



Cereal Processing

Level-II

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Module Title: Operating a Packaging Process

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LG #53 **LO #1: Operating a Packaging Process**

Instruction sheet

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

- Confirming and availing packaging materials to meet operating requirements
- Identifying and confirming cleaning and maintenance requirements and status
- Fitting and adjusting machine components and related attachments to meet operating requirements
- Entering operating parameters to meet safety and production requirements
- Loading materials, product and packaging components as packaging requirements
- Checking and adjusting equipment performance with operating requirements.
- Carry out pre-start checks as workplace requirements

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:

- Confirm and availing packaging materials to meet operating requirements
- Identify and confirming cleaning and maintenance requirements and status
- Fit and adjust machine components and related attachments to meet operating requirements
- Enter operate parameters to meet safety and production requirements
- Load materials, product and packaging components as packaging requirements
- Check and adjust equipment performance with operating requirements
- Carry out pre-start checks as workplace requirements



Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”



Information Sheet 1- Confirming and availing packaging materials to meet operating requirements

1.1 Introduction

The right selection of packaging materials and technologies maintains product quality and freshness during distribution and storage. Materials that have traditionally been used in cereals food packaging include glass, metals (aluminum, foils and laminates, tins, and tin-free steel), paper and paperboards, and plastics. Moreover, a wider variety of plastics have been introduced in both rigid and flexible forms. Today's food packages often combine several materials to exploit each material's functional or aesthetic properties. As research to improve food packaging continues, advances in the field may affect the environmental impact of packaging.

1.2 Materials Used in Cereals Food Packaging

Packaging has to be sturdy, attractive, economical and yet non-toxic. It must act as a physical barrier to protect food from contamination and must also preserve the nutrients through avoiding interaction of food with oxygen, carbon dioxide and humidity. Besides these the important properties of packaging material are their physical, chemical, biological and thermal stability, impermeability to liquids and special properties like X-Ray resilience. **The recommended packaging materials for consumer packs are as follows:**

- Linear Low Density Polyethylene
- High Molecular High Density Polyethylene
- Biaxially Oriented Polypropylene Film
- Polyethylene Film
- Co-extruded Films
- Laminate

1.2.1 Polyethylene Film

Low Density Polyethylene (LDPE) is the most commonly used packaging material for milled products owing to its low cost and easy availability. LDPE film has good balanced property such as tensile strength, bursting strength, impact resistance and tear strength. It has good barrier properties to water and water vapour. It can be heat sealed very

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easily and gives good tough welds. The film can also be printed very easily. However, it has poor barrier to gases.

1.2.2 Linear Low Density Polyethylene (LLDPE)

LLDPE is a superior material than LDPE. Comparative properties of LLDPE and LDPE are given below to highlight the advantages of LLDPE.

- Improved tensile properties: For products with similar melt flow index, the tensile strength of LLDPE is 50-60% higher.
- Improved stiffness: Strength of LLDPE is 50% higher than that of LDPE.
- Puncture Resistance: Puncture resistance of LLDPE film is twice as much as that of LDPE having similar thickness.

Table1. Properties of LDPE and LLDPE films comparative

Properties		ASTM Test Method	LLDPE Film	LDPE Film
Basic Density (g/cc)		D-792	0.925	0.923
Elmendorf Test Strength (g)	MD	D-1922	280	130
	TD	D-822	400	230
Tensile Strength (Psi)	MD	D-882	3240	2560
	TD			1980
Elongation (%)	MD		640	390
	TD		680	510
Gloss at 45° (%)		D-2457	80	83
Haze (%)		D-1003	6.4	4.0

Owing to better physical characteristics of LLDPE films, LDPE has now been replaced by LLDPE in number of cereal products applications. Thickness of LLDPE film used for different consumer packs is as follows:

- 1kg Pack-250 gauge
- 2kg Pack-300 gauge
- 5kg Pack-400 gauge White opaque film gives better aesthetics.

1.2.3 High Molecular High Density Polyethylene (HMHDPE)

This material is characterised by its toughness and high mechanical strength. The film prepared out of this material is translucent and it can be modified by addition of



pigments. The films have very good strength and are thus used in very low thickness for packing of cereal products. The film being tougher, insect penetration is difficult.

1.2.4 Co-extruded Films

Milled products like wheat flour contain small amount of fat which tend to ooze out through the LDPE or LLDPE film giving a sticky fat to the surface of the pack and also affecting the print of the film. It is therefore advantageous to use co-extruded film whereby a thin layer of HDPE/HMHDPE can be incorporated to prevent fat seepage. Three layer co-extruded film having structure LDPE/HDPE/LLDPE is found useful in overcoming this difficulty. Use of metallocene resins in the above structure was found to produce a film having good weldability and high hot tack. As Atta is a powdery product, fly-off of the product is observed during filling the packs. The powder which flies off gets deposited in the seal area thereby affecting the strength of the seal. The metallocene resin helps in producing good seal along contaminated area. The above structure of co-extruded film using metallocene resin is, therefore, a very effective packaging material for milled products like Atta

1.2.5 Polypropylene (PP)

Polypropylene finds wide application in packaging of food products, like atta, soji etc. owing to its following properties:

- Density: Polypropylene has very low density among the commonly used plastics due to which it gives higher yield {meterage of film per kg for material} as compared to LDPE or LLDPE.
- High stiffness and High Tensile Strength.
- High Transparency: Polypropylene has very high transparency as compared to LDPE and LLDPE. It is the most suitable material for products, which require visibility.
- Lower moisture vapour transmission rate
- Cost: One of the advantages of PP is its low cost as it can be used at lower thickness owing to its high tensile strength. This is a big advantage for low cost, bulky products like Atta.

1.2.6 Biaxially Oriented Polypropylene Film (BOPP)

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Biaxially Oriented Polypropylene film has higher strength than polypropylene film and it is available in a heat sealable grade also. It has excellent barrier to moisture, high transparency and gloss. It can be reversing printed and can be laminated as a two-layer film. Heat sealable BOPP film with thickness ranging from 2 μ to 40 μ is widely used for packaging of cereals.

1.2.7 Laminates

Laminates made of BOPP/LDPE or Polyester/LDPE is used for packaging of milled cereal products. The advantages of laminates are as follows:

- Polyester and BOPP based laminates can be reverse printed thus giving good appearance to the pack. As the printed side of the film is sandwiched between two film layers, the odour due to ink solvents appearing into the pouch is prevented thereby protecting the product from tainting.
- Polyester being a tough material, insects cannot puncture the pouch easily and hence the entry of insects can be controlled.
- Cereal products are mostly sold through grocery outlets. The grocer sells many other items like soaps and detergents, incense sticks, strong smelling deodorants, vegetable oils. It has been observed that the grocer displays the consumer packs by placing them next to strong smelling items like soaps, incense sticks etc., as a result, the products packed inside the LDPE pack pick up the odour of the material stored in its vicinity. This problem can be overcome by using laminates with polyester/poly structure.
- As the laminates are expensive, they are mostly used for packing high value products.

It is therefore evident that the types of packaging material to be selected for cereal based products depends on various factors mentioned above and the packaging technologist should combine these factors to suit the requirements of product to be packed and arrive at a cost effective packaging system. The packaging materials mentioned above are the primary packaging materials for milled products.

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Self-check 1	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Choose the best answer (4 point)

1. One is not packaging material?
 A. Paper B. glass C. metal D. none of the above
2. Which one of the following is the purpose of packaging?
 A. Protect the product B. store the product C. carry nutritional information D. none

Test II: Short Answer Questions

1. Define packaging (2 point).
2. Write down the use of packaging (5 point).
3. List appropriate packaging materials (5 points)

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

Note: Satisfactory rating - 15 points Unsatisfactory - below 15 points



Information Sheet 2 Identifying and confirming cleaning and maintenance Requirements and status

2.1 Cleaning

Cleaning is the complete removal of food soil using appropriate detergent chemicals under recommended conditions. It is important that personnel involved have a working understanding of the nature of the different types of food soil and the chemistry of its removal.

2.2 Cleaning Methods

There are a number of methods which can be used to apply detergents and disinfectants.

2.2.1 Manual cleaning

Manual cleaning using cloths, mops, brushes, pads, etc. It is normally used in small areas, equipment that is non-water proof or requires dismantling or areas which are difficult to clean by other methods. It is a labor intensive method and may limit the use of certain chemicals for safety reasons. To ensure cleaning is effective the method must be clearly defined and staff trained to an appropriate level.

2.2.2 Foam cleaning

This is the common method for cleaning most food operations. A foam blanket, created using a wide range of available equipment is projected from a nozzle and allowed time to act on the soil. It is then rinsed off with the released deposits. Large areas such as floors, walls, conveyors, tables and well-designed production equipment are ideal for foam cleaning. Foam is a carrier for the detergent. The foam should be applied in an even layer. Coverage rates are quick and chemical usage is economical.



Figure 1 foam cleaning

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2.2.3 Spray

Spray cleaning uses a lance on a pressure washer with chemical induction by venture. This method can be wasteful of chemical and can be slow to produce foam. It should be used where foaming properties are not essential for the cleaning action.

2.2.4 Fogging

Aerial fogging uses compressed air or other equipment to generate a fine mist of disinfectant solution which hangs in the air long enough to disinfect airborne organisms. It will also settle on surfaces to produce a bactericidal effect. The system can come in a small portable device or built in automatic central systems. Fogging should never be used as a primary sanitizing method. It should be used in conjunction with other methods. It is also important to ensure that coverage and saturation is sufficient and the mist is fine to allow proper action.

