kanban.
- Quick-changeover operations.
- Level production - small-lot, mixed production.

### **How to Eliminate Inventory Wastes**

- U-shaped manufacturing cells, layout of equipment by process instead of operation.
- Production leveling

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- Regulating the flow of production
- Pull production using kanban
- Quick changeover operations

#### How to Eliminate Motion Wastes

- Gradually switch to flow production
  - Create U-shaped cell layout of equipment
  - Make standardization through
  - Increase training
- Increase operator awareness about motion during an operation

#### 4.4 Reporting improvements

Name of the process: \_\_\_\_\_

Work

Place: \_\_\_\_\_

Problem Solving

Title: \_\_\_\_\_

**Table 5 Muda Elimination Indicators**

S.No	Improvement Indicators	Before Kaizen	Target	After Kaizen	Improvement (%)	Remark
1	<b>Muda Elimination Indicators</b>					
	1.1 Tools& Equipment					
	1.2 Parts Saving					
	1.3 Raw Material saving					
	1.4 Transportation					

	1.5 Motion in Meter					
	1.6 Transaction Time					
	1.7 Excess Stock/Inventory					
	1.8 Expired material/Stock)					
<b>2</b>	<b>Productivity indicators</b>					
	2.1 Lead time					
	2.2 Machine down time					
	2.3 Frequency of Machine failure					
	2.4 Production volume per day					
	2.5 Labor saving					
	2.6 labour productivity					
	2.7 Delivery Time					

Self-Check 4	<b>Written Test</b>
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1. Discuss and plan to prepare tools and equipment for Muda identification.
2. Prepare tools and equipment for Muda identification.



## Unit five: prevent occurrence of wastes and sustain operation

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

- Preparing and implementing Plan of MUDA prevention.
- Preparing and discussing Standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement
- Creating waste-free workplace using 5W and 1Hsheet.
- Doing the completion of required operation

Training and ensuring capability of the work team on the new Standard Operating Procedures (SOPs). This guide will also assist you to attain the learning objectives stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Prepare MUDA prevention.
- Creating waste-free workplace
- Reporting improvements
- Preventing occurrences of wastes/MUDA

### 5.1 Creating waste-free workplace using 5W and 1Hsheet.

There are four important methods you can use for maintaining a waste-free production environment:

- ✓ Standardization
- ✓ Visual controls
- ✓ Auditory controls
- ✓ 5w and 1h sheet

5W1H signifies six words that begin questions that are needed to be answered in order to describe a fact correctly: what, when, where, who, why, and how. QCC people are recommended to follow and ask these questions in order to grasp the facts without any omission. 4M1E stands for the five elements needed in production (man, machine, materials, method, and environment). Four words start with the letter m, and one with e, thus it is called 4M1E.

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### 5.1.1 Planned for material

- ✓ Zero equipment failure and break down.
- ✓ Improve reliability and maintainability by 50 %
- ✓ Reduce maintenance cost by 20
- ✓ Ensure availability of spares all the time

### 5.1.2 SAFETY, HEALTH AND ENVIRONMENT

- ✓ Zero accident,
- ✓ Zero health damage
- ✓ Zero fires.

In this area focus is on to create a safe workplace and a surrounding area that is not damaged by our process or procedures. This pillar will play an active role in each of the other pillars on a regular basis.

To create awareness among employees various competitions like safety slogans, Quiz, Drama, Posters, etc. related to safety can be organized at regular intervals

Self-Check 5	Written Test
--------------	--------------

**Directions:** Answer all the questions listed below.

What are the four methods for maintaining waste free production environment? (4 Points)

How standardization does maintain a waste free environment? (4 Points)

How a visual and auditory control does maintain a waste free environment? (4 Points)

How 5W and 1H sheet does maintain a waste free environment? (3 Points)

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## List of Reference **Materials**

- Reference Book: Identifying Waste on the Shopfloor (1996).
- Ethiopian Kaizen Manual (2011)
- Journals/publications/magazines

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