Dairy Products Processing

Level-II

Based on October 2019, Version 2 Occupational Standards

Module Title: Operating a Packaging Process

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Contents

LG #50	LO 1: Prepare the Equipment And Process for Operation

Instruction sheet

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

- Confirming and making available packaging component , materials and items
- Identifying and confirming cleaning and maintenance requirements
- Fitting and adjusting machine components and related attachments
- Entering processing/operating parameters
- Loading or positioning material , product and packaging components
- Checking and adjusting equipment performance
- Carrying out pre start checks

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 make available packaging component , materials and items
- Identify and confirm cleaning and maintenance requirements and status
- Fit and adjust machine components and related attachments
- Enter processing/operating parameters
- Load or position material , product and packaging components
- Check and adjust equipment performance
- Carry out pre start checks

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” which are placed following all information sheets.
5. Ask from your trainer the key to correct your work.
6. If you earned a satisfactory evaluation proceed to “Operation Sheets.
7. Perform “the LAP Test” which is placed following “Operation sheets”.
8. If your performance is satisfactory proceed to the next Learning Guide.
9. If your performance is unsatisfactory, go back to “Operation Sheets”.

Information Sheet 1- Confirming and making available packaging component, materials and items

1.1 Introduction

Packaging is science, art and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the process of design, evaluation and production of packages. It is the protection of materials of all/any kind by means of container so designed as to prevent damage to the contents by outside influences. Packaging has a complex, dynamic, scientific, artistic and controversial segment of business. It is certainly dynamic and constantly changing. New materials need new methods, a new methods demand new machinery, new machinery results in better quality and better quality opens up new markets which require changes in packaging.

Packaging is the enclosure of products, items, or packages in a wrapped pouch, bag, box, cup, tray, can, tube, bottle, or other container to perform the following functions: containment; protection or preservation; communication; and utility or performance. If the device or container performs one or more of these functions, it is considered a package. This definition implies that packaging serves more than one function; i.e., it is multifunctional.

There are different forms of packaging based on the packaging material.

a. **Primary packaging:** is the material that first envelops the product and holds it. This usually is the smallest unit of distribution or use and is the package which is in direct contact with the contents. It envelops and holds the food product.
b. **Secondary packaging:** is outside the primary packaging perhaps used to group primary packages together. It is exterior to the primary packaging.
c. **Tertiary packaging:** is used for bulk handling, warehouse storage and transport shipping. The most common form is a palletized unit load that packs tightly into containers. It is the tough outermost covering that is used for bulk handling, warehouse storage and transport / shipping.

1.1.1 Functions of 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.

There are around five basic functions of a food package.

a. Containment (Holding the product)

The primary function of any package is to contain the food and facilitate handling, storage, and distribution all the way from the manufacturer to the ultimate user or even the time the rest portion is utilized by the consumer.

b. Protection (Quality, Safety, Freshness)

One of the most important functions of any container is to protect the product contained against any form of loss, damage, deterioration, spoilage, or contamination that might be encountered throughout the distribution chain.

c. Medium of communication (Labels)

The information a package can convey to the consumer may include the following:

- Proper storage conditions
- Size and number of servings or portions per pack
- Nutritional information per serving
- Manufacturer‘s name and address, etc.

d. Means of minimizing costs

An important factor often overlooked is that packaging actually reduces costs for the consumer. Packaging reduces food costs by reducing the cost of processing.

e. Means of selling product

The packaging and labels can be used by marketers to encourage potential buyers to purchase the product.

1.2 Packaging Materials

Different types of materials are used for packaging different dairy products. The right selection of packaging materials and technologies maintain product quality and freshness during distribution and storage dairy products.

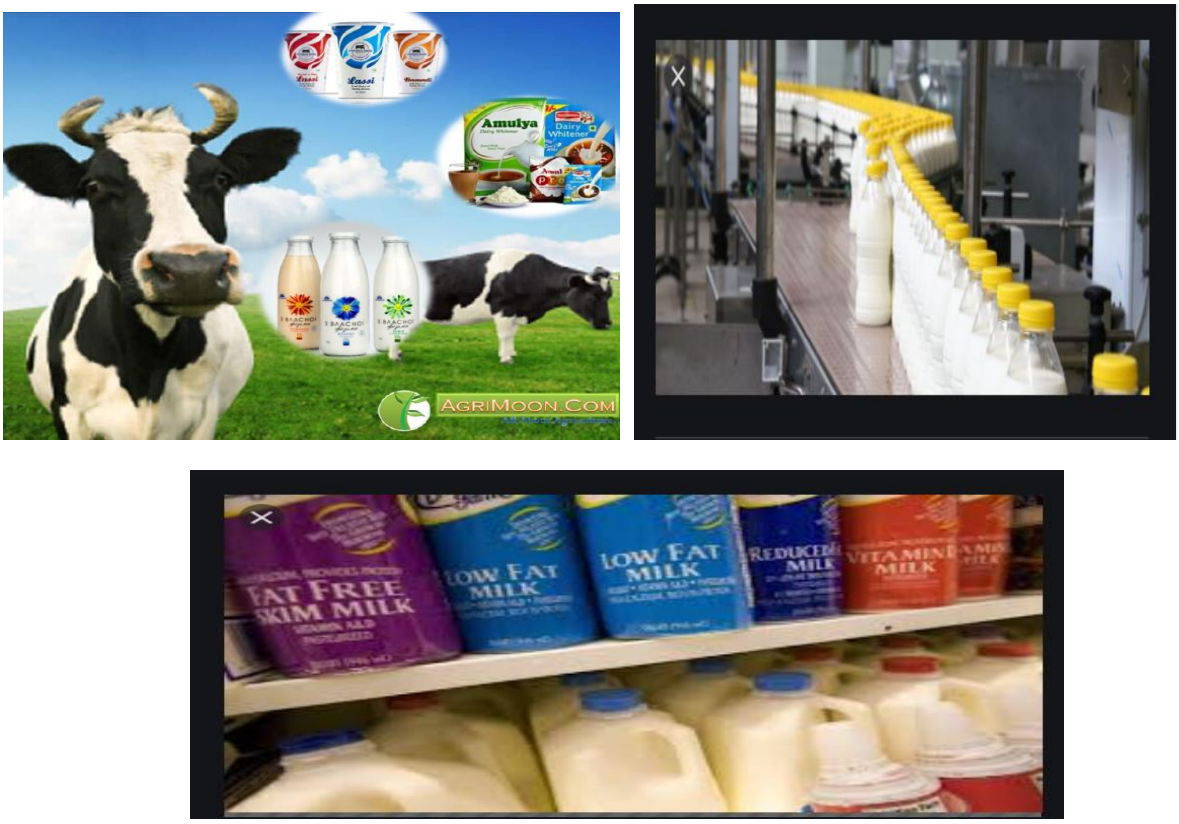

Figure 1 Dairy product packaging

1.2.1 Characteristic of an ideal packaging material

Good Packaging material should have the following characteristics;

- Compatible with product and Fit into a production line.
- Protection from Mechanical hazards especially during transportation.
- Advertising potential.
- Attractive appearance.
- Easy to handle during Production, storage and Distribution
- Moisture proof/resistance and Grease & oil resistance.
- Resistance to insects and rodents.
- Economic and easily available, etc.