2.2.5 Machine washing

This is normally an automatic or semi-automatic washing process conducted within a purpose built machine. There are many machine designs depending on the application. But failure to maintain them correctly can lead to a contamination risk to the product. Chemicals used in these machines should be low foaming. An effective system for controlling the dose of chemical should be employed and temperature control systems should be used where critical.

2.2.6 Cleaning in place (CIP)

Cleaning-in-place (CIP) is an automatically performed method of cleaning, applied to remove residues from complete items of plant equipment and pipeline circuits without dismantling or opening the equipment. It is a system of cleaning engineered to provide fast, productive, consistent and reproducible high quality cleaning of all product contact surfaces to a predetermined level of cleanliness, by circulating chemical (detergent and disinfectant) solutions and rinsing water through tanks and piping of a cereal food processing plant that remains assembled in its production configuration, and by jetting or spraying of the product contact surfaces under conditions of increased turbulence and flow velocity.

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2.3 Cleaning procedure

Cleaning is a complex process. To ensure it is conducted correctly a defined and systematic approach is required that takes into account a number of factors previously covered. This approach takes the form of a Procedure and this is usually a legal requirement in addition to a fundamental requirement of global food standards. A collection of these cleaning procedures forms a Cleaning Plan or Program which is plant specific.

The correct sequence of a general cleaning procedure for surfaces in a cereal food plant is:

- Gross Clean/Preparation
- Pre-rinse
- Detergent application
- Post-rinsing
- Disinfection
- Terminal rinsing

2.1 Legal cleaning requirements

Compliance regarding cleaning of food premises

Make sure that:

- Processing rooms are designed and laid out so as to permit good food hygiene practices
- The lay out, design, construction, sitting and size of food premises, including facilities for cleaning and storing working utensils and equipment and refuse stores, allow for adequate cleaning.
- In rooms of processing the design and laid out are to permit good food hygiene practices, including protection against contamination between and during operations.
- In particular floor surfaces, wall surfaces, doors are to be easy to clean and where necessary, disinfect. Windows and other openings fitted with insect proof screens which can be easily removed for cleaning.

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2.2 Maintenance requirements

Maintenance is a general upkeep and repair of equipment, buildings and grounds, heating and air-conditioning; removing toxic wastes; parking; and perhaps security.

Cereal food premises and equipment that are not kept in good repair and condition are a potential source of microbiological and physical contamination of food. Poorly maintained premises and equipment cannot be cleaned effectively. Poor maintenance may allow the entry of other sources of physical, microbiological and chemical contaminants such as water, pests and dust. Poor maintenance can have health and safety implications for workers. Maintenance may include:

- Hand sharpening
- Cleaning
- Lubricating
- Tightening
- Simple tool repairs and adjustments

2.5.1 Types of maintenance

Basically there are two types of maintenance:

- ✓ **Preventive or proactive maintenance:** is carried out to keep something functional. This type of activity is usually planned and scheduled.
- ✓ **Corrective or reactive maintenance:** is repairing something to get it working again. This is an unscheduled, unplanned task, usually associated with greater hazards and higher risk levels. Routine maintenance tasks refer to **on-going, scheduled tasks** that are performed in order to keep hand tools and basic equipment functioning properly.

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2.5.2 Perform maintenance safely

Do maintenance safely:

- ✓ Always disconnect powered tools before servicing, adjusting, oiling, cleaning or repairing them, sharpening or changing accessories such as blades.
- ✓ Follow the manufacturer's instructions in user's manual for maintenance and servicing (e.g. lubrication, cleaning) and changing parts and accessories.
- ✓ Use appropriate tools and equipment while carrying out maintenance
- ✓ When maintenance is complete workers have to check if the maintenance has left the portable tools in a safe and functioning condition:
- ✓ Replace all guards and safety devices
- ✓ Record your inspection and actions, sign out and pass the tool to the worker or store it safely

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Self-Check – 2	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Define cleaning? (5 points)
2. Write cleaning methods? (5 points)
3. Write the correct sequence of general cleaning procedures? (5 points)
4. Mention types of maintenance? (5 points)

Note: Satisfactory rating - 15 points Unsatisfactory - below 15 points
 You can ask you teacher for the copy of the correct answers.



Information Sheet 3- Fitting and adjusting machine components and related attachments to meet operating requirements

3.1 Machine Adjustment

Before allowing someone to start using any machine you need to think about what risks there are and how these can be managed. Before starting any operation the operator should be check the main parts of the equipment appropriately and identify faulty and unfit parts or components of the machine then adjust and fit all parts or components of the machine identified based on operation procedure standards.

3.2 Adjustment of Machine Operation

3.2.1 Safety check

Check and make sure there is no foreign matter on:

- ✓ The conveyer belt,
- ✓ Working table, and
- ✓ End sealing knives and there is no other person around the machine.

3.2.2 Switch on the power

Open the door of the cabinet and connect the main breaker, close the cabinet, check to see if all thermostats and power supply indicator lamp on the control board are normal, and see if the display of the human-machine interface is normal.



Self-Check – 3	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. What is the main purpose of safety checks? (5 points)
2. Write down the main parts of the machine to be check? (5 points)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points
 You can ask you teacher for the copy of the correct answers.



Information Sheet 4 - Entering parameters operation to meet safety and production requirements

4.1 Operation procedure of packaging equipment's

Operating procedures are followed to start and operate equipment to achieve required outcome. Provision of clear, concise and accurate operating procedures is the most effective measure to prevent, control and mitigate accidents. This procedure aims to:

- Increase employee awareness on the safe use of equipment used in the workplace;
- Ensure that work equipment is suitable for the purpose for which it is to be used or has been provided;
- Ensure that work equipment is inspected at regular intervals;
- Ensure that work equipment is maintained in good working order and kept in a good state repair;
- Ensure employees receive relevant information, instruction and training (where this is required and/or appropriate) in relation to using work equipment.

Comprehensive written operating procedures should be generated where applicable that address:

- Standard operating procedures and operating philosophy;
- Abnormal operating procedures;
- Temporary operating procedures;
- Plant trials;
- Emergency operating procedures;
- Commissioning;
- Plant Start-up;
- Plant Shut-down;
- Bulk loading and unloading;
- Process change; and
- Plant change.

These procedures should cover the following:

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- Material safety data control of substances hazardous to health (COSHH) states that general requirements on employers to protect employees and other persons from the hazards of substances used at work;
- Plant operatives should have an awareness and understanding of material safety data for raw materials, intermediates, products and effluent /waste;

N.B: Material safety data sheet is the document that list information relating to Occupational Health and Safety for the use of various substances and products. These include:

- Control measures and personal protective equipment;
- Location of plant where process to be undertaken;
- Roles and responsibilities of individuals involved in plant operations;
- Plant fit for purpose;
- The condition of main process plant and equipment (clean, empty etc. as appropriate) should be established as being fit for purpose;
- The condition of ancillary process plant and equipment (clean, empty etc. as appropriate);
- Plant correctly set-up for processing;
- Process monitoring and recording;
- Monitoring and recording of key process parameters (temperature, pressure etc.) in plant logs;
- Quality;
- Sampling of raw materials, intermediates, products and effluent/waste;
- Packaging of final product.

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Self-Check – 4	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test : Short Answer Questions

1. What is the aim of operational procedure during operating the machine or equipment? (5points)
2. Comprehensive written operating procedures was generated which were applicable to address what? (5points)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points
 You can ask you teacher for the copy of the correct answers.



**Information Sheet 5- Loading material, product and packaging components
as packaging requirements**

5.1 Shipping

Vehicles and containers that transport food products should be used only for the intended purpose and should have both sanitary design and pest control procedures in place. (Ex: truck’s doors should be sealed to prevent entry of pests.) Refrigeration equipment in vehicles and temperature measuring devices should be calibrated and in good working order.

5.2 Inspection of vehicles

Designated employees should evaluate and document the condition of trucks, containers and carriers of finished products before loading. The following should be verified before loading:

- Cleanliness of the truck,
- No odours or obvious dirt or debris,
- No evidence of chemical contamination such as fluids, powders, chemical residues,
- Correct temperature in the truck,
- Temperature measuring devices shall work properly during transportation,

Table1. Transport condition and temperature

Transport Condition	Temperature
Hot Storage	≥60°C (140°F)
Refrigeration	≤5°C (41°F)
Freezing	≤-15°C (5°F)



5.3 Loading

In the food industry, incoming and outgoing materials need to be properly shipped, received, handled and stored to prevent the risk of biological, chemical or physical hazards. Considerations for loading and unloading include:

- Employees responsible for loading and unloading food materials should follow company standards for hygiene and sanitation practices.
- Food products should be packaged in suitable containers to prevent product damage.
- Proper product temperature must be maintained during transport, loading and unloading. Movers should be aware of the product temperature requirements.

5.4 Food Packaging Materials

Selecting the suitable material for packaging a certain type of food depends on the functions that the package is supposed to fulfill. These functions include shielding the foods against moisture, temperature variations, oxygen, light, and biological microorganisms. Also, damage protection, permeability, food identification, and chemical and optical properties play a significant role in the material selection.

Of the plastics used for food packaging, polyolefins and polyester are the most common materials. Other materials include polyvinyl chloride, polyvinylidene chloride, polystyrene, polyamide, and ethylene vinyl alcohol. Polyethylene and polypropylene are materials from the polyolefin category.

5.5 Packaging component

Any individual assembled part of a package such as, but not limited to, any interior or exterior blocking, bracing, cushioning, weatherproofing, exterior strapping, coatings, closures, inks and labels are known as packaging component. Tin-plated steel that meets the recommended specification shall be considered as a single package component. Electro-galvanized coated steel and hot dipped coated galvanized steel shall be treated in the same manner as tin-plated steel.