1.2.2 Types of packaging materials

The choice of the proper packaging material will be made by the food processor based on the requirements:

- Composition of the food (solid or liquid)
- Physical, chemical, and microbiological and deteriorative reactions that might occur
- Socioeconomic situation of the anticipated customer or market
- Cost of the packaging material, etc.

There are several reasons for selecting or rejecting a particular packaging material over another listed below.

Table 1Reason for Selection and Rejection of Specific Packaging Material

Types of Packaging Materials			
Paperboard	**Glass**	**Metal/Steel**	**Plastics**
Selection			
Easily machined and folded	Product visibility	Strong, stiff	Fabricability
Easy to bond	Impervious, inert	Malleable /softness	Variety of forms
Composites well	Image of high quality	Retortable	Tough/strong, lightweight
Printability	Oven able, Reusability	Permanence, Reusability	Wide range of properties
Rejection			
Chances of water Absorption	Shatters, Scratability	Corrodes	Thermal limit
Penetrable	High weight-to strength ratio	Limits shapes	Permeable/water absorption
Image	Limited shapes	Appearance	Absorbs flavors
Tears, punctures	Large sizes	Flavor distortion	Distortion and creep/ leaving shape

1.2.2.1 Glass Containers

Glass generally refers to hard, brittle, transparent material, such as those used for windows, many bottles, or eyewear. Glass is one of the most important packaging materials because of its high barrier and see-through properties.

Glass coatings also increase and preserve the strength of the bottle to reduce breakage. The transparency of glass allows consumers to see the product, yet variations in glass color can protect light-sensitive contents.

Advantage of Glass Containers

- They are resistant to moisture, gases, odors, and microorganisms.
- They are inert and do not react with or migrate into food products.
- They are transparent and display the contents.
- They are perceived by the customer to add value to the product.

Disadvantages of glass containers

- Higher weight and hence higher transportation costs than other types.
- Lower resistance than other materials to cracks, scratches, and thermal shock.
- More variable dimensions than other containers.
- Potentially serious hazards arise from glass splinters or fragments in foods.

Figure 2 Glass containers

1.2.2.2 Metal Cans

Metal is the most versatile of all packaging forms. It offers a combination of excellent physical protection and barrier properties, formability and decorative potential, recyclability, and consumer acceptance.

Metal packaging materials are appropriate for packaging of light, moisture and oxygen sensitive products and carbonated beverages such as soft drinks, flavored milk etc. Metal cans, made from steel or aluminum, are widely used by the food industry to pack a wide range of foods.

Advantages of using Metal Cans:

- They have a high strength-to-weight ratio.
- They can be heat processed.
- They have excellent barrier and protective properties.
- When sealed with a double-seam they provide total protection of the contents,
- They can be made in a wide range of shapes and sizes.

Disadvantage of Metal Cans:

- High cost of metal and relatively high manufacturing costs make cans expensive.
- They are heavier than other materials, except glass, resulting in increased transportation costs for the finished product.

Figure 3 Metal and tin plate steel containers

1.2.2.3 Plastics Containers

Multiple types of plastics are being used as materials for packaging food, including polyolefin, polyester, polyvinyl chloride, polyvinylidene chloride, polystyrene, polyamide, and ethylene vinyl alcohol. Polyolefins and polyesters are the most common.

Plastic containers have the following benefits of plastics over other packaging materials;

- Good Versatility/ flexibility
- Plastic containers are light weight, flexible/rigid, has strength, so less breaking
- Cost of plastics is comparatively lower than that of glass and metal containers.
- Consumer's convenience at lower cost.
- Ease in Transportation and Distribution:
- Plastics are non-corrosive.
- Plastics can be recycled.

Figure 4 Plastic containers

1.2.2.4 Paper Containers

Paper is made from cellulose, trees being the main source of cellulose fiber (or wood pulp). Besides wood pulp, paper can be made from other materials such as cotton, flax, straw, hemp, manila and jute. Some of the pulp properties depend upon the process used to separate the fibers from the timber.

Paper and paperboards are commonly used in corrugated boxes, milk cartons, folding cartons, bags and sacks, cups, wrapping paper, tissue paper and paper plates. Laminated paper is used to package dehydrated products such as ready to serve soups, spices and grounded herbs.

Figure 5 Paper and wooden and cardboard boxes Containers

Self- Check 1	Written test

Name…… ID…… Date…….

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

Part I: Choose the best answer (**2 points each)**

1. Which One is the cost effective packaging material?

   A. **Plastic** B. Glass C. Metal Cans D. Aluminum cans

2. Which one of the following is not advantage of packaging?

   A. Protect the product B. Medium communication **C. Increase cost** D. Containment

3. ---------- is the material that first envelops the product and holds it.

   A. Secondary packaging B. Tertiary packaging C. **Primary packaging** D. None

4. Primary packages should have the following characteristics , except:

A. Sanitary **B. Toxic** C. Easy to pick up and handle D. Display the product

5. Which one is Characteristic of an ideal package?

   A. Compatible with product and Fit into a production line

   B. Protection from Mechanical hazards especially transportation

   C. Advertising potential D. Attractive appearance **E. All**

Part II: Short Answer Questions

1. Define packaging. (2 points each)
2. List dairy packaging materials. (3 points each)
3. Mention the five basic function of packaging. (5 points)

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

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

Information Sheet 2- Identifying and confirming cleaning and maintenance requirements

2.1 Cleaning

Cleaning is the complete removal of dirt particles from the surface of machines, tools and equipments 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 in order to maximize product quality and health promotion.

3.1.1 Cleaning Methods

There are various methods which can be used to apply detergents and disinfectants for cleaning and sanitizing machines and equipments activity.

a. Manual cleaning

Manual cleaning is practiced 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. There should be

b. Spray cleaning

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.

c. 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 dirt particle.

.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 6 Foam cleaning

d. 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.

3.1.2 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.

The correct sequence of a general cleaning procedure in a packaging plant is:

1. Gross Clean/Preparation
2. Pre-rinse
3. Detergent application
4. Post-rinsing
5. Disinfection

3.2 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.

Chamber Vacuum Sealer machines and others require routine maintenance. The vacuum pumps are oil-based, so the vacuum oil needs to be changed regularly. Additionally, since these units use an impulse mechanism to heat seal the pouches, Teflon tape and seal wires also need periodic replacement.