5.1 Food packaging

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Food packaging is the enclosure of a food product in a plastic pouch, a metal can, or glass bottle”. For scientists and engineers, “Is a coordinated system designed for the efficient delivery of high technical quality, safe food products throughout every phase of the supply chain, from raw material, production to food manufacture, packing, retail, wholesale, consumer use, disposal and recycling or other means of resource recovery.

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Self-Check – 5	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Short Answer Questions

1. What are considerations for loading and unloading? (5 points)
2. Write things should be verified before loading? (5 points)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points
 You can ask you teacher for the copy of the correct answers.



Information Sheet 6 - Checking and adjusting equipment performance with operating requirements

6.1 Checking equipment performance

Evaluation of performance of packaging machinery: Measure the packaging line efficiency, its throughput, if the equipment is operating at maximum speed, and so on. These data points give you a measure of a piece of the system but not necessarily an overall view of how effective the equipment is.

6.2 Overall equipment effectiveness

Overall equipment effectiveness (OEE) is a measure of how well a manufacturing operation is utilized (facilities, time and material) compared to its full potential, during the periods when it is scheduled to run. It identifies the percentage of manufacturing time that is truly productive. An OEE of 100% means that only good parts are produced (100% quality), at the maximum speed (100% performance), and without interruption (100% availability). Measuring OEE is a manufacturing best practice. By measuring OEE and the underlying losses, important insights can be gained on how to systematically improve the manufacturing process. OEE is an effective metric for identifying losses, bench-marking progress, and improving the productivity of manufacturing equipment (i.e., eliminating waste)

6.3 Total effective equipment performance

Total effective equipment performance (**TEEP**) is a closely related measure which quantifies OEE against calendar hours rather than only against scheduled operating hours. A TEEP of 100% means that the operations have run with an OEE of 100% 24 hours a day and 365 days a year (100% loading). The generic form of OEE allows comparison between manufacturing units in differing industries. It is not however an absolute measure and is best used to identify scope for process performance improvement, and how to get the improvement. OEE measurement is also commonly used as a key performance indicator (KPI) in conjunction with lean manufacturing efforts to provide an indicator of success. OEE can be illustrated by a brief discussion of the six metrics that comprise the system.

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6.4 Factors Affecting Overall Equipment Effectiveness

Packaging machinery manufacturers institute (PMMI's) Primary Packaging Line Play book explains that Overall Equipment Effectiveness (OEE) is a combination of three factors:

- **Availability** - Making things at the right time (keeping the machine up and running, minimizing downtime)
- **Performance** - Making the right thing
- **Quality** - Making things the right way (no defects, rework, or waste)

Put simply, Overall Equipment Effectiveness (OEE) is a measure of exactly where you can improve in your packaging line. Each of the three components of the OEE points to an aspect of the process that can be targeted for improvement. OEE may be applied to any individual Work Center, or rolled up to Department or Plant levels. This tool also allows for drilling down for very specific analysis, such as a particular Part Number, Shift, or any of several other parameters. It is unlikely that any manufacturing process can run at 100% OEE. Many manufacturers benchmark their industry to set a challenging target; 85% is not uncommon.

- OEE is calculated with the formula (Availability)*(Performance)*(Quality)
- Using the examples given below:
- (Availability= 86.6%)*(Performance=93%)*(Quality=91.3%) = (OEE=73.6%)

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6.5 Performance

Every piece of packaging machinery has an ideal cycle time (the time it takes to complete one finished product). Performance is measured against that ideal cycle time. So for the calculation of Overall Equipment Effectiveness (OEE) performance represents the speed at which the machine is currently running as a percentage of its ideal speed. Idle time, minor stoppages, and overall reduced operating speeds will negatively affect packing machine performance.

In the packaging equipment world, a changeover is adjusting a machine to accommodate different products. Changeovers mean the machine is offline and not producing, which equals money down the drain. So put away your tools, you won't need them.

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Self-Check – 6	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Define overall equipment effectiveness? (5 points)
2. Write down factors that affect overall equipment effectiveness? (5 points)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points
 You can ask you teacher for the copy of the correct answers.



Information Sheet 7- Carrying out pre start checks

7.1 Introduction

In an industry, there are many types of works to be operated. For example, machine and laboratory operation. So before we are going to operate machine/lab equipment we have to inspect/check whether it was in a good operating condition or not. Checking conditions of operating equipment has a vital role for the operator's safety, quality of a product and also for equipment safety.

Operators always have to check the following just before going to manipulate operations

- Parameter setting (pressure, temperature, flow...),
- Identify faulty conditions,
- Analyze maintenance requirements, and
- Identify hazards.

All these can be accomplished by investigating.

7.2 Conduct checks on machine/equipment

Before allowing someone to start using any machine you need to think about what risks there are and how these can be managed. So, you should:

- Check that it is complete, with all safeguards fitted, and free from defects.
- The term 'safeguard' includes guards, interlocks, two-hand controls, light guards, pressure-sensitive mats etc.
- Provide the right safeguards (from supplier by law) and inform buyers of any risks ('Residual risks') that users need to be aware of and manage because they could not be designed out.
- Produce a safe system of work for using and maintaining the machine.
- Require the inspection of critical features, before maintenance, where deterioration would cause a risk.
- Look at the residual risks identified by the manufacturer in the



information/instructions provided with the machine and make sure they are included in the safe system of work.

- Choose/make sure the right machine/equipment for the job.
 - ✓ safe for any work that has to be done when
 - setting up,
 - during normal use,
 - when clearing blockages,
 - when carrying out repairs for breakdowns, and
 - during planned maintenance;
- Properly switched off, isolated or locked-off before taking any action to
 - ✓ Remove blockages,
 - ✓ Clean or adjust the machine.

7.3 The pre- and post-operation equipment inspection checklist

- Clear any accumulated debris from the equipment's: It's important to check and remove any material from the jobsite
- Check signs of damage.
- Check for leaking or pooled fluid around and under the machine: This is an easy Indicator that something isn't right and the source of that fluid should be identified and addressed/fixed before operation.
- Check for new signs of structural damage, scratches or dents on the machine: This is almost more important post-operation than it is pre-operation.
- Inspect the operator compartment and clear away any debris or obstructions.
- Familiarize yourself with the control style and change as needed: Most of today's machine's come with rather simple pattern selectors that allow the operator to use the control pattern that they are most familiar with. This will lead to greater productivity and greater operator satisfaction.
- Identify auxiliary/attachment controls: Each type and style of machine controls attachments differently operators should identify how to properly work their attachment prior to attempting to use it.

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- Start the power and review console indicators and warnings: Today's machines are built to give the operator more feedback on the workings of internal systems than ever previously available.
- Review all external surroundings: Know your work site, and the people and structures that exist inside your working envelope. This will ensure optimal jobsite safety and productivity.

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Self-Check – 7	Written test
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Name..... ID.....Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Short Answer Questions

1. What are the things in which the machine operators will be always have to check just before going to manipulate operations? (5pts)
2. List what you or someone have to do before start using any machine.(5pts)
3. List and discuss in detail what you have to do during performing the Pre-Operation Equipment Inspection on a machine. (5pts)
4. What are the causes of accidents while working with machinery? (5pts)
5. What are the dangerous parts of machinery? (5pts)

Note: Satisfactory rating - 20 points Unsatisfactory - below 20 points
 You can ask you teacher for the copy of the correct answers.



LG #54	LO2: Operate and monitor the process
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Instruction sheet

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

- Starting and operating the process with workplace policies and procedures
- Monitoring equipment to identify operating conditions with work requirements
- Identifying variation in equipment operation and reporting with work place requirements
- Monitoring the process to confirm specifications
- Identifying, rectifying and/or reporting out-of-specification process outcomes
- Maintaining the work area as housekeeping standards
- Conducting work with workplace information
- Conducting work with environmental guidelines and legislative requirements
- Maintaining workplace records with workplace recording requirements.

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:**

- Start and operating the process with workplace policies and procedures
- Monitor equipment to identify operating conditions with work requirements
- Identify variation in equipment operation and reporting with work place requirements
- Monitor the process to confirm specifications
- Identify, rectify and/or report out-of-specification process outcomes
- Maintain the work area as housekeeping standards
- Conduct work with workplace information
- Conduct work with environmental guidelines and legislative requirements
- Maintain workplace records with workplace recording requirements



Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”



Information Sheet 1- Starting and Operating the Process with Workplace Policies and Procedures

1.1 Introduction

Packaging is a coordinated system of preparing goods for transport, distribution, storage, retailing and end-use. A means of ensuring safe delivery to the ultimate consumer in sound condition at minimum overall cost. A techno-economic function aimed at minimizing costs of delivery while maximizing sales (and hence profits) and the science, art and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging has its own importance in business as it allows the products to be transferred from the manufacturing plants to the customers and consumers.

1.2 Functions of Food Packaging

The primary purpose of food packaging must continue to be maintaining the safety, wholesomeness, and quality of food. Historically, package design was a task centered on specifying, an often pre-conceived package, with the primary goal of achieving compatibility with the filling and sealing operations.

The four basic functions of a food package are:

- Containment (holding the product),
- Protection (quality, safety, freshness)
- Communication (graphics, labels)
- Convenience or utility of use

1.3 Principles of Packaging

Packaging of food articles should be done in a way that chances of contamination, reaction with packed material, decomposition etc. is avoided. Packaging must be done in appropriate way or as per the norms so recommended by Food and Drug Authority. It can be done in multiple layers as enumerated here:

Primary packaging: It envelops and holds the food product

Secondary packaging: It is exterior to the primary packaging

Tertiary packaging: It is the tough outermost covering that is used for bulk handling, warehouse storage and transport/shipping.