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 side effect for workers.

Self- Check- 2	Written test

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (15 points)

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

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

Note: Satisfactory rating - 8 points Unsatisfactory - below 8 points

Information Sheet 3- Fitting and adjusting machine components and related attachments

3.1 Components of a custom filling machine

Every liquid filling project will include unique characteristics and features, which in turn will require packaging machinery to handle these characteristics and features.

- **Frame**

The frame used to manufacture a filling machine will change with the needs of the packaging process. A somewhat standard, portable frame will be used for most automatic machines. However, even these "standard" frames may be modified in certain circumstances. For instance, large bottles may require a width extension in order to support the manifold of the machine and get product to multiple bottles during each fill cycle.

While portable frames can be rolled up to an existing conveyor line and put into production, other frames can be used to create stand alone filling stations, using a slide track rather than a power conveyor and requiring the operator to place and remove bottles.

- **Tanks**

Different filling machines will use different tanks, sometimes at different locations. For example, overflow filler will use a re-supply or recirculation tank. This tank will be used for product returning from the overflow nozzles. Gravity filling machines will use a product supply tank that will rest over the top of the nozzles while other filling machines may or may not use tanks for product supply (though most do).

The tank size, location and material will depend on a number of different factors, including the fill principle, the product, the production demands and more. So like the frame, a standard tank may exist for each type of liquid filler, but changes will likely occur based on the unique traits of each project.

- **Product pathway and Nozzles**

Of course, product needs to get from the holding tank or supply tank to the waiting bottles and containers. The product pathway is the plumbing, tubes and nozzles that are used to achieve this goal. The actual physical path taken may differ from machine to machine based on the type of fill and tank location. .

At the end of that product pathway is a nozzle that allows product to be efficiently dispersed into the bottle or container. Nozzles are another item that will often be custom fit to the project at hand. Nozzle sizes may change based on the size of the containers or container opening and types may change based on the filling principle.

These are a few of the common areas where customization may take place on a filling machine. Different pumps and motors may be required for certain projects. Product pathways may need to be heated for molten materials. Agitators may also be required to keep product viscosity consistent. While filling a bottle with product may seem like an easy process or concept, there are many factors to take into account to keep the fill efficient, reliable, consistent and cost-effective.

3.2 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.

3.2.1 Safety check:

Safety check is very important to minimize hazards and risks on operator and to prevent machine damage.

Main parts of machine to 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

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (15 points)

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)
3. Write down Components of a custom filling machine. (5 points)

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

Note: Satisfactory rating - 8 points Unsatisfactory - below 8 points

Information Sheet 4- Entering processing/operating parameters

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;
- Plant Start-up;
- Plant Shut-down;
- Bulk loading and unloading;

These procedures should cover the following;

- 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;

Material safety data sheet (MSDS) is the document that list information relating to OHS 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;
- Plant correctly set-up for processing;
- Process monitoring and recording;
- Monitoring and recording of key process parameters (temperature, pressure etc.);
- Quality;
- Sampling of raw materials, intermediates, products and effluent/waste;
- Packaging of final product.

Self-Check – 4	Written test

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (10 points)

1. What is the aim of operational procedure during operating the equipment**? (5 points)**

2. Mention things to address by Comprehensive written operating procedures. **(5 points)**

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

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

Information Sheet 5- Loading material, product and packaging components

5.1 Loading material, product and packaging components

Different dairy products and grades should be kept separate and pumping new product into old product in particular should be avoided for oxidative quality reasons. It is preferable to transfer different products and grades through segregated lines. Where a number of products are transferred through a common pipeline system, the system must be cleared completely between different products or grades.

The order of loading and discharge should be carefully chosen to minimize adulteration. Before the transfer of solid, semi-solid and high viscosity dairy products in storage tanks, shore tanks, ship tanks and road and rail tanks; the product should be brought to transfer temperature by slow heating, so that the liquid is completely homogeneous.

The temperature is chosen according to different milk products and also to minimize damage to their nutrient value. Long term storage of all dairy products should be at ambient temperature and no heating should be there. If the products become solid during storage, extreme care should be taken during initial heating, ensuring no overheating.

Temperature at loading and unloading should refer to the average of top, middle and bottom temperature readings. Different product grades/types should be kept separate. The order of loading and discharge should be carefully chosen to minimize adulteration.

During loading materials and products, following principles should be observed:

- Fully refined dairy products before partly refined products
- Partly refined dairy products before crude products
- Special care should be taken to prevent adulteration between additives and dairy products.
- Packing with appropriate packaging material.
- Store in a suitable storage room to minimize quality deterioration on products.

Self-Check – 5	Written test

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (5 points)

1. Write principles of loading products and materials? (5 points)S

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

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

Information Sheet 6- Checking and adjusting equipment performance

6.1 Checking equipment performance

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.

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.

Evaluation of performance of packaging machinery may include;

a. Overall equipment effectiveness (**OEE**)

Overall equipment effectiveness 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.

b. Total effective equipment performance (TEEP)

Total effective equipment performance 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).

6.2 Factors affecting overall equipment performance

Packaging machinery manufacturers institute Primary Packaging Line Play book explains that Overall Equipment Effectiveness 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)

Self-Check – 6	Written test

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (10 points)

1. Define Overall Equipment Effectiveness? (5 points)
2. Write down factors that affect Overall Equipment Effectiveness? (5 points)

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

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

Information Sheet 7- Carrying out pre start checks

7.1 Carrying out pre start checks

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 is 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.

Before start using any machine and manipulate operations, consider the following guidelines;

- Parameter setting (pressure, temperature, flow...)
- Identify faulty conditions.
- Identify the possible hazards.
- Check it is complete, with all safeguards fitted, and free from defects.
- Follow manufacturer specification.
- Establish a safe system of work for using and maintaining the machine.
- Maintenance as required to prevent risk.
- Choose the right machine for the job.
- Make sure the machine/ equipment is;

  ✓ Safe for work that has to be done when setting up, during normal use, when clearing blockages, when carrying out repairs for breakdowns, and maintenance;

  ✓ Properly switched off, isolated or locked-off before taking any action to remove blockages, clean or adjust the machine.

7.2 The Pre- and Post-Operation Equipment Inspection Checklist

- Clear any accumulated debris from the equipment's.
- Check for leaking or pooled fluid around and under the machine.
- Check for new signs of structural damage, scratches on the machine.
- Familiarize with the control style and change as needed.
- Identify auxiliary/attachment controls.
- Start the power and review comfort indicators and warnings.
- Review all external surroundings.
- Finally test the machine as post operation task.

Self-Check – 7	Written test

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (10 points)

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 and discuss in detail what you have to do during performing the Pre- Operation Equipment Inspection on a machine.(5pts)

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

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

Operation Sheet - 3	Fitting and adjusting machine components and related attachments

Adjusting packaging machine parts;

Step 1: Wear appropriate personal protective equipments.