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The above materials are fashioned into different types of food packages and containers such as: Primary packaging is the main package that holds the food that is being processed. Secondary packaging combines the primary packages into one box being made. Tertiary packaging combines all of the secondary packages into one pallet.

1.4 Packaging and Food Safety

While food packaging is an integral component of food industry and helps to store food and beverages in hygienic manner, it can at times be a cause of concern for food safety. Some packaging materials such as certain types of plastic, politeness and styrofoam can release toxins when they are heated and can be dangerous to consumers. Packaging materials which are irradiated (along with food) can transfer unsafe nonfood substances into the food. Food packaging makes use of a variety of substances, including dyes for printing colorful labels, and glues and adhesives for keeping packaging closed. In order to protect consumers effectively, the relevant authority individually certifies each of these food packaging materials subjecting them to rigorous testing protocols.

1.5 Types of packaging

The type of packing depends on various factors e.g. food item, the process of production, and quality of food, shelf life desired, transport considerations, etc. so it is important to consider the shape, size, colour, stacking options, printing of labels, cost, environmental attributes (e.g. recyclability, carbon imprint), handling properties, etc.

Packaging includes:

- vacuum packing
- Modified atmosphere packaging (MAP)
- Blister packaging or over wrapping

1.5.1 Vacuum packing

Vacuum packaging is a method of packaging that removes air from the package prior to sealing. This method involves (manually or automatically) placing items in a plastic film package, removing air from inside and sealing the package.

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Figure 1 vacuum cereal products packer

1.5.2 Modified atmosphere packaging

Modified atmosphere packaging (MAP) is a type of food packaging in which the earth's normal atmosphere has been modified to extend a food's shelf life. A gas mix typically utilizing carbon dioxide, nitrogen, and oxygen gases. Cereal products are packed in a single gas or a combination of three gases, depending on the spoilage mechanism of the food item. There are a number of ways to slow down these processes of spoilage and to keep food attractive and edible for as long as possible. These include simple refrigeration the lower the temperature the slower most microbes will grow.

The type and proportion of gas used in the packaging is largely dictated by the type of food in the package and the sort of decay or change that the food undergoes. To package a product in a modified atmosphere requires sophisticated machinery to flush out air from the packaging chamber and replace it with a different gas or precisely defined mixture of gases, then seal the product in the packaging so that only the modified atmosphere surrounds the product and not any other unwanted gas.

The packaging machines are divided in two main groups.

1. Thermo-forming/chamber machines (vacuum with gas flushing)
2. Vertical and horizontal form, fill & seal machines (gas flushing by lance or tube, venting to atmosphere)



Horizontal Form Fill Seal



Vertical Form Fill Seal



Horizontal Pre-Made Pouch Fill & Seal

Figure2. Modified atmosphere packaging

1.5.3 Blister packaging or over wrapping

Blister pack is a term for several types of pre-formed plastic packaging used for small consumer goods, foods, and for pharmaceuticals. The primary component of a blister pack is a cavity or pocket made from a formable web, usually a thermoformed plastic. This usually has a backing of paperboard or a lidding seal of aluminum foil or plastic. A blister that folds onto itself is often called a clamshell. Blister packs are useful for protecting products against external factors, such as humidity and contamination for extended periods of time. Opaque blisters also protect light-sensitive products against ultra violet rays.



Figure 1 blister Cereal food packers

1.6 Summary of Labeling Requirements

The requirements that a food label must meet in international trade are defined in a series of codex standards on food labeling. This is of particular importance for those companies intending for those intending to export their products. For local markets the labels must conform to the food legislation. In summary the general labeling requirements are:

- The name of the food
- List of ingredients
- Quantitative ingredients declaration (where indicated)
- Net contents and drained weights
- Name and address
- The country of origin
- Lot identification
- Date marking and storage instructions
- Instructions for use and special storage requirement
- General script
- Nutrition labeling



Self-Check – 1	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Short Answer Questions

1. Define packaging? (5 points)
2. Explain functions of packaging? (4 points)
3. Mention types of food packaging and explain each of them? (6 points)
4. Write general labeling requirements? (5 points)

Note: Satisfactory rating – 15 points Unsatisfactory - below 15 points

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



Information Sheet 2- Monitoring equipment to identify operating conditions with work requirements

2.1 Packaging Machineries and Automation Systems

Food processors use a variety of machines for different production lines and for various food types. Several machine types are integrated into a single packaging line. Some of the machine types are cartooning, wrapping, labeling, shrinking, sealing, case and tray forming, capping, cooling and drying, feeding, palletizing, picking and placing (robotic systems), cleaning and sterilizing, in addition to inspection and detecting machines. According to the Organization for Machine Automation and Control (OMAC), the number of packaging machine types employed in a packaging line ranges from two to ten.

- **Food conveying systems in the plant:** Medium to large-scale plants require an efficient means for food transport through the assembly line. Usually, transportation is achieved via conveyor systems and they are the real work force. The conveying systems perform functions such as washing, flipping, rotating, pushing, indexing, diverting, or accumulating products at various points in the product line.



Figure1. Cereal food packaging conveyer



Figure2. Food package handling system



- **Filling:** The filling station can adjust the number of filling heads according to the actual production speed demand. The feeding system is added to store the liquid to be filled and ensure that the liquid maintains a certain amount of stock and maintains the liquid filling accuracy. The cap tightening system can be equipped with an automatic cap feeding mechanism.
- **Sealing:** Plain paper is not heat-sealable and as the barrier properties of papers are insufficient to protect most foods for long storage periods, the seal on paper packages is designed to simply contain the contents.
- **Wrapping:** Wrapping is a type of packing in which a solid food is enveloped in a sheet of flexible material, usually paper, cellulose, cloth or foil.
- Thermo-form equipment
- Case packers
- Bundlers
- Ink jet coders
- Labellers
- Palletisers
- Shrink wrappers
- Strappers

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Self-Check – 2	Written test
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Name.....ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Write equipment types on cereal food processing? (5 points)
2. What is wrapping? (5 points)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points

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



Information Sheet 3- Identifying Variation in Equipment Operation and Reporting with Work Place Requirements

3.1 Techniques of Identifying Variation in Equipment Operation

- Assess quality of received components, parts or materials
- Continuously check received components, parts, materials, information, service or final products against workplace standards and specifications for conformance
- Demonstrate an understanding of how the received components, parts or materials, information or service relate to the current operation and how they contribute to the final quality of the product or service
- Identify and isolate faulty components, parts, materials or information that relate to the operator's work
- Record and/or report faults and any identified causes in accordance with workplace procedures.
- Follow machine manufacturers manual

3.2 Steps of Corrective Action in Response to Variations

3.2.1 Define the Problem

Take time to adequately define the problem (who, what, when, why, where, how much and how often).

3.2.2 Interim Actions

Once a problem as been detected, the first priority should be to contain the problem, and prevent shipment to the customer. If already shipped, the customer needs to be notified to prevent further liability.



3.2.3 Root Cause Analysis

The key to resolving a problem is identifying the true root cause. There may be several underlying causes, a new operator, a change in procedure, or another ‘rush job’ circumventing the system. This is why it is important to find the root cause of the issue and define a permanent solution.

3.2.4 Permanent Actions

The process should be reviewed to arrive at a solution for correcting the root cause. This review should engage the 7 basic quality tools. The solution may involve longer term planning, requiring milestone dates, capital justification, training, and/or approval from the customer. It is good to review progress in management review to assure accountability after the Interim Actions have ‘stopped the bleeding’.

3.2.5 Verification

Checkpoints in the process should be created to verify effectiveness. This could be accomplished by inspection, internal audits, and/or measurement.

3.2.6 Control

If mistake proofing was not part of the solution, then a measurement to detect the root cause early should become part of the system. A procedural change should become part of the system by updating the work instruction and training for accountability. Consider putting a reaction plan in place should the problem reoccur.

3.2.7 Prevention

Very few organizations reach this step. For example, all the above steps are completed, yet the problem returns 6 months later. Perhaps, a new operator shows up who may have been qualified through ‘On-the Job’ training without verification of their competency. Or the filter was replaced as part of the solution, but it is dirty again and hasn’t been placed on the Preventive Maintenance schedule.

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Self-Check – 3	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: short answer

1. What are the techniques used in identifying equipment variations? (5pts)
2. Mention some steps of corrective action in response to equipment variations? (5 points)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points
 You can ask you teacher for the copy of the correct answers.



Information Sheet 4 - Monitoring the Process to Confirm Specifications

4.1 Monitoring the Process of Packaging Based on Specifications

Cereal food packaging process should be proceed in accordance with work place procedures, operation procedures, and should meet specifications.

4.2 Selection Criteria for Cereal Food Packaging Material

Various factors are focused on cereal food packaging and package design which effect the impulse during purchase. The nature of the packaging material has a notable influence on cereal food quality package types

4.3 Recommendations for Immediate Action by Processors

It is recommended that processors question packaging suppliers more closely using a simple checklist that includes:

- Detail of the content and thickness of the proprietary packaging laminate.
- Suppliers quote (weight of packaging material) then, must relate this to the number units per kilogram.
- Confirmation in writing from the packaging manufacturer that the packaging will not interact in an adverse way with the components of the food.
- An assurance in writing that the packaging will perform throughout the shelf life of the product.
- An assurance that the packaging will withstand the special environmental conditions

4.4 Packaging Systems

Cereal packaging traditionally has been mostly a matter of placing filled plastic bags inside cardboard boxes. The other types of packages like plastic containers, plastic cups or bowls, lined cartons, flexible pouches, vacuum-sealed containers, metal tins have been recently introduced to be used as the serving dish. Refrigerated cereal packing emerged to give consumers convenience, sometimes wrapping a serving of milk or yogurt with a serving of the grains so a complete meal could be eaten without requiring multiple packages of ingredients. There are cereal packaging evolved to be

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environmentally friendly, including recycled materials and less packaging overall to reduce usage.