Step 2: Identify the packaging machine to be adjusting.

Step 3: Differentiate different parts of machine.

Step 4: Identify faulty and unfit parts of the machine.

Step 5: Adjust or assemble part of the equipment identified.

Step 6: Test the machine.

Step 7: Record results.

N.B

- Conduct the activity in accordance with workplace procedure.
- Properly adjust the machine.

Operation Sheet – 7	Carrying out pre start checks

Conducting pre-start check of packaging equipment in packaging operation;

Step 1: Wear appropriate personal protective equipments.

Step 2: Identify the available packaging machines.

Step 3: Clean each components of the equipments.

Step 4: Disconnect the power of the machine.

Step 5: Check for damage on machine parts and maintain faulty parts.

Step 6: Adjust or assemble part of the equipment identified.

Step 7: Test the machine.

Step 8: Record results.

N.B

- Conduct the activity in accordance with workplace procedure.
- Conduct prestart check of equipments properly.

LAP Test	Performance Test

Name……ID……..Date…….

Time started: _____ Time finished: _____

Instruction: Given necessary templates, tools and materials you are required to perform the following tasks within **3:30 hour**. The project is expected from each trainee to do it.

Task-1: Fitting and adjusting machine components and related attachments .

Task-2: Carrying out pre start checks.

LG #51	LO2: Operate and Monitor the Process

Instruction Sheet

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

- Starting and operating packaging process
- Monitoring equipment
- Identifying and reporting Variation in equipment operation
- Monitoring the process
- Identifying, rectifying and/or reporting product/process outcomes
- Maintaining work area
- Conducting packaging work
- Maintaining workplace records

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 operate packaging process
- Monitor equipment
- Identify and report Variation in equipment operation
- Monitor the process
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Information Sheet 1- Starting and operating packaging process

1.1 Starting and operating packaging process

Packaging is 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 Types of packaging

The type and method of packing depends on various factors includes;

- Food item,
- The process of production,
- Quality of food,
- Shelf life desired,
- Transport considerations, etc.

There are three types of Packaging. These are;

A. 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. Vacuum packing (or vacuum sealing) is a form of packaging that involves the removal of air (and sometimes its replacement) from a pouch or plastic container.

A vacuum is simply the absence of air. We can create a vacuum in a plastic bag or container by sucking out all of the air and then sealing it to prevent air from leaking back in. The single most important reason for creating a vacuum is to remove oxygen from around the thing that we are going to store. This is because air is made up of about 21% oxygen. Most bacteria associated with food spoilage need oxygen to grow. The

less oxygen that is available, the slower bacteria will grow and the longer food will last before spoiling. Oxygen is a highly reactive element and many of the organic compounds that give food its flavour will react with it and make the food taste stale.

Vacuum Packaging has the following advantages;

- Protection against dehydration;
- Barrier against air or moisture;
- Tamper evident protection;
- Compressed packaging for fragmented cores;
- Protection from dust and moisture

There are two types of Vacuum Packing Machine

i. External Bag Machines or Non Chamber Vacuum Sealers

Where only the end of the bag fits into the machine and the rest of the bag and the contents remain outside of the machine. External bag machines work by clamping the open end of the vacuum bag (a vacuum pouch) whilst the air is being removed. Because the end of the bag is clamped shut, this type of machine needs to use a special type of bag with a finely ribbed or textured back surface so that the air can be removed easily.

ii. Vacuum Chamber Machines

It is the whole bag and contents fit inside the machine. These machines resemble a stainless steel box into which the vacuum pouch and contents are placed and the lid closed over them. The entire chamber is then vacuumed and the pouch is heat sealed. This type of machine does not need ribbed bags and consequently the vacuum pouches are cheaper than those which work best in the external bag machine.

Figure 7 a External Bag Machines

Figure 8 b Vacuum Chamber Machines

Figure 9 Vacuum Packing Machine

Vacuum Packing of Cheese

The main reason for vacuum packing cheese is to prevent it from drying out, developing surface mould and losing its fresh flavour and appearance. As a general rule, hard cheeses vacuum pack better than soft cheeses.

Medium hard cheeses such as Cheddar and Red Leicester are very prone to surface mould as well as drying out. The vacuum packing process prevents both of these from happening as well as helping to retain the full flavour of the cheese. Softer cheeses, for example, Brie and Camembert can be vacuum packed, but these cheeses are usually better eaten at the point at which they naturally ripen.

Most cheeses vacuum pack very well and the storage time in the fridge are usually increased by around three to four times as shown in the table below.

Table 2 Cheeses packed in vacuum

Stored in the Refrigerator	Regular Storage	Vacuum Storage
Hard Cheese	12-15 days	50-55 days
Soft Cheese	15-7 days	13-15 days

. All dairy products should be stored in the fridge or in a cool place even if they have been vacuum packed.

Figure 10 Cheeses packed in vacuum packaging method

B. Modified Atmosphere Packaging (MAP)

MAP is a packaging method in which an altered atmosphere inside a package is used to retard chemical deterioration of the product, and the growth of unwanted microorganisms. This new packaging concept is rapidly growing in the food packaging market. It improves the product quality, freshness and increases the shelf-life of the product as well as provides convenience to the consumer and adds value to the product. It is mainly used to extend the shelf life of fresh produce and perishable products.

MAP enables the fresh product to be packaged when it is fresh and then maintains it in that condition, thereby, reducing distribution costs and enhancing flavours and nutrition value for the consumer.

In a modified atmosphere package, the product is exposed inside the pack to the normal atmospheric gases (oxygen, nitrogen, carbon dioxide and water vapour) but in concentrations which are different from those in the ambient air.

Gases used in MAP

In MAP, the pack is flushed with a gas or a combination of gases. The common gases used are; Oxygen, Nitrogen and Carbon dioxide. Traces of carbon monoxide, nitrous oxide, ozone, argon, and ethanol vapour and sulphur dioxide are also used.

In case of active modification, two basic techniques are employed to replace air in MAP

- **Gas Flushing:** the air is replaced by passing a stream of gas. The air gets diluted and the pack is sealed. The oxygen level in gas-flushed packs is up to 2 - 5%.

- **Compensated Vacuum:** Here, vacuum is first applied to remove the air and then the desired gas or gas mixture is incorporated. Since it involves an extra step, this process is slower, but the residual oxygen is much less.

Storage Temperature

Temperature is one of the most important factors in extending the shelf-life of perishable food. Except for bakery products and some dried products, modified atmosphere packaged products are stored at 0–5°C.

Advantages of MAP Technology

- Increased shelf-life allowing lesser frequency of loading of retail display shelves.
- Improved presentation clear view of the product and all round visibility.
- Hygienic stackable pack sealed and free from product drip and odour.
- Potential shelf-life increases by 50 to 400%.
- Reduce production and storage costs due to better utilization of labour, space and equipment.

Disadvantages of MAP Technology

- Capital cost of gas packaging machinery
- Cost of gases and packaging materials
- Increased pack volume increases transport costs and retail display space

Packaging Materials of MAP Technology

The wide ranges of materials used for MAP are;

- **Glass and Metal Containers:** These are excellent barriers to gases but are not suitable for MAP because the quality of food processed and packed in these containers is not enhanced by gas introduction.
- **Semi-rigid and Plastic Containers:** A combination of low cost semi-rigid containers and flexible lidding material with suitable permeability can be used for products needing physical protection during shipment and marketing.

Figure 11 Modified Atmosphere Vacuum Map Tray Sealer Packaging Machine

C. 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. 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.

Blister Packaging of Butter

Butter packing may be accomplished in bulk or retail packs. Because butter is relatively stable and the profitability is lower than for many other dairy products, it has been used as a balancing wheel for surplus milk fat. Smaller bulk packs can be produced to comply with manual handling restrictions. The shelf-life of the bulk butter may be extended considerably by storing it in frozen conditions at below18 ^{0}C.

Packaging materials for butter should have excellent barrier properties such as:

- It should be moisture proof ·
- It should be greaseproof ·
- It should be impervious to light ·
- It should have good strength

Some of the packaging materials used for butter packaging are:

- ✓ Parchment paper – also known as butter paper.
- ✓ Wax coated paper
- ✓ Cardboard boxes and teak wood drums lined with food grade plastic
- ✓ Aluminum foil laminates and Lacquered tin cans

Figure 12 Blister DSU - Butter Case Packing Machine

Self-Check – 1	Written test

Name…… ID…… Date…….

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

Part I: Choose the best answer (2 points each)

1. The type and method of packing depends on;
   A. Food item, B. Quality of food, C. Transport considerations **D. All**
2. ---------- is a method of packaging that removes air from the package prior to sealing.
   A. MAP **B. Vacuum** C. Blister D. Wrapping
3. Which one of the following is a benefit of Vacuum packaging?

   A. Protection against dehydration;
   B. Barrier against air or moisture;
   C. Tamper evident protection;
   D. Compressed packaging for fragmented cores;
   E. All

Part II. Give short answer (3 points each)

1. Mention types of packaging
2. Write common Gases used in Modified atmosphere packaging (MAP)
3. . Mention the two types of Vacuum Packing Machine.

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

Note: Satisfactory rating - 8 points Unsatisfactory - below 8 points

Information Sheet 2- Monitoring equipment

2.1 Monitoring equipment

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 and parts to be monitored include;

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.

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.

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: it is a type of packing in which a solid food is enveloped or covered in a sheet of flexible material, usually paper, cellulose, cloth or foil.

Thermoforming equipment and vacuum forming equipment use two basic types of thermoplastic materials:

- **Thin-gauge thermoplastics:** are delivered in rolls &have a thickness less than 1.5 mm. which are used to produce rigid or semi-rigid parts for applications such as disposable packaging.

- **Thick/ heavy gauge thermoplastics:** are delivered as stackable sheets that vary in thickness between 1.5 mm and 3 mm and are used in automotive, consumer products, and electrical enclosure applications.

Case packers: a case packing machine takes a group of items and packs them together for shipping. There are many styles of case packing that are available based on the type of product that is being packaged.

Bundlers: a shrink bundler has a single sealing bar that closes to seal and cut the film. The single bar is air operated to open and close as products pass through the sealer. The single seal leaves open ends on each side of the package.

Ink jet coders: ink jet coders are a very versatile, proven solution for date coding, batch numbering and product identification on dairy packaging products, including: milk bottles, tetra bricks, cartons, etc.

Coding, labeling and marketing dairy products and packaging should have;

- ✓ Consistently clear coding.
- ✓ Print text, graphics and bar codes on a range of substrates.
- ✓ Large selection of color inks including Industry and Food Grade Inks.
- ✓ Print just about anywhere on the product.
- ✓ Excellent ink adhesion even with condensation.

Labelers: Label means any tag, brand, and mark, pictorial or other descriptive matter, written, printed, marked, embossed, and graphic, perforated, stamped or impressed on or attached to container, cover, lid or crown of any food package and includes a product insert.

Labelers are labeling machines that dispense, apply or print-and-apply labels to various dairy, products, items, containers, or packages which are finished. The most popular types of labeling machinery are the automatic labeling machine, which is able to do its job without needing an operator.

Figure 13 Automatic labeling machine

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
- Date marking and storage instructions
- Instructions for use and special storage requirement

Labeling has the following importance;

✓ Communication with consumer
  ✓ Product identity: Product name, manufacturer, lot no.
  ✓ General characteristics: Ingredients, nutritional information, food additives etc.
  ✓ Religious values
  ✓ Environmental aspects: Carbon footprint, water usage, tree felling etc.
  ✓ Usage instructions, etc.

Palletizes: it is a machine which provides automatic means for stacking cases of goods or products in to a pallet. Manually placing boxes on pallets can be time consuming and expensive; it can also put unusual stress on workers.

Figure 14 Palletizes

Shrink wrappers: Shrink wrap is a polymer plastic film that is used to cover products. Shrink wrap is applied to tightly fit a product using a heat source that shrinks the wrap to the particular dimensions of the product it's covering.

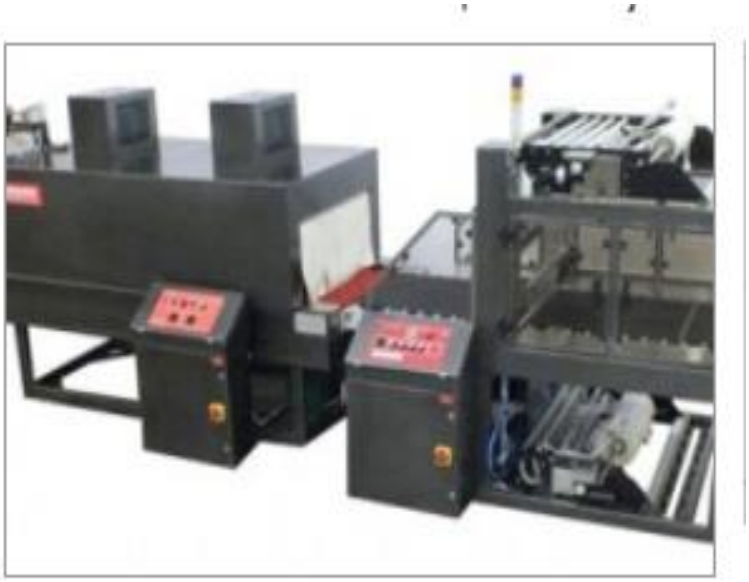

Figure 15 Damark B-180 Series Tray Wrappers

Self-Check -2	Written test

Name……ID…… Date……

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

Part I: Choose the best answer (2 points each)

1. -------- is a type of packing in which a solid food is enveloped in a sheet of flexible material, usually paper, cellulose, cloth or foil.