Even though packaging has witnessed many changes, till today cereal products continue to be traded in loose/unpacked form. This allows a lot of scope to pursue the dangerous practice of adulterating the cereal products with less expensive and unhygienic varieties. Plastic packaging provides safe hygienically packed cereal foods at competitive cost to consumers. It is extremely important that, whatever the packaging material used, it should be food grade and non-toxic. The product package compatibility is the starting point and shelf-life follows compatibility.

Aside from the large, flat area that is available on the outside for advertising, the exterior box serves has two other purposes. Cardboard will remove excess moisture that can be encountered during transport, keeping the cereal crisp. The second is to protect the grains from physical damage by absorbing impacts to the box, maintaining the shape of the cereal inside.

4.5 Packaging Specifications and Standards

The packaging assessment must include a definition of the optimum quality standards and these standards should not be compromised by cost. Ideally, packaging supplier selection is a techno-commercial decision agreed during discussions between the purchasing function and packaging technologists. Widely used quality management systems are those based on ISO 9000.

4.6 Types of packaging

4.5.1 Primary packaging

- ✓ The packaging that most closely touches a product, often referred to as “retail packaging.”
- ✓ Its main goals are to protect the product and inform or attract a customer.
- ✓ What’s considered to be primary packaging depends on the product. For example, a pop can is primary packaging (because it’s the primary way to carry around soda), while a corrugated box containing a camera and its

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accessories is also primary packaging (because it's the primary way to purchase it).

4.5.2 Secondary packaging

- ✓ The packaging used to ship products already in primary packaging.
- ✓ Its main goals are to protect products and provide branding during shipping.
- ✓ It's also used as display packaging in retail locations such as grocery stores.
- ✓ Examples of secondary packaging include 12-packs of soda cans, the corrugated box that a half-dozen camera boxes ship in, and the display stand for a newly-released Blu-Ray movie.
- ✓ As you can see, primary and secondary packaging's sometimes overlap.
- ✓ Secondary packaging can overlap with tertiary packaging as well.

4.5.3 Tertiary Packaging

- ✓ The packaging used most often by warehouses to ship secondary packaging.
- ✓ Its mail goal is to properly protect shipments during their time in transit.
- ✓ Tertiary packaging is typically not seen by consumers.
- ✓ Examples include the pallets that bulk shipments are placed on, corrugated pads used to separate layers of boxes and stretch wrap used to secure stacks of cartons.

Food Processing and Packaging:

Packaging Types:

Primary..provides protection to the food and information

Secondary..middle Layer of Packaging

Tertiary/ Transit...outer boxes or pallets for Transportation and distribution

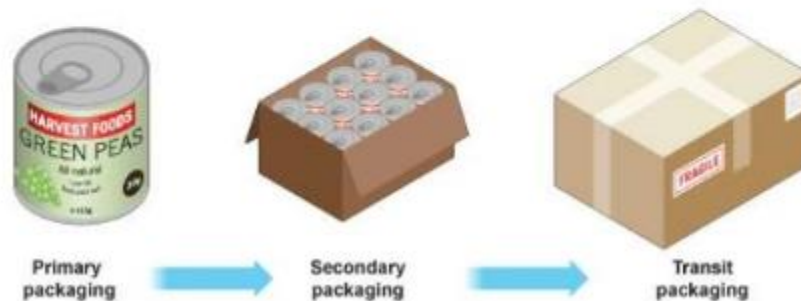


Figure1. An example of the three packaging types

4.7 Distinctions between levels of packaging

Because packaging is important, no matter what packaging types you're talking about. When you're creating a packaging strategy, it's important to consider how all 3 levels of packaging will impact your product's survival. Primary packaging is critical for branding and protection on the shelves. Secondary packaging is critical for protection and branding during transit. How your packaging looks tells consumers a great deal about your product and your business. Everything from the logo to the shape, the size, and the colours are important.

Your packaging is an opportunity to personalize your product and help it stand out from the crowd. Packaging sends a strong message, so choose your packaging strategy carefully. There are so many ways that a product can potentially be damaged—during shipping, during stocking at the store, and even while the customer is taking the product home. That's why it's critical to strike a balance between the levels of packaging to keep your product looking great and properly protected. The Packaging Company will help you achieve that goal.

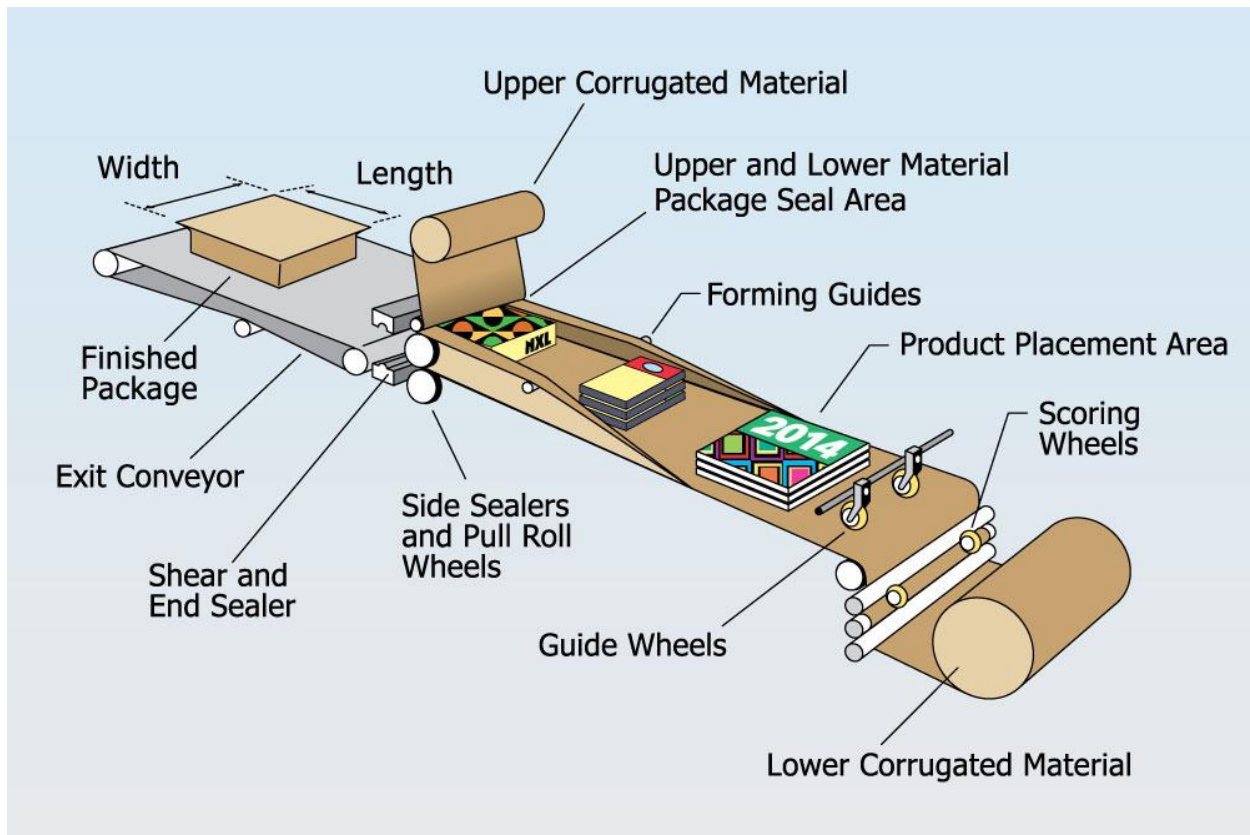


Figure2. An example of labelled packaging machine



Self-Check – 4	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Short Answer Questions

1. List down types of packaging. What do you know about each of them? (5 points)
2. Mention types of materials that to be used in packaging? (5 points)
3. **Why are the distinctions between levels of packaging so important?** (5 points)

Note: Satisfactory rating - 10 points Unsatisfactory - below 10 points
 You can ask you teacher for the copy of the correct answers.



Information Sheet 5 - Identifying, Rectifying and Reporting Out-of-Specification Process Outcomes

5.1 Introduction

Out of specification out comes

The term out of specifications, are defined as those results of in process or finished product testing, which falling out of specified limits. The out of specifications (OOS), may arise due to deviations in product manufacturing process, errors in testing procedure, or due to malfunctioning of analytical equipment. When OOS has arrived, a root cause analysis has to be performed to investigate the cause. The reasons for OOS can be classified as assignable and non-assignable. When the limits are not in specified limits, it is called out of specifications. When OOS has occurred, the analyst should inform to quality control (QC) manager. Each OOS will be identified with a unique identification number. The out of specifications investigation involves 2 phases:

5.1.1 Phase I Investigation - Laboratory

The purpose of the laboratory investigation is to identify the cause for OOS result. The reason for the OOS may be defect in measurement process or in manufacturing process. Irrespective of the rejection of batches, the OOS results must investigate for their trend. The investigation can be done to only those batches that are resulted in OOS, or also to other batches and even other products associated with OOS. The OOS investigation should be thorough, timely, unbiased, well documented and scientifically sound.

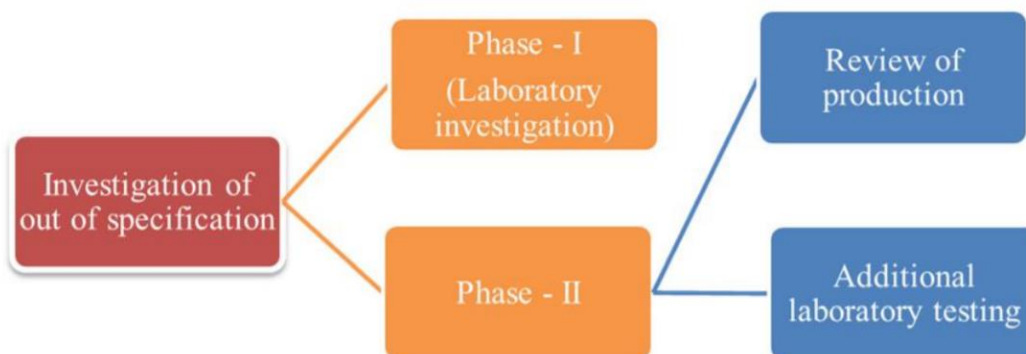


Figure1. Investigation of out of specification result



5.2.1 Phase II investigation

When there is no possible outcome has obtained from the phase I investigation, the phase II investigation should be commenced in context to investigate the errors occurred in manufacturing processes, sampling procedures along with other additional laboratory testing.

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Self-Check – 5	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Define the term out of specification out comes? (5 points)
2. Explain two phases of out of specification out comes? (5 points)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points
 You can ask you teacher for the copy of the correct answers.



Information Sheet 6- Maintaining the Work Area as Housekeeping Standards

6.1 Type of Workplace

The workplace may be permanently fixed, mobile or even temporary based on one off work (promotional activities), seasonal work types, work involving one off situation with different duration (hours, days or weeks).

6.2 Access

Consideration should be given to the ability of a person to access the amenities and facilities. The means of access to the facility or amenities should be safe and accessible for all persons who require access.

6.3 Maintenance

The work environment, facilities and amenities are required to be maintained in a safe and healthy condition, and need to be hygienic, secure and in a serviceable condition. This includes replenishment of consumables, repair of broken or damaged furnishings and equipment and ensuing cleanliness of these areas.

6.4 Work Layout

The layout of the workplace is required to allow persons to enter and exit the workplace and move within safely, both under normal work conditions and in an emergency.

6.4.1 Entry and Exit

Entries and exits are required to be safe to allow impeded access and outlet for all workers, students and visitors including those with special needs. **In particular:**

- Entries and exits should be slip resistant under wet and dry conditions
- Any walkways, boundaries or pathways shall be marked with standard wide with a contrasting color e.g. white or yellow
- Open sides of staircases should be guarded with an upper rail at standardized or higher and a lower rail
- Handrail should be provided on or at least one side of every staircase

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- Separate entry and exits for mobile equipment e.g. forklifts or trucks, and pedestrians are to be provided
- Power operated doors and gates should have safety features to prevent people from being stuck or trapped.
- Location of exits should be clearly marked and signs posted to show direction of exit doors to aid emergency evacuation.

6.5 Work Areas

The layout of the work area should be designed to provide sufficient clear space between machines, fixtures and fittings so workers can move freely without strain or injury also evacuate quickly in case of an emergency. **In determining how much space is required, the following should be considered:**

- The physical actions needed to perform the task,
- The need to move around while working,
- Whether the task is to be performed from a sitting or standing position
- Access to workstations
- The equipment to be handled and the personal protective equipment that may be worn to perform the work.
- Environmental factors including heat or noise may require an increase to the space, as will work activities that involve manual tasks or the use of equipment.

6.5.1 Floors and Other Surfaces

Floor surfaces shall be suitable for the work area and be chosen based on the type of work being carried out at the workplace, as well as the materials used during the work process, the likelihood of spills and other contaminants, including dust, chemicals, and the need for cleaning. **In general:**

- Floors shall be free from slip or trip hazards e.g. cables, uneven edges, broken surfaces
- Floor surfaces shall have sufficient grip to prevent slipping, especially in areas that may become wet or contaminated
- Anti-fatigue matting, carpet, shock absorbent underlay, cushion backed vinyl shall be provided for workers where static standing occurs

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- Carpet shall be properly laid without loose edges or ripples and should be well maintained
- Floors should be strong enough to support loads placed on them.

6.5.2 Workstations

Workstations should be designed so workers are comfortable undertaking their task and allow for a combination of sit and standing tasks.

For tasks undertaken in a seated position, workers should be provided with seating that:

- Provides good body support, especially for the lower back
- Provides foot support, preferable with both feet flat on the floor, otherwise a footrest shall be provided
- Allows adequate space for leg clearance and freedom of movement
- Is fully adjustable to accommodate different size workers (e.g. seat height, back rest height and back rest tilt adjustments) and should not tip or slip utilizing a five-point-base
- Chairs shall be fitted with castors for carpeted surfaces and glides or braked castors on hard surfaces.

Workstations shall be designed and procured according to FMD (Facilities Management Division) Design Standards and Australian

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6.5.3 Lighting

Sufficient lighting is required to allow safe movement around the workplace and to allow workers to perform their job without having to adopt awkward postures or strain their eyes to see.

Emergency lighting is to be provided for the safe evacuation of people in the event of an emergency. **Factors to be taken into account are:**

- The nature of the work activity,
- The nature of hazards and risks in the workplace,
- The work environment,
- Illumination levels, including both natural and artificial light,
- The transition of natural light over the day,
- Glare workplace environment guidelines,
- Contrast, and
- Reflections,.

6.5.4 Air Quality

Workplace are to be adequately ventilated which includes provision of fresh, clean air drawn from outside the workplace, uncontaminated from flues or other outlets and be circulated through the workplace. Workplace inside buildings may have natural ventilation, mechanical ventilation or air conditioning.

An air-conditioning system should:

- Provide a comfortable environment in relation to air temperature, humidity and air movement
- Prevent the excessive accumulation of odours.
- Reduce the levels of respiratory by-products, especially carbon dioxide, and other indoor contaminants that may arise from work activities
- Supply an amount of fresh air to the workplace, exhaust some of the stale air as well as filter and recirculate some of the indoor air.

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Natural ventilation should consist of permanent openings, including windows and doors, that:

- In total are the size of at least five per cent of the floor area of the room
- Are open to the sky, an open covered area or an appropriately ventilated adjoining room.

Natural ventilation may be assisted by mechanical ventilation.

Enclosed workplaces should be supplied with comfortable rates of air movement (usually between 0.1 m and 0.2 m per second).

Air-conditioning and other ventilation systems should be regularly serviced and maintained in accordance with manufacturer’s instructions. Cooling towers that form part of many air-conditioning systems are to be inspected, tested and treated as per legislative requirements. Work processes that release harmful levels of airborne contaminants (e.g. lead fumes, acid mist, solvent vapor) are to be undertaken with specific control measures in place to remove them at the source, e.g. fume cupboards. Refer to the Working with Hazardous Chemicals Guidelines for further information regarding monitoring of hazardous chemicals.

6.5.5 Heat and Cold

Refer to the Thermal Comfort Guidelines for further information on managing health and safety risks associated to hot and cold environments

6.5.6 Welfare Facilities

Workers, including those who have particular needs or disabilities, must have access to the facilities provided. **Workers are to be provided with:**

- Adequate breaks to use the facilities,
- Facilities which are within a reasonable distance from the work area,
- Shift workers have similar access to those who work during the day, and
- A means of access which is safe.

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Self-Check – 6	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test: Short Answer Questions

1. Mention welfare facilities should be fulfilled in the work area? (5 points)
2. What are the requirements a person should ensure during conducting work in accordance with workplace guideline? (6pts)
3. Write at list five items that a work environment, facilities and amenities are provided for basic health and welfare of employees, contractors and visitors? (5pts)

Note: Satisfactory rating - 16 points Unsatisfactory - below 16 points
 You can ask you teacher for the copy of the correct answers.



Information Sheet 7- Conducting Work with Workplace Information

7.1 Introduction

Having a **safe and healthy physical work environment**, including amenities and facilities, is critical to eliminating and controlling risk in the workplace. This includes ensuring the work environment, facilities and amenities are compliant with legislative and other identified requirements.

7.2 Conducting work in accordance with workplace guideline

A **safe work environment** includes:

- Facilities,
- Amenities and accommodation.

Facilities refer to toilets, washrooms, showers, lockers, dining areas, drinking water, etc. These facilities must be in good working order, clean, safe and accessible. When considering **how to provide and maintain facilities** that are adequate and accessible, a person conducting a business or undertaking must consider all **relevant matters** including:

- The nature of the work being carried out at the workplace
- The nature of the hazards at the workplace
- The size, location and nature of the workplace
- The number and composition of the workers at the workplace.

During Conducting work in accordance with **workplace guideline** a person should ensure the following requirements:

- Legislative requirements,
- Responsibilities,
- Need assessment,
- work environment,
 - ✓ Welfare facilities
 - ✓ Inspect and monitoring



7.3 Facilities as per Legislative Requirements

Workplace requirements to help workers to carry out work without risk to health and safety are:

- Layout of the workplace must allow people enter, exit, and move freely under normal and emergency conditions.
- Shall have enough space without risk for work,
- Floors and other surfaces are designed, installed and maintained to allow work,
- Lighting enables to give enough light to:
 - ✓ carry out work with no risk
 - ✓ Move in workplace without risk, and
 - ✓ evacuate safe in emergency,
- Appropriate ventilation,
- Protective devices for controlling extreme heat or cold, and
- Work in near essential services has to be compatible.

7.4 Responsibilities

7.4.1 Facilities Management Division (or Equivalent)

The Facilities Management Division (FMD) is responsible for ensuring that workplace amenities and facilities are:

- Designed and installed according to company legislative and requirements
- Inspected and maintained to ensure a safe level of hygiene.