   A. Vacuum, B. MAP, **C. Wrapping**

2. ---------- is a machine takes a group of items and packs them together for shipping.

   A. **Case packers** B. Ink jet coders C. Labelers D. Bundler

3. Which one of the following is importance of Labeling?

   A. Communication with consumer B. Product identity C. General Characteristic **D. All**

Part II. Give short answer (4 points)

1. Write down machine types and parts to be monitored.

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

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

Information Sheet 3- Identifying and reporting Variation in equipment operation

3.1 Identifying Variation in equipment operation

3.1.1 Techniques of identifying equipment variations

- 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.

3.1.2 Steps of corrective action in response to variations

a. Define the Problem

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

b. Interim/ Temporary Actions

Once a problem has been detected, the first priority should be to contain the problem, and prevent delivery to the customer. If already delivered, the customer needs to be notified to prevent further liability.

c. 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.

d. Permanent Actions

The process should be reviewed to arrive at a solution for correcting the root cause. The solution may involve longer term planning, requiring milestone dates, capital justification, training, and/or approval from the customer.

e. Prevention

Very few organizations reach this step. For example, all the above steps are completed, yet the problem returns few 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.

Self-Check -3	Written test

Name…… ID…… Date…….

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

Instruction: Short answer (10 points)

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

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

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

Information Sheet 4- Monitoring the Process

4.1 Monitoring the process of packaging based on specifications

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

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 International Standard Organization/ ISO 9000.

4.2 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.
- Should the supplier quote the weight of packaging material then they 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

Self-Check -4	Written test

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (10 points)

1. Write recommendations for immediate action by Processors to monitor the operation process.

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

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

Information Sheet 5 - Identifying, rectifying and reporting Out-of-specification process outcomes

5.1 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, may arise due to deviations in product manufacturing process, errors in testing procedure, or due to malfunctioning of analytical equipment. When an out of specifications has arrived, a root cause analysis has to be performed to investigate the cause for out of specifications.

The reasons for out of specifications can be classified as assignable and non-assignable. When the limits are not in specified, limits are called out of specifications. When out of specifications has occurred, the analyst should inform to quality control manager. Each out of specification will be identified with a unique identification number.

The out of specifications investigation involves 2 phases.

a. Phase I investigation

The purpose of this investigation is to identify the cause for out of specification result. The reason for the out of specification may be defect in measurement process or in manufacturing process.

b. Phase II investigation

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

Self-Check -5	Written test

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (10 points)

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

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

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

Information Sheet 6 - Maintaining work area

6.1 Maintaining work area

The work environment and facilities are required to be maintained in a safe and healthy condition, and need to be hygienic, secure and in a serviceable condition for processing operation.

The layout of the work area should be designed to provide sufficient clear space between machines, equipment and fittings so workers can move freely without strain or injury also evacuate quickly in case of an emergency.

Maintaining packaging work area should consider the following points;

a. Work area entry and exit

Generally the work place entry and exit should have:

- Entries and exits should be slip resistant under wet and dry conditions.
- Any walkways, boundaries or pathways shall be marked.
- Separate entry and exits for mobile equipment.
- Power operated doors and gates should have safety features.
- Location of exits should be clearly marked and signs posted to show direction.

b. Floors and Other Surfaces

Work area floor should be;

- Floors shall be free from slip hazards e.g. cables, uneven edges, & broken surfaces.
- Floor surfaces shall have sufficient grip to prevent slipping,
- Anti-fatigue matting, carpet, shock absorbent underlay, cushion backed vinyl shall be provided for workers where static standing occurs.
- Floors should be strong enough to support loads placed on them.
- Allows adequate space for leg clearance and freedom of movement.

c. 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.

d. Ventilation

Workplaces 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.

e. Welfare Facilities

Workers, including those who have particular needs or disabilities, must have access to the facilities provided.

Welfare facilities for workers who have particular needs or disabilities 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.
- A means of access which is safe.

Self-Check -6	Written test

Name…… ID…… Date……

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

Instruction: Short Answer Questions (15 points)

1. Write down points to be considered in maintaining packaging work area. (5 points)
2. Mention points the work place entry and exit should have. (5 points)
3. Mention welfare facilities should be fulfilled in the work area? (5 points)

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

Note: Satisfactory rating - 8 points Unsatisfactory - below 8 points

Information Sheet 7- Conducting packaging work

7.1 Conducting work in accordance with workplace guideline

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. A safe work environment including:

- Facilities,
- Amenities, and,
- Accommodations.

During conducting work, a person should ensure the following requirements;

a. **Legislative Requirements:** a person conducting a business or undertaking at a workplace must ensure so far as is reasonably feasible, the following:
   - The layout of the workplace allows, and the workplace is maintained, ,
   - Work areas have space for work to be carried out without risk to health & safety,
   - Floors and other surfaces are designed, installed and maintained to allow work to be carried out without risk to health and safety,
   - 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.

b. **Responsibilities:** the Facilities Management Division is responsible for ensuring that workplace amenities and facilities:
   - Are designed and installed according to company legislative and requirements
   - Are inspected and maintained to ensure a safe level of hygiene.

c. **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 difficult activities may need to access shower and change room facilities.

d. **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.

e. **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.

Self-Check -7	Written test

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (10 points)

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)

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

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

Information Sheet 8 -Maintaining workplace records

8.1 Workplace record keeping

Record keeping is an activity simply to collect relevant information that can help to take good decisions and to keep track of activities in packaging operation.

Records can be done about;

- Any performance of packaging,
- Economic development, or
- Any activity of the worker.

Workplace records have the following importance for dairy processing plant. It used to;

- Determining profitability of the processing plant.
- Decision making, especially on a strategic level
- Compare the efficiency of use of inputs,
- Rationalize labour
- Planning and management
- Assess profitability/losses (financial records)

Self-Check -8	Written test

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (10 points)

1. What is record keeping? (5 points)
2. Write the importance of recording? (5 points)

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

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

Operation Sheet -1 Starting and operating packaging process

Operating butter packaging process;

Step 1: Wear appropriate personal protective equipments.

Step 2: Prepare all necessary materials, tools and equipments.

Step 3: Identify the possible machine for butter packaging.

Step 4: Check the functionality of machines.

Step 5: Prepare the right butter packaging materials.

Step 6: Operate butter packaging process.

Step 7: Labeling packed product.

Step 8: Properly store packed products.

Step 9: Clean machines

N.B

- Conduct the activity in accordance with workplace procedure.
- Prepare quality packed butter.

Operation Sheet -2 Starting and operating packaging process

Operating cheese packaging process;

Step 1: Wear appropriate personal protective equipments.

Step 2: Prepare all necessary materials, tools and equipments.

Step 3: Identify the possible machine for cheese packaging.

Step 4: Check the functionality of machines.

Step 5: Prepare the right cheese packaging materials.

Step 6: Operate cheese packaging process.

Step 7: Labeling packed product.

Step 8: Properly store packed products.

Step 9: Clean machines

N.B

- Conduct the activity in accordance with workplace procedure.
- Prepare quality packed cheese.

LAP Test	Performance Test

Name……ID……..Date…….

Time started: _____ Time finished: _____

Instruction: Given necessary templates, tools and materials you are required to perform the following tasks within **6:30 hour**. The project is expected from each trainee to do it.

Task-1: Operating butter packaging process.

Task-2: Operating cheese packaging process.

LG #52	LO3: Shut down the Process

Instruction Sheet

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

- Identifying the appropriate 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 the appropriate 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” which are placed following all information sheets.
5. Ask from your trainer the key to correct your work.
6. If you earned a satisfactory evaluation proceed to “Operation Sheets.
7. Perform “the LAP Test” which is placed following “Operation sheets”.
8. If your performance is satisfactory proceed to the next Learning Guide,
9. If your performance is unsatisfactory, go back to “Operation Sheets”.

Information Sheet 1- Identifying the appropriate shutdown procedure

1.1 Identifying the appropriate shutdown procedure

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

Shut down can be;

a. **Scheduled shutdown**: it is initiated by the operator during normal operation of the unit.

Scheduled unit shutdown will prevent:

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

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 producing 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

b. **Maintenance shut down**: 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 or cleaned and gas freed
- Gas tested on a continuous basis prior to and during entry.

c. **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.

Self-Check-1	Written test

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (10 points)

1. Write down types of shutdown? (5 points)
2. Explain emergency shut down? (2 points)
3. Write down advantage of planned unit shutdown? (3 points)

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

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

Information Sheet 2 - Shutting down the Process

2.1 Shutting down the Process

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. In an upcoming article, we will help you restart your machinery, taking the best steps and precautions.

To perform proper shutdown of manufacturing line, consider the following;

a. **End of production sequence**: when pausing a manufacturing line, it is vital 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.
b. **Air purge**: once the machine is out of service, the next thing to be recommended is to purge any air that may be present in the equipment. Machines often use compressed air to activate the different containers, and most machines have an air purge valve that allows for bleeding off any accumulated air.
c. **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 avoids unpleasant surprises at startup.

d. **Environmental Protection**: more generally, suggest that keep the equipment in a stable environment, adequate in terms of temperature and ventilation. This will help avoid degrading your production line. However, keeping the temperature and humidity level stable is important so that the machine does not start to rust.

e. **Get 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.

f. **Preventive maintenance**: whether the shutdown affects all of your manufacturing lines or just a portion, 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.

Self-Check-2	Written test

Name…… ID…… Date…….

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

Instruction: Short Answer Questions (10 points)

1. What is the aim of shut down process? (5 points)
2. Write down consideration factors for proper shutdown? (5 points)

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

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

Information Sheet 3- Identifying and reporting maintenance requirements

3.1 Identifying maintenance requirements

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 equipment may include;

- Sharpening the cutter
- Cleaning,
- Lubricating,
- Tightening
- Simple tool repairs and adjustments.

3.2 Types of maintenance

a. Preventive or proactive maintenance

It is carried out to keep something functional. This type of activity is usually planned and scheduled.

b. Corrective or reactive maintenance

It is repairing something to get it working again and an unscheduled, unplanned task, usually associated with higher risk levels.

3.3 Routine maintenance tasks

It refers to On-going scheduled tasks that are performed in order to keep hand tools and basic equipment functioning properly. It could include 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.
- Use and maintain power tools according to their operator instructions.
- Make sure power tools are properly grounded.
- Wear appropriate personal protective equipment.
- Keep all guards and shields in place.
- Unplug and store tools after use.

Table 3 Maintenance check list

	Tool	Yes	No	Remark
1	Are tools and machines 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?			

3.4 Reporting faults and problems

In order to report faults and problems, there should be maintenance schedule. 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. A maintenance schedule assigns a specific date to specific maintenance tasks.

Table 4 Documenting and report maintenance

S.No.	**Date**	**Equipment**	**Maintenance Check points**	**Maintenance Required**	**Signature**
1					
2					
3					

Self-Check -3	Written test

Name…… ID…… Date…….

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

Instruction: Short answer questions (10points)

1. Define maintenance and write what it may include? (3 pts)
2. Mention and discuss the two types of maintenance? (5 pts)
3. Define routine maintenance? (2 pts)

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

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

Operation Sheet -1 Shutting down the Process

Shut downing equipment safely in packaging operation;

1. Wear appropriate personal protective equipment's.
2. Identify the possible packaging machines.
3. Disconnect the power source.
4. Follow steps for proper shutdown of manufacturing guide line.
5. Clean the machine.

N.B

- Conduct the activity in accordance with workplace procedure.
- Properly shut down the machine without any damage and hazard on the operator.

LAP Test	Performance Test

Name……ID……..Date…….

Time started: _____ Time finished: _____

Instruction: Given necessary templates, tools and materials you are required to perform the following tasks within **2:30 hour**. The project is expected from each trainee to do it.

Task-1: Shut downing packaging equipment safely.

Reference Materials

Alvarez, V., Pascall, M. (2011): Packaging In Encyclopedia of Dairy Sciences, 2nd ed.; (Fuquay, J., Fox, P., McSweeney,

Arvanitoyannis, I.S., Stratakos, A.C. (2012): Application of modified atmosphere packaging and active/smart technologies to red meat and poultry: A review.

Modified Atmosphere Packaging of Food by B. Ooraikul, M. E. Stiles https://doi.org/10.1016/j.ijfoodmicro.2013.12.013

Packaging International, Apr, '98, An Update on Modified Atmosphere Packaging of Fresh Produce

Packaging of Dairy Products pdf book

Principles and Applications of Modified Atmosphere Packaging of Foods by B. A. Blakistone

Clark S, Costello M, Drake MA, and Bodyfelt FW (2008) The sensory evaluation of dairy products, 2nd ed. New York: Springer-Verlag.

Fox PF and McSweeney PLH (1998) Dairy chemistry and biochemistry. London: Blackie Academic and Professional.

Frede E and Buchheim W (1994) Butterrnaking and the churning of blended oil emulsions. Journal of the Society of Dairy Technology 47: 17–27.