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7.4.2 Company Management and Supervisors

Management and supervisors of faculties, divisions and units are to ensure that amenities and facilities in the workplace do not expose workers, or visitors to health and safety risks.

This includes:

- Ensure, so far as is reasonably practicable, that the layout of the workplace, lighting and ventilation enables workers to carry out work without risks to health and safety,
- Ensure, so far as is reasonably practicable, the provision of adequate facilities for workers, including toilets, drinking water, washing and eating facilities,
- Manage risks associated with remote and isolated work,
- Prepare local area emergency response procedures,
- Implement risk control measures for any unsafe facilities or amenities within their responsibility to ensure the workplace is safe, and
- Consult with workers on health and safety issues pertaining to facilities and amenities.

7.4.3 Employees

Employees are responsible for reporting any identified hazard in the work environment, facilities or amenities that they become aware of in accordance with factory or company guidelines.

7.4.4 Nature of Work Performed

The requirements of amenities and facilities will depend on the type of work being performed and the equipment being used. For example, persons handling chemicals or conducting hot and arduous activities may need to access shower and change room facilities. Persons working remotely may require shelter sheds, food and water.

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7.4.5 Size and Location of the Work Area

Consideration should be given to the location such as the work area being in a building, remote area or outdoors. The work area may be multiple locations/sites over an extensive area. The workplace may not be in proximity to physical amenities.

7.4.6 The Composition of the Workforce

The workforce may be comprised of people of different sexes, religious beliefs and those people with special needs. This will influence the provision of amenities and facilities to accommodate the various needs.

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Self-Check – 7	Written test
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Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Write things fulfilled in a safe working environment? (5 points)
2. Write work place requirements that the worker should be ensure when conducting the work? (5 points)
3. What are legislative requirements? (5 points)

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points
 You can ask you teacher for the copy of the correct answers.



Information Sheet 8 -Conducting Work with Environmental Guidelines and Legislative Requirements.

8.1 Introduction

The goal of food packaging is to contain food in a cost-effective way that satisfies industry requirements and consumer desires, maintains food safety, and minimizes environmental impact.

8.2 The Trouble with Food Packaging

The trouble with food packaging begins at its creation. Each form of packaging uses a lot of resources like energy, water, chemicals, petroleum, minerals, wood and fibers to produce. Its manufacture often generates air emissions including greenhouse gases, heavy metals and particulates, as well as wastewater and/or sludge containing toxic contaminants. In other words, landfills emit ammonia and hydrogen sulfide and incinerators can emit mercury, lead, hydrogen chloride, sulfur dioxides, nitrous oxides and particulates.

8.3 Legislative Requirements

A person conducting a business or undertaking at a workplace must ensure so far as is reasonably practicable, the following:

- The layout of the workplace should allow persons to **enter, exit** and move without health and safety risk, both under normal working and emergency conditions,
- Work areas **space for work** to be carried out without risk to health and safety,
- Floors and other surfaces are designed, installed and maintained to allow work to be carried out without health and safety risk,
- Lighting enables:
 - ✓ Each worker to carry out work without risk to health and safety, and
 - ✓ Persons to move within the workplace without risk to health and safety, and
 - ✓ Safe evacuation in an emergency,
- Ventilation enables workers to carry out work without risk to health and safety,

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- Workers carrying out work in extremes of **heat or cold** are able to carry out work without risk to health and safety,
- Work in relation to or near essential services does not give rise to a risk to the health and safety of persons at the workplace.

Ethiopian food standard code follows requirements notified in structured format regulations or legislation for:

- Food and drug authority
- Occupational health safety environmental management
- Food standards and additives
- Weights and measures
- packaging & labelling
- Contaminants & toxins
- Prohibitions and restrictions
- laboratory sampling and analysis

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Self-Check – 8	Written test
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Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Write legislative requirements that the person who conducting a business has to follow? (6 points)
2. Mention Ethiopian food standard codes? (5 points)

Note: Satisfactory rating – 6 points Unsatisfactory - below 6 points

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



Information Sheet 9- Maintaining Workplace Records with Workplace Recording Requirements

9.1 Record Keeping Systems

There are certain written records or kinds of documentation that are needed in order to verify that the system is working. These records will normally involve the Implementing hazard analysis and critical control point plan itself and any monitoring, corrective action, or calibration records produced in the operation of the hazard analysis and critical control point system. Verification records may also be included. Records maintained in a hazard analysis and critical control point system serve to document that an ongoing, effective system is in place. Record keeping should be as simple as possible in order to make it more likely that employees will have the time to keep the records.

9.2 The purpose of records

Accurate record keeping is essential to the application of a preventive control plan. Your records should be sufficient to enable you to confirm easily and with confidence that your preventive control plan is implemented and working effectively. Records can also help you improve your preventive control plan by providing a means for you too, for example:

- Identify the root cause of an issue
- Analyze and improve a process or procedure
- Identify gaps in training and in training needs

9.3 Systematic Preventive Approach to Food Safety

Hazard Analysis and Critical Control Point plan is a systematic preventive approach to food safety from biological, chemical, physical hazards and more recently radiological hazards in production processes that can cause the finished product to be unsafe and designs measures to reduce these risks to a safe level.

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Make Up of Hazard Analysis and Critical Control Point Plan Records

- List of hazard analysis and critical control point team and their assigned responsibilities
- Description of each menu item
- Flow diagram for each menu item indicating critical control points
- Hazards associated with each critical control points and preventive measures
- Critical limits
- Monitoring procedures
- Corrective actions plans
- Record keeping procedures
- Procedures for verification of the hazard analysis and critical control points plan
- Production process
- Variation of results

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Self-Check – 9	Written test
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Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Discuss about what makeup hazard analysis and critical control point plan is? (5 points)
2. Why a workplace information recording is required? (4 points)

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points
 You can ask you teacher for the copy of the correct answers.



LG #55	LO3: Shut Down the Process
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Instruction sheet

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

- Identifying shutdown procedure
- Shutting down the Process
- Identifying and reporting maintenance requirements

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:**

- Identify shutdown procedure
- Shut down the Process
- Identify and reporting maintenance requirements

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”



Information Sheet 1 - Identifying Shutdown Procedure

1.1 Introduction

Normal shutdown includes steps to render the systems safe, such as removal of hazardous process materials and inert (asphyxiating) gases. The systems might be cleaned as part of the shutdown; cleaning is often a process itself requiring its own set of startup, operation, and shutdown procedures.

1.2 Types of Shutdowns

- Scheduled shutdown
- Maintenance shutdown
- Emergency shutdown
- Trips
- Shut down to a standby condition.

1.2.1 Scheduled Shutdown

A scheduled shutdown is initiated by the operator during normal operation of the unit when:

- ✓ Maintenance is required or
- ✓ Feed supply is low or exhausted

The shutdown procedure will depend on the type of equipment and the process chemistry. **Some steps taken in a unit shutdown may include:**

- Shutting off the feeds to stop processes and **heat generation** particularly if processes are exothermic (produce heat),
- **Re-circulating feeds** from **supply tanks** so they do not enter the unit,
- Shutting off heating or cooling to the unit or feed preheat system,
- Shutting off **mixing** and other mechanical operations
- Cooling and **flushing** materials from the unit

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1.2.2 Maintenance shutdown

When maintenance to the unit equipment is required, the equipment may need to be entered so that work can take place. The shutdown should be a scheduled or planned shutdown as per Standard Operating Procedures where equipment is:

- Isolated (process, mechanical and electrical)
- Cooled and depressurized
- Purged and gas freed
- Cleaned
- Gas tested on a continuous basis prior to and during entry.

A planned unit shutdown will prevent:

- Plugging of lines or equipment,
- Possible damage to equipment, and
- Possible injury.

Unit preparation for shutdown may need to be:

- Thoroughly drained and pumped out to remove chemical liquids,
- Purged with steam or inert gas to remove vapors,
- Solvent washed to remove deposits that build up on the equipment's internal surfaces,
- Flooded with water or a solvent to remove any remaining chemicals any chemicals trapped in the unit must be flushed out,
- Isolated to prevent the entry of hazardous chemicals, and
- Steam cleaned to remove remaining deposits.

During decontamination, regular sampling of the atmosphere inside a unit vessel is required to ensure toxic or explosive atmospheres do not build up inside the unit that could be a hazard to equipment or personnel. Gas testing must be carried out before anyone enters the vessel to ensure the atmosphere is not toxic, explosive or oxygen deficient.

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1.2.3 Emergency shutdown

An emergency shutdown is initiated in the event of a fire, major spill, instrument failure, power failure, or total loss of control of chemical or physical processes. Emergency shutdown procedures must be followed during a shutdown sequence.

1.2.4 Trips

Shutdown of a unit can be initiated by the automatic shutdown system. The systems may be shut down automatically because of temperatures, fluid levels, pressures or flows that are above or below trip points. Typical shutdowns initiated by trips may include:

- Low liquid level in a vessel
- High liquid level in a storage tank
- High viscosity causing increased load on pumping or mixing equipment
- Mixer failure
- Pressure too high
- Temperature too high
- Low feed flows

1.2.5 Shutting down to a standby condition

When a unit is to be shut down for a short period of time for maintenance on auxiliary equipment, the unit is shut down to a standby condition. A standby shutdown allows a quick startup of the unit after maintenance is completed in order to minimize lost production time and off spec material. Standard Operating Procedures must be referred to when shutting down each type of unit to a standby condition. A **typical standby condition may include:**

- Re-circulating material upstream and downstream
- Reduced heating or cooling (sufficient to maintain a safe process condition)
- Slow-rolling compressors
- Venting process gases to flare
- Diverting process streams to temporary storage.