Herrmann M, Godow A, and Hasse T (1995) Alternative butter production with scraped surface heat exchanger. Deutsche Milchwirtschaft 46: 62–67.

Hill J (2003) The Fonterra Research Centre. International Journal of Dairy Technology 56: 127–132.

Kawanari, M. (1992). Study on the continuous manufacturing of butter from high fat cream. Reports of Research Laboratory, Technical Research Institute, Snow Brand Milk Products Milk Co., 98, pp. 35–110.

WEB ADDRESSES /RELEVANT WEBSITES

http://www.fil-idf.org/Public/Download.php?media¼39335 – International Dairy Federation, IDF.
http://www.legis.state.wi.us/rsb/code/atcp/atcp085.pdf – The Wisconsin State Legislation, U.S.A.

http://nutritiondata.self.com/facts/recipe/2603984/2 – Nutrition Facts, India.

https://www.modifiedatmospherepackaging.com/Applications.aspx

https://en.wikipedia.org/wiki/Overall_equipment_effectiveness

https://orientech.com/8-steps-to-follow-for-proper-shutdown-of-your-manufacturing-line/

https://doi.org/10.1007/s11947-012-0803-z *Food and Bioprocess Technology* 5 (5), 1423-1446.

https://www.nanowerk.com/ nanotechnology-news/newsid=40955.php/ Accesed at 07.03.2018.

http://blog.drupa.com/de/ecoleanpackaging/ Accesed at 01.02.2018.

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This TTLM was developed on October 2020 at Bishoftu Management Institute Center.

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Answer Key for Self check Questions of the TTLM

LO1 (Information Sheet 1 -7)

Information Sheet-1:

Part I: 1. A. 2. C 3. C 4. B 5. E

Part II:

1. Packaging may be defined as is science, art and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the process of design, evaluation and production of packages.
2. Paperboard, Glass, Metals/Steel, Plastics
3.
   - Containment (Holding the product) ,
   - Protection (Quality, Safety, Freshness),
   - Medium of communication (Labels),
   - Means of minimizing costs,
   - Means of selling product

Information Sheet-2:

1. Cleaning is the complete removal of dirt particles from the surface of machines, tools and equipments using appropriate detergent chemicals under recommended conditions.
2. Manual cleaning, Spray cleaning, Foam cleaning, Machine washing
3. Gross Clean/Preparation, Pre-rinse, Detergent application, Post-rinsing, Disinfection

Information Sheet-3:

Safety check is very important to minimize hazards and risks on operator and to prevent machine damage.

1. The conveyer belt, Working table, and End sealing knives and there is no other person around the machine.
2. Tank, Frames, Production pathway and Nozzles

Information Sheet-4:

1.

- 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;
- Ensure that work equipment is inspected at regular intervals;
- Ensure that work equipment is maintained in good working order r;
- Ensure employees receive relevant information, instruction and training.

2.

- Standard operating procedures and operating philosophy;
- Abnormal operating procedures;
- Temporary operating procedures;
- Emergency operating procedures;
- Plant Start-up;
- Plant Shut-down;
- Bulk loading and unloading;

Information Sheet-5:

1.

- Fully refined dairy products before partly refined oils
- Partly refined dairy products before crude products
- Special care should be taken to prevent adulteration b/n additives and dairy products.
- Packing with appropriate packaging material.

Information Sheet-6:

1. Overall equipment effectiveness 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
2. Availability**,** Performance, and Quality

Information Sheet-7

1.

- Parameter setting (pressure, temperature, flow...)
- Identify faulty conditions.
- Analyze maintenance requirements.
- Identify hazards
- All these can be accomplished by investigating

2.

- Clear any accumulated debris from the equipment's.
- Check for new signs of structural damage, scratches on the machine.
- Check for leaking or pooled fluid around and under the machine.
- Identify auxiliary/attachment controls.
- Start the power and review console indicators and warnings.
- Review all external surroundings.

LO2 (Information Sheet 1 -8)

Information Sheet- 1:

Part I. 1. D 2. B 3. E

Part II.

1. Vacuum packing, Modified Atmosphere Packaging (MAP), Blister packaging or over wrapping
2. External Bag Machines or Non Chamber Vacuum Sealers & Vacuum Chamber Machines
3. Oxygen, Nitrogen, Carbon dioxide

Information Sheet- 2:

Part I. 1. C 2. A 3. D

Part II.

1. Food conveyer system, Filling, Sealing, wrapping, Labeler, Bundler, etc.

Information Sheet- 3:

1.

- 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.
- 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
- Follow machine manufacturers manual.

2. Define the Problem, Interim/ Temporary Actions, Root Cause Analysis, Permanent Actions, and Prevention

Information Sheet- 4:

1.

- Detail of the content and thickness of the proprietary packaging laminate.
- Should the supplier quote the weight of packaging material then they 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

Information Sheet- 5:

1. The term out of specifications, are defined as those results of in process or finished product testing, which falling out of specified limits.

2. Phase I investigation & Phase II investigation

Information Sheet- 6:

1. Work area entry and exit, Floors and Other Surfaces, Lighting, Ventilation, Welfare Facilities
2.

- Entries and exits should be slip resistant under wet and dry conditions.
- Any walkways, boundaries or pathways shall be marked.
- Separate entry and exits for mobile equipment.
- Power operated doors and gates should have safety features.
- Location of exits should be clearly marked and signs posted to show direction.

3.

- 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.
- A means of access which is safe.

Information Sheet- 7:

1. Facilities, Amenities or services, and Accommodations.
2. Legislative Requirements, Responsibilities, Size and Location of the Work Area, The Composition of the Workforce

Information Sheet- 8:

1. Record keeping is an activity simply to collect relevant information that can help to take good decisions and to keep track of activities in packaging operation.

2.

- Determining profitability of the processing plant.
- Decision making, especially on a strategic level
- Compare the efficiency of use of inputs,
- Rationalize labour
- Planning and management
- Assess profitability/losses (financial records)

LO3 (Information Sheet 1 -3)

Information Sheet- 1

1. Scheduled shutdown, Maintenance shutdown and Emergency shutdown.

2. 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.

3. To prevent; Plugging of lines or equipment, Possible damage to equipment, Possible injury.

Information Sheet- 2

2. The aim 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.
3. End of production sequence, Air purge, Cleaning of the machine, Preventive maintenance, Environmental Protection, Get support

Information Sheet- 3

1. Maintenance can be defined as working on something to keep it in a functioning and safe state and preserving it from failure or decline
2. **Preventive or proactive maintenance**: It is carried out to keep something functional. This type of activity is usually planned and scheduled.

   Corrective or reactive maintenance: It is repairing something to get it working again and an unscheduled, unplanned task, usually associated with higher risk levels.
3. It refers to On-going scheduled tasks that are performed in order to keep hand tools and basic equipment functioning properly.