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Self-Check – 1	Written test
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Name.....ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. What is shut down process? (5 points)
2. Write down steps of shutdown? (5 points)
3. Explain emergency shut down?
4. Write steps taken in unit shut down of schedule shut down? (5 points)

Note: Satisfactory rating - 15 points Unsatisfactory - below 15 points

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



Information Sheet 2 - Shut down the process with workplace procedures

2.1 Introduction

The point of a shutdown is to create a plan for a complete cessation of all plant activities in order to perform necessary maintenance, repairs, equipment replacements, and to perform internal maintenance. The shut-down procedure is just as important as the start-up procedure for both an extruder and an injection molding machine. By properly shutting down the equipment, the start-up will be much quicker and most effective. Shut down the line can have a major impact on your capacity to restart production promptly.

2.2 Steps to Follow for Proper Shutdown of Packaging Line

2.2.1 End of Production Sequence

At the pausing a packaging line, it is crucial to allow the machine to empty itself of all the components. The end of the production sequence clears the manufacturing equipment without loading new products into the cycle. This cycle finishes components in a machine and automatically removes most of the glue, parts, liquid, and powder from the production path. There are, however, certain elements that will not be automatically emptied until a later stage of the manufacturing processes. It may be necessary to remove these elements manually and thus completely empty the machine of any stray material that can complicate startup. This first step is crucial.



2.2.2 Air purge

Once the machine is out of service, the next thing we recommend is to purge any air that may be present in the equipment. Machines often use compressed air to activate the different cylinders, and most machines have an air purge valve that allows for bleeding off any accumulated air. Why is it important? It is important because the air can crystallize and eventually wear out pneumatic components.

2.2.3 Cleaning of the machine

Beyond clearing the line of product and residue, purging air, and cleaning filters, you should take the time to clean the machinery thoroughly during shutdown. Cleaning now will avoid unpleasant surprises at startup. For example, in the previous example where a company left food in their system, which froze, clean it was longer and more complex than just emptying it. During cleaning, they had to dismantle pipes and small components, resulting in broken parts because it was so “jammed”. It added an extra layer of unnecessary work and problems. Invest the time today, and you’ll save time in the long run.

2.2.4 Preventive maintenance

Whether the shutdown affects all of your manufacturing lines or just a portion, we recommend you use the disruption as an opportunity to perform preventive maintenance on your equipment. The manufacturer’s operation and maintenance manual is the best source for guidance on how to care for your equipment and how to identify issues that need repair. Dealing with repair needs today will help you to be better able to restart quickly. It is also advisable to ensure that you have critical parts and components that need frequent replacement beforehand. Lead times to supply your parts can be unpredictable, so we suggest that you make a list of parts that need changing and share it with your suppliers to anticipate when the product will be available.

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2.2.5 Keeping in Stable Environmental Condition

More generally, we suggest that you keep the equipment in a stable environment, adequate in terms of temperature and ventilation. This will help avoid **degrading** your production line. For example, in a medical clean room, if the machine is not in production, it may not be necessary to maintain particles per million, in the air at a level similar to that during production. However, keeping the temperature and humidity level stable is important so that the machine does not start to **rust**. As for air compressors especially **air dryers** and **filters** we highly recommend that you change these components at shutdown so there will be no contamination or blockage of filters. If you have just recently replaced filters, then you may not need to change to new filters at the time of the shutdown process. The main goal here is to avoid letting your machinery be dormant with dirty filters in place, as this could adversely affect the general functioning of your machine.

2.2.6 Protection of Equipment in Working Environment

When your equipment is in an industrial environment, certain activities such as cutting materials, welding, generate dust and debris occurs. This poses the **risk** of generating contaminants and **damaging** all that is mechanical, such as **seals**. Accumulated metal shavings, for example, can cause internal damage and pose a risk to operators when the machine is switched back on after the shutdown period. Normally, when the **fans** in the factory are running, **dust or contaminants** are filtered. At Orientate, when a machine is on physical hold at the customer’s request, we always **cover it with plastic** wrap to protect the machine and fragile components from contaminants. This simple step can save you from these problems at **restart**.

2.2.7 Electric System Investigation

We highly recommend you to start by making a backup of all of machines. There is a very specific procedure to change the **batteries** of robotics to **ensure that programming** does not get lost or altered. When you have backed up everything and replaced the parts and batteries that are needed, you should determine if you should cut off the

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power source, or maintain power during shutdown. It may be preferable to cut off the power to avoid any power surge. Electrical components must also be protected during dormancy. If there is dust, contaminants, oil, grease that go under the sensors, you will have issues when it comes time to start the machine again.

2.2.8 Partner Company Support

In case you are not comfortable with restarting, or if you have any questions, please do not hesitate to contact your partner company. You may even be able to ask them to reboot with you, online, video or phone. This crisis is unprecedented. Many factors are out of your hands, such as the duration of a shutdown period. It is a key to focus on what you actually can control. The approach to maintaining your machine, assembly lines, and manufacturing premises, is something you have the ability to actively manage.

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Self-Check – 2	Written test
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Name..... ID..... Date.....

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. What is shut down process? (5 points)
2. Write down steps to follow for proper shutdown? (5 points)
3. Write the main goal of shut down process?

Note: Satisfactory rating - 10 points Unsatisfactory - below 10 point

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



Information Sheet 3- Identifying and Reporting Maintenance with Workplace Requirements

3.1 Introduction

Maintenance can be defined as working on something to keep it in a functioning and safe state and preserving it from failure or decline. Maintenance procedures are written instructions that, when followed by the maintenance personnel, will ensure that equipment operates as designed within safe operating limits. **Maintenance may include:**

- Sharpening the cutter,
- cleaning,
- lubricating,
- Tightening
- Simple tool repairs and adjustments.

3.2 Types of maintenance

3.2.1 Preventive or proactive maintenance: is carried out to keep something functional. This type of activity is usually **planned and scheduled**.

3.2.2 Corrective or reactive maintenance: is **repairing** something to get it working again. This is an **unscheduled, unplanned task**, usually associated with greater hazards and higher risk levels.

3.3 Routine Maintenance Tasks

Routine maintenance tasks refer to **on-going scheduled tasks** that are performed in order to keep hand tools and basic equipment functioning properly. It includes tasks such as:

- unblocking pipes and nozzles,
- sharpening blunt tools,
- cleaning nozzles on sprayers,
- checking, cables and plugs



Some tips on routine maintenance:

- Use the correct tool for the job.
- Keep tools in good condition.
- Handles should be tight and free from defect.
- Cutting tools should be kept sharp.
- Use and maintain power tools according to their operator instructions.
- Make sure power tools are properly grounded or are double insulated.
- Switch off and unplug power tools before changing blades or servicing and repairing.
- Wear clothing that is **free of strings** or loose ends that could catch.
- Wear appropriate **personal protective equipment**, such as glasses, goggles, dust masks, face shields, hearing protection, etc.
- Keep all guards and shields in place.
- Unplug and store tools after use.
- Consider keeping power tools locked up to prevent unauthorized use.

3.4 Maintenance Check List

Table1. Maintenance check list

	Tool	Yes	No	Remark
1	Are tools in safe condition?			
2	Are instruction manuals available?			
3	Are power tools properly grounded?			
4	Are guards and shields in place?			
5	Is personal protective equipment available?			
6	Are tools properly stored?			

If necessary:

- Tighten nuts and bolts.
- Smooth off splinters and sharp points.
- Tighten shafts.



- Unblock pipes and nozzles.
- Sharpen blunt tools.
- Clean nozzles on sprayers.
- Check and maintain cables and plugs.

3.5 Reporting Maintenance Situation

Every work shop has a different maintenance schedule and it is important that you are familiar with the schedule implemented on the work shop where you work. There will usually be a **routine schedule** for particular tools that states how often maintenance checks have to be performed. These will also specify the checks that have to be performed. **Some tools may require daily checks** and maintenance after use.

Tools, such as **power tools**, usually must be checked once in **six months**. **Complicated** power tools would need to be serviced on a **regular interval**; refer to the operation manual. **Maintenance schedule** assigns a specific date to specific maintenance tasks. It states what has to be checked and will require that the assigned person signs off the document assuring that the checks were done. **If faults are found**, the tool must be sent for maintenance and the assigned person that fixes the tool has to report on exactly what was done and when it was completed. **An example of** how to fill or document maintenance required and report performed maintenance is given below:

Table2. Tools, check points, and maintenance required

Date	Tool or Equipment	Maintenance check points	Signature	Maintenance required	Signature

Table2. Performed maintenance reporting format

Maintenance Performed	Date	Signature
Splinters shaved off		



3.6 Performing safe Maintenance

- Always **disconnect** powered tools before servicing, adjusting, oiling, cleaning or repairing them, sharpening or changing accessories such as blades.
- Follow the **manufacturer's instructions** in user's manual for maintenance and servicing (e.g. lubrication, cleaning) and changing parts and accessories.
- Use **appropriate tools and equipment** while carrying out maintenance
- When maintenance is **complete** workers have to **check** if the maintenance has left the portable tools in a safe and functioning condition
- **Test** the **functionality** of the tool
- **Replace** all guards and safety devices
- **Pass your record to your inspection** and actions, sign out and pass the tool to the worker or store it safely

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Self-Check – 3	Written test
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Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Instruction: Short answer questions

1. List at list five points in some tips on routine maintenance. (5pts)
2. Define the two types of maintenance (5pts)
3. How do we/you perform maintenance safely? (10pts)
4. Define maintenance and write what maintenance may include. (5pts)

Note: Satisfactory rating – 20 points Unsatisfactory - below 20 points
 You can ask you teacher for the copy of the correct answers.



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